SECTION 19850

DESIGN BUILD SPECIFICAITON

SECTION 19850

1. GENERAL

1.1 SCOPE

1.1.1 TLI (OWNER) ARE INSTALLING REFRIGERATION SYSTEMS AT THEIR NEW FACILITY IN WESTPORT, MA. THIS SPECIFICATION AND THE REFERENCED SPECIFICATIONS DEFINE THE REQUIREMENTS FOR THE SUPPLY AND INSTALLATION OF A REFRIGERATION SYSTEM. THIS DESIGN SPECIFICATION ENCOMPASSES THE SUPPLY AND INSTALLATION TO BE PROVIDED BY THE SELECTED REFRIGERATION CONTRACTOR (REFERRED TO AS THE CONTRACTOR). WHERE WORK IS COMPLETED BY OTHER TRADE CONTRACTORS THEY SHALL BE REFERRED TO SPECIFICALLY, FOR EXAMPLE ELECTRICAL CONTRACTOR.

1.1.2 THE REFRIGERATION SYSTEM IS REQUIRED TO MAINTAIN TEMPERATURES IN THE FACILITIES COOLERS, DOCK, AND PROCESS AREAS. EACH PACKAGED SYSTEM SHALL BE LOCATED ON THE ROOF OF THE BUILDING MOUNTED IN WEATHERPROOF ENCLOSURES AND REJECTING HEAT THROUGH EVAPORATIVE CONDENSERS.

1.1.3 THE CONTRACTOR SHALL SUPPLY ALL OF THE MATERIALS AND LABOR TO ENGINEER, MECHANICALLY AND ELECTRICALLY INSTALL THE CONDENSER REFRIGERATION SYSTEM AS DETAILED IN THIS AND REFERENCED SPECIFICATIONS. MATERIALS SHALL INCLUDE ALL EQUIPMENT, PIPING, PIPE SUPPORTS, PIPING INSULATION AND COVERING, MISCELLANEOUS SUPPORT STEEL, RIGGING EQUIPMENT, AND REFRIGERANT CHARGE, AS REQUIRED. LABOR SHALL INCLUDE ALL ENGINEERING, DESIGN, AND PROJECT MANAGEMENT. MECHANICAL INSTALLATION LABOR SHALL INCLUDE SITE SUPERVISION, LABOR TO RIG THE EQUIPMENT, CRAFT LABOR TO PHYSICALLY INSTALL THE PIPING, INSULATION AND COVERINGS. ELECTRICAL INSTALLATION LABOR SHALL INCLUDE SITE SUPERVISION, LABOR, MATERIALS TO COMPLETE POWER AND CONTROL WIRING TO COMPLETE SYSTEM FUNCTIONALITY. THE CONTRACTOR SHALL INCLUDE LABOR TO START-UP AND SUPPORT VENDOR COMMISSIONING OF EQUIPMENT. THIS INCLUDES LABOR FOR DIRECT CONTRACTOR PERSONNEL AND THE REQUIRED FACTORY REPRESENTATIVES. THE LABOR COSTS SHALL BE INCLUSIVE OF ALL EXPENSES. THE LABOR SHALL ALSO INCLUDE COST FOR OPERATOR AND MAINTENANCE TRAINING. THE CONTRACTOR SHALL ALSO INCLUDE MISCELLANEOUS COSTS SUCH AS NECESSARY PERMITS, FEES, INSURANCE REQUIRED TO UNDERTAKE THE WORK.

1.1.4 THE CONTRACTOR SHALL CONFORM TO SITE REQUIREMENTS FOR CLOTHING AND PERSONAL PROTECTION CODES ESPECIALLY IF REQUIRED TO ENTER PROCESS AREAS.

1.1.5 THE FACILITIES ROOF IS A PVC MEMBRANE TYPE. THE CONTRACTOR SHALL FOLLOW THE GENERAL CONTRACTOR ROOF WORK PERMIT PRIOR TO COMPLETING ANY WORK ON ROOF. THIS WILL DETAIL THE MATERIALS AND PRECAUTIONS REQUIRED TO PREVENT DAMAGE TO ROOFING MEMBRANE.

1.1.6 THE CONTRACTOR SHALL SUPPLY ALL NECESSARY DOCUMENTATION AS REQUIRED BY THE OWNER FOR SAFE OPERATION, INSPECTION AND MAINTENANCE OF INSTALLED EQUIPMENT.

1.1.7 A PRELIMINARY ENGINEERING STUDY IDENTIFIED THE OUTLINE COOLING LOADS AS A GUIDE TO THE REQUIRED PIPING AND EQUIPMENT SELECTIONS. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO CONFIRM SYSTEM CAPACITY, LOADS AND PERFORM ALL FINAL ENGINEERING, LINE SIZING AND DETERMINATION OF FINAL PIPE ROUTING.

REFRIGERATION PIPING

SECTION 19852

GENERAL

1.1. WORK INCLUDED

1.1.1. THIS SPECIFICATION GOVERNS THE MINIMUM REQUIREMENTS FOR THE PROCUREMENT, MATERIALS, FABRICATION, ERECTION, ASSEMBLY, TESTING, CLEANING, INSPECTION, DELIVERY, INSTALLATION, AND START-UP SUPERVISION FOR REFRIGERATION PIPING SYSTEMS. THIS INCLUDES ALL LABOR, SUPERVISION, TOOLS, PIPING, MATERIALS, APPARATUS, SERVICES, PERMANENT AND TEMPORARY FACILITIES NECESSARY FOR A COMPLETE AND PERMANENT INSTALLATION AS INDICATED AND CALLED FOR IN THE SPECIFICATIONS AND AS REQUIRED BY JOB CONDITIONS.

MODIFICATIONS, ALTERATIONS, EXCEPTIONS AND ADDITION AS TO THIS SPECIFICATION SHALL BE AS DETAILED IN SPECIAL INSTRUCTIONS, OR PUBLISHED IN NUMBERED ADDENDA. CHANGES IN THE WORK SHALL BE MADE ONLY BE THE ISSUANCE OF A SIGNED CHANGE ORDER.

1.2. DRAWINGS

1.2.1. THE CONTRACTOR IS RESPONSIBLE FOR GENERATING THE EQUIPMENT LAYOUT AND PIPING DRAWINGS FOR THE SYSTEM. THE CONTRACTOR SHALL CAREFULLY INVESTIGATE THE STRUCTURAL AND FINISHED CONDITIONS AFFECTING ALL HIS WORK AND SHALL ARRANGE SUCH WORK ACCORDINGLY, FURNISHING SUCH FITTING AND ACCESSORIES AS MAY BE REQUIRED TO MEET SUCH CONDITIONS FOR A COMPLETE AND OPERABLE SYSTEMS AT NO ADDITIONAL COSTS TO THE OWNER. A FULL SET OF ENGINEERING DRAWINGS FOR THE FACILITY WILL BE MADE AVAILABLE TO THE CONTRACTOR IN A SUITABLE ELECTRONIC FORMAT.

1.3. CUTTING AND PATCHING

1.3.1. UNLESS SPECIFIED ELSEWHERE, THE CONTRACTOR SHALL PERFORM ALL CUTTING, PATCHING, AND REPAIRING OF CONSTRUCTION TO INSTALL ITS WORK. FAILURE TO INSTRUCT OTHER TRADES WITH REGARD TO OPENINGS, SLEEVES, CHASES, ETC. SHALL NOT RELIEVE THE CONTRACTOR OF THE RESPONSIBILITY OF INSTALLING THE SAME AT THEIR OWN EXPENSE.

1.3.2. VERIFY ELEVATIONS, LOCATION, CONFLICTS WITH OTHER TRADES AND ARCHITECTURAL, FINISHERS. THE CONTRACTOR SHALL DO ALL CUTTING, FITTING OR PATCHING OF ITS WORK THAT MAY BE REQUIRED TO COMPLETE THE WORK OR TO MAKE ITS SEVERAL PARTS FIT TOGETHER PROPERLY, AND SHALL NOT DAMAGE OR ENDANGER ANY WORK BY CUTTING, EXCAVATING OR OTHERWISE ALTERING THE WORK OR ANY PART OF IT.

1.3.3. STRUCTURAL MEMBERS SHALL NOT BE CUT EXCEPT BY THE WRITTEN AUTHORITY OF THE OWNER. WORK DONE CONTRARY TO SUCH AUTHORITY IS AT THE CONTRACTOR'S RISK, SUBJECT TO REPLACEMENT AT ITS OWN EXPENSES IF SO DIRECTED.

1.3.4. AIR HAMMERS MAY NOT BE USED. OPENINGS SHALL BE MADE BY CORING, SAWING, OR OTHER METHODS AS REVIEWED BY OWNER'S REPRESENTATIVE.

1.3.5. HOLES SHALL NOT EXCEED DUCT, PIPES, AND CONDUIT SIZES, INCLUDING INSULATION, BY MORE THAT 2". REQUIRED SLEEVES SHALL BE PROVIDED BY THE RESPECTIVE CONTRACTOR WHO REQUIRES THE SLEEVES.

1.4. FLOOR AND ROOF PROTECTION

1.4.1. THE CONTRACTOR SHALL TAKE EXTRA PRECAUTIONS TO PROTECT THE FLOORS AND ROOF FROM OIL SPILLAGE AND DRIPPING. ANY OPERATION, SUCH AS CUTTING AND THREADING OF PIPE THAT CAN RESULT IN DRIPPING OF OIL AND THREAD CUTTING SHALL BE DONE OVER A DRAIN PAN THAT WILL COLLECT ALL DRIPPINGS. TARPAULINS, PLYWOOD OR DROP CLOTHS SHALL BE USED AROUND SUCH PIPING TO PREVENT CONTRACTOR'S EMPLOYEES FROM TRACKING OIL OVER THE AREA. ANY LIQUIDS, SUCH AS OIL, THAT WILL BE USED IN THIS WORK SHALL BE KEPT IN TIGHTLY CLOSED CONTAINERS, AND EXTREME CARE SHALL BE USED WHEN CHARGING EQUIPMENT WITH THESE MATERIALS SO AS TO AVOID ANY SPILLS.

1.4.2. EXTRA PRECAUTIONS SHALL BE TAKEN DURING WELDING PROCEDURES TO AVOID DAMAGE TO THE ROOF. PLYWOOD AND FIRE BLANKETS SHALL BE USED TO PROTECT THE ROOF. ALL USED WELDING RODS AND MISCELLANEOUS MATERIAL SHALL BE COLLECTED IN A BUCKET.

1.4.3. ALL RESIDUAL MATTER DEPOSITED ON FLOORS, ROOFS, WALLS AND OTHER SURFACES AS A RESULT OF THE REFRIGERATION SYSTEM INSTALLATION SHALL BE COMPLETELY REMOVED TO THE SATISFACTION OF THE OWNER'S REPRESENTATIVE.

1.5. REQUIRED COMPLIANCE

THE SYSTEM SHALL BE DESIGNED IN ACCORDANCE WITH THE LATEST VERSION OF THE FOLLOWING CODES AND STANDARDS AS SHOWN ON THE COVER SHEET:

1.5.1. OTHER REFERENCED CODES, STANDARD, AND REGULATIONS:

MSS - SP69-2002 AND SP89-1998 (REFERENCED IN HANGERS AND SUPPORTS).

1.6. QUALITY ASSURANCE

1.6.1. ALL WORK SHALL BE DONE BY SKILLED CRAFTSMEN REGULARLY ENGAGED IN REFRIGERATION PIPING.

1.6.2. INSTALLER QUALIFICATIONS: MINIMUM OF 5-YEAR EXPERIENCE ON COMPARABLE PROJECTS.

1.6.3. ALL MATERIALS AND PIPING FURNISHED BY THE CONTRACTOR SHALL BE NEW AND FREE FROM DEFECTS. NO MATERIALS AND PIPING, WHETHER FURNISHED BY THE CONTRACTOR OR OTHERS, SHALL BE INSTALLED OR USED IN FABRICATION ASSEMBLIES IF THE ITEMS ARE PHYSICALLY DAMAGED OR FUNCTIONALLY DEFECTIVE.

1.6.4. ALL WORK PERFORMED BY THE CONTRACTOR SHALL BE OF GOOD QUALITY AND DONE IN A SAFE MANNER. THE CONTRACTOR AND HIS EMPLOYEES SHALL OBSERVE ALL JOB SITE WORK RULES. THE CONTRACTOR SHALL NOT PERFORM ANY WORK DURING PERIODS IN WHICH ENVIRONMENTAL OR SITE CONDITIONS MAY ADVERSELY AFFECT THE QUALITY OF THE INSTALLATION. THE CONTRACTOR, IN PERFORMING HIS WORK, SHALL NOT DAMAGE, DESTROY OR OTHERWISE REDUCE THE SERVICEABILITY OF AN EXISTING INSTALLATION OR WORK PERFORMED BY OTHERS INCLUDING, BUT NOT LIMITED TO, ROOFING, INSULATED PANELS, FLOORS, STRUCTURAL STEEL, AND BURIED PIPING. THE

CONTRACTOR SHALL REPAIR ANY DAMAGE AT HIS OWN EXPENSE AND AT THE DIRECTION AND APPROVAL OF THE OWNER'S REPRESENTATIVE.

1.6.5. ALL PERSONNEL WORKING ON THE REFRIGERATION PIPING SYSTEMS SHALL BE QUALIFIED TO DO THIS WORK AND SHALL BE FAMILIAR WITH REFRIGERATION SYSTEMS, THE EQUIPMENT USED, AND HOW THEY OPERATE. WHERE THERE ARE COLD REFRIGERANT LIQUID LINES, IT IS NECESSARY THAT CERTAIN PRECAUTIONS BE TAKEN TO AVOID DAMAGE, WHICH COULD RESULT FROM LIQUID EXPANSION. TEMPERATURE INCREASE IN A PIPING SECTION FULL OF LIQUID WILL CAUSE HIGH PRESSURE DUE TO THE EXPANDING LIQUID, WHICH CAN POSSIBLY RUPTURE A GASKET, PIPE OR VALVE. HAND VALVES ISOLATING SUCH SECTIONS SHALL BE MARKED TO WARN AGAINST ACCIDENTAL CLOSING, AND THEY SHALL NOT BE CLOSED UNTIL THE LIQUID IS REMOVED. ANY PIPING SECTION THAT CANNOT BE PROPERLY MARKED SHALL HAVE A RELIEF DEVICE INSTALLED WHERE LIQUID EXPANSION COULD TAKE PLACE. ALL CONTROL GROUPS THAT CAN BE ISOLATED BY BLOCKING VALVES SHALL BE PROVIDED WITH A PUMP-OUT CONNECTION TO FACILITATE REMOVAL OF THE TRAPPED REFRIGERANT. IF NO PUMP-OUT IS AVAILABLE, A SMALL PURGE VALVE SHALL BE PROVIDED.

1.6.6. BEFORE ANY WELDING IS PERFORMED, THE CONTRACTOR SHALL SUBMIT TO THE OWNER, OR HIS AUTHORIZED REPRESENTATIVE, A COPY OF THE WELDING PROCEDURE SPECIFICATION TOGETHER WITH THE PROCEDURE QUALIFICATION RECORDS AS REQUIRED BY SECTION IX OF THE ASME BOILER AND PRESSURE VESSEL CODE.

1.6.7. BEFORE EACH WELDER PERFORMS ANY WELDING, THE CONTRACTOR SHALL SUBMIT TO THE OWNER'S REPRESENTATIVE, A COPY OF THE CERTIFICATION RECORDS OF WELDER OR WELDING OPERATOR QUALIFICATION TESTS AS REQUIRED BY SECTION IX OF THE ASME BOILER AND PRESSURE VESSEL CODE.

1.6.8. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE QUALITY OF WELDING DONE BY ITS ORGANIZATION AND SHALL REPAIR OR REPLACE ANY WORK NOT IN ACCORDANCE WITH THESE SPECIFICATIONS.

1.6.9. ALL PIPING SHALL BE CERTIFIED AS TO ITS SPECIFICATION *IN WRITING* BY THE CONTRACTOR.

1.7. CLEAN REFRIGERATION PIPING SYSTEM

1.7.1. THE REFRIGERATION PIPING SYSTEM SHALL BE INSTALLED IN STRICT ACCORDANCE WITH THIS SPECIFICATION THAT ADDRESS PIPE INSTALLATION, EVACUATION, AND PRESSURE TESTING. THE CONTRACTOR SHALL ADHERE TO THIS SPECIFICATION FOR THE PURPOSE OF PROVIDING THE OWNER WITH LEAK-FREE PIPING SYSTEMS THAT IS FREE OF METAL SHAVINGS, WELD SLAG, DIRT, FOREIGN MATTER, AND MOISTURE. THE PIPING SYSTEM MUST BE CLEAN.

1.7.2. THE CONTRACTOR SHALL PURCHASE ONLY PIPE THAT HAS BEEN STORED INDOORS AND HAS BEEN CAPPED TO PREVENT RUSTING. ALL PIPE SHIPPED FROM THE MANUFACTURER SHALL BE CAPPED AND PROTECTED TO KEEP THE PIPING CLEAN. WHEN THE PIPE IS DELIVERED TO THE JOB SITE, THE CONTRACTOR SHALL INSPECT THE PIPE WITH THE OWNER'S REPRESENTATIVE. THE PIPING SHALL NOT CONTAIN RUST OR MILL SCALE. THE OWNER RESERVES THE RIGHT TO REJECT ANY PIPING THAT DOES NOT MEET THESE SPECIFICATIONS. THE PIPING SHALL BE STORED AT THE JOB SITE, A MINIMUM OF 12" OFF THE GROUND AND SHALL BE COVERED. ALL PIPING IS TO REMAIN CAPPED UNTIL SUCH TIME THAT IT IS TO BE USED.

1.7.3. THE OWNER'S REPRESENTATIVE SHALL HAVE THE OPTION OF INSPECTING THE PIPE AT THE PIPE MANUFACTURER'S FACILITY PRIOR TO SHIPMENT.

1.8. DELIVERY, STORAGE AND HANDLING

1.8.1. BEFORE ACCEPTING ANY MATERIALS ONTO THE JOB SITE, THE CONTRACTOR AND THE OWNER'S REPRESENTATIVE SHALL INSPECT THE MATERIALS OF EQUIPMENT. ANY MATERIALS THAT ARE FOUND TO BE DAMAGED, DEFECTIVE, OR UNSUITABLE FOR THE INTENDED SERVICE SHALL NOT BE ACCEPTED.

1.8.2. THE CONTRACTOR SHALL PROVIDE SUITABLE PROTECTION FROM DAMPNESS, DAMAGE, DIRT, ETC., FOR ALL EQUIPMENT AND MATERIALS DURING CONSTRUCTION UNTIL FINAL ACCEPTANCE BY THE OWNER'S REPRESENTATIVE. SUCH PROTECTION SHALL BE ACCOMPLISHED BY A MEANS ACCEPTABLE TO THE OWNER.

1.8.3. ALL HANDLING OF MATERIALS AND EQUIPMENT SHALL BE DONE IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATION AND IN A MANNER, WHICH WILL NOT DAMAGE OR REDUCE THE SERVICEABILITY OF THE MATERIAL.

1.9. PROJECT SITE CONDITIONS

1.9.1. THE CONTRACTOR MUST VISIT THE PREMISES AND BECOME THOROUGHLY ACQUAINTED WITH THE CONDITIONS TO BE ENCOUNTERED IN THE INSTALLATION OF THE WORK SHOWN ON THE DRAWINGS AND DESCRIBED IN THE SPECIFICATIONS. AS NO EXTRAS WILL BE ALLOWED TO COVER THE WORK THAT HAS NOT BEEN INCLUDED IN THE BID DUE TO FAILURE TO THOROUGHLY EXAMINE THE PREMISES.

1.10. SEQUENCING / SCHEDULING

1.10.1. THE CONTRACTOR SHALL BE RESPONSIBLE FOR COORDINATION AND COOPERATION WITH THE OTHER TRADES SO THAT THE INSTALLATION IS PERFORMED WITH MINIMUM INTERFERENCE AND CONFLICT. PARTICULAR ATTENTION MUST BE PAID TO TESTING PROCEDURES.

1.10.2. THE CONTRACTOR SHALL BE PREPARED TO START, PROGRESS WITH, AND COMPLETE THE WORK WITHIN THE TERMS OF THE INTENDED SCHEDULE, SUBJECT TO THE ACTIVITY OF OTHER PERFORMING PRIOR WORK.

1.10.3. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE TIMELY PROCUREMENT OF MATERIALS AS SPECIFIED IN THIS SPECIFICATION. THE CONTRACTOR SHALL SCHEDULE PROCUREMENT OF ALL MATERIALS SO THAT THEY MAY BE DELIVERED AND INSTALLED WITHIN THE TERMS OF THE INTENDED SCHEDULE.

1.11. NON-INTERFERENCE WITH EQUIPMENT, ETC.

1.11.1. THE CONTRACTOR SHALL TAKE NOTE OF THE PROCESS EQUIPMENT, DUCTS, PRODUCT PIPING, ELECTRICAL WORK, ETC. ENTERING INTO THE CONSTRUCTION OF THE BUILDING, AND SHALL LOCATE THIS WORK SO AS NOT TO CAUSE INTERFERENCE. CONSULT THE OWNER'S REPRESENTATIVE WHEN IN DOUBT AS TO LOCATIONS.

2. MATERIALS

2.1. PIPE AND FITTINGS

2.1.1. ALL PIPING SHALL HAVE CODE MARKINGS CLEARLY VISIBLE. MATERIALS SHALL CONFORM TO THE STANDARDS SPECIFIED, SHALL BE NEW, FREE FROM DEFECTS AND IMPERFECTIONS, AND SHALL BE OF RECENT MANUFACTURE. MATERIALS NOT COVERED BY DETAILED SPECIFICATIONS SHALL BE STANDARD PRODUCTS OF REPUTABLE

MANUFACTURERS AND SUITABLE FOR INTENDED USE. MATERIALS SHALL BE STANDARD CATALOGUED PRODUCTS, COMMERCIALLY AVAILABLE.

2.1.2. ALL WELDING ELBOWS PROCURED UNDER THIS SPECIFICATION SHALL BE OF THE STANDARD, LONG-RADIUS TYPE, UNLESS SPECIFICALLY NOTED OTHERWISE. MITERED ELBOWS SHALL NOT BE USED.

2.1.3. FOR GROUP A1 REFRIGERANTS THE FOLLOWING COPPER PIPE MAYBE USED

2.1.3.1. 4-1/8" AND SMALLER ACR GRADE COLOUR BLUE PER ASTM B280 COPPER TUBING

2.1.4. ALTERNATIVELY THE FOLLOWING GENERAL SELECTIONS OF CARBON STEEL PIPING CAN BE IN APPLICATIONS OPERATING AT -20^{O}F AND ABOVE.

2.1.4.1. 2" AND SMALLER – SCHEDULE 80, ASTM A106 GRADE B SEAMLESS TUBING

2.1.4.2. 2 1/2" THROUGH 6" - SCHEDULE 40, ASTM A53 GRADE B ERW

2.1.4.3. 8" THROUGH 12" - SCHEDULE 30, ASTM A53 GRADE B ERW

2.1.4.4. THE CONTRACTOR CAN PROVIDE A COST OPTION TO USE ASTM A106 OR ASTM A53 IN LIEU OF ASTM A333 IN LOW TEMPERATURE APPLICATIONS PROVIDED ALL OF THE REQUIREMENTS OF ANSI/ASME B31.5 ARE SATISFIED, I.E. IMPACT TESTING, STRESS ANALYSIS, ETC.

2.1.5. ALL THREADED PIPES SHALL BE SCHEDULE 80. THREADED CONNECTIONS SHALL BE UTILIZED ONLY WHEN A WELDED OR BRAZED CONNECTION IS NOT POSSIBLE AND SHALL ONLY BE USED IN SIZES OF ¾" AND SMALLER.

2.1.6. ALL FITTINGS SHALL MATCH PIPE SCHEDULES.

2.1.6.1. ALL FITTINGS UP TO 2" SHALL BE 3,000 PSI FORGED STEEL SOCKET WELD TYPE. FITTINGS FOR 2 1/2' AND LARGER PIPING SHALL BE BUTT WELD, WITH THE SAME SCHEDULE AS THE CONNECTING PIPE. LONG RADIUS ELBOWS SHALL BE USED WHERE POSSIBLE.

EXCEPTION: THREADED JOINTS SHALL BE USED WHERE NECESSARY FOR CONNECTING CONTROLS, INSTRUMENTS, VALVES, ETC., ONLY WHERE WELDED JOINTS OR LEAK PROOF JOINTS UTILIZING HYDRAULIC TYPE COMPRESSION FITTINGS ARE NOT POSSIBLE. A SUITABLE THREAD COMPOUND SUCH AS "EXPANDO" OR SUITABLE "TEFLON" PASTE SHALL BE USED. TEFLON TAPE IS NOT ACCEPTABLE.

2.1.6.2. BRANCH CONNECTIONS SHALL BE TEES.

EXCEPTION: WELDOLETS MAY BE USED FOR BRANCH CONNECTIONS WHEN THE BRANCH IS AT LEAST TWO SIZES SMALLER THAN THE MAIN

2.1.7. EVAPORATOR DRAIN LINES

2.1.7.1. IN +34dF SPACES OR GREATER- DRAIN LINES SHALL BE SOLVENT WELDED PVC SCH 80 CONNECTED BY UNION TO DRAIN PAN.

2.1.7.2. IN SPACES LESS THAN +34dF – DRAIN LINES SHALL THREADED GALVANISED SCH 40 WITH ELECTRICAL HEAT TRACING AND INSULATED.

2.2. FLANGES AND UNIONS

2.2.1. UNIONS SHALL BE MANUFACTURE'S STANDARD TONGUE-AND-GROOVE TYPE FLANGES.

2.2.2. ALL REFRIGERATION FLANGES SHALL BE DESIGNED FOR REFRIGERATION SERVICE WITH TONGUE AND GROOVE JOINTS.

2.3. FASTENERS

2.3.1 THE MINIMUM GRADE FOR ALL FLANGE FASTENERS SHALL BE ASTM A193 GRADE B7 OR L7. IN PROCESS AREAS, ONLY STAINLESS STEEL FASTENERS ASTM A193 GRADE B8 OR B8H MAYBE USED. ENSURE DISSIMILAR STAINLESS STEEL GRADES ARE USED FOR THE BOLT AND NUT TO PREVENT THE THREAD GAULING.

2.4. VALVES

2.4.1. ALL EQUIPMENT SHALL HAVE VALVES THAT ALLOW COMPLETE ISOLATION FOR SERVICING.

2.4.2. ALL ISOLATION VALVES SHALL BE STEEL BODY IN LINE TYPE WITH SEALED CAP DESIGN. GATE VALVES SHALL NOT BE USED FOR REFRIGERANT SERVICE.

2.4.3. VALVES 2" AND SMALLER SHALL BE SOCKET WELD TYPE (EXCEPT WHERE SPECIFIC FITTINGS ARE AVAILABLE ONLY SCREWED). SOCKET WELD OR BUTT WELD VALVES SHALL BE USE IN SIZES LARGER THAN 2".

2.4.4. VALVES SHALL HAVE BOLTED BONNETS.
EXCEPTION: GAUGE VALVES MAY HAVE SCREWED BONNETS.

2.4.5. ALL VALVES SHALL BE BACK SEATED FOR REPACKING IN SERVICE.

2.4.6. CHECK VALVES SHALL BE LIFT, DISC OR SWING CHECK TYPE.

2.4.7. REFRIGERATION HAND (SERVICE) VALVES SHALL BE HANSEN, R/S, OR APPROVED EQUAL.

2.4.8. ISOLATION VALVES SHALL BE SUPPLIED IN PIPING HEADERS TO FACILITATE FUTURE EXPANSION.

2.5. HANGERS AND SUPPORTS

2.5.1. FURNISH ALL HANGERS AND SUPPORTS REQUIRED FOR PIPING AND EQUIPMENT, UNLESS SPECIFICALLY STATED OTHERWISE. THIS INCLUDES ALL PIPE HANGERS, SUPPORTS, ANCHORS, AND GUIDES.

3. EXECUTION

3.1. INSPECTION

3.1.1. EXAMINE THE AREAS AND CONDITIONS UNDER WHICH THIS WORK IS TO BE INSTALLED. DO NOT PROCEED WITH THE WORK UNTIL UNSATISFACTORY CONDITIONS HAVE BEEN CORRECTED.

3.1.2. STARTING OF WORK WILL BE CONSTRUED AS ACCEPTANCE OF THE CONDITIONS WITHIN ANY PARTICULAR AREA.

3.1.3. THE OWNER AND PROJECT MANAGER RESERVES THE RIGHT TO INSPECT WELDS VIA DESTRUCTIVE OR NON DESTRUCTIVE METHODS SUCH AS RADIOGRAPHIC EXAMINATION. ALL UNACCEPTABLE WELDS SHALL BE REPAIRED AND RE-INSPECTED BY THE METHOD THAT EXPOSED THE DEFECT AT THE EXPENSE OF THE CONTRACTOR. IN ADDITION, FOR EACH WELD FOUND TO BE UNACCEPTABLE, THE CONTRACTOR WILL INSPECT FIVE ADDITIONAL WELDS AT HIS EXPENSE USING THE METHOD THAT EXPOSED THE WELD DEFECT.

3.2. PIPING – GENERAL

3.2.1. BRAZED AND SOLDERED JOINTS OF COPPER PIPING: FIELD BRAZING AND SOLDERING OF PIPING SHALL CONFORM TO ANSI/ASME B31.5 AND THE FOLLOWING SPECIFICATIONS:

3.2.1.1. THE QUALIFICATION OF THE BRAZING PROCEDURES AND BRAZING OPERATORS SHALL BE IN ACCORDANCE WITH THE REQUIREMENTS OF PART QB, ARTICLES XII AND XIII, SECTION IX, ASME BPV CODE.

3.2.1.2. WHERE POSSIBLE ALL COPPER TUBING JOINTS AND COMPONENT CONNECTIONS SHALL BE BRAZED.

3.2.1.3. THE SURFACES TO BE BRAZED SHALL BE CLEAN AND FREE FROM GREASE, OXIDES AND ANY CONTAMINATE THAT MAY REDUCE THE QUALITY OF THE BRAZED JOINT. A SUITABLE CHEMICAL OR MECHANICAL CLEANING METHOD MAYBE USED TO PROVIDE CLEAN WETTABLE SURFACE FOR BRAZING. THE PROCEDURE FOR JOINTS IS COVERED IS OUTLINED IN COPPER TUBE HANDBOOK, PUBLISHED BY COPPER DEVELOPMENT ASSOCIATION.

3.2.1.4. BRAZED SOCKET TYPE JOINTS MAY BE USED PROVIDED IT IS DETERMINED THAT THE FITTINGS ARE ADEQUATE AND SAFE FOR THE DESIGN CONDITIONS IN ACCORDANCE WITH THE REQUIREMENTS LISTED IN ASME B31.5-2010 PARA 515A TO 515D FOR FLARED AND FLARELESS FITTINGS.

3.2.1.5. THE PIPING SYSTEMS SHOULD BE KEPT FREE OF FLUX AND OTHER FOREIGN MATERIALS.

3.2.1.6. SOLDERING IF REQUIRED SHALL BE IN ACCORDANCE WITH THE STANDARD PROCEDURE DESCRIBED IN ASTM B828.

3.2.1.7. SOLDERED JOINTS SHALL NOT BE USED FOR TEMPERATURES IN EXCESS OF THOSE GIVEN IN ASME B16.22

3.2.2. WELDED PIPING: FIELD WELDING OF PIPING SHALL CONFORM TO ANSI/ASME B31.5 AND THE FOLLOWING SPECIFICATIONS:

3.2.2.1. WELDERS SHALL USE PROCEDURES AS OUTLINED UNDER "STANDARD SPECIFICATION PROVISIONS FOR FABRICATION AND ERECTION OF PIPING SYSTEMS" AS RECOMMENDED BY THE NATIONAL CERTIFIED PIPE WELDING BUREAU.

3.2.2.2. ALL WELDING SHALL BE DONE BY WELDERS CERTIFIED BY THE "NATIONAL CERTIFIED PIPE WELDING BUREAU". UPON REQUEST BY THE OWNER'S REPRESENTATIVE, WELDERS SHALL DISPLAY PROOF OF THEIR CERTIFICATION. ALL WELDING SHALL BE DONE IN A THOROUGH FIRST-CLASS AND 'WORK MAN LIKE' MANNER USING THE ELECTRIC ARC OR OXYACETYLENE PROCESS.

3.2.2.3. PIPE SHALL BE UPENDED BEFORE INSTALLATION AND CLEARED OF SCALE. INTERNALLY CLEAN ALL PIPES BEFORE INSTALLATION. REMOVE OIL, GREASE, CHIPS, RUST, DIRT, ETC. CLEAN ALL SCREWED JOINTS WITH SOLVENT BEFORE APPLYING SEALANT TO THE THREADS, IF APPLICABLE.

3.2.2.4. EXTERNALLY CLEAN ALL LINES AFTER INSTALLATION AND BEFORE PAINTING WITH PRIMER TO REMOVE ALL GREASE, OIL, PIPE JOINT COMPOUND, DIRT, PLASTER, MORTAR, ETC.

3.2.2.5. ALL PIPES TO BE WELDED SHALL BE FURNISHED WITH BEVELED ENDS TO PROVIDE A SUITABLE WELDING GROOVE, AND THE PIPE SHALL BE IN PROPER ALIGNMENT BEFORE THE WELD IS MADE. USE CLAMPS OR OTHER APPROVED DEVISES FOR ASSURING PROPER ALIGNMENT.

3.2.2.6. CARE SHALL BE TAKEN WHEN WELDING TO HAVE NO UNDERCUT IN THE COMPLETED JOINTS, AS THE WELD AT EACH JOINT SHALL PROVIDE A REINFORCEMENT OF NOT MORE THAT 25% OF THE WALL THICKNESS OF THE PIPE. THE INSIDE OF THE WELD SHALL BE FREE FROM "ICICLES".

3.2.2.7. WHEN A LEAK APPEARS IN A WELD, IT SHALL NOT BE REWELDED WITHOUT FIRST CHIPPING AWAY THE WELDING FOR ABOUT 1/2" EACH WAY AND THEN WELDING OVER THE CHIPPED SURFACE.

3.2.2.8. WELDING FITTINGS SHALL BE USED FOR ALL WELDED PIPE SYSTEMS. ELBOWS SHALL BE LONG RADIUS.

3.2.2.9. SHAPED PIPE NOZZLES, WITH OR WITHOUT SADDLE REINFORCING, SHALL NOT BE USED.

3.2.2.10. ONCE WELD IS COMPLETED ALL SLAG MUST BE REMOVED, WELD AREA WIRE BRUSHED AND PAINTED USING AN APPROVED PRIMER WITHIN 24 HOURS.

3.2.3. FABRICATE AND INSTALL PIPING TO PROVIDE FOR AND CONTROL THE MOVEMENT DUE TO THERMAL EXPANSION AND/OR CONTRACTION IN ACCORDANCE WITH THE REQUIREMENTS OF ANSI/ASME B31.5. THE CONTRACTOR SHALL SUBMIT DESIGN CALCULATIONS FOR OWNER'S REVIEW INDICATING COMPLIANCE WITH THE CODE.

3.2.4. ALL PIPING SHALL BE LOCATED ESSENTIALLY AS INDICATED ON THE CONTRACTOR'S DRAWINGS. PIPES SHALL BE BLOCKED UP ON THE SUPPORTS THE PROPER DISTANCE TO ALLOW FOR INSULATION. PIPES SHALL BE LOCATED, AS CLOSE TOGETHER AS POSSIBLE; HOWEVER, SPACE SHALL BE LEFT SO THAT INSULATION CAN BE PROPERLY INSTALLED AND PIPING CAN BE SECURED TO SUPPORTS.

3.2.5. ALL STOP VALVES SHALL BE INSTALLED ON THEIR SIDE, WITH THE HANDLE IN A HORIZONTAL PLANE WHEREVER POSSIBLE.

3.2.6. RELIEF VALVES SHALL BE USED AT VESSELS AND AT ANY OTHER LOCATION AS REQUIRED BY THE CODE. RATING SHALL BE AS REQUIRED FOR USE OF THE SYSTEM BEING PROTECTED.

3.2.6.1. SAFETY RELIEF VENTS SHALL BE POSITIONED, SUCH THAT DISCHARGE WILL NOT ENDANGER NEARBY PERSONNEL. VENT DISCHARGE SHALL BE EIGHT FEET ABOVE ROOF LINE WITH BIRD SCREEN OVER IT. BASE OF VENT LINE SHALL HAVE CONDENSATE DRAIN FITTED WITH ISOLATION VALVE.

3.2.7. PIPE REDUCERS, REDUCING TEES, REDUCING ELBOWS, ETC. ON SUCTION LINES SHALL BE ECCENTRIC TYPE WITH THE FLAT SIDE MOUNTED ON THE BOTTOM OF THE PIPING TO PREVENT LIQUID OR OIL FROM BEING TRAPPED.

3.2.8. FLANGES OR UNIONS SHALL BE INSTALLED AT ALL ITEMS OF EQUIPMENT TO FACILITATE DISMANTLING FOR REPAIR OR INSPECTIONS.

3.2.9. PIPING AND TUBING FOR GAUGES, CONTROLS, INSTRUMENTS AND OTHER EQUIPMENT INSTALLED ON ANY APPARATUS SHALL NOT BE COILED NOR EXCESSIVE IN LENGTH, BUT SHALL BE INSTALLED NEATLY, CAREFULLY BENT AT ALL CHANGES IN DIRECTION, SECURED IN PLACE AND PROPERLY FASTENED TO EQUIPMENT TO PREVENT SAGGING.

3.2.10. WHERE NONFERROUS ITEMS SUCH AS COILS OR HEAT EXCHANGERS ARE CONNECTED TO FERROUS PIPING SYSTEMS, SUCH AS GALVANIZED STEEL, BLACK STEEL OR WROUGHT IRON, ALL SUCH CONNECTIONS SHALL BE MADE USING DIELECTRIC UNIONS.

3.2.11. POCKETS AND UNNECESSARY TRAPS WILL NOT BE ALLOWED.

3.3. PIPE SLOPE

3.3.1. IN GENERAL, PITCH PIPING 1" IN 100' MINIMUM DOWN TOWARDS CARBON DIOXIDE STORAGE TANKS, UNLESS OTHERWISE INDICATED.

3.4. SLEEVES, FLASHINGS AND OPENINGS

3.4.1. PIPE SLEEVES AND OPENINGS SHALL BE PROVIDED WHERE PIPES, TUBING, VALVE OPERATOR STEMS, OR DUCT WORK PASS THROUGH FLOORS, ROOFS, WALLS, PARTITIONS, OR OTHER BUILDING ELEMENTS. ALL PENETRATIONS MUST BE SEALED TO MAINTAIN THE INTEGRITY OF THE INSULATION AND VAPOR BARRIER FOR THE BUILDING

3.4.2. SLEEVES AND OPENINGS SHALL BE LOCATED, AS NEARLY AS POSSIBLE, CONCENTRIC WITH THE CENTERLINE AXIS OF THE PENETRATING PIPE OR CONDUIT. CONCENTRICITY OF PIPE AND SLEEVE OR OPENING CENTERLINES SHALL NOT VARY MORE THAN ONE-SIXTH OF THE TOTAL CLEARANCE.

3.4.3. INDIVIDUAL PIPE SLEEVES THROUGH WALLS AND PARTITIONS: FOR INTERIOR PARTITIONS, SLEEVES FOR PIPES SHALL BE #20 GAUGE GALVANIZED IRON; FOR EXTERIOR WALLS, SLEEVES FOR PIPES SHALL BE GALVANIZED SCHEDULE 40 STEEL PIPE. SLEEVES SHALL BE 1” LARGER THAN THE PIPE PLUS THE THICKNESS OF INSULATION. THE LENGTH OF THE SLEEVE SHALL BE THE SAME AS THE WALL OR PARTITION THICKNESS.

NOTE: CORE DRILLING AND SAWING OF WALLS IS BY CONTRACTOR.

3.4.4. PIPES THROUGH ROOFS: THE CONTRACTOR SHALL LOCATE AND PROVIDE THE SIZE THROUGH THE ROOF DECK. THE CONTRACTOR WILL PROVIDE CUTTING, PATCHING, FLASHING AND METAL CAP.

3.4.5. ALL PIPE PENETRATING INSULATION PANELS IS TO BE PROPERLY INSULATED TO PREVENT FORMATION OF CONDENSATION ON THE WARM SIDE, WHERE LINES PASS THROUGH INSULATED PANELS, THE PANELS SHALL BE NEATLY CUT TO FIT AROUND THE PIPE, WITH OPENINGS FILLED TIGHTLY WITH INSULATION, OR CAULK.

3.5. HANGER AND SUPPORT INSTALLATION

3.5.1. FABRICATE AND INSTALL PIPING TO PROVIDE FOR AND CONTROL THE MOVEMENT DUE TO THERMAL EXPANSION AND/OR CONTRACTION.

3.5.2. GENERAL: COMPLY WITH MSS SP-69 AND SP-89. INSTALL HANGERS, SUPPORTS, CLAMPS, AND ATTACHMENTS AS REQUIRED TO PROPERLY SUPPORT PIPING FROM BUILDING STRUCTURE.

3.5.3. ARRANGE FOR GROUPING OR PARALLEL RUNS OF HORIZONTAL PIPING, SUPPORTED TOGETHER ON FILED, FABRICATED, HEAVY-DUTY TRAPEZE HANGERS WHERE POSSIBLE.

3.5.4. INSTALL SUPPORTS WITH MAXIMUM SPACING COMPLYING WITH MSS SP-69.

3.5.5. WHERE PIPES OF VARIOUS SIZES ARE SUPPORTED TOGETHER BY TRAPEZE HANGERS, SPACE THE HANGERS FOR SMALLEST PIPE SIZE OR INSTALL INTERMEDIATE SUPPORTS FOR SMALLER DIAMETER PIPES, AS SPECIFIED ABOVE, FOR INDIVIDUAL PIPE HANGERS.

3.5.6. INSTALL BUILDING ATTACHMENTS WITHIN CONCRETE OR TO STRUCTURAL STEEL. SPACE ATTACHMENTS WITHIN MAXIMUM PIPING SPAN LENGTH INDICATED IN MSS SP-69. INSTALL ADDITIONAL ATTACHMENTS AT CONCENTRATED LOADS, INCLUDING VALVES, FLANGES, GUIDES, STRAINERS, AND AT CHANGES IN DIRECTION OF PIPING.

3.5.7. INSTALL POWDER-ACTUATED DRIVE-PIN FASTENERS IN CONCRETE AFTER CONCRETE IS PLACED AND COMPLETELY CURED. USE OPERATORS THAT ARE LICENSED BY POWER-ACTUATED TOOL MANUFACTURER. INSTALL FASTENERS ACCORDING TO POWDER-ACTUATED TOOL MANUFACTURER'S OPERATING MANUAL. DO NOT USE IN LIGHTWEIGHT CONCRETE SLABS OR IN CONCRETE SLABS LESS THAN 4 INCHES THICK.

3.5.8. INSTALL MECHANICAL-ANCHOR FASTENERS IN CONCRETE AFTER CONCRETE IS PLACED AND COMPLETELY CURED. INSTALL ACCORDING TO FASTENER MANUFACTURER'S WRITTEN INSTRUCTIONS. DO NOT USE IN LIGHTWEIGHT CONCRETE SLABS OR IN CONCRETE SLABS LESS THAN 4 INCHES THICK.

3.5.9. INSTALL HANGERS AND SUPPORTS COMPLETE WITH NECESSARY INSERTS, BOLTS, RODS, NUTS, WASHERS, AND OTHER ACCESSORIES.

3.5.10. INSTALL HANGERS AND SUPPORTS TO ALLOW CONTROLLED MOVEMENT OF PIPING SYSTEMS.

3.5.11. LOAD DISTRIBUTION: INSTALL HANGERS AND SUPPORTS SO THAT PIPING LIVE AND DEAD LOADING AND STRESSES FROM MOVEMENT WILL NOT BE TRANSMITTED TO CONNECTED EQUIPMENT.

3.5.12. PIPE SLOPES: INSTALL HANGERS AND SUPPORTS TO PROVIDE INDICATED PIPE SLOPES AND SO THAT MAXIMUM PIPE DEFLECTIONS ALLOWED BY ASME B31.9 "BUILDING SERVICES PIPING" IS NOT EXCEEDED.

3.5.13. PROVIDE ROOF PIPE SUPPORTS AS REQUIRED.

3.5.14. ALL HANGER AND PIPE SUPPORT MATERIALS SHALL BE GALVANIZED.

ALL-THREAD ROD IS NOT PERMITTED.

3.5.15. DO NOT SUPPORT PIPING FROM OTHER PIPING. INDEPENDENTLY SUPPORT PIPING AT COILS, TANKS, EQUIPMENT, ETC. SO THAT ITS WEIGHT IS NOT SUPPORTED BY THE EQUIPMENT.

3.6. LABELING

3.6.1. ALL PIPING AND VALVES SHALL BE MARKED IN ACCORDANCE WITH REQUIRED CODE AND IIAR STANDARDS.

3.6.2. ALL CONTROL VALVES SHALL BE TAGGED WITH UNIQUE NUMBER CONSISTENT WITH THE FINAL DRAWINGS.

3.6.3. ALL ISOLATION VALVES REQUIRED TO ISOLATE EQUIPMENT OR SECTION OF REFRIGERANT SHALL BE TAGGED WITH NUMBERS CONSISTENT WITH THE FINAL DRAWINGS.

3.6.4. THE CONTRACTOR SHALL PROVIDE EQUIPMENT AND GENERAL SIGNAGE AS REQUIRED BY CODE.

3.7. PAINTING

3.7.1. ALL UNINSULATED , NON-GALVANIZED STEEL PIPE SHALL BE PREPARED AND PAINTED.

3.7.2. INSULATED STEEL PIPE SHALL BE PAINTED WITH ONE EPOXY PRIMER COAT PLUS ONE FINISH COAT OF THE BEST QUALITY, EPOXY PAINT BY SHERWIN WILLIAMS OR APPROVED EQUAL WITH REQUIRED COLOR CODE. ALL PAINT SHALL BE SUITABLE FOR USE IN USDA INSPECTED FACILITIES.

3.7.3. ALL COLORS SHALL BE APPROVED IN WRITING BEFORE WORK IS STARTED.

3.7.4. FOR INSULATED PIPE, PAINT SHALL BE COMPATIBLE WITH INSULATION AND ADHESIVES.

3.8. TESTING

3.8.1. THE CONTRACTOR WILL PROVIDE PRIOR NOTIFICATION OF THE SYSTEM PRESSURE TESTING TO THE OWNER. WHEN TESTING OF THE SYSTEM MAY INTERFERE WITH AN EXISTING PLANT OPERATION, SUCH WORK SHALL BE SCHEDULED WITH THE OWNER'S REPRESENTATIVE AND PLANT MANAGEMENT SO AS TO MINIMIZE DISRUPTION TO PLANT OPERATIONS.

3.8.1.1. CONTRACTOR WILL TAKE MEASURES TO PROTECT ALL PERSONNEL FROM POTENTIAL RUPTURE OF PIPING COMPONENTS DURING PNEUMATIC TEST OF PIPING.

3.8.1.2. TESTS SHALL BE MADE TO THE COMPLETE SATISFACTION OF THE OWNER'S REPRESENTATIVE AND THE AUTHORITIES HAVING JURISDICTION. DEFECTS DISCLOSED BY THE TEST SHALL BE REMEDIED AND THE TEST REPEATED AS OFTEN IS REQUIRED TO PROVE THE SYSTEM AND/OR EQUIPMENT TO BE IN THE PROPER AND SATISFACTORY OPERATING CONDITION.

3.8.1.3. PRESSURE TEST ALL REFRIGERATION PIPING FOR LEAKS IN ACCORDANCE WITH REQUIRED CODES AND THIS SPECIFICATION.

3.8.1.4. PRESSURE TEST ALL REFRIGERATION PIPING WITH NITROGEN AND PROVE TIGHT BY SWABBING ALL JOINTS AND CONNECTIONS WITH A SOAP SOLUTION OR OTHER EQUALLY EFFECTIVE MEANS.

3.8.1.5. PRESSURE TESTING WILL BE DONE WITH PRESSURE GAUGES INSTALLED SO THAT TEST PRESSURES MAY BE OBSERVED. ALL TESTING SHALL BE DONE IN THE PRESENCE OF THE OWNER'S REPRESENTATIVE.

3.8.1.6. REMOVE OR ISOLATE PRESSURE RELIEF VALVES AND GAUGES THAT MAY BE AFFECTED OR DAMAGED BY THE PRESSURE TEST

3.8.1.7. PNEUMATICALLY TEST ALL REFRIGERATION PIPING WITH DRY NITROGEN GAS AT THE FOLLOWING PRESSURES.

REFRIGERANT PIPING TEST PRESSURES

LOW SIDE	150% OF DESIGN PRESSURE
HIGH SIDE	150% OF DESIGN PRESSURE

THE PNEUMATIC TEST PRESSURE SHALL NOT EXCEED 130% OF THE DESIGN PRESSURE OF ANY COMPONENT IN THE SYSTEM.

FOR LARGE SYSTEMS NOT COMPLETELY VISIBLE TO TESTING OPERATOR REFER TO ANSI/ASME B31.5 SECTION 5384.2 D.

MAINTAIN EACH TEST PRESSURE FOR A MINIMUM OF ONE (1) HOUR OR AS DIRECTED BY OWNER'S REPRESENTATIVE. COMPLETE PRESSURE TEST FORM AND COPY TO OWNER'S REPRESENTATIVE.

3.8.1.8. REPLACE DEFECTIVE MATERIAL AND PROPERLY REPAIR LEAKS.

3.8.1.9. REPLACE AND RETURN TO SERVICE ANY PRESSURE RELIEF VALVES OR GAUGES THAT WERE REMOVED.

3.9. EVACUATION

3.9.1. REFRIGERATION SYSTEM

3.9.1.1. THE ENTIRE REFRIGERATION SYSTEM SHALL HAVE BEEN TESTED AND BE FREE OF ALL REFRIGERANT LEAKS BEFORE STARTING TO EVACUATE THE AIR FROM WITHIN THE SYSTEMS. ALL SUCH AIR SHALL BE REMOVED BEFORE THE SYSTEM IS READY TO BE CHARGED WITH REFRIGERANT.

3.9.1.2. EVACUATION PROCEDURES:

1. CONNECT SUCTION SIDE OF VACUUM PUMP TO THE LOW AND HIGH SIDE OF THE NEW REFRIGERATION WORK, WITH AN SHUT-OFF VALVE BETWEEN THE PUMP AND REFRIGERATION SYSTEMS.
2. MANUALLY OPEN ALL SOLENOID, BACK PRESSURE, AND CHECK VALVES.
3. WHEN 26 INCHES OF VACUUM IS OBTAINED, SHUT OFF THE VALVE BETWEEN THE SYSTEM AND THE PUMP.

3.9.2. UPON SUCCESSFUL COMPLETION OF TESTING, NOTIFY THE OWNER'S REPRESENTATIVE THAT:

3.9.2.1. THE APPLICATION OF INSULATION MAY COMMENCE.

3.9.2.2. THE SYSTEM IS READY FOR THE REFRIGERANT CHARGE.

NOTE: REFER TO SYSTEM DESIGN SPECIFICATION FOR PIPE EVACUATION, CHARGING AND SUBSEQUENT WORK.

4. REPORT FORM(S)

4.1. REFRIGERANT PIPING TEST REPORT. THE CONSTRUCTION MANAGER SHALL PROVIDE PIPING TEST RECORD REPORT TO BE COMPLETED BY CONTRACTOR.

*****END SECTION 19852*****

REFRIGERANT PIPING TEST REPORT

INSTRUCTIONS TO CONTRACTOR (INDICATE TYPE) ❑ PRESSURE TEST ❑ VACUUM TEST FORWARD ORIGINAL TO OWNER MAINTAIN 1 COPY ON FILE

CONTRACTOR NAME: _____ CONTRACTOR PHONE: _____

SYSTEM TESTED: _____ AREA OR BUILDING: _____

HOW TESTED ❑ PNEUMATIC AIR ❑ PNEUMATIC NITROGEN ❑ VACUUM

EXCEPTIONS MADE TO SPECIFICATIONS:

_____

_____

REASONS FOR EXCEPTIONS:

_____

_____

APPROVED BY: _____ DATE: _____

SECTION TESTED	PRESSURE PSIG		PERIOD DATE/TIME		CONDUCTED BY FOREMAN ENGINEER PRINT & SIGN NAME	INSPECTION: BY OWNER REPRESENTATIVE PRINT AND SIGN NAME
	START	END	FROM	TO		

LIST ALL AUXILIARY EQUIPMENT (PUMPS, GAGES, ETC.) INCLUDING SERIAL NUMBERS AND CALIBRATION DATES USED IN EACH TEST.

_____

_____

1.1.8 THE SYSTEM SHALL BE DESIGNED TO OPERATE SAFELY AND BE EASILY MAINTAINABLE. ONLY THE HIGHEST QUALITY COMPONENTS SHALL BE UTILIZED. IT IS DESIRABLE THAT THE SYSTEM BE DESIGNED WHERE PRACTICAL TO MINIMIZE THE QUANTITY OF SPARE PARTS REQUIRED.

1.1.9 THE CONTRACTOR CAN PROVIDE ALTERNATE BID FOR AN ARRANGEMENT OF EQUIPMENT OTHER THAN AS DETAILED IN THIS SPECIFICATION PROVIDED THE PROPOSED SYSTEM PRODUCES THE REQUIRED REFRIGERATING EFFECT AND DELIVERS THE OPERATING FEATURES REQUIRED. THE CONTRACTOR MUST PROVIDE A DETAILED COMMENTARY IN THE PROPOSAL AS TO THE BENEFITS OF THIS SYSTEM FROM AN INSTALLED/OPERATING COST, REDUNDANCY AND MAINTAINABILITY STANDPOINT. A SIMPLIFIED PROCESS FLOW DIAGRAM SHALL BE SUBMITTED WITH ALL SYSTEM CONFIGURATIONS.

1.1.10 THE REFRIGERATION RACK SYSTEMS SHALL BE DESIGNED TO OPERATE AUTOMATICALLY 24 HOURS/DAY, 7 DAYS/WK WITH ONLY REMOTE MONITORING.

1.2 APPLICABLE SPECIFICATIONS

THE REFRIGERATION DESIGN BUILD SYSTEM SHALL BE IN ACCORDANCE WITH THE FOLLOWING SPECIFICATIONS;

DRAWING	DESCRIPTION
R10.20	19852 REFRIGERATION SYSTEM PIPING SPECIFICATION

1.3 CODES AND STANDARDS

THE REFRIGERATION SYSTEM INSTALLATION, EQUIPMENT AND MATERIALS SHALL COMPLY WITH THE LATEST STANDARDS, ORDERS, SPECIFICATIONS AND REGULATIONS AS OUTLINED BY THOSE SHOWN ON REFRIGERATION COVER SHEET DRAWING R0.00.

1.4 CONFLICTING REQUIREMENTS

ALL CONFLICTS BETWEEN THE REQUIREMENTS OF THIS SPECIFICATION, PURCHASE ORDER, AND STANDARDS, SHALL BE REFERRED TO THE PROJECT MANAGER FOR CLARIFICATION BEFORE PROCEEDING WITH THE MANUFACTURE OF THE EQUIPMENT.

1.5. BUILDING CONSTRUCTION/PROCESS DETAILS

THE NEW REFRIGERATION RACK SYSTEM PACKAGES WITH WEATHER PROOF ENCLOSURES WILL BE INSTALLED ON THE STRUCTURAL STEEL PLATFORMS PROVIDED BY GENERAL CONTRACTOR.

THE CONTRACTOR SHALL SUPPLY ALL SECONDARY SUPPORT STEEL REQUIRED TO COMPETE INSTALLATION OF THE REFRIGERATION SYSTEM, FOR EXAMPLE EVAPORATORS, PIPING SUPPORTS ETC.

2. SCOPE OF REFRIGERATION SYSTEM EQUIPMENT AND LOADS

THE CONTRACTOR IS RESPONSIBLE FOR DESIGNING, INSTALLING OWNERS PREPURCHASED EQUIPMENT AND SUPPLYING COMPONENTS AS REQUIRED TO COMPLETE SYSTEM DESIGN PER THE REFRIGERATION EQUIPMENT AS OUTLINED BELOW AND ON THE DRAWINGS AND AS DETAILED IN THE ENCLOSED SPECIFICATIONS. ALL COMPONENTS SHALL BE NEW.

1.5.1. HOT PRODUCT, P108 (+34°F)
THE HOT PRODUCT ROOM IS APPROXIMATELY 140 SQ FT, WITH OVERALL LENGTH OF 10FT, WIDTH 14FT ADJACENT TO CURING COOLER, SMOKE HOUSE AND EXTERIOR WALLS. THE WALLS ARE 6" IMP. THE ROOM HAS A 6" IMP CEILING 12FT AFF TO THE CEILING. THE ROOM HAS ONE (1) MAN DOOR.

1.5.2. CURING COOLER, P106 (+34°F)

THE CURING COOLER IS APPROXIMATELY 140 SQ FT, WITH OVERALL LENGTH OF 10FT, WIDTH OF 14FT ADJACENT TO HOT PRODUCT ROOM, SMOKE HOUSE, BREAKING AND FABRICATION ROOM, AND EXTERIOR WALL. THE WALLS ARE 6" IMP/ THE ROOM HAS A 6" IMP CEILING 12FT AFF TO THE CEILING. THE ROOM HAS ONE (1) MAN DOOR.

1.5.3. PACKAGING ROOM, P109 (+45°F)

THE PACKAGING ROOM IS APPROXIMATELY 340 SQ FT, WITH OVERALL LENGTH OF 20 FT, WIDTH OF 17FT ADJACENT TO SMOKEHOUSE, CHILLED BOXED COOLER, RETAIL STORE, AND EXTERIOR WALL. THE WALLS ARE 6" IMP. THE ROOM HAS 6" IMP CEILING 12FT AFF TO CEILING. THE ROOM HAS ONE (1) SET FO DOUBLE MAN DOORS.

1.5.4. CHILLED BOXED COOLER, S105 (+28°F)

THE CHILLED BOXED COOLER IS APPROXIMATELY 250 SQ FT WITH OVERALL LENGTH OF 11 FT, WIDTH OF 23 FT. ADJACENT TO PACKAGING ROOM, RETAIL STOOR, MEETING ROOM, AND PLANT CORRIDOR. THE WALLS ARE 6" IMP. THE ROOM HAS 6" IMP CEILING 16 FT AFF TO CEILING. THE ROOM HAS ONE (1) SLIDING DOOR AND ONE (1) MAN DOOR.

1.5.5. SALES COOLER, S103 (+34°F)

THE SALES COOLER IS APPROXIMATELY 1000 SQ FT WITH OVERALL LENGTH OF 36 FT AND WIDTH OF 28 FT. ADJACENT TO CHILL COOLER, KILL FLOOR (HIDE ON), BREAKING AND FABRICATION ROOM, AND EXTERIOR WALL. THE WALLS ARE 6" IMP. THE ROOM HAS 6" IMP CEILING 20 FT AFF TO CEILING. THE ROOM HAS TWO (2) SLIDING DOORS.

1.5.6. CHILL COOLER, S102 (+34°F)

THE CHILL COOLER IS APPROXIMATELY 400 SQ FT WITH OVERALL LENGTH OF 36 FT AND WIDTH OF 11 FT. ADJACENT TO SALES COOLER, KILL FLOOR (HIDE ON), KILL FLOOR CLEANING, FROZEN BOXED FREEZER, AND INGREDIENT STORAGE. THE WALLS ARE 6" IMP. THE ROOM HAS 6" IMP CEILING 20 FT AFF TO CEILING. THE ROOM HAS TWO (2) SLIDING DOORS.

1.5.7. FROZEN BOXED FREEZER, S107 (-20°F)

THE FROZEN BOXED FREEZER IS APPROXIAMTELY 350 SQ FT WITH OVERALL LENGTH OF 31 FT AND WIDTH OF 12 FT. ADJACENT TO PLANT CORRIDOR, INGREDIENT STORAGE, WOMENS BATHROOM, CHILL COOLER, KILL FLOOR CLEANING, AND CHEMICAL STORAGE. THE WALLS ARE 6" IMP. THE ROOM HAS 6" IMP CEILING 16FT AFF TO CEILING. THE ROOM HAS ONE (1) SLIDING DOOR.

1.5.8. INEDIBLES/HIDES DOCK, S100 (+45°F)

THE INEDIBLES/HIDES DOCK IS APPROXIMATELY 680 SQ FT WITH OVERALL LENGTH OF 47 FT AND WIDTH OF 15 FT. ADJACENT TO KILL FLOOR CLEANING, UTILITY ROOM, AND EXTERIOR WALLS. THE WALLS ARE 4" IMP. THE ROOM HAS 4" IMP CEILING 16 FT AFF TO CEILING. THE ROOM HAS TWO (2) SLIDING DOORS, ONE (1) MAN DOOR, AND ONE (1) DOCK

2.2 REFRIGERATION LOAD SUMMARY

THE FOLLOWING TABLE PROVIDES AN INITIAL ESTIMATE OF THE REFRIGERATION LOADS FOR THE SYSTEM. THE CONTRACTOR SHALL REVIEW THE PRODUCT SUMMARY PROVIDED AND CONFIRM ALL PRODUCT LOADS AND PROVIDE A NEW LOAD SUMMARY WITH THE PROPOSAL.

REFRIGERATION LOAD SUMMARY			
ROOM DESIGNATIONS	SPACE/PROCESS TEMPERATURE	COOLNG LOAD	COMMENTS
HOT PRODUCT (P108)	+34ºF	2.3 TR	
CURING COOLER (P106)	+36ºF	6 TR	
PACKAGING ROOM (P109)	+45ºF	6 TR	
CHILLED BOXED COOLER (S105)	28ºF	2 TR	
SALES COOLER (S103)	+34ºF	3 TR	STAINLESS STEEL EVAPORATOR CASING
CHILL COOLER (S102)	+34ºF	16 TR	STAINLESS STEEL EVAPORATOR CASING
FROZEN BOXED FREEZER (S107)	-20ºF	18 TR	
INEDIBLES-HIDES DOCK (S100)	+45ºF	8 TR	

3. SCOPE OF REFRIGERATION RACK SYSTEM EQUIPMENT

THE CONTRACTOR IS RESPONSIBLE FOR DESIGNING, PURCHASING AND INSTALLING THE REFRIGERATION EQUIPMENT AS OUTLINED BELOW AND ON THE DRAWINGS AND AS DETAILED IN THE ENCLOSED SPECIFICATIONS. ALL COMPONENTS SHALL BE NEW.

3.1 REFRIGERATION PACKAGE

3.1.1 THESE SHALL COMPRISE OF A COMPRESSOR / CONDENSER PACKAGE WITH WEATHER PROOF ENCLOSURE, FACTORY COMPLETED PIPING AND WIRING.

3.1.2 AS SHORT OVERVIEW EACH PACKAGE SHALL COMPRISE

- PAINTED STRUCTURAL STEEL BASE FRAME WITH GALVANIZED DRIP PANS
- GALVANISED METAL PANEL FOR WALLS AND ROOF WITH ACOUSTIC INSULATION
- ENCLOSURE SHALL BE FITTED WITH INTERNAL LIGHTS.
- SEMI HERMETIC COMPRESSOR(S) MOUNTED ON ISOLATION PADS
- LIQUID SUBCOOLER
- LIQUID RECEIVER
- REFRIGERANT FILTER DRYERS
- CONTROL PANEL WITH STARTERS FOR COMPRESSORS, FAN MOTORS

3.1.3 THE CONTRACTOR SHALL SELECT COMPRESSORS ON “N+1” STRATEGY SUCH THAT IN EVENT OF ONE COMPRESSOR FAILURE THE SPACE DESIGN COOLING LOADS CAN STILL BE MAINTAINED.

3.1.4 COMPRESSORS CAN BE HERMETIC, SEMI HERMETIC RECIPROCAL OR SCREW COMPRESSORS.

~~3.1.5 THE COMPRESSOR RACK AND RACK ENCLOSURE SHALL BE SIZED SUCH THAT IN THE FUTURE IF OWNERS COMPLETES THE FUTURE BUILDING EXPANSIONS THEY ONLY HAVE TO PURCHASE AND INSTALL ADDITIONAL COMPRESSORS FOR RACK TO COMPLETE THE FULL BUILD OUT.~~

3.1.6 COMPRESSOR CONFIGURATION CAN BE DETERMINED BY CONTRACTOR BASED ON COMPRESSOR VENDOR CAPACITY.

3.1.7 THE CONDENSER CAPACITY SHALL BE RATED AT CONDENSING PRESSURE OF 95DF ON ASHRAE 0.4% DESIGN DAY WETBULB AT PROJECT SITE.

~~3.1.8 THE EVAPORATIVE CONDENSER WILL HAVE A VFD DEDICATED TO EACH FAN MOTOR AND ALL MOTOR/HEATER STARTERS, CONTROLS SHALL BE LOCATED WITH MAIN CONTROL PANEL.~~

3.1.9 THE EVAPORATIVE CONDENSER WILL BE CONTROLLED FROM THE REFRIGERATION CONTROL PANEL.

3.2 EVAPORATOR COILS (AU1-22)

3.2.1 THE CONTRACTOR SHALL PURCHASE AND INSTALL EVAPORATOR UNITS PER THE FOLLOWING SPECIFICATIONS AND SCHEDULE.

3.2.1.1 FAN SECTIONS SHALL HAVE DEEP SPUN ORIFICES FOR EFFICIENT FAN OPERATIONS. FAN SELECTION SHALL BE COMPARTMENTED.

3.2.1.2 MOTOR SHALL BE PREMIUM EFFICIENCY TEFC 460 VAC/3PH/60HZ 870 OR 1140RPM. EACH MOTOR BE WIRED TO PANEL MOUNTED ON EVAPORATOR WITH COMMON DISCONNECT.

3.2.1.3 DIRECT DRIVE AXIAL PROPELLER FANS SHALL BE OF CAST ALUMINUM OR STAMPED STEEL CONSTRUCTION. FAN GUARDS SHALL BE FACTORY MOUNTED AND MEET OSHA STANDARDS.

3.2.1.4 THE COOLING COIL SHALL BE COMPLIANT WITH ASME B31.5.

3.2.1.5 THE COIL/FIN MATERIAL SHALL BE COPPER WITH ALUMINUM FINS IN THE ROOMS OR SS WITH ALUMINUM FINS AS DETAILED IN EVAPORATOR SCHEDULE. THE EVAPORATOR HOUSING SHALL BE MADE OF HEAVY GAUGE RUST-PROOF GALVANIZED STEEL.

3.2.1.6 ALL OF THE EVAPORATORS OPERATING AT OR ABOVE 36°F SHALL BE DESIGNED FOR AIR DEFROST OF THE COIL AND PAN.

3.2.1.7 EVAPORATORS OPERATING BELOW 36°F SHALL BE DESIGNED FOR ELECTRIC DEFROST OF THE COIL AND PAN.

3.2.1.8 THE MANUFACTURER SHALL PROVIDE A ONE YEAR PARTS WARRANTY ON THE EVAPORATORS.

3.3 REFRIGERANT DETECTION SYSTEM

3.3.1 CONTRACTOR TO PROVIDE FINAL CHARGE CALCULATION WITH CONSTRUCTION RELEASE SET OF DRAWINGS FOR OWNER.

3.3.2 THE CONTRACTOR SHALL SUPPLY AND INSTALL THIRTEEN HONEYWELL IR F9 REFRIGERANT DETECTORS CONFIGURED FOR R507 WORKING RANGE 0-2000 PPM AT LOCATIONS SHOWN IN THE DRAWINGS.

3.3.3 THE DETECTORS SHALL BE WIRED BACK TO CONTROL PANEL CONTROLLING THE SPACE EVAPORATORS.

3.3.4 THE STATUS OF EACH DETECTOR SHALL DISPLAYED ON SPECIFIC SCREEN PC FOR LOCAL/REMOTE MONITORING. THIS INFORMATION WOULD ACCESSED THROUGH ETHERNET CONNECTION TO EACH CONTROLLER.

3.4 REFRIGERATION CONTROL SYSTEM

3.4.1 THE CONTRACTOR SHALL SUPPLY ALL INSTRUMENTATION, ELECTRICAL DEVICES AND CONTROLLER REQUIRED TO PROVIDE A FULL FUNCTIONAL CONTROL SYSTEM AS OUTLINED IN THESE SPECIFICATIONS AND BY APPLICABLE CODES AND STANDARDS. THIS SYSTEM WILL CONTROL THE COMPRESSOR / CONDENSER UNITS AND RESPOND TO THE LOADS FROM THE PLANT. THE CONTRACTOR SHALL COMPLETE THE INSTALLATION AND WIRING OF THESE COMPONENTS.

3.4.2 THE CONTRACTOR SHALL SUPPLY AND INSTALL ROOM TEMPERATURE PROBES AS INDICATED IN DRAWINGS.

3.4.3 THE CONTRACTOR SHALL PURCHASE THE SYSTEMS AS FACTORY ASSEMBLED COMPLETE PACKAGES INCLUSIVE PIPING, WIRING AND CONTROLS. WITHIN THIS ENCLOSURE THERE SHALL BE A REFRIGERATION CONTROL PANEL COMPRISING

- SCREEN FOR LOCAL OPERATER AND AUTO/OFF/MANUAL SWITCHES FOR ALL EVAPORATOR, CONDENSER AND ANCILLARIES
- STARTERS FOR ALL MOTORS FOR EXAMPLE; COMPRESSORS, CONDENSER FANS, EVAPORATOR FAN MOTORS.

3.4.4 THE OWNER'S ELECTRICAL CONTRACTOR WILL SUPPLY THE POWER WIRING TO SINGLE TERMINATION ON REFRIGERATION CONTROL PANEL AND THE CONTRACTOR SHALL COMPLETE ALL THE ELECTRICAL POWER AND CONTROL CABLING FROM THIS POINT OUT TO SYSTEM.

3.4.5 THE CONTRACTOR WILL INTEGRATE REFRIGERATION CONTROL SYSTEMS WITH HVAC DDC CONTROLS. SEE HVAC CONTROLS SPECIFICATION FOR DETAILS.

3.5 MISCELLANEOUS

THE CONTRACTOR IS ALSO RESPONSIBLE FOR:

3.3.1. VALVES, PIPE, FITTINGS AND ALL OTHER MISCELLANEOUS ITEMS AS REQUIRED FOR THE INSTALLATION OF THE ABOVE EQUIPMENT.

3.3.2. INSULATION, SUPPORTS, LABELS, AND VALVE TAGGING

3.3.3. DRAIN PIPING FROM HANGING EVAPORATORS TO FLOOR HUB DRAINS.

~~3.3.4. WATER PIPING FROM CONNECTION IN MECHANICAL ROOMS BENEATH THE PACKAGES.~~

~~3.3.5. SUPPLY AND INSTALLATION OF THE EVAPORATIVE CONDENSER WATER TREATMENT SYSTEM.~~

3.3.6. PROVIDING COMMISSIONING BY MANUFACTURER, START-UP AND OPERATOR TRAINING.

3.3.7. PROVIDE INFORMATION NEEDED FOR PSM/RMP DOCUMENTATION, IF REQUIRED.

4. SCOPE OF WORK

THE CONTRACTOR IS RESPONSIBLE FOR THE SCOPE OF WORK AS NEEDED TO DESIGN, PROCURE AND INSTALL EQUIPMENT AND COMPONENTS AND TO BRING THE NEW REFRIGERATION EQUIPMENT AND SYSTEM INTO COMPLETE OPERATION. THE INTENT OF THIS SCOPE MUST BE ACCOMPLISHED IN ACCORDANCE WITH THE SPECIFICATIONS, THE DRAWINGS AND THE WORKING EXPERIENCE OF THE REFRIGERATION CONTRACTOR.

THE FOLLOWING INFORMATION DESCRIBES THE GENERAL METHODS AND BASIC DESIGN DATA TO BE USED BY THE REFRIGERATION CONTRACTOR TO DESIGN, CONSTRUCT AND START UP THE REFRIGERATION SYSTEM FOR THE FACILITY RENOVATIONS AND NEW EQUIPMENT INSTALLATIONS.

THE SCOPE OF WORK INCLUDES BUT IS NOT NECESSARILY LIMITED TO THE FOLLOWING NARRATIVE SPECIFICATION SECTIONS.

4.1. PROJECT MANAGEMENT

4.1.1. THE CONTRACTOR'S PROJECT MANAGEMENT SERVICES WILL INCLUDE, BUT NOT BE LIMITED TO THE FOLLOWING:

4.1.1.1. PROVIDE A QUALIFIED PROJECT MANAGER SERVING AS SINGLE POINT OF CONTACT WITH THE OWNER AND PROJECT MANAGER.

4.1.1.2. PLANNING AND SCHEDULING.

4.1.1.3. PREPARATION OF PAYMENT APPLICATIONS AND CHANGE ORDER REQUESTS.

4.1.1.4. OBTAINING WRITTEN APPROVALS FROM OWNER'S REPRESENTATIVE WHEN DEPARTURES FROM DRAWING OR SPECIFICATION ARE REQUIRED BEFORE PROCUREMENT AND/OR INSTALLATION.

4.1.1.5. LISTING AND PRE-QUALIFICATION OF SUBCONTRACTORS.

4.1.1.6. ORDERING, RECEIVING AND STORAGE OF EQUIPMENT AND COMPONENTS.

4.1.1.7. INSTALLATION SUPERVISION.

4.1.1.8. QUALITY CONTROL (DURING INSTALLATION).

4.1.1.9. ISSUING OF SHOP DRAWINGS AND SUBMITTALS.

4.1.1.10. TESTING AND INSPECTION COORDINATION.

4.1.1.11. ASSEMBLY OF OPERATING, INSTALLATION AND MAINTENANCE MANUALS.

4.1.1.12. ASSEMBLY OF WARRANTY AND GUARANTEE DOCUMENTS.

4.1.1.13. SECURING OF LIEN RELEASES FROM ALL PARTIES.

4.1.1.14. RECORD DRAWINGS.

4.1.1.15. ENGINEERING COORDINATION MEETINGS TO BE HELD AT APPROPRIATE FREQUENCY OR UPON REQUEST TO REVIEW, DESIGN, SCHEDULE, LAYOUT, PIPE ROUTING, PIPE ELEVATIONS, ELECTRICAL AND CONTROLS DETAILS. THESE SHALL BE HELD AT THE SHEETZ FACILITY IN BURLINGTON, NORTH CAROLINA. THE CONTRACTOR SHALL INCLUDE ALL TRAVEL EXPENSES FOR THE PROJECT MANAGER AND DISCIPLINE ENGINEERS (AS REQUIRED) TO ATTEND THE MEETINGS.

4.1.1.16. COORDINATION WITH SUBCONTRACTORS ENGAGED IN BUILDING CONSTRUCTION AND THE PROCESS INSTALLATION.

4.2. ENGINEERING

4.2.1. THE REFRIGERATION CONTRACTOR'S ENGINEERING SERVICES WILL INCLUDE, BUT NOT BE LIMITED TO THE FOLLOWING:

4.2.1.1. PERFORM FINAL LOAD CALCULATION.

4.2.1.2. LINE SIZING AND VALVE SELECTION.

4.2.1.3. FINAL REFRIGERATION LOAD CALCULATIONS

4.2.1.3.1. PRESSURE RELIEF VALVE AND VENT LINE SIZING.

4.2.1.3.2. SUMMARY OF SHIPPING AND OPERATING WEIGHTS OF ALL MAJOR PIECES OF EQUIPMENT.

4.2.1.3.3. THERMAL EXPANSION

4.2.1.3.4. STRUCTURAL ENGINEERING AS APPLICABLE (SEE SECTION "STRUCTURAL REQUIREMENTS"). STRUCTURAL ENGINEERING CALCULATION AND DRAWINGS SHALL BE COMPLETED AND WET-STAMPED BY A PROFESSIONAL ENGINEER IN CIVIL OR STRUCTURAL ENGINEERING REGISTERED IN NORTH CAROLINA.

4.2.1.3.5. GENERATION OF DRAWINGS FOR OWNER REVIEW. THE DRAWINGS SHALL INCLUDE, AT A MINIMUM. THREE (3) COPIES OF ALL DRAWINGS AND SUBMITTAL DOCUMENTS SHALL BE PROVIDED:

4.2.1.3.5.1. PROJECT DRAWING SIZE: D.

4.2.1.3.5.2. PLAN VIEW, ELEVATION OF THE NEW INSTALLATION, DETAILS OF EQUIPMENT FINAL CONNECTION AND ISOMETRICS SHALL BE PROVIDED WHERE INSTALLATION REQUIREMENTS CANNOT BE ADEQUATELY CONVEYED USING PLANS AND SECTIONS.

4.2.1.3.5.3. P&ID - THE P&IDS SHALL INCLUDE INFORMATION SUCH AS MATERIALS OF CONSTRUCTION (I.E. PIPE SPECIFICATIONS), EQUIPMENT INFORMATION (I.E. CAPACITY, NATIONAL BOARD NUMBER, SERIAL NUMBER, ETC.) AND INSTRUMENTATION.

4.2.1.3.5.4. SET OF COLORED CODED P&ID'S WITH COLOR CODES TO MATCH ACTUAL PIPE COLOR

CODING IN THE FIELD. ALL COLOR CODING SHALL BE PER THE OWNER'S CODING CHART PROVIDED WITH THE BID PACKAGE.

4.2.1.3.5.5. CONTROL PANEL LAYOUT DRAWINGS DETAILING INDIVIDUAL COMPONENTS COMPLETE WITH BILLS OF MATERIALS. I/O CARD WIRING.

4.2.1.3.5.6. ELECTRICAL POINT-TO-POINT EXTERNAL CONNECTION DRAWING DETAILING ALL EXTERNAL CONNECTION REQUIREMENTS FOR POWER AND CONTROLS, WIRE QUANTITIES AND TYPES INCLUDING TERMINAL NUMBERS.

4.2.1.3.5.7. CABLE AND RACEWAY SCHEDULES FOR ALL ELECTRICAL COMPONENTS WIRED TO THE REFRIGERATION CONTROL SYSTEM.

4.2.1.3.5.8. ELECTRICAL LOCATOR - PLAN VIEW. DETAILING POWER AND CONTROL DEVICE AND CONTROL PANEL LOCATIONS.

4.2.1.3.5.9. EACH FIELD-INSTALLED VALVE MUST BE IDENTIFIED ON THE DRAWINGS BY LOCATION, MANUFACTURER AND MODEL NUMBER.

4.2.1.3.5.10. MISCELLANEOUS DETAILS AS APPLICABLE - EMERGENCY CONTROL BOX, PIPE SUPPORTS, ETC.

4.2.1.3.5.11. MANUFACTURER DRAWINGS MUST BE REFERENCED ON THE REFRIGERATION DRAWINGS. THE MANUFACTURER DRAWING AND SUPPORT DOCUMENTATION MUST IDENTIFY VALVES BY LOCATION, MANUFACTURER AND MODEL NUMBER. THE MANUFACTURER MUST IDENTIFY PIPE AND TUBING SPECIFICATIONS FOR THE MANUFACTURED COMPONENT.

4.2.1.3.6. GENERATION OF DRAWINGS FOR SUBMISSION TO THE LOCAL BUILDING DEPARTMENT, IF REQUIRED. THE REFRIGERATION DRAWINGS SHALL BE WET-STAMPED BY A PROFESSIONAL ENGINEER IN MECHANICAL ENGINEERING REGISTERED IN NORTH CAROLINA.

4.2.1.3.7. GENERATION OF CONSTRUCTION DRAWINGS.

4.2.1.3.8. GENERATION OF FINAL AS-BUILT DRAWINGS.

4.2.1.3.9. DEVELOPMENT OF VALVE TAGGING AND LABELING INFORMATION FOR NEW EQUIPMENT, PIPING AND VALVES.

4.2.1.3.10. DEVELOPMENT OF OPERATING PROCEDURES FOR NEW EQUIPMENT AND SYSTEM AS A WHOLE.

4.2.1.3.11. DEVELOPMENT OF OPERATIONS AND MAINTENANCE MANUALS.

4.2.1.3.12. SUPPORT DURING COMMISSIONING AND START-UP.

4.2.1.3.13. THE CONTRACTOR SHALL SPECIFY ALL AUXILIARY EQUIPMENT.

4.2.2. LABOR/PRINTING OF MATERIALS FOR ABOVE ITEMS.

4.2.3. LABELING OF NEW PIPING

4.2.4. TAGGING OF NEW VALVES

4.3. STRUCTURAL REQUIREMENTS

4.3.1. THE REFRIGERATION CONTRACTOR'S SERVICES RELATED TO STRUCTURAL REQUIREMENTS WILL INCLUDE, BUT NOT BE LIMITED TO THE FOLLOWING:

4.3.1.1. REFER TO LOCAL CODES FOR ANY SEISMIC REQUIREMENTS FOR ATTACHMENT OF EQUIPEMENT TO PLATFORMS.

4.3.1.2. EVAPORATOR SUPPORT. THE PRIMARY STEEL (COLUMNS, ETC.) WILL BE ENGINEERED AND INSTALLED BY OTHERS. THE REFRIGERATION CONTRACTOR WILL BE RESPONSIBLE FOR ENGINEERING HORIZONTAL SUPPORT STEEL TO TIE INTO COLUMNS AS WELL AS ALL ACCESS PLATFORMS. THE CONTRACTOR SHALL PROVIDE COORDINATION INFORMATION TO VERIFY THE ADEQUACY OF THE PRIMARY STRUCTURE THAT IS BEING PROVIDED BY THE OWNER.

4.3.1.3. PIPE AND VALVE SUPPORTS. THE REFRIGERATION CONTRACTOR WILL BE RESPONSIBLE FOR MATERIALS AND LABOR TO INSTALL, SECURE AND BRACE THE SUPPORTS

4.3.1.4. COMPRESSORS, VESSELS, AUTOPURGER, MISCELLANEOUS. THE REFRIGERATION CONTRACTOR WILL BE RESPONSIBLE FOR MATERIALS AND LABOR TO SECURE COMPONENTS TO THE RESPECTIVE FOUNDATION OR WALL, AS INDICATED ON THE DRAWINGS. FOUNDATIONS ARE DESIGNED AND PROVIDED BY THE OWNER. THE CONTRACTOR SHALL PROVIDE ANY SPECIFIC FOUNDATION OR PAD DETAILS FOR THEIR EQUIPMENT IF REQUIRED.

4.3.1.5. THE CONTRACTOR SHALL CLEARLY IDENTIFY ANY STRUCTURAL STEEL THAT IS NOT INCLUDED IN THE PROPOSAL. ALL LOAD INFORMATION SHALL BE INCLUDEDPIPE AND VALVE SUPPORTS. THE REFRIGERATION CONTRACTOR WILL BE RESPONSIBLE FOR MATERIALS AND LABOR TO INSTALL, SECURE AND BRACE THE SUPPORTS.

4.4. ARCHITECTURAL REQUIREMENTS

4.4.1. THE REFRIGERATION CONTRACTOR'S SERVICES RELATED TO ARCHITECTURAL REQUIREMENTS WILL INCLUDE, BUT NOT BE LIMITED TO THE FOLLOWING:

4.4.1.1. ROOF PENETRATIONS. THE CONTRACTOR WILL BE ONLY RESPONSIBLE FOR CUTTING REQUIRED ROOF PENETRATIONS ONCE COORDINATED WITH PROJECT MANAGER. THE ROOFING

CONTRACTOR WILL COMPLETE THE REMEDIATION TO MAINTAIN ROOF WARRANTY

4.4.1.2. WALL PENETRATIONS. THE REFRIGERATION CONTRACTOR WILL BE RESPONSIBLE FOR CUTTING AND SEALING WALL PENETRATIONS, IF REQUIRED. THE REFRIGERATION CONTRACTOR MUST PROVIDE A SHOP DRAWING, WHICH DETAILS SEALING MATERIALS AND METHOD, TO THE PROJECT MANAGER FOR APPROVAL BEFORE STARTING WORK.

~~4.5. WATER TREATMENT~~

~~4.5.1. THE REFRIGERATION CONTRACTOR'S SERVICES RELATED TO THE WATER TREATMENT SYSTEM FOR THE EVAPORATIVE CONDENSER WILL INCLUDE THE FOLLOWING:~~

~~4.5.1.1. AT EACH EVAPORATIVE CONDENSER THE CONTRACTOR SHALL INSTALL THE OWNERS SUPPLIED CHEMICAL TREATMENT PANEL, PUMPS, CHEMICAL DRUMS THEN COMPLETE STAINLESS STEEL PIPING TO EVAPORATIVE CONDENSER AND POLY TUBE FROM DRUMS TO PIPING INJECTION POINT.~~

~~4.5.1.2. OWNER'S CHEMICAL CONTRACTOR (TBD) WILL COMPLETE THE CHEMICAL FILLING AND COMMISSIONING OF SYSTEM.~~

4.6. RIGGING REQUIREMENTS

4.6.1. THE FOLLOWING IS INCLUDED IN THE REFRIGERATION CONTRACTOR'S SCOPE OF WORK:

4.6.1.1. EQUIPMENT RIGGING: THE REFRIGERATION CONTRACTOR WILL BE RESPONSIBLE TO PROVIDE RIGGING EQUIPMENT AS NEEDED TO SET EQUIPMENT IN PLACE AND SECURE.

4.6.1.2. INSTALLATION RIGGING: THE REFRIGERATION CONTRACTOR WILL BE RESPONSIBLE TO PROVIDE ALL LIFTS, PLATFORMS AND OTHER REQUIRED METHODS TO ENABLE CONTRACTOR EMPLOYEES TO SAFELY INSTALL EQUIPMENT, PIPING AND ASSOCIATED COMPONENTS.

4.7. INSULATION REQUIREMENTS

4.7.1. THE FOLLOWING IS INCLUDED IN THE REFRIGERATION CONTRACTOR'S SCOPE OF WORK:

4.7.1.1. THE REFRIGERATION CONTRACTOR WILL BE RESPONSIBLE FOR INSULATION PROCUREMENT AND INSTALLATION. (SEE INSULATION SPECIFICATIONS FOR DETAILS.) THE REFRIGERATION CONTRACTOR MAY SUBCONTRACT THIS WORK. THE INSULATION CONTRACTOR (WHETHER IT IS A SUBCONTRACTOR OR THE REFRIGERATION CONTRACTOR) MUST HAVE EXPERIENCE IN INSTALLING INSULATION FOR OTHER PROJECTS OF THIS GENERAL SIZE AND SCOPE. THE PROPOSED INSULATION CONTRACTOR MUST COMPLETE A STATEMENT OF CONTRACTOR QUALIFICATIONS (USE FORM CQ 19.1: CONTRACTOR APPLICATION OR EQUIVALENT).

4.7.1.2. THE CONTRACTOR IS RESPONSIBLE FOR INSULATING THEIR RESPECTIVE SECTION AND ELECTRICAL HEAT TRACING FOR ALL FREEZER DRAIN PIPING TO PREVENT FREEZING OF OUTFLOWING CONDENSATE.

4.8. PLUMBING REQUIREMENTS

4.8.1. THE FOLLOWING IS INCLUDED IN THE REFRIGERATION CONTRACTOR'S SCOPE OF WORK:

4.8.1.1. MAKE UP WATER LINE FROM OWNER'S WATER METER IN MAINTENANCE AREA UP TO THE EVAPORATIVE CONDENSER.

4.8.1.2. DRAIN PIPING. THE CONTRACTOR WILL BE RESPONSIBLE FOR 3" OVERFLOW AND 2" MANUAL DRAIN PIPING (THEY CAN BE COMBINED INTO ONE LINE) FROM EACH EVAPORATIVE CONDENSER TO HUB DRAIN IN MAINTENANCE ROOM BELOW.

4.8.1.3. WATER LINES FROM SPRAY PUMP TO CHEMICAL TREATMENT PANEL AND THEN BACK UP TO SUMP.

4.9. ELECTRICAL INSTALLATION AND CONTROLS

4.9.1. THE CONTRACTOR IS RESPONSIBLE FOR THE DESIGN AND SUPPLY OF A CONTROL SYSTEM AS DETAILED IN THESE SPECIFICATIONS.

4.9.2. THE CONTRACTOR IS RESPONSIBLE FOR THE DESIGN AND SUPPLY OF A POWER AND CONTROL WIRING FROM THE RACK REFRIGERATION CONTROL PANEL TO EVAPORATORS, PUMPS, TEMPERATURE SENSORS, AND CONTROL VALVES TO COMPLETE SYSTEM.

4.9.3. THE OWNER'S CONTRACTOR WILL ONLY SUPPLY THE POWER FEED SUPPLY TO EACH OF THE TWO REFRIGERATION RACK CONTROL PANELS AS SINGLE TERMINATION.

4.10. WORK NOT INCLUDED

4.10.1. SEE ABOVE SECTION FOR WORK NOT INCLUDED IN THE REFRIGERATION CONTRACTOR'S SCOPE OF WORK. SCOPES WITH PARTIAL OR NO WORK REQUIRED FROM THE REFRIGERATION CONTRACT INCLUDE:

4.10.1.1. EQUIPMENT PLATFORMS (EXCEPT WHERE NOTED IN THE SPECIFICATIONS)

4.11. REFRIGERANT CHARGE, R507

4.11.1. FOLLOWING SYSTEM INSTALLATION AND UPON SUCCESSFUL COMPLETION OF PRESSURE TESTING (SEE PIPING SPECIFICATION), NOTIFY THE OWNER'S REPRESENTATIVE THAT:

4.11.1.1. THE APPLICATION OF INSULATION MAY COMMENCE.

4.11.1.2. THE SYSTEM IS READY FOR THE REFRIGERANT CHARGE

4.11.1.2.1. AFTER RECEIVING APPROVAL BY THE OWNER TO CHARGE THE SYSTEM, THE REFRIGERATION CONTRACTOR SHALL FOLLOW THE OWNER'S CHARGING PROCEDURE AND PERSONAL PROTECTION EQUIPMENT (PPE) PRACTICES WHILE CHARGING THE SYSTEM.

4.11.1.2.2. THE REFRIGERATION CONTRACTOR SHALL PROVIDE THE INITIAL FULL R507A CHARGE.

4.12. OIL CHARGE

4.12.1. THE REFRIGERATION CONTRACTOR SHALL PROVIDE OIL AND GREASE FOR THE EQUIPMENT FINISHED UNDER THIS CONTRACT. BEARINGS ON ALL EQUIPMENT SHALL BE OILED AND GREASED EITHER IN THE FACTORY OR IN FIELD, BEFORE STARTING ANY EQUIPMENT, VERIFY THAT ALL BEARINGS HAVE BEEN EITHER FACTORY-LUBRICATED OR FIELD-LUBRICATED. THE CONTRACTOR SHALL PROVIDE A LUBRICATION CHECKLIST TO THE OWNER PRIOR TO COMMENCEMENT OF EQUIPMENT OPERATION.

4.12.2. PROVIDE SPECIAL LOW TEMPERATURE LUBRICATION WHERE REQUIRED.

4.13. BALANCING AND ADJUSTMENTS

4.13.1. THE REFRIGERATION CONTRACTOR SHALL ADJUST ALL HAND VALVES AND REGULATORS TO PROVIDE THE PROPER FLOW OF LIQUID REFRIGERANT AS THE SYSTEM IS PLACED IN OPERATION. FINAL SETTINGS FROM COMMISSIONING SHALL BE AS SHOWN IN THE SYSTEM OPERATING AND MAINTENANCE MANUAL.

4.13.2. THE REFRIGERATION CONTRACTOR SHALL WRING-OUT, ADJUST SETTING AND CONFIRM ACCURATE OPERATIONS OF THE REFRIGERATION CONTROL SYSTEM AND ASSOCIATED COMPONENTS FOR ALL PHASES OF OPERATIONS.

4.14. START-UP AND TRIAL RUN

4.14.1. THE REFRIGERATION CONTRACTOR WILL PROVIDE ASSISTANCE AND COMMISSIONING SUPPORT TO THE EQUIPMENT VENDOR’S ENGINEER.

4.14.2. FOLLOWING SUCCESSFUL OPERATION OF THE SYSTEM, THE OWNER OR OWNER'S REPRESENTATIVE WILL SIGN-OFF APPROVAL AND THEREBY CONFIRM ACCEPTANCE OF EQUIPMENT.

4.15. TRAINING

4.15.1. BEFORE AND DURING THIS TRIAL RUN PERIOD, THE REFRIGERATION CONTRACTOR WILL INSTRUCT THE OWNER'S OPERATING ENGINEER IN ALL DETAILS OF THE CARE, OPERATION, AND MAINTENANCE OF EQUIPMENT FURNISHED.

4.15.2. MAINTENANCE TRAINING SHALL INCLUDE BUT NOT BE LIMITED TO THE FOLLOWING:

4.15.2.1. MAINTENANCE OF MAJOR COMPONENTS.

4.15.2.2. LUBE AND GREASE SCHEDULES.

4.15.2.3. COMMON TROUBLESHOOTING.

4.15.2.4. PREVENTIVE MAINTENANCE SCHEDULE

4.15.2.5. MAINTENANCE OPERATORS SHALL BE TRAINED IN THE COMPLETE OPERATION OF THE EQUIPMENT AND UNDERSTAND THE OPERATING LIMITS OF THE UNIT.

4.15.2.6. PROVIDE ALL NECESSARY OPERATING AND MAINTENANCE MANUALS FOR THE REFERENCED PIECE OF EQUIPMENT.

4.15.3. OPERATOR TRAINING SHALL INCLUDE BUT NOT LIMITED TO THE FOLLOWING:

4.15.3.1. COMPLETE OVERVIEW OF THE PIECE OF EQUIPMENT.

4.15.3.2. TECHNICAL DISCUSSION ON THE OPERATION OF THE EQUIPMENT INCLUDING START-UP AND SHUTDOWN.

4.15.3.3. EMERGENCY PROCEDURES.

4.15.3.4. SAFETY PRECAUTIONS.

4.15.3.5. MANUAL AND AUTOMATIC MODE OPERATION.

4.16. WARRANTY

4.16.1. THE REFRIGERATION CONTRACTOR SHALL REFER TO THE ADMINSTRATIVE SPECIFICATIONS FOR WARRANTY REQUIREMENTS.

4.17. FINAL DOCUMENTATION

4.17.1. PROVIDE A COMPLETE SET OF REPRODUCIBLE PROJECT RECORD DRAWINGS ("AS-BUILTS"), BOTH ON PAPER AND IN AUTOCAD RELEASE 2013 ON CD, OF THE COMPLETED INSTALLATION.

4.17.2. PROVIDE THREE (3) COPIES OF SYSTEM MANUAL BOUND IN 3-RING BINDER.

4.17.2.1. AT MINIMUM, THE SYSTEM MANUAL SHALL BE INDEXED AND INCLUDE:

4.17.2.1.1. MANUFACTURER CUT SHEETS (OR REFERENCE TO MANUFACTURE BINDER).

4.17.2.1.2. VESSELS NATIONAL BOARD FORMS (UIA FORM).

4.17.2.1.3. VALVE CUT SHEETS.

4.17.2.1.4. REFERENCE SPECIFIC COMPONENTS TO DRAWING ID NUMBERS.

4.17.2.1.5. ELECTRICAL DRAWINGS

4.17.2.1.6. SPARE PARTS LISTS

4.17.2.1.7. OPERATING AND MAINTENANCE INSTRUCTIONS

4.17.3. PROVIDE DETAIL PREVENTION MAINTENANCE PROGRAM FOR ALL EQUIPMENT FURNISHED BY CONTRACTOR.

4.17.4. CONTRACTOR WILL PROVIDE A SCHEMATIC OF THE SYSTEM OR DIRECTIONS AT CONVENIENT LOCATIONS (FRONT OF RACK CONTROL PANEL) FOR THE OPERATOR TO SHUT DOWN THE SYSTEM, EMERGENCY CONTACT NUMBERS, AND NAMES OF LOCAL CORPORATE, STATE, AND FEDERAL AGENCIES IN EVENT OF A REPORTABLE INCIDENT.

4.17.5. CONTRACTOR SHALL COMPLETE TWO COPIES OF SIGNED CERTIFICATE OF TEST NAMING THE REFRIGERANT CHARGE, FIELD TEST PRESSURE APPLIED TO HIGH AND LOW SIDE. ONE TO BE PROVIDED TO THE OWNER AND SECOND COPY PROVIDED TO CITY OF BURLINGTON FOR PUBLIC RECORD.

4.17.6. CONTRACTOR AS PART OF HIS DESIGN/BUILD RESPONSIBILITIES WILL PROVIDE OWNER WITH ALL REFRIGERATION SYSTEM DRAWINGS IN .PDF AND WORKING AUTOCAD (.DWG) FORMATS. ALL REFRIGERATION SYSTEM SPECIFICATIONS NOT ON THE DRAWINGS WILL BE PROVIDED TO THE OWNER IN .PDF AND WORKING MS WORD (.DOC) FORMATS. CONTRACTOR WILL GRANT OWNER AN UNCONDITIONAL PERPETUAL LICENSE TO USE THESE DOCUMENTS.

5. PROPOSAL

5.1 THE CONTRACTOR SHALL PROVIDE THE FOLLOWING INFORMATION WITH THE PROPOSAL AS A MINIMUM **(AS APPLICABLE TO SYSTEM QUOTED)**;

- REFRIGERATION LOAD SUMMARY INDICATING THE CALCULATED LOADS.
- COMMENTARY AS TO THE MERITS OF THE SYSTEM CONFIGURATION.
- CUTSHEETS ON EQUIPMENT QUOTED FOR EXAMPLE EVAPORATOR, COMPRESSORS, EVAPORATIVE CONDENSER.
- PIPING AND INSULATION MATERIALS UTILIZED.
- MANUFACTURER OF MAJOR ELECTRICAL COMPONENTS PROVIDED
- RECOMMENDED LIST OF SPARE PARTS AND COST.

+ + END OF SPECIFICATION 19850 + +

SECTION 21 00 01
FIRE-SUPPRESSION GENERAL PROVISIONS

PART 1: GENERAL

1.1 SUMMARY

A. THE WORK AS SHOWN, INDICATED, AND SPECIFIED IN THE PROJECT FIRE PROTECTION DESIGN DRAWINGS, DIVISION 21 SPECIFICATIONS, AND AS SPECIFIED WITHIN THE BID DOCUMENTS INCORPORATES THIS SECTION BY REFERENCE AND IS INCOMPLETE WITHOUT THE PROVISIONS STATED HEREIN.

B. EXAMINE ALL DRAWINGS, CRITERIA SHEETS, AND ALL OTHER SECTIONS OF THE SPECIFICATIONS FOR REQUIREMENTS WHICH AFFECT WORK UNDER THIS SECTION WHETHER OR NOT SUCH WORK IS SPECIFICALLY MENTIONED IN THIS SECTION.

C. COORDINATE WORK WITH THAT OF ALL OTHER TRADES AFFECTING OR AFFECTED BY WORK OF THIS SECTION. COOPERATE WITH SUCH TRADES TO ASSURE THE STEADY PROGRESS OF ALL WORK UNDER THE CONTRACT.

D. PROVIDE ALL MATERIAL, LABOR, EQUIPMENT AND OTHER NECESSARY ITEMS TO COMPLETE THE WORK OF THIS SECTION IN STRICT ACCORDANCE WITH THE DESIGN CRITERIA PLANS AND SPECIFICATIONS, WITH ALL APPLICABLE CODES, RULES, AND STANDARDS.

E. THE WORK SHALL BE COMPLETED IN A MANNER CONSISTENT WITH GOOD PRACTICE AND THE REQUIREMENTS OF THE LOCAL FIRE CODE. ANY WORK NOT ACCEPTABLE TO THE OWNER SHALL BE REMOVED AND REPLACED AS NECESSARY, AT NO COST TO THE OWNER.

F. THE WORK SHALL BE COMPLETED IN ACCORDANCE WITH THE CONTRACT SCHEDULE ESTABLISHED BY THE CONSTRUCTION MANAGERAND THE OWNER.

G. THE DEFINED HAZARD CLASSIFICATIONS AND DENSITIES ARE TO BE USED AS THE DESIGN CRITERIA FOR THE BID RESPONSE. IN THE EVENT THAT THE CONTRACTOR AND/OR SUBCONTRACTOR BELIEVES THE ACTUAL CRITERIA TO BE DIFFERENT THAN THAT STATED IN THE DRAWINGS IT SHOULD BE CLEARLY DESCRIBED AND NOTED IN THE BID RESPONSE. DEVIATIONS IN COST FROM THE BASE BID SHOULD BE NOTED IN THE REQUEST FOR QUOTATION, SECTION “C VENDOR SUGGESTED ALTERNATIVES”.

1.2 DEFINITIONS

A. AHJ: REFERS TO THE AUTHORITY HAVING JURISDICTION, WHICH IN MOST CIRCUMSTANCES REFERS TO THE LOCAL FIRE MARSHALL OR THEIR REPRESENTATIVES.

B. APPROVED: AS USED IN THESE SPECIFICATIONS, MEANS ACCEPTABLE TO THE INSURANCE UNDERWRITER AND LOCAL FIRE DEPARTMENT.

C. ARCHITECT: REFERS TO “THE DENNIS GROUP, LLC (DGL)”.

D. CONCEALED: IS USED IN CONJUNCTION WITH PIPING, EQUIPMENT AND THE LIKE. THE WORD CONCEALED IS UNDERSTOOD TO MEAN HIDDEN FROM SIGHT, SUCH AS INSIDE: CHASES, FURRED SPACES ABOVE SUSPENDED CEILINGS, AND WALLS. ALL PIPING, HANGERS, EQUIPMENT, ETC. THAT IS LOCATED ABOVE A WALK-ON CEILING SHALL BE CONSIDERED EXPOSED.

E. CONTRACTOR: REFERS TO THE FIRE PROTECTION CONTRACTOR RESPONSIBLE FOR FURNISHING AND INSTALLATION OF ALL WORK INDICATED ON THE FIRE PROTECTION CRITERIA DRAWINGS AND IN THE FIRE PROTECTION SPECIFICATIONS.

F. CONSTRUCTION MANAGER OR CM: REFERS TO “THE DENNIS GROUP, LLC (DGL)".

G. ENGINEER: REFERS TO “THE DENNIS GROUP, LLC (DGL)”.

H. EXPOSED: IS UNDERSTOOD TO MEAN OPEN TO VIEW.

I. FMG: REFERS TO FACTORY MUTUAL GLOBAL.

J. NFPA: REFERS TO NATIONAL FIRE PROTECTION ASSOCIATION.

K. NON-PROCESS AREAS: SHALL INCLUDE ALL AREAS OUTSIDE OF THE “PROCESS AREAS” INCLUDING OFFICE AREAS, UTILITY ROOMS, WASTE TREATMENT, ETC.

L. OWNER: REFERS TO THE OWNER, “TLI”, OR ITS DESIGNATED REPRESENTATIVE.

M. PROCESS AREAS: SHALL INCLUDE ALL AREAS INVOLVED IN THE PROCESSING, PRODUCTION, PACKAGING AND STORAGE OF FOOD PRODUCTS OR AREAS SUBJECTED TO WET WASH DOWN OR PROCESSES. THE FOLLOWING ROOMS ARE DEFINED AS PROCESS AREAS:

1. P100, KILL FLOOR HIDE ON
2. P101, KILL FLOOR CLEANING

3. P102, PLANT CORRIDOR
4. P103, PLANT CORRIDOR
5. P104, PLANT CORRIDOR
6. P105, BREAKING AND FABRICATION
7. P106, CURING COOLER
8. P107, SMOKE HOUSE
9. P108, HOT PRODUCT
10. P109, PACKAGING
11. S100, HIDES / INEDIBLES DOCK
12. S101, CHEMICAL STORAGE
13. S102, CHILL COOLER
14. S103, SALES COOLER
15. S105, CHILLED BOX COOLER
16. S106, INGREDIENT STORAGE
17. S107, FROZEN BOXED FREEZER
18. S108, DRY STORAGE / DOCK

N. PROVIDE: IS UNDERSTOOD TO MEAN “THE CONTRACTOR SHALL FURNISH AND INSTALL” THE EQUIPMENT, TESTS, INSPECTIONS, ETC. REFERENCED.

O. RELATED WORK: SECTIONS REFERENCED UNDER THE PARAGRAPH “RELATED WORK SPECIFIED ELSEWHERE” ARE UNDERSTOOD TO INCLUDE PROVISIONS WHICH DIRECTLY AFFECT THE WORK BEING SPECIFIED IN THE SECTION WHERE THE RELATED WORK PARAGRAPH OCCURS.

P. UL: REFERS TO UNDERWRITERS LABORATORY.

Q. REFER TO THE CONTRACT CONDITIONS FOR ANY ADDITIONAL DEFINITIONS.

1.3 CODES, STANDARDS, AND PERMITS

A. PERFORM WORK IN ACCORDANCE WITH THE ACCEPTED EDITION, REVISION, AMENDMENT OR SUPPLEMENT OF APPLICABLE STATUTES, ORDINANCES, CODES OR REGULATIONS OF NATIONAL, STATE, COUNTRY AND LOCAL AUTHORITIES HAVING JURISDICTION IN EFFECT ON THE DATE BIDS ARE RECEIVED.

B. WHERE APPROVAL STANDARDS HAVE BEEN ESTABLISHED BY OHSA, UNDERWRITER’S LABORATORIES, THE 2015 INTERNATIONAL FIRE CODE, ASCE, ASME, ASTM, AWS, AWWA, IEEE, FM, NEC, NFPA, AND THE STATE OF MASSACHUSETTS, THESE STANDARDS SHALL BE FOLLOWED WHETHER OR NOT INDICATED ON THE CONTRACT DRAWINGS AND SPECIFICATIONS. INCLUDE THE COST OF ALL WORK REQUIRED TO COMPLY WITH THE REQUIREMENTS OF THESE AUTHORITIES IN THE ORIGINAL PROPOSAL.

C. REQUIREMENTS IN REFERENCE SPECIFICATIONS AND STANDARDS ARE A MINIMUM FOR ALL EQUIPMENT, MATERIAL, AND WORK. IN INSTANCES WHERE CAPACITIES, SIZE, OR OTHER FEATURES OF EQUIPMENT, DEVICES, OR MATERIALS EXCEED THESE MINIMUMS, MEET LISTED OR SPECIFIED CAPACITIES.

D. RESOLVE ANY CODE VIOLATIONS DISCOVERED IN CONTRACT DOCUMENTS WITH THE CONTRACTOR AND ENGINEER. CONTRACTOR SHALL MAKE ANY CORRECTION OR ADDITION NECESSARY FOR COMPLIANCE WITH APPLICABLE CODES AT NO ADDITIONAL COMPENSATION.

E. PERMITS:

1. THE CONSTRUCTION MANAGER SHALL OBTAIN A GENERAL BUILDING PERMIT FOR THE WORK.
2. THE CONTRACTOR SHALL OBTAIN ALL OTHER NECESSARY PERMITS AS REQUIRED BY THE AHJ IN CONNECTION WITH HIS WORK.
3. THE CONTRACTOR SHALL PAY ALL NECESSARY FEES AND CHARGES ISSUED BY THE AHJ IN CONNECTION WITH HIS WORK.
4. THE CONTRACTOR SHALL BE RESPONSIBLE FOR MAKING ARRANGEMENTS FOR ALL REQUIRED INSPECTIONS IN CONNECTION WITH HIS WORK.

5. THE CONTRACTOR SHALL DELIVER PERMITS, TESTS, CERTIFICATES OF INSPECTION, ETC. TO THE OWNER AT THE COMPLETION OF THE WORK

1.4 SUBMITTALS

A. SUBMITTALS SHALL BE SUBMITTED IN CONFORMANCE WITH THE REQUIREMENTS OF SECTION *01300 – ADMINISTRATIVE REQUIREMENTS*, SECTION *01600 – PRODUCT REQUIREMENTS*, AND THE FOLLOWING:

1. MANUFACTURERS
    a. THE LISTED MANUFACTURERS WILL BE ACCEPTABLE AS LONG AS THEY COMPLY WITH THE SPECIFICATIONS AND SCHEDULES.
    b. MANUFACTURERS WHO ARE NOT LISTED AS “ACCEPTABLE MANUFACTURERS” BEAR THE BURDEN OF PROOF TO THE CONTRACTOR AND ENGINEER THAT THEIR PRODUCTS COMPLY WITH THE DRAWINGS AND SPECIFICATIONS. ALTERNATE MANUFACTURERS WILL NOT BE ACCEPTED UNTIL SHOP DRAWING SUBMITTAL. THE SUBCONTRACTOR BEARS THE RESPONSIBILITY IF ALTERNATE MANUFACTURERS ARE USED FOR PREPARING BID PROPOSALS.
2. CONTRACTOR’S CERTIFICATION
    a. SUBMITTALS SHALL BE SUBMITTED ONLY BY THE CONTRACTOR. INDICATE BY SIGNED STAMP THAT THE CONTRACT DOCUMENTS HAVE BEEN CHECKED, THAT THE WORK SHOWN IN THE SUBMITTALS IS IN ACCORDANCE WITH CONTRACT REQUIREMENTS, AND THAT DIMENSIONS AND RELATIONSHIP WITH WORK OF OTHER TRADES HAVE BEEN CHECKED.
    b. SUBMITTALS SENT TO THE CM OR ENGINEER DIRECT FROM THE EQUIPMENT VENDOR WILL NOT BE ACCEPTED.
3. PREPARATION
    a. WHERE PRODUCT DATA PUBLISHED BY THE MANUFACTURER IS PART OF A SUBMITTAL, INCLUDE ONLY INFORMATION RELEVANT TO THE PARTICULAR EQUIPMENT OR MATERIALS TO BE FURNISHED. STRIKE ALL NON-RELEVANT PRODUCTS AND PAGES. SUBMITTALS INCLUDING PRODUCTS NOT USED ON THE PROJECT WILL BE RETURNED FOR RESUBMISSION.
        1) PROVIDE PRODUCT DATA FOR THE FOLLOWING: SEE INDIVIDUAL SPECIFICATIONS FOR MORE INFORMATION
            a) SUPPLEMENTARY COMPONENTS FORE FIRE-SUPPRESSION WORK
            b) GENERAL-DUTY VALVES FOR WATER-BASED FIRE-SUPPRESSION PIPING
            c) HANGERS AND SUPPORTS FOR WATER-BASED FIRE-SUPPRESSION PIPING AND EQUIPMENT
            d) IDENTIFICATION FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT
            e) FIRE-SUPPRESSION PIPING INSULATION
            f) WET-PIPE FIRE-SUPPRESSION SPRINKLER SYSTEMS
            g) DRY-PIPE FIRE-SUPPRESSION SPRINKLER SYSTEMS
            h) PREACTION FIRE-SUPPRESSION SPRINKLER SYSTEMS
            i) DELUGE FIRE-SUPPRESSION SPRINKLER SYSTEMS
            j) CLEAN-AGENT FIRE-EXTINGUISHING SYSTEMS
            k) ELECTRIC-DRIVE CENTRIFUGAL FIRE PUMPS
            l) DIESEL-DRIVE CENTRIFUGAL FIRE PUMPS
    b. IN ALL CASES WHERE COMPLIANCE WITH UL, FM, OR OTHER SIMILAR ORGANIZATIONS’ STANDARDS ARE REQUIRED, PROVIDE PROPER DOCUMENTATION OF THIS COMPLIANCE WITH THE MANUFACTURER’S PUBLISHED LITERATURE OR DRAWINGS OR BY A LETTER SIGNED BY AN OFFICER OF THE COMPANY. FOR ALL EQUIPMENT, FURNISH THE MANUFACTURER’S REPRESENTATIVE NAME, CURRENT ADDRESS, AND TELEPHONE NUMBER WITH AREA CODE.

c. PROVIDE SHOP DRAWINGS CONSISTING OF PLANS DRAWN TO SCALE, WITH ELEVATIONS AND SECTIONS, TO SHOW CLEARLY THE LOCATION OF MAJOR ITEMS OF EQUIPMENT AND CLEARANCES FOR MAINTENANCE AND CODE REQUIREMENTS.
d. SUBMIT ONLY THE REQUESTED SUBMITTALS COMPLETE BY TYPES OF EQUIPMENT (I.E., SPRINKLER HEADS, PIPING, FITTINGS, RISER ASSEMBLIES, ETC.) LABELED WITH APPLICABLE SPECIFICATION SECTION(S) INCLUDED. EACH SUBMITTAL WILL BE HANDLED SEPARATELY. SHOULD ANY ITEM NOT BE ACCEPTABLE, THE ENTIRE SUBMITTAL WILL BE RETURNED TO THE CONTRACTOR FOR CORRECTION AND RESUBMISSION. PARTIAL SUBMITTALS ARE UNACCEPTABLE. THE INTENT OF THIS REQUIREMENT IS THAT ALL APPROVED BOUND SETS OF DATA WILL BE IDENTICAL AND WILL CONTAIN ONLY ACCEPTABLE INFORMATION.
e. SUBMIT A COMPLIANCE SHEET FOR EACH SUBMITTAL INDICATING THE SUBMITTAL IS IN FULL COMPLIANCE WITH THE DRAWINGS AND SPECIFICATIONS. INDICATE BY DRAWING NUMBER OR SPECIFICATION SECTION NUMBER AND PARAGRAPH NUMBERS ALL EXCEPTIONS TAKEN AND INCLUDE AN EXPLANATION.
f. BY PREPARING, APPROVING, AND SUBMITTING SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, THE CONTRACTOR REPRESENTS THAT THEY HAVE DETERMINED AND VERIFIED ALL MATERIAL, FIELD MEASUREMENTS AND FIELD CONSTRUCTION CRITERIA RELATED THERETO, OR WILL DO SO WITH REASONABLE PROMPTNESS. IN ADDITION, THE CONTRACTOR HAS CHECKED AND COORDINATED THE INFORMATION CONTAINED WITHIN SUCH SUBMITTALS WITH THE REQUIREMENTS OF THE WORK, THE PROJECT, AND THE CONTRACT DOCUMENTS.
g. THE REVIEW OF SUBMITTALS BY THE ENGINEER DOES NOT RELIEVE OR MODIFY THE CONTRACTOR'S RESPONSIBILITY FOR COMPLIANCE WITH THE CONTRACT DOCUMENTS. THE REQUIREMENTS OF THE CONTRACT DOCUMENTS SHALL SUPERCEDE ANY DIMENSION, QUALITY, OR QUANTITY DISCREPANCIES FOUND IN THE SUBMITTALS. IT IS CLEARLY UNDERSTOOD THAT, IN THE REVIEW PROCESS, NOTING OF SOME DISCREPANCIES BUT OVERLOOKING OTHERS DOES NOT GRANT THE CONTRACTOR PERMISSION TO PROCEED IN ERROR. REGARDLESS OF ANY INFORMATION CONTAINED IN THE SUBMITTALS, THE CONTRACT DOCUMENTS GOVERN THE WORK, AND ARE NEITHER WAIVED NOR SUSPENDED IN ANY WAY BY THE REVIEW OF THE SUBMITTALS.
h. INCLUDE IN SUBMITTALS SUFFICIENT PLANS, ELEVATIONS, SECTIONS, PERFORMANCE DATA, ELECTRICAL REQUIREMENTS, DIMENSIONS, RATINGS, AND SCHEMATICS TO CLEARLY DESCRIBE THE EQUIPMENT AND TO SHOW COMPLIANCE WITH APPLICABLE SPECIFICATIONS AND THE DESIGN CRITERIA.
i. PROVIDE A COVER OR TITLE SHEET FOR THE SUBMITTAL CONTAINING THE FOLLOWING:
    1) NAME OF CONTRACTOR ORIGINATING THE SUBMITTAL.
    2) NAME OF PROJECT FOR WHICH THE SUBMITTAL IS MADE.
    3) AN INDEX OF ALL ITEMS SUBMITTED INCLUDING:
        a) MARK OF EQUIPMENT ON DRAWINGS
        b) MANUFACTURER
        c) CATALOG NUMBER
        d) SPECIFICATION SECTION NUMBER
    4) DATE OF SUBMITTAL AND DATE OF EACH REVISION
    5) CONTRACTOR'S CERTIFICATION OF REVIEW
    6) CONTRACTOR'S CERTIFICATION OF COMPLIANCE

4. APPROVED SPRINKLER PIPING DRAWINGS
    a. WORKING PLANS, PREPARED ACCORDING TO NFPA 13, WHICH HAVE BEEN APPROVED BY THE LOCAL AHJ, OR IN THE PROCESS OF APPROVAL.
    b. HYDRAULIC CALCULATIONS.
5. FIRE-HYDRANT FLOW TEST REPORT.
6. FIELD TEST REPORTS AND CERTIFICATES.
    a. INDICATE AND INTERPRET TEST RESULTS FOR COMPLIANCE WITH PERFORMANCE REQUIREMENTS AND AS DESCRIBED IN NFPA 13. INCLUDE "CONTRACTOR'S MATERIAL AND TEST CERTIFICATE FOR ABOVEGROUND PIPING".
7. OPERATION AND MAINTENANCE DATA.
8. SHOP DRAWINGS AND PRODUCT DATA THAT DO NOT COMPLY WITH THE REQUIREMENTS HEREIN WILL BE RETURNED FOR RESUBMISSION.
9. REFER TO THE CONTRACT GENERAL CONDITIONS AND/OR SUPPLEMENTAL GENERAL CONDITIONS FOR ANY ADDITIONAL OR SUPERSEDING REQUIREMENTS.

1.5 PROJECT / SITE CONDITIONS

A. VISIT THE SITE OF THE PROPOSED CONSTRUCTION TO THOROUGHLY BECOME FAMILIAR WITH ALL DETAILS OF THE WORK AND WORKING CONDITIONS, VERIFY ALL DIMENSIONS IN THE FIELD, AND ADVISE THE CM, AND ENGINEER OF ANY DISCREPANCY BEFORE PERFORMING ANY FABRICATION OR WORK.

B. SAFETY MEETINGS
    1. CONTRACTOR SHALL BE REQUIRED TO ATTEND ALL SAFETY AND CM MEETINGS AS REQUESTED BY THE CM.

C. SPACE REQUIREMENTS
    1. CONSIDER SPACE LIMITATIONS IMPOSED BY CONTIGUOUS WORK IN SELECTION AND LOCATION OF EQUIPMENT AND MATERIAL. DO NOT PROVIDE EQUIPMENT OR MATERIAL THAT IS NOT SUITABLE IN THIS RESPECT.
    2. CHANGES IN EQUIPMENT LOCATION OF UP TO 5 FT TO ALLOW FOR FIELD CONDITIONS SHALL BE MADE BY THE CONTRACTOR AT NO ADDITIONAL COMPENSATION, AS DIRECTED BY THE CM.
    3. INSTALL ALL EQUIPMENT REQUIRING SERVICE SO THAT IT IS EASILY ACCESSIBLE.
    4. COMPARE THE EQUIPMENT SIZES WITH THE SPACE ALLOTTED FOR INSTALLATION BEFORE INSTALLATION AND MAKE WRITTEN NOTICE OF POSSIBLE CONFLICT. DISASSEMBLE LARGE EQUIPMENT TO PERMIT INSTALLATION THROUGH NORMAL ROOM OPENINGS WHEN REQUIRED. SHOULD WRITTEN NOTICE NOT BE MADE IN A TIMELY MANNER, MAKE ADJUSTMENTS AND MODIFICATIONS NECESSARY WITHOUT ADDITIONAL COMPENSATION.
    5. TIMELY PLACE ALL EQUIPMENT TOO LARGE TO FIT THROUGH FINISHED OPENINGS, STAIRWAYS, ETC.

D. SITE OBSTRUCTIONS
    1. THE DRAWINGS INDICATE CERTAIN INFORMATION PERTAINING OBSTRUCTIONS WHICH HAVE BEEN TAKEN FROM AVAILABLE DRAWINGS. SUCH INFORMATION IS NOT GUARANTEED; HOWEVER, AS TO THE ACCURACY OF LOCATION OR THE COMPLETENESS OF THE INFORMATION.
    2. REFER TO THE CM GENERAL CONDITIONS AND SUPPLEMENTAL GENERAL CONDITIONS FOR PRICING ADJUSTMENT REQUIREMENTS.

E. CUTTING AND PATCHING
    1. SUBMIT A WRITTEN NOTIFICATION TO CM IN ADVANCE OF CUTTING OR ALTERATIONS.
    2. EXECUTE CUTTING AND DEMOLITION BY METHODS THAT WILL PREVENT DAMAGES TO OTHER WORK AND WILL PROVIDE PROPER SURFACES TO RECEIVE INSTALLATION OF REPAIRS.

3. RESTORE WORK THAT HAS BEEN CUT OR REMOVED; INSTALL NEW PRODUCTS COMPLYING WITH SPECIFIED PRODUCTS, FUNCTIONS, TOLERANCES, AND FINISHES AS STATED IN THE CONTRACT DOCUMENTS.
4. REFER TO CONTRACT DRAWINGS AND DETAILS FOR INFORMATION PERTAINING TO PENETRATIONS THROUGH SURFACES.

1.6 QUALITY ASSURANCE

A. INSTALLER QUALIFICATIONS:
   1. INSTALLER'S RESPONSIBILITIES INCLUDE DESIGNING, FABRICATING, AND INSTALLING FIRE PROTECTION SYSTEMS AND PROVIDING PROFESSIONAL DESIGN SERVICES NEEDED TO ASSUME ENGINEERING RESPONSIBILITY. BASE CALCULATIONS ON RESULTS OF FIRE-HYDRANT FLOW TEST.
      a. ENGINEERING RESPONSIBILITY: PREPARATION OF WORKING PLANS, CALCULATIONS, AND FIELD TEST REPORTS BY A QUALIFIED DESIGNER OR PROFESSIONAL ENGINEER AS REQUIRED BY THE AHJ.

B. WELDING: QUALIFY PROCESSES AND OPERATORS ACCORDING TO ASME BOILER AND PRESSURE VESSEL CODE: SECTION IX.

C. NFPA STANDARDS: FIRE PROTECTION SYSTEMS EQUIPMENT, SPECIALTIES, ACCESSORIES, INSTALLATION, AND TESTING SHALL COMPLY WITH THE FOLLOWING:
   1. NFPA 13, "INSTALLATION OF SPRINKLER SYSTEMS."

1.7 MATERIALS AND WORKMANSHIP

A. PROVIDE NEW MATERIALS AND EQUIPMENT BY THOSE REGULARLY ENGAGED IN THE PRODUCTION AND MANUFACTURE OF SPECIFIED MATERIALS AND EQUIPMENT. THE COMMERCIALLY STANDARD ITEMS OF EQUIPMENT AND THE SPECIFIC NAMES MENTIONED HEREIN ARE INTENDED TO IDENTIFY STANDARDS OF QUALITY AND PERFORMANCE NECESSARY FOR THE PROPER FUNCTIONING OF THE WORK. USE UL LISTED AND LABELED EQUIPMENT AND MATERIALS WHERE REQUIRED BY THE LOCAL FIRE CODE.

B. PERFORM WORK BY WORKMEN SKILLED IN THE TRADE REQUIRED FOR THE WORK. INSTALL ALL MATERIALS AND EQUIPMENT TO PRESENT A NEAT APPEARANCE WHEN COMPLETED AND IN ACCORDANCE WITH THE APPROVED RECOMMENDATIONS OF THE MANUFACTURER AND THE BEST PRACTICES OF THE TRADE AND IN CONFORMANCE WITH THE CONTRACT DOCUMENTS.

C. PROVIDE ALL LABOR, MATERIALS, TOOLS, EQUIPMENT, APPARATUSES, AND APPLIANCES ESSENTIAL TO THE COMPLETE FUNCTIONING OF THE SYSTEMS DESCRIBED OR INDICATED HEREIN, OR WHICH MAY BE REASONABLY IMPLIED AS ESSENTIAL WHETHER MENTIONED IN THE CONTRACT DOCUMENTS OR NOT.

D. ALL MATERIALS, WHERE REQUIRED BY LOCAL CODE, SHALL BE MARKED AND LABELED WITH THE NAME OF THE APPROPRIATE STANDARDS AGENCY AND THE SPECIFIC STANDARD.

1.8 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. FOLLOW THE MANUFACTURER'S DIRECTIONS COMPLETELY IN THE DELIVERY, STORAGE, AND HANDLING OF EQUIPMENT AND MATERIALS.

B. STORE EQUIPMENT AND MATERIALS IN A CLEAR, DRY PLACE PROTECTED FROM OTHER CONSTRUCTION IN A LOCATION AS SPECIFIED BY THE CM. WHILE STORED, MAINTAIN FACTORY WRAPPING OR TIGHTLY COVER AND PROTECT EQUIPMENT AGAINST DIRT, WATER, CONSTRUCTION DEBRIS, CHEMICAL, PHYSICAL, OR WEATHER DAMAGE, TRAFFIC, AND THEFT.

C. ADEQUATELY BRACE AND PACKAGE EQUIPMENT AND MATERIAL TO PREVENT BREAKAGE AND DISTORTION WHILE IN TRANSIT.

D. ACCEPT MATERIALS ONSITE IN FACTORY PACKAGING. INSPECT FOR DAMAGE.

1.9 CONTRACT DRAWINGS

A. THE CONTRACT DRAWINGS ARE INTENDED TO CONVEY THE FIRE PROTECTION DESIGN CRITERIA FOR THE CONTRACTOR TO UTILIZE IN DESIGNING THE FIRE PROTECTION SYSTEMS.

B. PRELIMINARY SPRINKLER HEAD LOCATION AND PIPING LAYOUT MAY BE SHOWN FOR REFERENCE AND COORDINATION PURPOSES. THE CONTRACTOR SHALL BE RESPONSIBLE FOR FINAL SPRINKLER HEAD LAYOUT AND SPRINKLER SYSTEM CALCULATION AND DESIGN.

1.10 RECORD DRAWINGS (I.E. AS-BUILT DRAWINGS)

A. THE CONTRACTOR SHALL KEEP ON THE JOB AT ALL TIMES, ONE COMPLETE AND SEPARATE SET OF BLACK LINE PRINTS OF THE FIRE PROTECTION WORK ON WHICH SHALL BE CLEARLY, NEATLY AND ACCURATELY NOTED, PROMPTLY AS THE WORK PROGRESSES, ALL ARCHITECTURAL AND FIRE PROTECTION CHANGES, REVISIONS AND ADDITIONS TO THE WORK. WHEREVER WORK IS INSTALLED THAN AS OTHERWISE SHOWN ON THE CONTRACT DRAWINGS, SUCH CHANGES SHALL BE NOTED.

B. INDICATE DAILY PROGRESS ON THESE PRINTS BY COLORING IN THE VARIOUS PIPES, VALVES, APPARATUS, AND ASSOCIATED APPURTENANCE AS THEY ARE ERECTED.

C. NO APPROVAL OF REQUISITION FOR PAYMENT FOR WORK INSTALLED WILL BE GIVEN UNLESS SUPPORTED BY RECORD PRINTS AS REQUIRED ABOVE.

D. AT THE CONCLUSION OF WORK, PREPARE FINAL DRAWINGS THAT INCORPORATE ANY FIELD CHANGES AND SUBMIT THREE HARD COPIES AND ONE DISK COPY OF AUTOCAD DRAWING FORMAT FILES TO THE CONSTRUCTION MANAGER.

1.11 OPERATION & MAINTENANCE (O&M) MANUALS

A. FURNISH COPIES OF COMPLETE OPERATION AND MAINTENANCE INSTRUCTIONS, SERVICE MANUALS, AND PARTS LIST APPLICABLE TO EACH MANUFACTURED ITEM OF EQUIPMENT FURNISHED. BIND OPERATION AND MAINTENANCE INFORMATION IN HEAVY-DUTY LOOSE-LEAF BINDERS.

1. REQUIRED MINIMUMS: 3 HARDCOPY SETS AND 3 ELECTRONIC SETS ON CD OR DVD.

B. ORGANIZE BINDERS TO CONTAIN LIKE EQUIPMENT SUCH AS PUMPS, DEVICES, EQUIPMENT, , VALVES, ETC., IN SEPARATE DIVISIONS. PROVIDE A COMPLETE DOUBLE INDEX FOR EACH BINDER TO INCLUDE:

1. AN ALPHABETIZED LIST OF THE PRODUCTS BY NAME.
2. AN ALPHABETIZED LIST OF MANUFACTURERS WHOSE PRODUCTS HAVE BEEN INCORPORATED IN THE WORK, TOGETHER WITH THEIR ADDRESSES AND THE NAME, ADDRESSES, AND TELEPHONE NUMBERS OF THE LOCAL SALES REPRESENTATIVE OR SUPPLIER.

C. FOR EACH SECTION OF PRODUCT, EQUIPMENT, OR SYSTEM, ORGANIZE THE DATA AS FOLLOWS:

1. FURNISH A GENERAL DESCRIPTION OF THE EQUIPMENT OR SYSTEM LISTING THE MAJOR COMPONENTS, INTENDED SERVICE, AND OTHER GENERAL DATA.
2. FURNISH TECHNICAL DATA INCLUDING NAMEPLATE DATA, DESIGN PARAMETERS, RATINGS, CAPACITY, PERFORMANCE DATA, OPERATING CURVES, CHARACTERISTICS AND THE LIKE. CLEARLY DISTINGUISH BETWEEN INFORMATION WHICH DOES AND DOES NOT APPLY.
3. LIST WARNINGS AND CAUTIONS TO BE OBSERVED DURING BOTH INSTALLATION AND OPERATIONS.
4. FULLY DETAILED INSTALLATION AND OPERATION INSTRUCTIONS INCLUDING SPECIAL TOOLS REQUIRED, ALIGNMENT INSTRUCTIONS, START-UP, AND SHUT-DOWN SEQUENCES.
5. FURNISH MAINTENANCE, SERVICE, AND REPAIR INSTRUCTIONS INCLUDING MAINTENANCE AND SERVICE SCHEDULES, MATERIALS, AND METHODS FOR PERFORMING ROUTINE AND ANNUAL SERVICE.
6. FURNISH A TROUBLESHOOTING GUIDE AND CHECKLIST INDICATING COMMON FAILURES AND TEST METHODS AND PROCEDURES FOR DETERMINING COMPONENT FAULT OR FAILURE.
7. FURNISH A SPARE PARTS LIST INDICATING PART AND ORDER NUMBER WITH NAME, ADDRESS, AND TELEPHONE NUMBER OF SUPPLIER. INCLUDE CURRENT PRICES OF REPLACEMENT PARTS AND SUPPLIES.
8. FURNISH DIAGRAMS INCLUDING CONTROLS, WIRING, INSTALLATION OR OPERATION OF THE EQUIPMENT OR SYSTEM.
9. FURNISH COPIES OF ALL APPROVED SUBMITTALS.

10. FURNISH COPIES OF ALL TEST REPORTS.
11. PROVIDE A LUBRICATION SECTION IN THE SUBMITTAL CONTAINING A CHECKLIST OR SCHEDULE SHOWING THE TYPE OF LUBRICANT TO BE USED AT EACH POINT, THE LUBRICATION INTERVALS, AND THE FREQUENCY OF LUBRICATION REPLACEMENT FOR EQUIPMENT AS REQUIRED.

1.12 GUARANTEE

A. REFER TO THE GENERAL CONDITIONS AND SPECIAL CONDITIONS OF THE CONTRACT DOCUMENTS.

B. ALL EQUIPMENT, LABOR AND MATERIALS FURNISHED UNDER THIS SECTION OF THE SPECIFICATIONS SHALL BE GUARANTEED FOR A PERIOD OF ONE YEAR FROM THE DATE OF BENEFICIAL OCCUPANCY THEREOF AGAINST DEFECTIVE MATERIALS, DESIGN AND WORKMANSHIP. MATERIALS AND/OR EQUIPMENT FOUND DEFECTIVE SHALL BE REPLACED WITH NEW MATERIALS AND/OR EQUIPMENT AT THIS CONTRACTOR'S EXPENSE. THIS CONTRACTOR SHALL GUARANTEE THAT ALL ELEMENTS OF THE SYSTEM ARE OF SUFFICIENT CAPACITY TO MEET THE REQUIREMENTS SET FORTH HEREIN. UPON RECEIPT OF NOTICE FROM THE OWNER OR HIS REPRESENTATIVE OF ANY FAILURE DURING THE GUARANTEE PERIOD, THE DEFECT SHALL BE REMEDIED PROMPTLY BY AND AT THE EXPENSE OF THIS CONTRACTOR.

C. THIS CONTRACTOR SHALL SEE THAT THERE IS NO CONFLICT IN THE WORK AND NO CONFLICT WITH THE WORK OF OTHER TRADES. ANY CONFLICT SHALL BE IMMEDIATELY BROUGHT TO THE ATTENTION OF THE OWNER'S REPRESENTATIVE.

D. IN GENERAL, OTHER TRADES SYSTEMS SHALL BE GIVEN THE RIGHT OF WAY. ALL FIRE PROTECTION PIPING SHALL BE INSTALLED TO ACCOMMODATE OTHER WORK AS SHOWN ON THE FLOOR PLANS, AND SHALL BE INSTALLED TO CLEAR ALL ELECTRICAL EQUIPMENT INDICATED.

1.13 CERTIFICATES OF APPROVAL

A. CERTIFICATES OF TESTING AND APPROVAL OF THE COMPLETED INSTALLATION BY THE INSURING AGENCY AND THE LOCAL FIRE DEPARTMENT SHALL BE FURNISHED TO THE OWNER.

1.14 ALTERNATES

A. SEE BID DOCUMENTS FOR ALTERNATES.

PART 2: PRODUCTS

(NOT APPLICABLE)

PART 3: EXECUTION

3.1 GENERAL

A. THE CONTRACTOR, UNDER THIS SECTION OF THE SPECIFICATIONS, SHALL BE RESPONSIBLE FOR THE SUPERVISION OF HIS PERSONNEL AND THE INSPECTION OF EQUIPMENT AND APPLIANCES PROVIDED BY HIM TO ASSURE A SAFE WORKING ENVIRONMENT IN COMPLIANCE WITH O.S.H.A. REGULATIONS. IN ADDITION, THIS CONTRACTOR SHALL IMMEDIATELY REPORT TO THE GENERAL CONTRACTOR, IN WRITING, ANY POSSIBLE VIOLATION OF SAID O.S.H.A. REGULATIONS OBSERVED IN AREAS OCCUPIED BY HIS PERSONNEL. FAILURE TO NOTIFY THE GENERAL CONTRACTOR SHALL CONSTITUTE THIS CONTRACTOR'S ACCEPTANCE OF THE WORKING CONDITIONS AND THE RESPONSIBILITY THEREFORE.

3.2 REGULATIONS

A. WHILE MATERIALS AND INSTALLATION SHALL CONFORM TO THE RULES AND REGULATIONS OF THE GOVERNING BODIES, THE SPECIFICATION OUTLINED IN THIS SECTION SHALL BE FOLLOWED WHERE THEY ARE IN EXCESS OF THE MINIMUM REQUIREMENTS OF THE UNDERWRITERS RECOMMENDATIONS, OR ANY LOCAL AUTHORITY. THE FIRE PROTECTION SYSTEMS SHALL CONFORM TO THE REQUIREMENTS OF THE OWNER'S INSURANCE COMPANY.

3.3 SPECIFIC POLICIES/PROCEDURES

A. SMOKING IS NOT PERMITTED IN ANY MANUFACTURING OR WAREHOUSING AREA. SMOKELESS OR CHEWING TOBACCO IS ALSO PROHIBITED.

B. PROTECTIVE EYE AND FACE EQUIPMENT IS REQUIRED WHERE THERE IS A REASONABLE PROBABILITY OF INJURY THAT CAN BE PREVENTED BY SUCH EQUIPMENT. INCLUDED ARE AREAS WHERE MACHINES OR OPERATIONS PRESENT THE HAZARD OF FLYING OBJECTS, GLARE, HAZARDOUS LIQUIDS, INCLUDING CHEMICALS, ACIDS OR CAUSTIC LIQUIDS, CHEMICAL GASES OR VAPORS, OR POTENTIALLY INJURIOUS LIGHT RADIATION, ETC. AREAS THAT REQUIRE EYE AND FACE PROTECTION ARE TO BE SO DESIGNATED AND INCLUDE AT A MINIMUM BOTTLING, PROCESSING, AND MAINTENANCE SHOP LOCATIONS.

C. EYEWEAR MUST MEET ANSI Z87 STANDARDS. AS A RESULT, ONLY COMPANY ISSUED NON-PRESCRIPTION EYE PROTECTION IS TO BE PERMITTED. EMPLOYEES WHOSE VISION REQUIRES THE USE OF CORRECTIVE LENSES ARE PERMITTED TO WEAR CORRECTIVE EYEWEAR WHICH MEETS THE ANSI Z87 STANDARDS AND IS SO MARKED AND EQUIPPED WITH SIDE SHIELDS; OR A PROTECTIVE GOGGLE MAY BE WORN OVER THE CORRECTIVE EYEWEAR.

D. ALL CONTRACTORS IN THE MANUFACTURING AND STORAGE AREAS (INCLUDING THE TANK FARM) ARE REQUIRED TO WEAR 'SAFE' SHOES. A 'SAFE' SHOE CONSISTS OF A SUBSTANTIAL THICK COMPOSITE OR HARD LEATHER SOLE AND UPPER. THE SHOE MUST COVER THE INSTEP AND FIT SECURELY. SANDALS, CANVAS SNEAKERS, SOFT LEATHER, SOFT SOLED, HIGH-HEELED, OR OPEN TOED SHOES ARE PROHIBITED.

E. SAFETY SHOES MEETING THE ANSI FOOTWEAR STANDARD Z41.1 ARE REQUIRED WHERE THE PROBABILITY OF FOOT INJURY IS HIGH AND A SAFETY SHOE WILL REDUCE THIS PROBABILITY. AT A MINIMUM, MECHANICS AND TRADES PEOPLE ARE REQUIRED TO WEAR SAFETY SHOES.

F. NO ITEMS ARE TO BE KEPT IN BREAST POCKETS WHILE IN THE PROCESSING OR BOTTLING AREAS OR WHERE CONTAMINATION OF PRODUCT OR INGREDIENTS IS POSSIBLE.

G. ALL CONTRACTORS EXPOSED TO SOUND EQUAL TO OR EXCEEDING 90DBA MUST BE PROVIDED WITH, AND WEAR, HEARING PROTECTORS. AREAS MEETING THE ABOVE CRITERIA MUST BE SO DESIGNATED AND INCLUDE AT A MINIMUM ALL BOTTLING AREAS.

H. EXPOSED JEWELRY IS NOT TO BE WORN IN THE PROCESSING OR BOTTLING AREAS OR WHERE THERE MAY BE A SAFETY OR FOOD CONTAMINATION RISK. THIS INCLUDES EARRINGS, CHAINS, BRACELETS, RINGS (INCLUDING WEDDING BANDS), AND WATCHES. GLOVES ARE NOT CONSIDERED ADEQUATE PROTECTION FOR RINGS.

I. RUNNING, HORSEPLAY, AND UNNECESSARY YELLING IN ANY AREA OF THE PLANT IS PROHIBITED.

J. ALL ACCIDENTS AND INJURIES ARE TO BE REPORTED TO SUPERVISORY PERSONNEL IMMEDIATELY.

K. FOOD AND BEVERAGES MUST NOT BE CONSUMED IN PROCESSING (INCLUDING TANK FARMS), BOTTLING, WAREHOUSING AREAS, LOCKER ROOMS, RESTROOMS, OR HALLWAYS IN THE MANUFACTURING AREA. FOOD IS TO BE CONSUMED ONLY IN DESIGNATED AREAS SUCH AS THE CAFETERIA AREA, OFFICES, AND CONFERENCE ROOMS.

L. DURING THE OPERATING, SERVICING, AND MAINTENANCE OF EQUIPMENT, A GUARD MUST NOT BE REMOVED OR BY-PASSED UNLESS A SAFE PRACTICE SUCH AS A LOCKOUT OR KEYSWITCH IS FIRST UTILIZED. EQUIPMENT IS NOT TO BE OPERATED UNLESS ALL GUARDS ARE IN PLACE.

M. DEFECTIVE EQUIPMENT AND/OR UNSAFE CONDITIONS MUST IMMEDIATELY BE REPORTED TO SUPERVISORY PERSONNEL.

N. RIDING POWERED VEHICLES, UNLESS THEY ARE DESIGNED TO CARRY PASSENGERS, IS PROHIBITED. ONLY PROPERLY-AUTHORIZED INDIVIDUALS ARE TO OPERATE FORKLIFT VEHICLES.

O. "HOT WORK" (E.G. WELDING) IS ONLY TO BE PERFORMED IF THE OWNER PROCEDURES, INCLUDING THE ISSUANCE OF A PERMIT, ARE FOLLOWED. 'HOT WORK' IS PROHIBITED IN HAZARDOUS LOCATIONS.

P. WALK AND AISLEWAYS ARE TO REMAIN FREE OF DEBRIS AND CLEAN. CORDS, HOSES, ETC. MUST BE STRUNG OVER WALKWAYS OR AISLEWAYS. IF PROPERLY PROTECTED, THEY MAY BE PLACED ACROSS AISLEWAYS. EQUIPMENT AND AISLEWAYS RELATED TO FIRE PROTECTION (INCLUDING FIRE DOORS, HOSE AND EXTINGUISHER STATIONS, FIRE EXITS AND AISLES, ETC.) MUST NOT BE TAMPERED WITH, BLOCKED, OR REMOVED.

Q. BOOM LIFTS, SCISSOR LIFTS AND OTHER EQUIPMENT TO BE OPERATED WITHIN THE FACILITY SHALL HAVE ONLY NON-MARKING TIRES OR PROTECTIVE TIRE COVERS INSTALLED. ANY EQUIPMENT FOUND NOT TO BE IN COMPLIANCE WILL BE REMOVED FROM THE SITE.

R. BOOM LIFTS, SCISSOR LIFTS AND OTHER EQUIPMENT TO BE OPERATED WITHIN THE FACILITY AFTER THE BUILDING IS CLOSED IN MAY AT THE CONSTRUCTION MANGERS REQUEST BE REQUIRED TO BE EITHER PROPANE OPERATED, ELECTRIC OR DIESEL WITH EXHAUST SCRUBBERS IN ORDER TO PREVENT NOXIOUS FUME BUILD UP WITHIN THE FACILITY. ANY EQUIPMENT FOUND NOT TO BE IN COMPLIANCE WILL BE REMOVED FROM THE SITE.

S. ALL CONTRACTORS WHOSE HANDS ARE EXPOSED TO HAZARDS SUCH AS THOSE FROM SKIN ABSORPTION OF HARMFUL SUBSTANCES, SEVERE CUTS OR LACERATIONS, SEVERE ABRASIONS, PUNCTURES, CHEMICAL BURNS, THERMAL BURNS, AND HARMFUL TEMPERATURE EXTREMES ARE TO WEAR APPROVED HAND PROTECTION.

T. PROTECTIVE GLOVES ARE REQUIRED WHERE THE PROBABILITY OF HAND INJURY IS HIGH AND A GLOVE WILL REDUCE THE PROBABILITY. THE TYPE OF GLOVE REQUIRED; RUBBER, CLOTH, ETC., WILL DEPEND ON THE HAZARDS INVOLVED. AT A MINIMUM, MECHANICS, JANITORS, PROCESSING EMPLOYEES AND ANYONE HANDLING HAZARDOUS CHEMICALS ARE REQUIRED TO WEAR GLOVES WHILE PERFORMING DANGEROUS DUTIES INCLUDING HANDLING BROKEN GLASS.

U. PEDESTRIANS ARE TO USE DESIGNATED WALKWAYS WHERE AVAILABLE. DRIVERS MUST USE EXTREME CAUTION WHEN OPERATING AROUND PEDESTRIAN TRAFFIC. BOTH DRIVERS AND PEDESTRIANS ARE RESPONSIBLE FOR EACH OTHER'S SAFETY. BE ALERT.

V. CONTRACTOR SHALL GIVE ALL NOTICES AND COMPLY WITH ALL FEDERAL, STATE AND LOCAL LAWS, ORDINANCES AND REGULATIONS IN ANY MANNER AFFECTING CONDUCT OF WORK, AND ALL SUCH ORDERS AND DECREES AS EXIST, OR MAY BE ENACTED BY BODIES OR TRIBUNALS HAVING JURISDICTION OR AUTHORITY OVER WORK, AND SHALL INDEMNIFY AND SAVE HARMLESS OWNER AGAINST ANY CLAIM OR LIABILITY ARISING FROM OR BASED ON, VIOLATION OF ANY SUCH LAW, ORDINANCE, REGULATION, ORDER OR DECREE, WHETHER BY HIMSELF OR HIS EMPLOYEES. SPECIAL ATTENTION IS DIRECTED TOWARD O.S.H.A. CONSTRUCTION SAFETY STANDARD WHICH ARE ADHERED TO BY CONTRACTOR.

3.4 ENVIRONMENTAL

A. THE CONTRACTOR SHALL DISPOSE OF ANY HAZARDOUS OR TOXIC SUBSTANCES IN ACCORDANCE WITH ALL APPLICABLE REGULATIONS, INCLUDING EPA AND DOT AND SHALL PROVIDE THE OWNER WITH THE APPROPRIATE GENERATOR EPA NUMBER.

B. THE CONTRACTOR SHALL DO ALL THINGS NECESSARY TO INSURE THAT THERE WILL BE NOT DISCHARGE, SPILLAGE, UNCONTROLLED LOSS, SEEPAGE, OR FILTRATION OF ANY HAZARDOUS OR TOXIC WASTE ON THE SITE CAUSED BY HIS OPERATION. CONTRACTOR IS RESPONSIBLE FOR ANY AND ALL COSTS AND LIABILITIES ASSOCIATED WITH THE CLEAN UP OF ANY SUCH SPILLAGE, ETC., OR AS REQUIRED BY ANY REGULATING AUTHORITY AND HOLDS THE OWNER HARMLESS AGAINST ANY CURRENT OR FUTURE LIABILITIES RESULTING FROM SUCH AN INCIDENT.

C. THE CONTRACTOR SHALL PROVIDE THE OWNER WITH COPIES OF ALL HAZARDOUS WASTE DISPOSAL DOCUMENTATION.

D. THE OWNER SHALL BE NOTIFIED IN ADVANCE IN WRITING OF THE FACILITY TO BE USED TO DISPOSE OF HAZARDOUS WASTE. THE OWNER SHALL HAVE THE RIGHT TO REQUEST AN ALTERNATE SITE BE USED IF THEY DESIRE.

3.5 SERVICE

A. PLACE ALL FIRE PROTECTION SYSTEMS IN COMPLETE WORKING ORDER AND CLEAN AND POLISH ALL DEVICES, EQUIPMENT, VALVES, INSTRUMENTS, AND MATERIALS THOROUGHLY RETURNING THEM TO "AS NEW" CONDITION PRIOR TO REQUEST FOR FINAL REVIEW.

B. REMOVE ALL EXCESS MATERIAL AND DEBRIS. LEAVE ALL AREAS "BROOM CLEAN".

END OF SECTION

SECTION 21 00 02
FIRE-SUPPRESSION SCOPE OF WORK

PART 1: GENERAL

1.1 SCOPE OF WORK

A. THE WORK INCLUDED WITHIN THIS SECTION OF THE SPECIFICATIONS SHALL INCLUDE BUT NOT BE LIMITED TO THE FOLLOWING:

1. OBTAIN EXISTING HYDRANT FLOW TEST IMMEDIATELY UPON AWARD OF CONTRACT TO ESTABLISH DESIGN FLOW PARAMETERS. FLOW TEST SHALL BE COORDINATED WITH THE ENGINEER, CM, AND LOCAL WATER AUTHORITY.
2. PROVIDE MIC WATER SAMPLING LABORATORY ANALYSIS AT THE BEGINNING OF PROJECT. CONTRACTOR SHALL ALSO PROVIDE WATER SAMPLING TEST PORTS WITH ISOLATION VALVES AND LABORATORY CERTIFIED TEST COUPONS AT STRATEGIC POINTS IN SPRINKLER SYSTEMS.
3. ALL AREAS OF THE NEW BUILDING SHALL BE PROTECTED WITH AUTOMATIC SPRINKLERS AS DESCRIBED IN DRAWINGS AND IN THE FIRE PROTECTION DESIGN CRITERIA MATRICES ON DRAWING FP5.001 AND AS NOTED OTHERWISE.
4. PROVIDE ALL REQUIRED EXTENSIONS AND MODIFICATIONS OF EXISTING SPRINKLER SYSTEMS INCLUDING REQUIRED NEW FIRE PROTECTION SPRINKLER PIPING, FITTINGS, DEVICES, SPRINKLER HEADS AND ACCESSORIES FOR ALL SPRINKLER SYSTEMS AS NOTED ON DRAWINGS AND IN SCOPE OF WORK.
5. THE DESIGN-BUILD FIRE PROTECTION CONTRACTOR WILL BE RESPONSIBLE FOR THE WORK OF THIS SECTION INCLUDING ALL DESIGN, EQUIPMENT AND MATERIALS, LABOR AND INSTALLATION AND TESTING OF THE FIRE PROTECTION SYSTEMS FOR ALL NEW AND/OR RENOVATED AREAS OF THE PROJECT. THE FIRE PROTECTION SYSTEMS SHALL BE COMPLETE, IN STRICT ACCORDANCE WITH THIS SECTION OF THE SPECIFICATIONS, AND THE REQUIREMENTS OF NFPA, THE STATE OF MASSACHUSETTS, CITY/TOWN OF WESTPORT AND THE OWNER'S INSURANCE UNDERWRITER. THE WORK SHALL INCLUDE PROVIDING A DETAILED FIRE PROTECTION SYSTEM DESIGN WITH APPROPRIATE DOCUMENTATION IN ACCORDANCE WITH THE REQUIREMENTS OF THE STATE OF MASSACHUSETTS, CITY/TOWN OF WESTPORT AND NFPA.
6. THE CONTRACTOR SHALL PREPARE AND SUBMIT A COMPLETE, DETAILED SET OF HYDRAULIC CALCULATIONS, PIPING SHOP DRAWING PLANS AND EQUIPMENT AND MATERIALS SUBMITTAL DOCUMENTATION FOR THE PROJECT. HYDRAULIC CALCULATIONS, PIPE SIZING AND PLANS SHALL BE IN ACCORDANCE WITH THE MOST RECENT VERSION OF NFPA 13, AND OTHER APPLICABLE NFPA DOCUMENTS. ALL SPRINKLER SYSTEM, SUPPORT AND BRACING DESIGNS SHALL BE IN ACCORDANCE WITH REQUIREMENTS OF THE STATE OF MASSACHUSETTS. THE PLANS AND DRAWINGS AND SHALL BE SUBMITTED TO THE ENGINEER, THE LOCAL FIRE DEPARTMENT AND THE INSURANCE UNDERWRITER FOR REVIEW AND APPROVAL PRIOR TO ORDERING ANY EQUIPMENT AND PERFORMING ANY INSTALLATION.
7. PROVIDE DETAILED PLANS PREPARED BY THE FIRE PROTECTION DESIGN/BUILD CONTRACTOR TO BE PREPARED IN AUTOCAD 2010 DRAWING FORMAT, FILES SHALL BE PROVIDED TO THE ENGINEER AS PART OF THE SHOP DRAWING REVIEW PROCESS.
8. PROVIDE COORDINATION OF SPRINKLER PIPING LOCATIONS AND ELEVATIONS WITH THAT OF OTHER TRADES EQUIPMENT, INCLUDING LIGHTING, HVAC EQUIPMENT AND DUCTWORK, AND PROCESS PIPING AND EQUIPMENT, TO AVOID CONFLICTS. ELEVATIONS OF FIRE PROTECTION PIPING WITHIN WALK-ON CEILING SPACE AREAS SHALL MAXIMIZE HEAD ROOM AND WILL REQUIRE REVIEW AND ACCEPTANCE BY THE ENGINEER.
9. PROVIDE COORDINATION OF SPRINKLER HEAD LOCATIONS WITH THE ARCHITECTURAL REFLECTED CEILING PLANS, LIGHTING, HVAC DUCTWORK, DIFFUSERS, GRILLES AND REGISTERS AND OTHER ITEMS OF CONFLICT. LOCATION OF SPRINKLER HEAD LOCATIONS WILL REQUIRE REVIEW AND ACCEPTANCE BY THE ENGINEER AND THE ARCHITECT.
10. PROVIDE SPRINKLER PROTECTION FOR OBSTRUCTIONS AS REQUIRED BY NFPA.

11. PROVIDE SPRINKLER PROTECTION BELOW ALL CEILINGS AND MEZZANINES AND OBSTRUCTIONS AS CLASSIFIED BY NFPA.
12. PROVIDE PROTECTION BELOW ELEVATED ACCESS PLATFORMS WITH CONFIGURATIONS AND HEIGHTS AS INDICATED ON DRAWINGS. DETAILED DRAWINGS OF PLATFORMS WILL BE PROVIDED TO SELECTED CONTRACTOR AFTER AWARD OF CONTRACT.
13. THE CONTRACTOR SHALL BE REQUIRED TO PROVIDE REASONABLE REVISIONS REQUESTED BY THE INSURANCE UNDERWRITER. THE CONTRACTOR SHALL ATTEND REVIEW MEETINGS WITH THE CONSTRUCTION MANAGER AND THE INSURANCE UNDERWRITER TO RESOLVE ANY CONFLICTING REQUIREMENTS.

B. SYSTEMS:
   1. SERVICE ENTRANCE:
      a. PROVIDE FIRE PROTECTION SPRINKLER PIPING SYSTEMS BEGINNING FROM FLANGED FIRE PROTECTION WATER MAINS LEFT CAPPED AT APPROXIMATELY 12" ABOVE SLAB IN LOCATIONS AS INDICATED ON DRAWINGS. PROVIDE ALL PIPING, FITTINGS, SPRINKLER HEADS AND ACCESSORIES FOR ALL SPRINKLER SYSTEMS.
   2. FIRE PUMP:
      a. PROVIDE ELECTRIC MOTOR DRIVEN FIRE PUMP SYSTEM WITH JOCKEY PUMP, CONTROLLERS AND ACCESSORIES AND APPURTENANCES AS SPECIFIED AND AS REQUIRED BY NFPA 20 AND APPLICABLE SECTIONS OF LATEST NATIONAL ELECTRIC CODE. FIRE PUMP INSTALLATION SHALL COMPLY WITH FM GLOBAL REQUIREMENTS.
      b. PROVIDE ALTERNATE PRICING TO INCLUDE PACKAGED PUMP AND HOUSE SET OUTSIDE THE BUILDING.
   3. WET PIPE SYSTEMS:
      a. PROVIDE WET ALARM VALVE SYSTEM RISERS FOR WET SYSTEMS INCLUDING TRIM, FLOW SWITCHES, GONGS, ELECTRIC BELLS AND ACCELERATORS REQUIRED FOR COMPLETE INSTALLATION.
   4. HOSE SYSTEMS:
      a. PROVIDE HOSE CABINETS AS SPECIFIED IN LOCATIONS AS REQUIRED BY THE AHJ.
      b. PROVIDE CLASS-I FIRE HOSE CABINETS IN LOCATIONS WHERE REQUIRED BY THE AHJ.
      c. PROVIDE CLASS-II FIRE HOSE CABINETS IN LOCATIONS WHERE REQUIRED BY THE AHJ.
      d. PROVIDE CLASS-III FIRE HOSE CABINETS IN LOCATIONS WHERE REQUIRED BY THE AHJ.

C. PIPING AND VALVES:
   1. PROVIDE AN UL LISTED AND FMG APPROVED INDICATING TYPE BUTTERFLY VALVES WITH RESILIENT SEATS AT EACH SYSTEM RISER.
   2. PROVIDE DRAIN PIPING AT LOW POINTS OF SPRINKLER PIPING.
   3. PROVIDE A MANUAL SHUT OFF VALVE AT EACH AUDIBLE ALARM LOCATION.
   4. PROVIDE TAMPER SWITCHES FOR ALL SHUTOFF, CONTROL AND ISOLATION VALVES.
   5. PROVIDE ALL PIPE HANGERS AND SUPPORTS TO SUPPORT PIPING PER NFPA REQUIREMENTS. "UNISTRUT" OR SIMILAR METAL FRAMING SYSTEM SUPPORTS AND ALL THREADED ROD ARE NOT ALLOWED FOR EXPOSED PIPING SUPPORTS IN PRODUCTION AND PRODUCT STORAGE AREAS WITH FINISHED CEILINGS.
   6. PROVIDE ALL SUPPLEMENTARY STRUCTURAL SUPPORTS FOR SEISMIC PROTECTION AS REQUIRED BY STATE AND LOCAL AUTHORITIES.
   7. PROVIDE ALL CUTTING AND PATCHING, WALL SLEEVES AND ESCUTCHEONS.
   8. PROVIDE PIPE INSULATION ON WARM SIDE OF PIPING PASSING THROUGH WALLS, CEILINGS OR FLOORS WHICH HAVE A TEMPERATURE DIFFERENTIAL BETWEEN THE TWO

SIDES OF MORE THAN 20°F. THIS SHALL INCLUDE DROPS TO COLD ROOM DRY PENDENT HEADS AND PENDENT HEADS AS INDICATED IN DETAILS ON DRAWINGS.

9. PROVIDE SPRAY FOAM INSULATION AND SEALANT FOR PIPE PENETRATIONS AND SPRINKLER HEADS IN INSULATED METAL PANEL CEILINGS AS SPECIFIED AND AS DETAILED ON DRAWINGS.

D. MOCKUP INSTALLATIONS
   1. WALL AND CEILING PENETRATIONS
      a. PROVIDE MOCKUP INSTALLATION FOR EACH WALL TYPE AND CEILING PENETRATION FOR DIFFERENT TEMPERATURE APPLICATIONS.
   2. UNDER PLATFORM MOUNTING
      a. PROVIDE MOCKUP INSTALLATION FOR AREAS OF SANITARY CONDITIONS WITH STAINLESS STEEL PIPE INSTALLATIONS.
   3. IN-RACK SPRINKLERS
      a. PROVIDE MOCKUP INSTALLATION FOR MOUNTING AND ROUTING OF SPRINKLER PIPING AND HEADS WITHIN RACK STORAGE AREAS.

E. ALTERNATE SCOPE:
   1. PROVIDE PAINTING OF FIRE PROTECTION SYSTEM PIPING AND EQUIPMENT AS SPECIFIED. PAINTING SHALL INCLUDE ALL PIPING, VALVES AND FITTINGS IN THE FIRE PUMP ROOM BEGINNING AT THE SERVICE ENTRANCE CONNECTIONS AND INCLUDING THE SYSTEM RISERS, DRAIN PIPING AND COMPRESSED AIR PIPING.
      a. GALVANIZED PIPE SHALL NOT BE PAINTED.

F. PROJECT START-UP AND CLOSEOUT:
   1. PROVIDE START-UP AND COMMISSIONING SERVICES FOR FIRE PUMP SYSTEM BY FACTORY AUTHORIZED START-UP TECHNICIAN. DATE AND TIME OF TESTING TO BE DETERMINED BASED UPON AVAILABILITY OF LOCAL OFFICIALS, INSURANCE UNDERWRITER REPRESENTATIVE, OWNER PERSONNEL AND THE ENGINEER.
   2. PROVIDE SYSTEM TRAINING OF FACILITY ENGINEERING AND MAINTENANCE PERSONNEL. MINIMUM OF TWO (2) TRAINING SESSIONS SHALL BE PROVIDED TO ALLOW FOR TRAINING OF PERSONNEL AT DIFFERENT TIMES. DATE AND DURATION OF TRAINING SHALL BE AS DICTATED BY THE ENGINEER AT A LATER DATE.
   3. PROVISION OF FINISHED LAMINATED COLOR CODED DRAWINGS TO BE HUNG IN RISER ROOMS AND AT BUILDING FIRE ALARM MAIN PANELS WHICH CLEARLY DISPLAY RISER NUMBERS AND AREAS SERVED BY RISERS. FINAL SIZE, FORMATTING, MOUNTING AND HANGING DETAILS TO BE APPROVED BY THE ENGINEER.
   4. PROVIDE AS-BUILT RECORD DRAWINGS AT PROJECT CLOSEOUT AS SPECIFIED.
   5. PROVIDE OPERATIONS AND MAINTENANCE MANUALS AT PROJECT CLOSE OUT AS SPECIFIED.

G. WORK NOT INCLUDED
   1. UNDERGROUND SITE FIRE PROTECTION PIPING INCLUDING FIRE HYDRANTS, FIRE DEPARTMENT CONNECTION, POST INDICATOR SHUTOFF VALVES AND INCOMING BUILDING FEEDS. FIRE PROTECTION CONTRACTOR WORK IS TO START AT PIPING FLANGES LEFT ABOVE FLOOR BY SITE UTILITY PIPING CONTRACTOR.
   2. ELECTRICAL WIRING OF ALARM DEVICES PROVIDED BY THIS CONTRACTOR TO BE PROVIDED BY DIVISION 16 CONTRACTOR, WITH THE EXCEPTION OF PRE-ACTION SYSTEM HEAT ACTUATED DEVICES AND CONTROL PANEL WIRING.
   3. BUILDING FIRE AND SMOKE ALARM SYSTEM BY BUILDING FIRE ALARM CONTRACTOR.
   4. ELECTRICAL GROUNDING OF PIPING TO BUILDING STRUCTURE BY DIVISION 16 CONTRACTOR.
   5. DRY CHEMICAL FIRE SUPPRESSION SYSTEMS.
   6. KITCHEN COOKING HOODS FIRE SUPPRESSION SYSTEMS.
   7. FIRE EXTINGUISHERS.

8. CONCRETE PADS AND/OR SLABS AND FOOTINGS REQUIRED FOR FIRE PUMP, JOCKEY PUMP AND CONTROLLERS.

1.2 AVAILABLE WATER SUPPLY

A. SEE DRAWING FP0.000 FOR DATA ON WATER PRESSURE AND FLOW. ACTUAL FLOW TEST IS INCLUDED IN RFQ.

B. CONTRACTOR IS RESPONSIBLE FOR OBTAINING OR PERFORMING CURRENT HYDRANT/FIRE PUMP FLOW TESTS FOR FACILITY TO ESTABLISH WATER SUPPLY CHARACTERISTICS FOR BASIS OF DESIGN.

C. CONTRACTOR IS REFERRED TO CIVIL SITE UTILITY DRAWINGS FOR CONFIGURATION OF NEW SITE FIRE MAIN PIPING TO BUILDING.

1.3 PERFORMANCE REQUIREMENTS

A. STANDARD PIPING SYSTEM COMPONENT WORKING PRESSURE: LISTED FOR AT LEAST 175 PSIG.

B. FIRE PROTECTION SPRINKLER SYSTEM DESIGN SHALL BE APPROVED BY AUTHORITIES HAVING JURISDICTION.

C. MARGIN OF SAFETY FOR AVAILABLE WATER FLOW AND PRESSURE: 15 PERCENT, INCLUDING LOSSES THROUGH WATER-SERVICE PIPING, VALVES, AND BACKFLOW PREVENTERS.

D. SPRINKLER OCCUPANCY HAZARD CLASSIFICATIONS:

1. ACCORDING TO NFPA 13, UNLESS OTHERWISE INDICATED. SEE DESIGN CRITERIA MATRICES PROVIDED ON FIRE PROTECTION DRAWING FP5.001.

E. MINIMUM DENSITY FOR AUTOMATIC-SPRINKLER PIPING DESIGN:

1. ACCORDING TO NFPA 13, UNLESS OTHERWISE INDICATED. SEE DESIGN CRITERIA MATRICES PROVIDED ON FIRE PROTECTION DRAWING FP5.001.

F. MAXIMUM PROTECTION AREA PER SPRINKLER:

1. ACCORDING TO NFPA 13, UNLESS OTHERWISE INDICATED. SEE DESIGN CRITERIA MATRICES PROVIDED ON FIRE PROTECTION DRAWING FP5.001.

G. TOTAL COMBINED HOSE-STREAM DEMAND REQUIREMENT:

1. ACCORDING TO NFPA 13, UNLESS OTHERWISE INDICATED. SEE DESIGN CRITERIA MATRICES PROVIDED ON FIRE PROTECTION DRAWING FP5.001.

1.4 SEISMIC PERFORMANCE:

A. FIRE PROTECTION PIPING SHALL BE CAPABLE OF WITHSTANDING THE EFFECTS OF EARTHQUAKE MOTIONS DETERMINED ACCORDING TO NFPA 13.

1.5 MICROBIOLOGICALLY INFLUENCED CORROSION

A. AFTER AWARD OF CONTRACT AND PRIOR TO START OF DESIGN THE CONTRACTOR SHALL COLLECT MULTIPLE WATER SAMPLES OF LOCAL WATER SUPPLY FROM CLOSEST AVAILABLE LOCATION TO PROJECT SITE. SAMPLES SHALL BE COLLECTED ON SEPARATE DAYS AT TIMES DIFFERING BY AT LEAST 8 HOURS. WATER SAMPLES SHALL BE SUBMITTED TO INDEPENDENT TESTING LABORATORY AND ANALYZED FOR MICROBIOLOGICALLY INFLUENCED CORROSION (MIC) POTENTIAL.

B. REPORT OF FINDINGS BY INDEPENDENT LABORATORY SHALL BE SUBMITTED TO THE ENGINEER FOR EVALUATION PRIOR TO INSTALLATION OF ANY PIPING ON PROJECT.

C. CONTRACTOR SHALL ALSO PROVIDE TO THE ENGINEER WRITTEN RECOMMENDATIONS FOR ANY OPTIONAL PERMANENT TREATMENT SYSTEMS FOR THE PIPING SYSTEMS TO MONITOR AND ACTIVELY TREAT FOR MIC RELATED CORROSION ISSUES.

1.6 TESTS

A. AFTER COMPLETION, THE SYSTEM SHALL BE SUBJECTED TO A HYDROSTATIC PRESSURE OF NOT LESS THAN 200 PSI FOR A PERIOD OF TWO HOURS IN THE PRESENCE OF THE OWNER AND/OR HIS REPRESENTATIVE. THIS CONTRACTOR AT HIS EXPENSE SHALL REPAIR ANY DEFECTS SHOWING DURING THE TEST PERIOD. DEFECTS SHALL BE REPAIRED BY REPLACING THE DEFECTIVE PARTS WITH NEW MATERIAL. NO CAULKING OF LEAKS OR JOINTS SHALL BE PERMITTED.

B. THE CONTRACTOR SHALL CONDUCT A FULL SYSTEM OPERATION TEST OF ALL DEVICES. IN THE EVENT THAT A DEVICE DOES NOT OPERATE OR PERFORM AS REQUIRED, THE DEVICE SHALL BE REPLACED AND THE SYSTEM RETESTED UNTIL ALL DEVICES OPERATE AS REQUIRED.

1.7 DAMAGE TO OTHER WORK

A. THE CONTRACTOR SHALL BE HELD RESPONSIBLE AND SHALL PAY FOR ALL DAMAGE TO OTHER WORK CAUSED BY HIS WORK OR WORKMEN. REPAIRING OF SUCH DAMAGE SHALL BE DONE BY THIS CONTRACTOR WHO INSTALLED THE WORK AND AS DIRECTED BY THE OWNER OR HIS REPRESENTATIVE.

PART 2: PRODUCTS

(NOT APPLICABLE)

PART 3: EXECUTION

3.1 DESIGN PARAMETERS

A. THE DESIGN PARAMETERS SHALL BE PER THE SCHEDULE ON THE PLANS.
B. HOSE ALLOWANCES SHALL BE PER THE REQUIREMENTS OF THE LOCAL FIRE MARSHAL.
C. CALCULATIONS SHALL BE BASED ON AVAILABLE WATER PRESSURES AND FLOW INDICATED IN THE SCOPE OF WORK.

3.2 INSTALLATION

A. INSTALL ENTIRE SYSTEM IN ACCORDANCE WITH NFPA 13.
B. REFER TO ARCHITECTURAL, STRUCTURAL, CIVIL, AND MECHANICAL FOR THE GENERAL BUILDING ARRANGEMENT. ALL PIPING SHALL BE INSTALLED TO CONFORM TO THE STRUCTURAL AND GENERAL BUILDING CONSTRUCTION REQUIREMENTS. PIPING SHALL BE CLEAR OF ALL EQUIPMENT. LOCATIONS SHOWN ON PLANS MUST BE CHECKED WITH THE BUILDING CONDITIONS BEFORE STARTING WORK.
C. REFERENCES TO THE ARCHITECTURAL, GENERAL AND DETAIL PLANS AND STRUCTURAL PLANS SHALL BE MADE, WHICH CLEARLY INDICATE THE TYPE OF BUILDING CONSTRUCTION IN WHICH THE SPRINKLER WORK SHALL BE INSTALLED.
D. THE DETAILED INSTALLATION PLANS PREPARED BY THE CONTRACTOR SHALL BE COORDINATED WITH THE REQUIREMENTS OF OTHER TRADES. ANY CONFLICTS SHALL BE BROUGHT TO THE ATTENTION OF THE CONSTRUCTION MANAGER IN WRITING.
E. PIPING SYSTEM SHALL BE CONSTRUCTED TO ALLOW FOR THE EASE OF VISUAL INSPECTION OF PIPING INTERIOR.
F. PROVIDE ADDITIONAL PIPING AND SPRINKLERS TO COMPLETE THE INSTALLATION, PROVIDING ADEQUATE PROTECTION FOR FLOOR OPENINGS IN PROCESS MEZZANINE, OPEN STAIR AREAS IN OFFICE
G. FLUSH CLEAN ALL PIPING UNTIL CLEAR AT THE HIGHER OF TWO VELOCITIES, 10 FT PER SECOND OR THE DESIGN VELOCITY FOR EACH SECTION. PROVISIONS FOR FLUSHING SHALL BE INSTALLED IN ACCORDANCE WITH NFPA 13.

3.3 PREPARATION

A. PERFORM FIRE-HYDRANT FLOW TEST ACCORDING TO NFPA 13 AND NFPA 291. USE RESULTS FOR SYSTEM DESIGN CALCULATIONS REQUIRED IN PART 1. REPORT TEST RESULTS PROMPTLY AND IN WRITING.

END OF SECTION

SECTION 21 05 01
SUPPLEMENTARY COMPONENTS FOR FIRE-SUPPRESSION WORK

PART 1: GENERAL

1.1 SUMMARY

A. THE WORK OF THIS SECTION SHALL INCLUDE:

1. ALARM DEVICES
2. PRESSURE GAUGES
3. FIRE DEPARTMENT CONNECTIONS
4. SPRINKLER HEADS
5. HOSE STATIONS
6. MICROBIOLOGICALLY INFLUENCED CORROSION MONITORING
7. DIELECTRIC FITTINGS
8. FLEXIBLE CONNECTORS
9. SPRINKLER SPECIALTY FITTINGS
10. DRAINS
11. FIRE-STOPPING MATERIALS (COMPOUND, PACKING, PREFABRICATED FIRESTOP COLLARS, SEALANT)
12. PAINTING
13. SEALANT

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. THE FOLLOWING REFERENCED SECTIONS ARE LISTED AS A MINIMUM OF ADDITIONAL REQUIREMENTS AND/OR WORK NOT INCLUDED IN THIS SECTION WHICH MAY BE REQUIRED TO BE PERFORMED UNDER OTHER DESIGNATED SECTIONS:

1. *21 00 01 – FIRE-SUPPRESSION GENERAL PROVISIONS*
2. *21 05 23 – GENERAL-DUTY VALVES FOR WATER-BASED FIRE-SUPPRESSION PIPING*
3. *21 13 13 – WET-PIPE FIRE-SUPPRESSION SPRINKLER SYSTEMS*
4. *21 13 16 – DRY-PIPE FIRE-SUPPRESSION SPRINKLER SYSTEMS*
5. *21 13 19 – PREACTION FIRE-SUPPRESSION SPRINKLER SYSTEMS*
6. *21 13 19 – DELUGE FIRE-SUPPRESSION SPRINKLER SYSTEMS*
7. *21 22 00 – CLEAN-AGENT FIRE-EXTINGUISHING SYSTEMS*
8. *21 31 13 – ELECTRIC-DRIVE CENTRIFUGAL FIRE PUMPS*
9. *21 31 16 – DIESEL-DRIVE CENTRIFUGAL FIRE PUMPS*

1.3 REFERENCE STANDARDS

A. ASME (AMERICAN SOCIETY OF MECHANICAL ENGINEERS)

1. E119 FIRE TESTS OF BUILDING CONSTRUCTION AND MATERIALS

B. ASTM (ASTM INTERNATIONAL)

1. C719 STANDARD METHOD FOR THE ADHESION AND COHESION OF ELASTOMERIC JOINT SEALANTS UNDER CYCLIC MOVEMENT
2. C920 STANDARD SPECIFICATION FOR ELASTOMERIC JOINT SEALANTS
3. D3730 STANDARD GUIDE FOR TESTING HIGH-PERFORMANCE INTERIOR ARCHITECTURAL WALL COATINGS
4. G21 STANDARD PRACTICE FOR DETERMINING RESISTANCE OF SYNTHETIC POLYMERIC MATERIALS TO FUNGI

C. FDA (FOOD AND DRUG ADMINISTRATION)

D. NFPA (NATIONAL FIRE PROTECTION ASSOCIATION)

1. 13 STANDARD FOR THE INSTALLATION OF SPRINKLER SYSTEMS
2. 1961 STANDARD ON FIRE HOSE
3. 1963 STANDARD FOR FIRE HOSE CONNECTIONS

E. SSPC (THE SOCIETY FOR PROTECTIVE COATINGS)

F. UL (UNDERWRITER'S LABORATORIES)

1. 47 STANDARD FOR SEMIAUTOMATIC FIRE HOSE STORAGE DEVICES
2. 199 STANDARD FOR AUTOMATIC SPRINKLER FOR FIRE-PROTECTION SERVICE
3. 213 STANDARD FOR RUBBER GASKETED FITTING FOR FIRE-PROTECTION SERVICE
4. 219 STANDARD FOR LINED FIRE HOSE FOR INTERIOR STANDPIPES

5. 263 STANDARD FOR FIRE TESTS OF BUILDING CONSTRUCTION AND MATERIALS
6. 346 STANDARD FOR WATERFLOW INDICATORS FOR FIRE PROTECTIVE SIGNALING SYSTEMS
7. 393 STANDARD FOR INDICATING PRESSURE GAUGES FOR FIRE-PROTECTION SERVICE
8. 401 STANDARD FOR PORTABLE SPRAY HOSE NOZZLES FORE FIRE-PROTECTION SERVICE
9. 405 STANDARD FOR FIRE DEPARTMENT CONNECTION DEVICES
10. 464 STANDARD FOR AUDIBLE SIGNALING DEVICES FOR FIRE ALARM AND SIGNALING DEVICES, INCLUDING ACCESSORIES
11. 486A, 486B STANDARD FOR WIRE CONNECTORS
12. 668 STANDARD FOR HOSE VALVES FOR FIRE-PROTECTION SERVICE
13. 753 STANDARD FOR ALARM ACCESSORIES FOR AUTOMATIC WATER-SUPPLY CONTROL VALVES FOR FIRE-PROTECTION SERVICE
14. 1474 STANDARD FOR ADJUSTABLE DROP NIPPLES FOR SPRINKLER SYSTEMS
15. 1479 STANDARD FOR FIRE TEST OF PENETRATION FIRESTOPS
16. 1726 STANDARD FOR AUTOMATIC DRAIN VALVES FOR STANDPIPE SYSTEMS
17. 1767 STANDARD FOR EARLY-SUPPRESSION FAST-RESPONSE SPRINKLERS

G. USDA (UNITED STATES DEPARTMENT OF AGRICULTURE)

1.4 SUBMITTALS

A. SUBMITTALS SHALL BE SUBMITTED IN CONFORMANCE WITH THE REQUIREMENTS OF SECTION *21 00 01 – FIRE-SUPPRESSION GENERAL PROVISIONS*.

B. SUBMITTALS ARE REQUIRED FOR:

1. ALARM DEVICES
2. PRESSURE GAUGES
3. FIRE DEPARTMENT CONNECTIONS
4. SPRINKLER HEADS
5. HOSE STATIONS
6. MICROBIOLOGICALLY INFLUENCED CORROSION MONITORING
7. DIELECTRIC FITTINGS
8. FLEXIBLE CONNECTORS
9. SPRINKLER SPECIALTY FITTINGS
10. DRAINS
11. FIRE-STOPPING MATERIALS (COMPOUND, PACKING, PREFABRICATED FIRESTOP COLLARS, SEALANT)
12. PAINTING
13. SEALANT

PART 2: PRODUCTS

2.1 MATERIALS

A. ALL MATERIALS AND EQUIPMENT USED IN THE INSTALLATION OF THE SPRINKLER SYSTEM SHALL BE LISTED IN THE UNDERWRITERS LABORATORIES, INC. "FIRE PROTECTION EQUIPMENT LIST". MANUFACTURER'S AND PRODUCT NAMES ARE TO ESTABLISH A QUALITY OF ITEMS; OTHER MANUFACTURERS' PRODUCTS MAY BE SUBMITTED FOR APPROVAL TO ITEMS, AND THE DECISION OF THE OWNER'S REPRESENTATIVE SHALL BE FINAL.

2.2 MANUFACTURERS

A. IN OTHER PART 2 ARTICLES WHERE TITLES BELOW INTRODUCE LISTS, THE FOLLOWING REQUIREMENTS APPLY TO PRODUCT SELECTION:

1. AVAILABLE MANUFACTURERS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, MANUFACTURERS OFFERING PRODUCTS THAT MAY BE INCORPORATED INTO THE WORK INCLUDE, BUT ARE NOT LIMITED TO, MANUFACTURERS SPECIFIED.
2. MANUFACTURERS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE PRODUCTS BY ONE OF THE MANUFACTURERS SPECIFIED.

2.3 ALARM DEVICES

A. ALARM-DEVICE TYPES SHALL MATCH PIPING AND EQUIPMENT CONNECTIONS.

B. WATER-MOTOR-OPERATED ALARM: MECHANICAL-OPERATION TYPE WITH PELTON-WHEEL OPERATOR WITH SHAFT LENGTH, BEARINGS, AND SLEEVE TO SUIT WALL CONSTRUCTION AND 10-INCH- DIAMETER, CAST-ALUMINUM ALARM GONG WITH RED-ENAMEL FACTORY FINISH. INCLUDE NPS 3/4 INLET AND NPS 1 DRAIN CONNECTIONS.
   1. AVAILABLE MANUFACTURERS:
      a. RELIABLE AUTOMATIC SPRINKLER CO., INC.
      b. TYCO FIRE & BUILDING PRODUCTS.
      c. VICTAULIC COMPANY OF AMERICA
      d. VIKING CORP.

C. ELECTRICALLY OPERATED ALARM: WITH 8-INCH MINIMUM DIAMETER, VIBRATING-TYPE, METAL ALARM BELL WITH RED-ENAMEL FACTORY FINISH AND SUITABLE FOR OUTDOOR USE.
   1. AVAILABLE MANUFACTURERS:
      a. POTTER ELECTRIC SIGNAL COMPANY.
      b. SYSTEM SENSOR.

D. WATER-FLOW INDICATOR: ELECTRICAL-SUPERVISION, PADDLE-OPERATED-TYPE, WATER-FLOW DETECTOR WITH 250-PSIG PRESSURE RATING AND DESIGNED FOR HORIZONTAL OR VERTICAL INSTALLATION. INCLUDE TWO SINGLE-POLE, DOUBLE-THROW CIRCUIT SWITCHES FOR ISOLATED ALARM AND AUXILIARY CONTACTS, 7 A, 125-V AC AND 0.25 A, 24-V DC; COMPLETE WITH FACTORY-SET, FIELD-ADJUSTABLE RETARD ELEMENT TO PREVENT FALSE SIGNALS AND TAMPERPROOF COVER THAT SENDS SIGNAL IF REMOVED.
   1. AVAILABLE MANUFACTURERS:
      a. ADT SECURITY SERVICES, INC.
      b. GRINNELL FIRE PROTECTION.
      c. ITT MCDONNELL & MILLER.
      d. POTTER ELECTRIC SIGNAL COMPANY.
      e. SYSTEM SENSOR.
      f. VIKING CORP.
      g. WATTS INDUSTRIES, INC.; WATER PRODUCTS DIV..

E. PRESSURE SWITCH: ELECTRICAL-SUPERVISION-TYPE, WATER-FLOW SWITCH WITH RETARD FEATURE. INCLUDE SINGLE-POLE, DOUBLE-THROW, NORMALLY CLOSED CONTACTS AND DESIGN THAT OPERATES ON RISING PRESSURE AND SIGNALS WATER FLOW.
   1. AVAILABLE MANUFACTURERS:
      a. GRINNELL FIRE PROTECTION.
      b. POTTER ELECTRIC SIGNAL COMPANY.
      c. SYSTEM SENSOR.
      d. VIKING CORP.

F. VALVE SUPERVISORY SWITCH: ELECTRICAL, SINGLE-POLE, DOUBLE-THROW SWITCH WITH NORMALLY CLOSED CONTACTS. INCLUDE DESIGN THAT SIGNALS CONTROLLED VALVE IS IN OTHER THAN FULLY OPEN POSITION.
   1. AVAILABLE MANUFACTURERS:
      a. MCWANE, INC.; KENNEDY VALVE DIV.
      b. POTTER ELECTRIC SIGNAL COMPANY.
      c. SYSTEM SENSOR.

G. INDICATOR-POST SUPERVISORY SWITCH: ELECTRICAL, SINGLE-POLE, DOUBLE-THROW SWITCH WITH NORMALLY CLOSED CONTACTS. INCLUDE DESIGN THAT SIGNALS CONTROLLED INDICATOR-POST VALVE IS IN OTHER THAN FULLY OPEN POSITION.
   1. AVAILABLE MANUFACTURERS:
      a. POTTER ELECTRIC SIGNAL COMPANY.
      b. SYSTEM SENSOR.

2.4 PRESSURE GAGES

A. AVAILABLE MANUFACTURERS:

1. AGF MANUFACTURING CO.
2. AMETEK, INC.; U.S. GAUGE.
3. BRECCO CORPORATION.
4. DRESSER EQUIPMENT GROUP; INSTRUMENT DIV.
5. MARSH BELLOFRAM.
6. WIKA INSTRUMENT CORPORATION.

B. DESCRIPTION: 3-1/2- TO 4-1/2-INCH- DIAMETER, DIAL PRESSURE GAGE WITH RANGE OF 0 TO 250 PSIG MINIMUM.

C. WATER SYSTEM PIPING: INCLUDE CAPTION "WATER" OR "AIR/WATER" ON DIAL FACE.

D. AIR SYSTEM PIPING: INCLUDE RETARD FEATURE AND CAPTION "AIR" OR "AIR/WATER" ON DIAL FACE.

2.5 FIRE DEPARTMENT CONNECTION:

A. AVAILABLE MANUFACTURERS:

1. CENTRAL SPRINKLER CORP.
2. ELKHART BRASS MFG. CO., INC.
3. FIRE-END AND CROKER CORP.
4. FIRE PROTECTION PRODUCTS, INC.
5. GMR INTERNATIONAL EQUIPMENT CORPORATION.
6. GUARDIAN FIRE EQUIPMENT INCORPORATED.
7. POTTER-ROEMER; FIRE-PROTECTION DIV.
8. RELIABLE AUTOMATIC SPRINKLER CO., INC.
9. UNITED BRASS WORKS, INC.

B. WALL-TYPE, FIRE DEPARTMENT CONNECTION: 175-PSIG MINIMUM PRESSURE RATING; WITH CORROSION-RESISTANT-METAL BODY WITH BRASS INLETS, BRASS WALL ESCUTCHEON PLATE, BRASS LUGGED CAPS WITH GASKETS AND BRASS CHAINS, AND BRASS LUGGED SWIVEL CONNECTIONS. INCLUDE INLETS WITH THREADS ACCORDING TO NFPA AND MATCHING LOCAL FIRE DEPARTMENT SIZES AND THREADS, OUTLET WITH PIPE THREADS, EXTENSION PIPE NIPPLES, CHECK DEVICES OR CLAPPERS FOR INLETS, 3/4 INCH AUTOMATIC DRIP FOR OUTSIDE DRAIN AND ESCUTCHEON PLATE WITH MARKING SIMILAR TO "AUTO SPKR."

1. TYPE: FLUSH, WITH INLET NUMBERS AS REQUIRED BY NFPA AND SQUARE OR RECTANGULAR ESCUTCHEON PLATE.
2. FINISH: POLISHED BRASS.

C. INSTALL A 90-DEGREE ELBOW WITH DRAIN CONNECTION AT ALL FIRE DEPARTMENT CONNECTIONS FOR SYSTEM DRAINAGE TO PREVENT FREEZING.

2.6 SPRINKLER HEADS

A. SPRINKLERS SHALL BE UL LISTED OR FMG APPROVED, WITH 175-PSIG MINIMUM PRESSURE RATING.

B. AVAILABLE MANUFACTURERS:

1. RELIABLE AUTOMATIC SPRINKLER CO., INC.
2. VICTAULIC CO. OF AMERICA.
3. TYCO FIRE & BUILDING PRODUCTS.
4. VIKING CORP.

C. AUTOMATIC SPRINKLERS: WITH HEAT-RESPONSIVE ELEMENT COMPLYING WITH UL.

D. SPRINKLER BODY: SPRINKLERS SHALL BE MANUFACTURED OF DIE CAST BRASS, WITH HEX-SHAPED WRENCH BOSS INTEGRALLY CAST INTO THE SPRINKLER BODY TO FACILITATE INSTALLATION AND REDUCE THE RISK OF DAMAGE DURING INSTALLATION.

E. SPRINKLER TYPES AND CATEGORIES:

1. NOMINAL 1/2-INCH ORIFICE FOR "ORDINARY" TEMPERATURE CLASSIFICATION RATING, UNLESS OTHERWISE INDICATED OR REQUIRED BY APPLICATION.
2. SPRINKLER HEAD TYPE AND FINISH SHALL BE AS INDICATED IN THE FIRE PROTECTION DESIGN CRITERIA MATRICES. TEMPERATURE RATINGS FOR ALL SPRINKLER HEADS SHALL CONFORM TO THE DESIGN CRITERIA AND THE REQUIREMENTS OF NFPA.

F. SPRINKLER FINISHES: SPRINKLER HEAD FINISH SHALL BE AS INDICATED IN THE FIRE PROTECTION DESIGN CRITERIA MATRICES.

G. RACK INTERMEDIATE LEVEL SPRINKLERS AND SPRINKLERS IN BOILER ROOM, REFRIGERATION ROOM AND MAINTENANCE ROOMS SHALL BE PROVIDED WITH PROTECTION GUARDS, WIRE-CAGE TYPE, INCLUDING FASTENING DEVICE FOR ATTACHING TO SPRINKLER

H. NOTE: NO SPRINKLER HEADS WITH GLASS BULBS ARE ALLOWED WITHIN THE FACILITY WHERE FUSIBLE LINK HEADS ARE SPECIFIED WITH THE EXCEPTION OF SPECIALTY HEADS SUCH AS DRY PENDENTS AND OTHERS THAT ARE NOT MANUFACTURED WITH FUSIBLE LINKS.

2.7 SPARE SPRINKLER HEADS

A. SPRINKLER CABINETS: FINISHED, WALL-MOUNTING, STEEL CABINET WITH HINGED COVER, WITH SPACE FOR MINIMUM OF SIX SPARE SPRINKLERS PLUS SPRINKLER WRENCH. INCLUDE NUMBER OF SPRINKLERS REQUIRED BY NFPA AND SPRINKLER WRENCH. INCLUDE SEPARATE CABINET WITH SPRINKLERS AND WRENCH FOR EACH TYPE OF SPRINKLER ON PROJECT.

2.8 HOSE STATIONS

A. AVAILABLE MANUFACTURERS:
   1. AFAC INC.
   2. AMERICAN FIRE HOSE CABINET CO.
   3. ANGUS FIRE, INC.
   4. BROOKS EQUIPMENT CO., INC.
   5. ELKHART BRASS MFG. CO., INC.
   6. FIRE-END AND CROKER CORP.
   7. GMR INTERNATIONAL EQUIPMENT CORPORATION.
   8. POTTER-ROEMER; FIRE-PROTECTION DIV.

B. DESCRIPTION: SEMIAUTOMATIC HOSE STATIONS. INCLUDE BRASS RACK NIPPLE, HOSE RACK, AND THE FOLLOWING:
   1. VALVE: BRASS OR BRONZE, 300 MINIMUM PRESSURE RATING, 90-DEGREE-ANGLE-PATTERN HOSE VALVE WITH FEMALE NPS INLET AND OUTLET, UNLESS OTHERWISE INDICATED.
      a. VALVE OPERATION: NONADJUSTABLE TYPE.
   2. THREADS AND GASKETS: MATCHING LOCAL FIRE DEPARTMENT THREADS.
   3. FLOW-RESTRICTING DEVICES: NPS 1-1/2, BRASS, ADJUSTABLE FOR NPS 1-1/2 FIRE HOSE INLET.
   4. FIRE HOSE: LINED FIRE HOSE WITH COUPLINGS, GASKETS, AND NOZZLE. INCLUDE THE FOLLOWING FIRE HOSE MATERIALS:
      a. JACKET: SYNTHETIC THREAD.
      b. LINING: PLASTIC COMPOUND.
      c. COVER: RUBBER, PLASTIC, OR COMBINATION OF RUBBER AND PLASTIC COMPOUNDS.
   5. NOZZLES
   6. DRAIN VALVES
   7. MOUNTINGS: PIPE CLAMP OR WALL BRACKET FOR FREESTANDING UNITS.

C. CLASS-I HOSE STATION:
   1. NPS 2-1/2 HOSE CONNECTION VALVE, ANGLE TYPE, BRASS, POLISHED BRASS FINISH, THREAD TO MATCH FIRE DEPARTMENT HARDWARE, 300 PSI WORKING PRESSURE, WITH THREADED CAP AND CHAIN OF SAME MATERIAL AND FINISH.

D. CLASS-II HOSE STATION:
   1. NPS 1-1/2 HOSE STATION: NPS 1-1/2 HOSE VALVE; HOSE RACK WITH WATER-RETENTION DEVICE AND PINS FOR FOLDED, NPS 1-1/2 LINED HOSE; AND NPS 1-1/2 LINED HOSE WITH SWIVEL INLET COUPLING AND NOZZLE.
      a. HOSE-RACK FINISH: RED ENAMEL.
      b. HOSE VALVE AND TRIM FINISH: POLISHED CHROME-PLATED.

c. FIRE HOSE: 100% SYNTHETIC LINED 100% SYNTHETIC JACKETED HOSE, 100-FOOT LENGTH.
d. NOZZLE: POLISHED-CHROME-PLATED BRASS, ADJUSTABLE FROM SHUTOFF TO FOG SPRAY OR STRAIGHT STREAM.
e. PROVIDE MANUFACTURERS MOUNTING HARDWARE.

E. CLASS-III HOSE STATION:
1. NPS 2-1/2 HOSE CONNECTION VALVE, ANGLE TYPE, BRASS, POLISHED BRASS FINISH, THREAD TO MATCH FIRE DEPARTMENT HARDWARE, 300 PSI WORKING PRESSURE, WITH THREADED CAP AND CHAIN OF SAME MATERIAL AND FINISH. NPS 1-1/2 HOSE VALVE; HOSE RACK WITH WATER-RETENTION DEVICE AND PINS FOR FOLDED, NPS 1-1/2 LINED HOSE; AND NPS 1-1/2 LINED HOSE WITH SWIVEL INLET COUPLING AND NOZZLE.
a. HOSE-RACK FINISH: RED ENAMEL.
b. HOSE VALVE AND TRIM FINISH: POLISHED CHROME-PLATED.
c. FIRE HOSE: 100% SYNTHETIC LINED 100% SYNTHETIC JACKETED HOSE, 100-FOOT LENGTH.
d. NOZZLE: POLISHED-CHROME-PLATED BRASS, ADJUSTABLE FROM SHUTOFF TO FOG SPRAY OR STRAIGHT STREAM.
e. PROVIDE MANUFACTURERS MOUNTING HARDWARE.

2.9 MICROBIOLOGICALLY INFLUENCED CORROSION MONITORING

A. CORROSION COUPON MONITORING STATIONS SHALL BE PROVIDED FOR WET SPRINKLER PIPING SYSTEMS TO BE LOCATED AT EACH SERVICE ENTRANCE AT EASILY ACCESSIBLE LOCATION.
B. MONITORING STATION SHALL BE MADE UP OF 1” PIPE FITTING OR WELD-O-LET AT BOTTOM OF MONITORED PIPE. 1” BALL VALVES SHALL BE PROVIDED FOR ISOLATION AND REMOVAL OF COUPONS. THE COUPON SHALL BE ATTACHED TO THE END OF A PLUG THAT IS THREADED INTO A FPT CONNECTION.
C. COUPONS AND LABORATORY ANALYSIS FOR ONE YEAR OF SYSTEM SERVICE SHALL BE INCLUDED IN PROJECT SCOPE. COUPONS SHALL BE RETURNED EVERY 90 DAYS TO TESTING LABORATORY FOR ANALYSIS AND REPLACEMENT.

2.10 DIELECTRIC FITTINGS

A. ASSEMBLY SHALL BE COPPER ALLOY, FERROUS, AND INSULATING MATERIALS WITH ENDS MATCHING PIPING SYSTEM.
B. DIELECTRIC UNIONS: FACTORY-FABRICATED ASSEMBLY, DESIGNED FOR 250-PSIG MINIMUM WORKING PRESSURE AT 180 DEG F INCLUDE INSULATING MATERIAL THAT ISOLATES DISSIMILAR MATERIALS AND ENDS WITH INSIDE THREADS ACCORDING TO ASME B1.20.1.
C. DIELECTRIC FLANGES: FACTORY-FABRICATED COMPANION-FLANGE ASSEMBLY, FOR 175-PSIG MINIMUM WORKING-PRESSURE RATING AS REQUIRED FOR PIPING SYSTEM.
D. DIELECTRIC FLANGE INSULATION KITS: COMPONENTS FOR FIELD ASSEMBLY SHALL INCLUDE CR OR PHENOLIC GASKET, PE OR PHENOLIC BOLT SLEEVES, PHENOLIC WASHERS, AND STEEL BACKING WASHERS.
E. DIELECTRIC COUPLINGS: GALVANIZED STEEL WITH INERT AND NONCORROSIVE THERMOPLASTIC LINING AND THREADED ENDS AND 300-PSIG WORKING-PRESSURE RATING AT 225 DEG F
F. DIELECTRIC NIPPLES: ELECTROPLATED STEEL WITH INERT AND NONCORROSIVE THERMOPLASTIC LINING, WITH COMBINATION OF PLAIN, THREADED, OR GROOVED ENDS AND 300-PSIG WORKING-PRESSURE RATING AT 225 DEG F.

2.11 FLEXIBLE CONNECTORS

A. FLEXIBLE CONNECTORS SHALL HAVE MATERIALS SUITABLE FOR SYSTEM FLUID. INCLUDE 175-PSIG MINIMUM WORKING-PRESSURE RATING AND ENDS ACCORDING TO THE FOLLOWING:
1. NPS 2 AND SMALLER: THREADED.
2. NPS 2-1/2 AND LARGER: FLANGED.
3. OPTION FOR NPS 2-1/2 AND LARGER: GROOVED FOR USE WITH GROOVED-END-PIPE COUPLINGS.

a. THREE GROOVED FLEXIBLE TYPE COUPLINGS MAY BE USED IN LIEU OF A FLEXIBLE CONNECTOR AT EQUIPMENT CONNECTIONS. COUPLINGS SHALL BE PLACED IN CLOSE PROXIMITY TO THE VIBRATION SOURCE.

B. AVAILABLE MANUFACTURERS:
1. ANAMET INC.
2. FLEX-HOSE CO., INC.
3. FLEXICRAFT INDUSTRIES.
4. FLEX-PRESSION, LTD.
5. FLEX-WELD, INC.
6. HYSPAN PRECISION PRODUCTS, INC.
7. MERCER RUBBER CO.
8. METRAFLEX, INC.
9. PROCO PRODUCTS, INC.
10. UNAFLEX INC.

C. STAINLESS-STEEL-HOSE/STEEL PIPE, FLEXIBLE CONNECTORS: CORRUGATED, STAINLESS-STEEL, INNER TUBING COVERED WITH STAINLESS-STEEL WIRE BRAID. INCLUDE STEEL NIPPLES OR FLANGES, WELDED TO HOSE.

D. STAINLESS-STEEL-HOSE/STAINLESS-STEEL PIPE, FLEXIBLE CONNECTORS: CORRUGATED, STAINLESS-STEEL, INNER TUBING COVERED WITH STAINLESS-STEEL WIRE BRAID. INCLUDE STAINLESS-STEEL NIPPLES OR FLANGES, WELDED TO HOSE.

2.12 SPRINKLER SPECIALTY FITTINGS

A. SPRINKLER SPECIALTY FITTINGS SHALL BE UL LISTED OR FMG APPROVED, WITH 175-PSIG MINIMUM WORKING-PRESSURE RATING, AND MADE OF MATERIALS COMPATIBLE WITH PIPING. SPRINKLER SPECIALTY FITTINGS SHALL HAVE 250-PSIG MINIMUM WORKING-PRESSURE RATING IF FITTINGS ARE COMPONENTS OF HIGH-PRESSURE PIPING SYSTEM.

B. OUTLET SPECIALTY FITTINGS:
1. MECHANICAL-T AND -CROSS FITTINGS: DUCTILE-IRON HOUSING WITH GASKETS, BOLTS AND NUTS, AND THREADED, LOCKING-LUG, OR GROOVED OUTLETS.
2. SNAP-ON AND STRAPLESS OUTLET FITTINGS: DUCTILE-IRON HOUSING OR CASTING WITH GASKET AND THREADED OUTLET.

C. SPRINKLER DRAIN AND ALARM TEST FITTINGS: CAST-BRONZE OR DUCTILE-IRON BODY; WITH THREADED OR GROOVED INLET AND OUTLET, TEST VALVE, AND ORIFICE AND SIGHT GLASS.

D. SPRINKLER BRANCH-LINE TEST FITTINGS: BRASS BODY WITH THREADED INLET, CAPPED DRAIN OUTLET, AND THREADED OUTLET FOR SPRINKLER.

E. SPRINKLER INSPECTOR'S TEST FITTING: CAST- OR DUCTILE-IRON HOUSING WITH THREADED INLET AND DRAIN OUTLET AND SIGHT GLASS.

F. DROP-NIPPLE FITTINGS: ADJUSTABLE WITH THREADED INLET AND OUTLET, AND SEALS.

G. DRY-PIPE-SYSTEM FITTINGS: UL LISTED FOR DRY-PIPE SERVICE.

2.13 DRAINS

A. ALL LOW POINTS AND POCKETS IN THE PIPING SHALL BE PROVIDED WITH SUITABLE MEANS OF DRAINING.

B. PITCH ALL DRY MAINS AND BRANCHES AT 1/2” PER 10 FEET.

C. SPRINKLER BRANCH LINES SHALL BE DRAINED BY INSTALLING 1/2" DRAIN VALVES WHERE REQUIRED. DRAW-OFF PIPING TO BE PROVIDED AND RUN OUTSIDE THE BUILDING.

D. ALL DRAIN CONNECTION AND VALVES SHALL BE IN ACCORDANCE WITH THE STANDARDS OF THE NATIONAL FIRE PROTECTION ASSOCIATION FOR THE INSTALLATION OF SPRINKLER SYSTEMS.

E. ALL SYSTEMS SHALL PITCH TO DRAIN IN ACCORDANCE WITH NFPA.

2.14 FIRE-STOPPING MATERIALS

A. FIRESTOP COMPOUND
1. DESCRIPTION: COMPLIANT FIRESTOP, RED COLOR, LISTED FOR UP TO 4 HOUR FIRE RATING.
2. MANUFACTURER / MODEL: NELSON CMP FIRESTOP COMPOUND OR EQUAL.

B. FIRE RATED PACKING MATERIALS
   1. FOAM FIRESTOP
      a. DESCRIPTION: INTUMESCENT FIRE BARRIER FOAM, UL LISTED FOR USE IN THROUGH-PENETRATION FIRESTOP SYSTEMS, MAROON COLOR, LOW VOC LEED COMPLIANT, LISTED FOR UP TO 2 HOUR FIRE RATING.
      b. MANUFACTURER / MODEL: 3M FIRE BARRIER RATED FOAM 1-STEP OR EQUAL.
   2. MINERAL WOOL
      a. DESCRIPTION: MINERAL WOOL FIRESTOP PACKING MATERIAL, UL LISTED FOR USE IN THROUGH-PENETRATION FIRESTOP SYSTEMS, GRAY COLOR, 8 PCF, LISTED FOR UP TO 4 HOUR FIRE RATING.
      b. MANUFACTURER / MODEL: NELSON FIRESTOP MINERAL WOOL OR EQUAL.
   3. WRAP STRIPS
      a. DESCRIPTION: TUCK-IN INTUMESCENT WRAP STRIP, UL LISTED FOR USE IN PLASTIC PIPE THROUGH-PENETRATION FIRESTOP SYSTEMS, LISTED FOR UP TO 3 HOUR FIRE RATING.
      b. MANUFACTURER / MODEL: 3M FIRE BARRIER TUCK-IN WRAP STRIPS (NOT TO BE USED FOR CPVC), 3M FIRE BARRIER WRAP ULTRA GS, OR EQUAL.
   4. ALTERNATE PACKING MATERIAL
      a. DESCRIPTION: INORGANIC WOVEN PACKING MATERIAL TO BE USED IN LIEU OF MINERAL WOOL, UL LISTED FOR USE IN THROUGH-PENETRATION FIRESTOP SYSTEMS, OFF-WHITE COLOR, 8 PCF, LISTED FOR UP TO 4 HOUR FIRE RATING.
      b. MANUFACTURER / MODEL: 3M FIRE BARRIER PACKING MATERIAL PM4 OR EQUAL.

C. PREFABRICATED FIRESTOP COLLAR ASSEMBLIES
   1. DESCRIPTION: FACTORY FABRICATED FIRE WRAP AND COLLAR ASSEMBLY, GALVANIZED STEEL HOUSING, INTUMESCENT FIRE WRAP, UL LISTED FOR PLASTIC PIPE THROUGH-PENETRATION FIRESTOP SYSTEMS, LOW VOC LEED COMPLIANT, LISTED FOR UP TO 3 HOUR FIRE RATING.
   2. MANUFACTURER / MODEL: HILTI CP 643 OR CP 644, 3M PPD, OR EQUAL.

2.15 PIPE PAINTING:

A. PROVIDE PAINTING OF ALL CARBON STEEL FIRE PROTECTION SYSTEM PIPING LOCATED WITHIN THE SERVICE ENTRANCE ROOM. PAINTING SHALL INCLUDE ALL FIRE PROTECTION SYSTEM PIPING, FITTINGS AND VALVES INCLUDING THE SERVICE ENTRANCE CONNECTIONS, RISER HEADERS, RISERS, DRAINS AND COMPRESSED AIR PIPING.

B. PIPING SHALL BE THOROUGHLY CLEANED OF DUST, DIRT, OILS, GREASE AND OTHER FOREIGN MATERIAL PRIOR TO PRIMING AND PAINTING.

C. AFTER CLEANING, PIPING SHALL BE PRIMED AS REQUIRED FOR FINISH PAINT TYPE. FINISH PAINT PIPING WITH TWO (2) COATS OF HIGH GLOSS, CORROSION INHIBITING ALKYD ENAMEL PAINT, SUITABLE FOR PIPING MATERIAL.
   1. SPRINKLER PIPING COLOR TO BE SAFETY RED.
   2. COMPRESSED AIR PIPING COLOR SHALL BE SAFETY BLUE.
   3. DRAIN PIPING COLOR SHALL BE SAFETY ORANGE.

D. ALL GALVANIZED PIPING FOR DRY SYSTEMS AND PRE-ACTION SYSTEMS SHALL NOT BE PAINTED.

E. PAINTING OF PIPING SHALL BE COMPLETED PRIOR TO INSTALLATION OF PIPE LABEL MARKERS.

F. NOTE: SEE FIRE PROTECTION ALTERNATES FOR ANY ALTERNATES FOR ADDITIONAL PIPE PAINTING.

2.16 SEALANT

A. FIRE RATED SILICONE SEALANT
   1. DESCRIPTION: FIRE BARRIER WATER TIGHT INTUMESCENT SILICONE SEALANT, RED OR LIGHT GRAY COLOR, FUNGI RESISTANCE, LOW VOC LEED COMPLIANT, LISTED FOR UP TO 4 HOUR FIRE RATING.
   2. MANUFACTURER / MODEL: 3M FB-3000 WT, HILTI FS ONE MAX, OR EQUAL.

B. SILICONE SEALANT (NON-FIRE RATED)

1. DESCRIPTION: JOINT MOVEMENT, WHITE COLOR, USDA AND FDA APPROVED, LOW VOC LEED COMPLIANT.
2. MANUFACTURER / MODEL: GE SCS1000 OR EQUAL.
3. JOINT SEALER TYPE SC (SILICONE, GENERAL CONSTRUCTION): ONE-PART MEDIUM MODULUS, NATURAL CURE, SYNTHETIC SEALANT, HAVING A USEFUL LIFE EXPECTANCY OF AT LEAST 20 YEARS, CONFORMING TO ASTM, TYPE S, NS, CLASS 25, USE NT, G, A, M, O WITH A MINIMUM MOVEMENT CAPABILITY OF ±50 PERCENT, EQUAL TO THE FOLLOWING AND COMPLYING WITH LEED REQUIREMENTS FOR VOC LIMITS.
    a. DOW CORNING CORPORATION, MIDLAND MI.; PRODUCT, “791”.
    b. GENERAL ELECTRIC COMPANY (GE SILICONES) WATERFORD NY; PRODUCT, “SILPRUF”.
    c. TREMCO, BEACHWOOD OH.; PRODUCT, “SPECTREM 2”.
4. COLORS FOR SEALANT TYPES “SC”, AS SELECTED BY THE ARCHITECT FROM MANUFACTURER’S STANDARD COLORS.
5. PENDENT HEADS INSTALLED IN INSULATED METAL PANEL CEILINGS SHALL HAVE VOIDS BETWEEN ESCUTCHEONS AND IMP CAULKED AS WELL AS AROUND PIPING ON TOP OF IMP AS SHOWN ON DETAILS DRAWINGS. SEALANT SHALL BE USDA APPROVED SILICONE BASED WHITE SEALANT TREMCO MODEL SPECTREM-2 OR EQUAL.

PART 3: EXECUTION

3.1 GENERAL REQUIREMENTS

A. REFER TO MANUFACTURER INSTALLATION DOCUMENTATION FOR ADDITIONAL INFORMATION ON EACH OF THE PRODUCTS SPECIFIED HEREUNDER.

B. PRE-CLEAN: BEFORE APPLYING FIRE-STOPPING MATERIALS, SEALANTS, AND PAINT, SURFACE MUST BE CLEAN, DRY, AND IN SOUND CONDITION. REMOVE ALL OIL, DUST, GREASE, DIRT, LOOSE RUST, AND OTHER FOREIGN MATERIAL TO ENSURE ADEQUATE ADHESION.

C. ONLY APPLY FIRE-STOPPING MATERIALS, SEALANTS, AND PAINT WHEN TEMPERATURE AND HUMIDITY CONDITIONS ARE WITHIN RANGES SPECIFIED BY THE PRODUCT MANUFACTURER.

3.2 EXAMINATION

A. EXAMINE ROUGHING-IN FOR HOSE CONNECTIONS AND STATIONS TO VERIFY ACTUAL LOCATIONS OF PIPING CONNECTIONS BEFORE INSTALLATION.

B. EXAMINE WALLS AND PARTITIONS FOR SUITABLE THICKNESSES, FIRE- AND SMOKE-RATED CONSTRUCTION, FRAMING FOR HOSE-STATION CABINETS, AND OTHER CONDITIONS WHERE HOSE CONNECTIONS AND STATIONS ARE TO BE INSTALLED.

C. PROCEED WITH INSTALLATION ONLY AFTER UNSATISFACTORY CONDITIONS HAVE BEEN CORRECTED.

3.3 INSTALLATION

A. INSTALL "INSPECTOR'S TEST CONNECTIONS" IN SPRINKLER SYSTEM PIPING, COMPLETE WITH SHUTOFF VALVE, SIZED AND LOCATED ACCORDING TO NFPA.

B. INSTALL SPRINKLER ZONE CONTROL VALVES, TEST ASSEMBLIES, AND DRAIN RISERS ADJACENT TO STANDPIPES WHEN SPRINKLER PIPING IS CONNECTED TO STANDPIPES.

C. INSTALL BALL DRIP VALVES TO DRAIN PIPING BETWEEN FIRE DEPARTMENT CONNECTIONS AND CHECK VALVES. DRAIN TO FLOOR DRAIN OR OUTSIDE BUILDING.

D. INSTALL ALARM DEVICES IN PIPING SYSTEMS.

E. INSTALL PRESSURE GAGES ON RISER OR FEED MAIN, AT EACH SPRINKLER TEST CONNECTION, AND AT TOP OF EACH STANDPIPE. INCLUDE PRESSURE GAGES WITH CONNECTION NOT LESS THAN NPS 1/4 AND WITH SOFT METAL SEATED GLOBE VALVE, ARRANGED FOR DRAINING PIPE BETWEEN GAGE AND VALVE. INSTALL GAGES TO PERMIT REMOVAL, AND INSTALL WHERE THEY WILL NOT BE SUBJECT TO FREEZING.

F. PRESSURIZE AND CHECK DRY-PIPE SPRINKLER SYSTEM PIPING AND AIR-PRESSURE MAINTENANCE DEVICES AND AIR COMPRESSORS.

3.4 SPRINKLER APPLICATIONS

A. DRAWINGS INDICATE SPRINKLER TYPES TO BE USED.

3.5 SPRINKLER INSTALLATION

A. SPRINKLER HEAD SPACING, DISTANCE FROM WALLS AND OBSTRUCTIONS AND DISTANCES BELOW ROOF AND ABOVE STORAGE SHALL BE AS REQUIRED BY NFPA FOR THE TYPE OF SPRINKLER HEAD AND SPRINKLER SYSTEM

B. IN-RACK SPRINKLERS SHALL BE LOCATED PER REQUIREMENTS OF NFPA AND FMG DATA SHEETS.

C. SPRINKLER HEADS IN FINISHED LAY-IN ACOUSTICAL TILE CEILING SYSTEM AREAS SHALL BE SYMMETRICAL IN RELATION TO CEILING SYSTEM COMPONENTS AND CENTERED IN THE CEILING TILE, OR CENTERED IN ONE-HALF OF THE CEILING TILE.

D. DO NOT INSTALL PENDENT OR SIDEWALL, WET-TYPE SPRINKLERS IN AREAS SUBJECT TO FREEZING. USE DRY-TYPE SPRINKLERS WITH WATER SUPPLY FROM HEATED SPACE.

E. APPLY MASKING TAPE OR PAPER COVER TO ENSURE CONCEALED SPRINKLERS, COVER PLATES, AND SPRINKLER ESCUTCHEONS DO NOT RECEIVE FIELD PAINT FINISH. REMOVE AFTER PAINTING. REPLACE PAINTED SPRINKLERS.

F. DO NOT INSTALL SPRINKLERS THAT HAVE BEEN DROPPED, DAMAGED, OR SHOW A VISIBLE LOSS OF FLUID. NEVER INSTALL SPRINKLERS WITH CRACKED BULBS.

3.6 HOSE-STATION INSTALLATION

A. HOSE STATIONS SHALL BE LOCATED SUCH THAT THEY ARE CAPABLE OF REACHING ALL STORAGE AREAS TO AID IN THE FIRE FIGHTING AND MOP-UP OPERATIONS. HOSE STATION LOCATION SHALL REQUIRE APPROVAL BY THE ENGINEER, THE CONSTRUCTION MANAGER OR THE OWNER.

B. SHOW HOSE-STATION LOCATIONS, SIZES, AND SPECIAL DEVICES ON DRAWINGS.

C. INSTALL FREESTANDING HOSE STATIONS FOR ACCESS AND MINIMUM PASSAGE RESTRICTION.

D. INSTALL NPS 1-1/2 HOSE-STATION VALVES WITH FLOW-RESTRICTING DEVICE, UNLESS OTHERWISE INDICATED.

E. INSTALL FREESTANDING HOSE STATIONS WITH SUPPORT OR BRACKET ATTACHED TO STANDPIPE OR SUBSTRATE.

F. INSTALL WALL-MOUNTING, RACK-TYPE HOSE STATIONS IN CABINETS. INCLUDE PIPE ESCUTCHEONS, WITH FINISH MATCHING VALVES, INSIDE CABINET WHERE WATER-SUPPLY PIPING PENETRATES CABINET. INSTALL VALVES AT ANGLE REQUIRED FOR CONNECTION OF FIRE HOSE.

G. INSTALL HOSE-REEL HOSE STATIONS ON WALL WITH BRACKET ATTACHED TO SUBSTRATE.

3.7 ROOF HOSE CABINET INSTALLATION

A. INSTALL CABINETS, AND INSTALL SHUTOFF VALVE INSIDE BUILDING IN HEATED SPACE.

3.8 FIRE DEPARTMENT CONNECTION INSTALLATION

A. LOCATE FIRE DEPARTMENT CONNECTION WITH SUFFICIENT CLEARANCE FROM WALLS, OBSTRUCTIONS, OR ADJACENT FIRE DEPARTMENT CONNECTORS TO ALLOW FULL SWING OF FIRE DEPARTMENT WRENCH HANDLE.

B. INSTALL WALL-TYPE, FIRE DEPARTMENT CONNECTIONS IN VERTICAL WALL.

C. INSTALL FREESTANDING-TYPE, FIRE DEPARTMENT CONNECTIONS IN LEVEL SURFACE.

1. INSTALL PROTECTIVE PIPE BOLLARDS ON THREE SIDES OF EACH FIRE DEPARTMENT CONNECTION. REFER TO DIVISION 5 SECTION "METAL FABRICATIONS" FOR PIPE BOLLARDS.

D. INSTALL BALL DRIP VALVE AT EACH CHECK VALVE FOR FIRE DEPARTMENT CONNECTION.

3.9 CONNECTIONS

A. DRAWINGS INDICATE GENERAL ARRANGEMENT OF PIPING, FITTINGS, AND SPECIALTIES.

B. CONNECT EXCESS-PRESSURE PUMPS TO THE FOLLOWING PIPING AND WIRING:

1. SPRINKLER SYSTEM, HYDRAULICALLY.
2. PRESSURE GAGES AND CONTROLS, HYDRAULICALLY.
3. ELECTRICAL POWER SYSTEM.
4. ALARM DEVICE ACCESSORIES FOR PUMP.
5. FIRE ALARM.

C. CONNECT COMPRESSED-AIR SUPPLY TO DRY-PIPE SPRINKLER PIPING.

D. CONNECT AIR COMPRESSOR TO THE FOLLOWING PIPING AND WIRING:

1. PRESSURE GAGES AND CONTROLS.
2. ELECTRICAL POWER SYSTEM.
3. FIRE ALARM DEVICES, INCLUDING LOW-PRESSURE ALARM.

E. ELECTRICAL CONNECTIONS: POWER WIRING IS SPECIFIED IN DIVISION 16.

F. CONNECT ALARM DEVICES TO FIRE ALARM.

G. GROUND EQUIPMENT ACCORDING TO DIVISION 16 SECTION "GROUNDING AND BONDING."

H. CONNECT WIRING ACCORDING TO DIVISION 16 SECTION "CONDUCTORS AND CABLES."

I. TIGHTEN ELECTRICAL CONNECTORS AND TERMINALS ACCORDING TO MANUFACTURER'S PUBLISHED TORQUE-TIGHTENING VALUES. IF MANUFACTURER'S TORQUE VALUES ARE NOT INDICATED, USE THOSE SPECIFIED IN UL.

3.10 CLEANING AND PROTECTION

A. CLEAN DIRT AND DEBRIS FROM SPRINKLERS.

B. REMOVE AND REPLACE SPRINKLERS WITH PAINT OTHER THAN FACTORY FINISH.

C. PROTECT SPRINKLERS FROM DAMAGE UNTIL SUBSTANTIAL COMPLETION.

3.11 FIRE-STOPPING MATERIALS

A. APPLY FIRE-STOPPING FOR FIRE-RATED PENETRATIONS AS SPECIFIED IN PART 3 OF SECTION *22 10 00 – PLUMBING PIPING* OR AS SHOWN ON DETAILS.

B. SURFACE PREPARATION

1. PRE-CLEAN: SEE GENERAL REQUIREMENTS.

C. APPLICATION

1. FILL FIRE-RATED PENETRATION VOIDS AS SPECIFIED IN PART 3 OF SECTION *22 10 00 – PLUMBING PIPING* OR AS SHOWN ON DETAILS.

3.12 PAINTING

A. APPLY PAINT WHERE SPECIFIED IN OTHER SECTIONS OR AS SPECIFIED ON DRAWINGS.

B. APPLICATION EQUIPMENT

1. NYLON/POLYESTER BRUSH

C. SURFACE PREPARATION

1. DO NOT USE HYDROCARBON SOLVENT FOR CLEANING.
2. PRE-CLEAN: SEE GENERAL REQUIREMENTS.
3. SOLVENT CLEAN: PER SSPC-SP1
4. POWER TOOL CLEAN: PER SSPC-SP3

D. PRIMING

1. APPLY PRIMER ON CLEANED BARE EXTERIOR PIPE SURFACES AT RECOMMENDED FILM THICKNESS AND SPREADING RATE AS INDICATED BY PRIMER MANUFACTURER.

E. FINISH COATING

1. APPLY FINISH COATING ON EXPOSED SURFACES AT RECOMMENDED FILM THICKNESS AND SPREADING RATE AS INDICATED BY PAINT MANUFACTURER.

3.13 SEALANT

A. APPLY SEALANT WHERE SPECIFIED IN OTHER SECTIONS AND AS SHOWN ON DETAILS.

B. SURFACE PREPARATION

1. PRE-CLEAN: SEE GENERAL REQUIREMENTS.
2. SOLVENT CLEAN: ISOPROPYL DAMPENED LINT-FREE CLEANING RAG.

C. MASKING

1. MASK SURFACES TO ELIMINATE OVERSPREAD. REMOVE MASKING TAPE IMMEDIATELY AFTER TOOLING SEALANT.

D. APPLICATION

1. APPLY SEALANT IN A CONTINUOUS OPERATION TO PROPERLY FILL THE SEAM, CAVITY, OR JOINT.
2. TOOL SEALANT TO SPREAD EVENLY AND NEATLY.

END OF SECTION

SECTION 21 05 23
GENERAL-DUTY VALVES FOR WATER-BASED FIRE-SUPPRESSION PIPING

PART 1: GENERAL

1.1 SUMMARY

A. THE WORK OF THIS SECTION SHALL INCLUDE:
   1. LISTED FIRE-SUPPRESSION VALVES
   2. UNLISTED GENERAL-DUTY VALVES
   3. SPECIALTY VALVES

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. THE FOLLOWING REFERENCED SECTIONS ARE LISTED AS A MINIMUM OF ADDITIONAL REQUIREMENTS AND/OR WORK NOT INCLUDED IN THIS SECTION WHICH MAY BE REQUIRED TO BE PERFORMED UNDER OTHER DESIGNATED SECTIONS:
   1. *21 00 01 – FIRE-SUPPRESSION GENERAL PROVISIONS*
   2. *21 13 13 – WET-PIPE FIRE-SUPPRESSION SPRINKLER SYSTEMS*
   3. *21 31 13 – ELECTRIC-DRIVE CENTRIFUGAL FIRE PUMPS*

1.3 REFERENCE STANDARDS

A. ANSI / UL (AMERICAN NATIONAL STANDARDS INSTITUTE / UNDERWRITER'S LABORATORIES)
   1. ANSI / UL 193, ALARM VALVES FOR FIRE PROTECTION SERVICE
   2. ANSI / UL 260, DRY PIPE AND DELUGE VALVES FOR FIRE PROTECTION SERVICE
   3. ANSI / UL 312, CHECK VALVES FOR FIRE PROTECTION SERVICE
   4. ANSI / UL 1468, DIRECT ACTING PRESSURE REDUCING AND PRESSURE RESTRICTING VALVES

B. FMG (FACTORY MUTUAL INSURANCE COMPANY)
   1. 1021, DRY PIPE VALVES
   2. 1041, ALARM CHECK VALVES
   3. 1112, INDICATING VALVES
   4. 1120 AND 1130, FIRE SERVICE WATER CONTROL VALVES
   5. 1210, SWING CHECK VALVES
   6. 1362, PRESSURE REDUCING VALVES

C. NFPA (NATIONAL FIRE PROTECTION ASSOCIATION)
   1. NFPA 13 STANDARD FOR THE INSTALLATION OF SPRINKLER SYSTEMS
   2. NFPA 14 STANDARD FOR THE INSTALLATION OF STANDPIPE AND HOSE SYSTEMS
   3. NFPA 25 STANDARD FOR THE INSPECTION, TESTING, AND MAINTENANCE OF WATER-BASED FIRE PROTECTION SYSTEMS

D. UL (UNDERWRITER'S LABORATORIES)
   1. UL 262, GATE VALVES FOR FIRE PROTECTION SERVICE
   2. UL 789, INDICATOR POSTS FOR FIRE PROTECTION SERVICE
   3. UL 1091, BUTTERFLY VALVES FOR FIRE PROTECTION SERVICE
   4. UL 1726, AUTOMATIC DRAIN VALVES FOR STANDPIPE SYSTEMS

1.4 SUBMITTALS

A. SUBMITTALS SHALL BE SUBMITTED IN CONFORMANCE WITH THE REQUIREMENTS OF SECTION 21 00 01 – FIRE SUPPRESSION GENERAL PROVISIONS.

B. SUBMITTALS ARE REQUIRED FOR:
   1. GATE VALVES
      a. WITH WALL INDICATOR POST
      b. OS&Y TYPE
   2. BALL VALVES
   3. BUTTERFLY VALVES
   4. SYSTEM CHECK VALVES
   5. CHECK VALVES
   6. INDICATING VALVES
   7. GLOBE VALVES
   8. SPRINKLER SYSTEM CONTROL VALVES
   9. PRESSURE-REGULATING VALVES

10. AUTOMATIC DRAIN VALVES

PART 2: PRODUCTS

2.1 GENERAL REQUIREMENTS

A. VALVES SHALL BE UL LISTED OR FMG APPROVED, WITH 175-PSIG MINIMUM PRESSURE RATING. VALVES SHALL HAVE 250-PSIG MINIMUM PRESSURE RATING IF VALVES ARE COMPONENTS OF HIGH-PRESSURE PIPING SYSTEM.

2.2 MATERIALS

A. ALL VALVES USED IN THE INSTALLATION OF THE SPRINKLER SYSTEM SHALL BE LISTED IN THE UNDERWRITERS LABORATORIES, INC. "FIRE PROTECTION EQUIPMENT LIST". MANUFACTURER'S AND PRODUCT NAMES ARE TO ESTABLISH A QUALITY OF ITEMS; OTHER MANUFACTURERS' PRODUCTS MAY BE SUBMITTED FOR APPROVAL TO ITEMS, AND THE DECISION OF THE OWNER'S REPRESENTATIVE SHALL BE FINAL.

2.3 MANUFACTURERS

A. IN OTHER PART 2 ARTICLES WHERE TITLES BELOW INTRODUCE LISTS, THE FOLLOWING REQUIREMENTS APPLY TO PRODUCT SELECTION:
   1. AVAILABLE MANUFACTURERS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, MANUFACTURERS OFFERING PRODUCTS THAT MAY BE INCORPORATED INTO THE WORK INCLUDE, BUT ARE NOT LIMITED TO, MANUFACTURERS SPECIFIED.
   2. MANUFACTURERS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE PRODUCTS BY ONE OF THE MANUFACTURERS SPECIFIED.

2.4 LISTED FIRE-PROTECTION VALVES

A. GATE VALVES WITH WALL INDICATOR POSTS
   1. GATE VALVES: CAST-IRON BODY, BRONZE MOUNTED, WITH SOLID DISC, NON-RISING STEM, OPERATING NUT, AND FLANGED ENDS.
   2. INDICATOR POSTS: HORIZONTAL-WALL TYPE, CAST-IRON BODY, WITH HAND WHEEL, EXTENSION ROD, LOCKING DEVICE, AND CAST-IRON BARREL.

B. BALL VALVES: COMPLY WITH UL 1091, EXCEPT WITH BALL INSTEAD OF DISC.
   1. NPS 1-1/2 AND SMALLER: BRONZE BODY WITH THREADED OR GROOVED ENDS.
   2. NPS 2 AND NPS 2-1/2 BRONZE BODY WITH THREADED OR GROOVED ENDS OR DUCTILE-IRON BODY WITH GROOVED ENDS.
   3. NPS 3 DUCTILE-IRON BODY WITH GROOVED ENDS.

C. BUTTERFLY VALVES
   1. NPS 2 AND SMALLER: BRONZE BODY WITH THREADED ENDS.
   2. NPS 2-1/2 AND LARGER: BRONZE, CAST-IRON, OR DUCTILE-IRON BODY; WAFER TYPE OR WITH FLANGED OR GROOVED ENDS, WEATHER PROOF ACTUATOR AND SUPERVISORY SWITCHES.

D. SYSTEM CHECK VALVES
   1. CHECK VALVES SHALL BE UL LISTED AND FACTORY MUTUAL APPROVED FOR USE ON FIRE PROTECTION SYSTEMS.
   2. THE SPRINKLER RISER CHECK VALVES SHALL BE MANUFACTURED WITH SUPPLY SIDE AND SYSTEM SIDE GAUGE CONNECTIONS AND A MAIN DRAIN OUTLET IN CONFORMANCE WITH NFPA 13.
   3. THE CHECK VALVES SHALL BE CONSTRUCTED OF A DUCTILE IRON BODY WITH A BRASS SEAT AND A RUBBER FACED CLAPPER ASSEMBLY HINGED TO A REMOVABLE ACCESS COVER. THE CHECK VALVES SHALL BE EQUIPPED WITH A REMOVABLE ACCESS COVER FOR PERIODIC INSPECTION AS REQUIRED IN NFPA.
   4. THE CHECK VALVES SHALL HAVE A WORKING WATER PRESSURE OF 250 PSI.

E. CHECK VALVES: NPS 2 AND LARGER
   1. SWING TYPE, CAST-IRON BODY WITH FLANGED OR GROOVED ENDS.

F. GATE VALVES: OS&Y TYPE.
   1. NPS 2 AND SMALLER: BRONZE BODY WITH THREADED ENDS.

2. NPS 2-1/2 AND LARGER: CAST-IRON BODY WITH FLANGED ENDS.

G. INDICATING VALVES: WITH INTEGRAL INDICATING DEVICE AND ENDS MATCHING CONNECTING PIPING.
1. INDICATOR: ELECTRICAL, 115-V AC, PREWIRED, SINGLE-CIRCUIT, SUPERVISORY SWITCH
2. NPS 2 AND SMALLER: BALL OR BUTTERFLY VALVE WITH BRONZE BODY AND THREADED ENDS.
3. NPS 2-1/2 AND LARGER: BUTTERFLY VALVE WITH CAST- OR DUCTILE-IRON BODY; WAFER TYPE OR WITH FLANGED OR GROOVED ENDS.

2.5 UNLISTED GENERAL-DUTY VALVES

A. BALL VALVES NPS 2 AND SMALLER: MSS SP-110, 2-PIECE COPPER-ALLOY BODY WITH CHROME-PLATED BRASS BALL, 600-PSIG MINIMUM CWP RATING, BLOWOUT-PROOF STEM, AND THREADED ENDS.

B. BALL VALVES NPS 2-1/2 AND LARGER: 2-PIECE DUCTILE IRON BODY WITH CHROME PLATED CARBON STEEL BALL AND STEM, 800-PSIG MAXIMUM CWP RATING, BLOWOUT-PROOF STEM, AND THREADED ENDS.

C. CHECK VALVES NPS 2 AND SMALLER: MSS SP-80, TYPE 4, CLASS 125 MINIMUM, SWING TYPE WITH BRONZE BODY, NONMETALLIC DISC, AND THREADED ENDS.

D. GATE VALVES NPS 2 AND SMALLER: MSS SP-80, TYPE 2, CLASS 125 MINIMUM, WITH BRONZE BODY, SOLID WEDGE, AND THREADED ENDS.

E. GLOBE VALVES NPS 2 AND SMALLER: MSS SP-80, TYPE 2, CLASS 125 MINIMUM, WITH BRONZE BODY, NONMETALLIC DISC, AND THREADED ENDS.

2.6 SPECIALTY VALVES

A. SPRINKLER SYSTEM CONTROL VALVES: CAST- OR DUCTILE-IRON BODY WITH FLANGED OR GROOVED ENDS.

B. PRESSURE-REGULATING VALVES
1. BRASS OR BRONZE, 400-PSIG MINIMUM RATING. INCLUDE FEMALE NPS INLET AND OUTLET, ADJUSTABLE SETTING FEATURE, AND STRAIGHT OR 90-DEGREE-ANGLE PATTERN DESIGN AS INDICATED.
2. FINISH: ROUGH METAL.
3. AVAILABLE MANUFACTURERS
a. AFAC INC.
b. ELKHART BRASS MFG. CO., INC.
c. FIRE-END AND CROKER CORP.
d. GMR INTERNATIONAL EQUIPMENT CORPORATION.
e. GRINNELL FIRE PROTECTION.
f. POTTER-ROEMER; FIRE PROTECTION DIV.
g. ZURN INDUSTRIES, INC.; WILKINS DIV.

C. AUTOMATIC DRAIN VALVES
1. NPS ¾, BALL-CHECK DEVICE WITH THREADED ENDS.
2. AVAILABLE MANUFACTURERS
a. AFAC INC.
b. GRINNELL FIRE PROTECTION.

PART 3: EXECUTION

3.1 VALVE APPLICATIONS

A. WHERE SPECIFIC VALVE TYPES ARE NOT INDICATED ON DRAWINGS, THE FOLLOWING REQUIREMENTS APPLY:
1. LISTED FIRE-PROTECTION VALVES: UL LISTED AND FMG APPROVED FOR APPLICATIONS WHERE REQUIRED BY NFPA.
a. SHUTOFF DUTY: USE BALL, BUTTERFLY, OR GATE VALVES.
2. UNLISTED GENERAL-DUTY VALVES: FOR APPLICATIONS WHERE UL-LISTED AND FMG-APPROVED VALVES ARE NOT REQUIRED BY NFPA.

a. SHUTOFF DUTY: USE BALL, BUTTERFLY, OR GATE VALVES.
b. THROTTLING DUTY: USE BALL OR GLOBE VALVES.

3.2 VALVE INSTALLATION

A. INSTALL LISTED FIRE-PROTECTION VALVES, UNLISTED GENERAL-DUTY VALVES, SPECIALTY VALVES AND TRIM, CONTROLS, AND SPECIALTIES ACCORDING TO NFPA ND AUTHORITIES HAVING JURISDICTION.

B. INSTALL LISTED FIRE-PROTECTION SHUTOFF VALVES SUPERVISED-OPEN, LOCATED TO CONTROL SOURCES OF WATER SUPPLY EXCEPT FROM FIRE DEPARTMENT CONNECTIONS. INSTALL PERMANENT IDENTIFICATION SIGNS INDICATING PORTION OF SYSTEM CONTROLLED BY EACH VALVE.

C. INSTALL CHECK VALVE IN EACH WATER-SUPPLY CONNECTION. INSTALL BACKFLOW PREVENTERS INSTEAD OF CHECK VALVES IN POTABLE-WATER SUPPLY SOURCES.

D. INSTALL VALVES WITH STEMS UPRIGHT OR HORIZONTAL, NOT INVERTED. REMOVE PROTECTIVE COATINGS AFTER INSTALLATION.

E. PROVIDE INDICATING BALL OR BUTTERFLY VALVES FOR SHUT-OFF OR ISOLATING SERVICE.

F. PROVIDE DRAIN VALVES AT MAIN SHUT-OFF VALVES, LOW POINTS OF PIPING AND APPARATUS.

G. LOCATE BACKFLOW PREVENTER WITH SUFFICIENT CLEARANCE FROM WALLS, OBSTRUCTIONS, OR ADJACENT EQUIPMENT.

END OF SECTION

SECTION 21 05 29
HANGERS AND SUPPORTS FOR WATER-BASED FIRE-SUPPRESSION PIPING AND EQUIPMENT

PART 1: GENERAL

1.1 SUMMARY

A. THE WORK OF THIS SECTION SHALL INCLUDE:
   1. PIPE HANGERS
   2. HANGER RODS
   3. HORIZONTAL PIPE WALL SUPPORTS
   4. VERTICAL PIPE WALL SUPPORTS
   5. FLOOR SUPPORTS
   6. BUILDING ATTACHMENTS

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. THE FOLLOWING REFERENCED SECTIONS ARE LISTED AS A MINIMUM OF ADDITIONAL REQUIREMENTS AND/OR WORK NOT INCLUDED IN THIS SECTION WHICH MAY BE REQUIRED TO BE PERFORMED UNDER OTHER DESIGNATED SECTIONS:
   1. *21 00 01 – FIRE-SUPPRESSION GENERAL PROVISIONS*
   2. *21 13 13 – WET-PIPE FIRE-SUPPRESSION SPRINKLER SYSTEMS*
   3. *21 31 13 – ELECTRIC-DRIVE CENTRIFUGAL FIRE PUMPS*

1.3 REFERENCE STANDARDS

A. ANSI / UL (AMERICAN NATIONAL STANDARDS INSTITUTE / UNDERWRITER'S LABORATORIES)
   1. ANSI / UL 203, PIPE HANGER EQUIPMENT FOR FIRE PROTECTION SERVICE

B. FMG (FACTORY MUTUAL INSURANCE COMPANY)
   1. 1950, SEISMIC SWAY BRACE COMPONENTS FOR AUTOMATIC SPRINKLER SYSTEMS
   2. 1951, 1952, AND 1953, PIPE HANGER COMPONENTS FOR AUTOMATIC SPRINKLER SYSTEMS

C. NFPA (NATIONAL FIRE PROTECTION ASSOCIATION)
   1. NFPA 13 STANDARD FOR THE INSTALLATION OF SPRINKLER SYSTEMS

1.4 SUBMITTALS

A. SUBMITTALS SHALL BE SUBMITTED IN CONFORMANCE WITH THE REQUIREMENTS OF SECTION 21 00 01 – FIRE SUPPRESSION GENERAL PROVISIONS.

B. SUBMITTALS ARE REQUIRED FOR:
   1. PIPE HANGERS
   2. HANGER RODS
   3. HORIZONTAL PIPE WALL SUPPORTS
   4. VERTICAL PIPE WALL SUPPORTS
   5. FLOOR SUPPORTS
   6. BUILDING ATTACHMENTS

PART 2: PRODUCTS

2.1 GENERAL REQUIREMENTS

A. HANGERS AND SUPPORTS SHALL BE UL LISTED AND FMG APPROVED.

B. HANGERS, ANCHORS OR BRACKETS SHALL SUPPORT THE PIPING FROM THE BUILDING STRUCTURE TO MAINTAIN THE REQUIRED GRADE AND PITCH OF THE PIPE LINES, PREVENT VIBRATION, SECURE THE PIPING IN PLACE, AND PROVIDE FOR EXPANSION AND CONTRACTION IN CONFORMANCE TO NFPA.

2.2 PIPE HANGERS AND SUPPORTS

A. NON-PROCESS AREA SUPPORTS:
   1. HANGERS FOR PIPE SIZES 1/2 TO 1-1/2 INCH: CARBON STEEL, ADJUSTABLE SWIVEL, SPLIT RING.
   2. HANGERS FOR PIPE SIZES 2 INCHES AND OVER:
      a. CARBON STEEL, ADJUSTABLE, CLEVIS.
      b. OR ENGINEER APPROVED EQUAL.
   3. MULTIPLE OR TRAPEZE HANGERS:
      a. STRUCTURAL STEEL CHANNELS OR ANGLES, OR OPEN CHANNEL WITH WELDED SPACERS AND HANGER RODS.

b. OR ENGINEER APPROVED EQUAL.

4. WALL SUPPORT FOR PIPE SIZES TO 3 INCHES: CAST IRON HOOK.
5. WALL SUPPORT FOR PIPE SIZES 4 INCHES AND OVER: WELDED STEEL BRACKET AND WROUGHT STEEL CLAMP.
6. VERTICAL SUPPORT: STEEL RISER CLAMP.
7. FLOOR SUPPORT: CAST IRON ADJUSTABLE PIPE SADDLE, LOCK NUT, NIPPLE, FLOOR FLANGE, AND CONCRETE PIER OR STEEL SUPPORT.
8. COPPER PIPE SUPPORT: CARBON STEEL RING, ADJUSTABLE, COPPER PLATED.
9. REFER TO FIRE PROTECTION DESIGN CRITERIA MATRICES ON DRAWINGS FP5.001 AND COLUMNS WITH HEADING “SUPPORT TYPE”. SUPPORTS FOR ZONES WITH INDICATION OF “CS OR “GAL” ARE CONSIDERED NON-PROCESS AREAS. ALL SUPPORTS SHALL BE EITHER CARBON STEEL, HOT DIPPED GALVANIZED STEEL OR ELECTRO PLATED GALVANIZED STEEL SUPPORTS AS INDICATED. ALL SUPPORT RODS SHALL BE HOT DIPPED GALVANIZED STEEL OR ELECTRO PLATED GALVANIZED STEEL AND SHALL BE SMOOTH ROD END THREADED ONLY.

B. PROCESS AREA SUPPORTS:

1. SUPPORTS IN PROCESS, PRODUCTION OR PRODUCT STORAGE AREAS IN WHICH FIRE PROTECTION PIPING IS REQUIRED TO BE EXPOSED BELOW A FINISHED CEILING SHALL COMPLY WITH THE REQUIREMENTS OF THIS SUBSECTION.
    a. REFER TO FIRE PROTECTION DESIGN CRITERIA MATRICES ON DRAWINGS FP5.001 AND COLUMNS WITH HEADING “SUPPORT TYPE”. SUPPORTS FOR ZONES WITH INDICATION OF “SS” AND “SSET” ARE CONSIDERED PROCESS AREAS. ALL SUPPORTS SHALL BE STAINLESS STEEL. ALL HANGER RODS SHALL BE 304 STAINLESS STEEL SMOOTH RODS END THREADED ONLY.
2. PROCESS, PRODUCTION OR PRODUCT STORAGE AREAS WHICH DO NOT HAVE A FINISHED CEILING, BUT ARE EXPOSED TO THE ROOF OR FLOOR STRUCTURAL MEMBERS ARE EXEMPT FROM THE REQUIREMENTS OF THIS SECTION.
3. “UNISTRUT” OR SIMILAR OPEN CHANNEL METAL FRAMING SYSTEM SUPPORTS IS NOT ALLOWED FOR PIPING SUPPORTS IN EXPOSED PRODUCTION AND PRODUCT STORAGE AREAS WITH FINISHED CEILING. STAINLESS STEEL SOLID ANGLE MEMBERS SHALL BE UTILIZED FOR TRAPEZE SUPPORTS.
4. ALL THREADED ROD IS NOT ALLOWED FOR PIPING SUPPORTS IN EXPOSED PRODUCTION AND PRODUCT STORAGE AREAS. HANGER RODS SHALL BE STAINLESS STEEL THREADED AT THE END CONNECTIONS ONLY WITH A MAXIMUM OF 4 EXPOSED THREADS PER CONNECTION.
5. ALL PIPING HANGERS AND SUPPORTS SHALL BE OF STAINLESS STEEL CONSTRUCTION.

PART 3: EXECUTION

3.1 HANGERS AND SUPPORTS:

A. COMPLY WITH NFPA FOR HANGER MATERIALS.
B. INSTALL HANGERS TO PROVIDE MINIMUM 1/2 INCH SPACE BETWEEN FINISHED COVERING AND ADJACENT WORK.
C. PLACE HANGERS WITHIN 12 INCHES OF EACH HORIZONTAL ELBOW.
D. USE HANGERS WITH 1-1/2 INCH MINIMUM VERTICAL ADJUSTMENT. DESIGN HANGERS FOR PIPE MOVEMENT WITHOUT DISENGAGEMENT OF SUPPORTED PIPE.
E. SUPPORT VERTICAL PIPING AT EVERY FLOOR. SUPPORT RISER PIPING INDEPENDENTLY OF CONNECTED HORIZONTAL PIPING.
F. WHERE SEVERAL PIPES CAN BE INSTALLED IN PARALLEL AND AT SAME ELEVATION, PROVIDE MULTIPLE OR TRAPEZE HANGERS.
G. PROVIDE COPPER PLATED HANGERS AND SUPPORTS FOR COPPER PIPING.

H. PRIME COAT EXPOSED STEEL HANGERS AND SUPPORTS. HANGERS AND SUPPORTS LOCATED IN CRAWL SPACES, PIPE SHAFTS, AND SUSPENDED CEILING SPACES ARE NOT CONSIDERED EXPOSED.

I. INSERTS:
   1. PROVIDE INSERTS FOR PLACEMENT IN CONCRETE FORMWORK.
   2. PROVIDE INSERTS FOR SUSPENDING HANGERS FROM REINFORCED CONCRETE SLABS AND SIDES OF REINFORCED CONCRETE BEAMS.
   3. PROVIDE HOOKED ROD TO CONCRETE REINFORCEMENT SECTION FOR INSERTS CARRYING PIPE OVER 4 INCHES.
   4. WHERE CONCRETE SLABS FORM FINISHED CEILING, LOCATE INSERTS FLUSH WITH SLAB SURFACE.
   5. WHERE INSERTS ARE OMITTED, DRILL THROUGH CONCRETE SLAB FROM BELOW AND PROVIDE THROUGH-BOLT WITH RECESSED SQUARE STEEL PLATE AND NUT RECESSED INTO AND GROUTED FLUSH WITH SLAB.

END OF SECTION

SECTION 21 05 53
IDENTIFICATION FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT

PART 1: GENERAL

1.1 SUMMARY

A. THE WORK OF THIS SECTION SHALL INCLUDE:

1. FIRE PROTECTION EQUIPMENT TAGS
2. FIRE PROTECTION PIPING MARKERS
3. VALVES TAGS (BOTH CONTROL AND HAND)

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. THE FOLLOWING REFERENCED SECTIONS ARE LISTED AS A MINIMUM OF ADDITIONAL REQUIREMENTS AND/OR WORK NOT INCLUDED IN THIS SECTION WHICH MAY BE REQUIRED TO BE PERFORMED UNDER OTHER DESIGNATED SECTIONS:

1. *21 00 01 – FIRE-SUPPRESSION GENERAL PROVISIONS*
2. *21 05 23 – GENERAL-DUTY VALVES FOR WATER-BASED FIRE-SUPPRESSION PIPING*
3. *21 13 13 – WET-PIPE FIRE-SUPPRESSION SPRINKLER SYSTEMS*
4. *21 31 13 – ELECTRIC-DRIVE CENTRIFUGAL FIRE PUMPS*

1.3 REFERENCE STANDARDS

A. ASME (AMERICAN SOCIETY OF MECHANICAL ENGINEERS)

1. A13.1 SCHEME FOR THE IDENTIFICATION OF PIPING SYSTEMS

B. NFPA (NATIONAL FIRE PROTECTION ASSOCIATION)

1. NFPA 13 STANDARD FOR THE INSTALLATION OF SPRINKLER SYSTEMS

1.4 SUBMITTALS

A. SUBMITTALS SHALL BE SUBMITTED IN CONFORMANCE WITH THE REQUIREMENTS OF SECTION 21 00 01 – FIRE SUPPRESSION GENERAL PROVISIONS.

B. SUBMITTALS ARE REQUIRED FOR:

1. EQUIPMENT TAGS
2. PIPE SERVICE MARKERS
3. VALVE TAGS

1.5 MISCELLANEOUS

A. CONTRACTOR SHALL PROVIDE 15% ADDITIONAL IDENTIFICATION MATERIALS, OVER THE AMOUNT USED, TO THE OWNER AT PROJECT CLOSEOUT.

PART 2: PRODUCTS

2.1 MANUFACTURERS

A. ALL IDENTIFICATION MATERIALS SHALL BE AS MANUFACTURED BY BRADY, BRIMAR INDUSTRIES, SETON, OR APPROVED EQUAL.

2.2 EQUIPMENT TAGS

A. CONSTRUCTION: LAMINATED THREE-LAYER PLASTIC.

B. LABELING: ENGRAVED BLACK LETTERS ON LIGHT CONTRASTING BACKGROUND COLOR FOR READING CLARITY.

C. SIZE: 2” HIGH BY 4” WIDE.

D. ATTACHMENT: SECURE TAG TO EQUIPMENT WITH BRASS SELF TAPPING SCREWS.

2.3 PIPE SERVICE MARKERS

A. PIPE PLUS FINISHED COVERING OUTER DIAMETER LESS THAN 1 1/2"

1. SINGLE STRIP INDIVIDUAL MARKER OF FLEXIBLE VINYL FILM TAPE WITH PRESSURE SENSITIVE ADHESIVE BACKING AND PRINTED MARKINGS.

B. PIPE PLUS FINISHED COVERING OUTER DIAMETER 1 1/2" AND LARGER

1. ‘FULL WRAP AROUND STYLE’, FACTORY FABRICATED, FLEXIBLE SEMI-RIGID PLASTIC, PREFORMED TO FIT AROUND PIPE OR PIPE COVERING.
   OR
2. ‘FULL WRAP AROUND STYLE’, FLEXIBLE VINYL FILM TAPE WITH PRESSURE SENSITIVE ADHESIVE BACKING AND PRINTED MARKINGS.

C. PIPING SHALL BE IDENTIFIED AS TO THE SERVICE OF THE PIPE.

D. PIPE SERVICE MARKERS SHALL HAVE SYMBOLS AND LETTERS OF THE FOLLOWING SIZE:

PIPE / INSULATION DIAMETER	MIN LENGTH	SIZE OF LETTERS
3/4" – 1 1/4"	8”	1/2"
1 1/2" – 2 3/8”	8”	3/4"
2 1/2" – 7 7/8”	12”	1 1/4”
8” – 10”	24”	2 1/2”
OVER 10”	32”	3 1/2”

E. COLOR AND LETTERING FOR PIPING SYSTEMS TO CONFORM TO ASME, UNLESS THERE IS AN EXISTING PLANT STANDARD, WHICH SHALL BE FOLLOWED.

2.4 VALVE TAGS

A. CONSTRUCTION: VALVE IDENTIFICATION TAGS SHALL BE MADE OF BRASS, ENGRAVED LAMINATED PLASTIC, OR ENGRAVED ANODIZED ALUMINUM WHEN LOCATED IN NON-PROCESS AREAS. TAGS SHALL BE MADE OF ENGRAVED STAINLESS STEEL WHEN LOCATED IN PROCESS AREAS.

B. LABELING: MARKING SHALL BE STAMPED OR ENGRAVED INDELIBLY, BLACK LETTERING ON LIGHT CONTRASTING BACKGROUND COLOR FOR READING CLARITY INDICATING SERVICE. VALVE NUMBER SHALL BE INCLUDED ON CONTROL VALVES.

C. ATTACHMENT: TAGS SHALL BE ATTACHED TO VALVES WITH CHROME-PLATED BEADED CHAIN FOR NON-PROCESS AREAS AND STAINLESS STEEL BEADED CHAIN FOR PROCESS AREAS.

PART 3: EXECUTION

3.1 EXAMINATION AND PREPARATION

A. DEGREASE AND CLEAN SURFACES TO RECEIVE ADHESIVE FOR IDENTIFICATION MATERIALS.

B. EQUIPMENT, PIPE, VALVES, ETC. MUST BE PAINTED AND INSULATED PER SPECIFICATIONS BEFORE INSTALLING IDENTIFICATION MATERIALS.

3.2 GENERAL REQUIREMENTS

A. INSTALL LABELING AND PIPE MARKERS ON EQUIPMENT AND PIPING ACCORDING TO REQUIREMENTS IN NFPA.

B. IDENTIFICATION MATERIALS SHALL BE SECURED TO THE EQUIPMENT, VALVE, PIPE, ETC. METHOD OF SECURING EACH TYPE SHALL BE APPROVED BY PLANT SANITATION MANAGER.

C. IDENTIFICATION MATERIALS SHALL BE INSTALLED SO AS NOT TO CREATE VOIDS OR HARBORAGES, INCLUDING INACCESSIBLE SPACES BEHIND TAGS OR LABELS. ALL SPACES MUST BE EASILY ACCESSIBLE FOR CLEANING OR MUST BE HERMETICALLY SEALED.

D. INSTALLATION OF IDENTIFICATION MATERIALS IS TO BE COORDINATED WITH OTHER CRAFTS TO INSURE PROPER AND TIMELY INSTALLATION.

E. INSTALL IDENTIFICATION MATERIALS SUCH THAT THEY CAN BE EASILY SEEN FROM THE PLANT FLOOR LEVEL.

F. INSTALL IDENTIFYING DEVICES AFTER COMPLETION OF COVERINGS OR PAINTING.

3.3 EQUIPMENT TAGS

A. SIGNS SHALL BE PLACED ON THE EQUIPMENT IN A LOGICAL, EASILY VISIBLE LOCATION TO MAINTENANCE PERSONNEL, E.I. NEAR CONTROL PANELS, DISCONNECT SWITCHES, ON OR NEAR EQUIPMENT MAIN ACCESS DOORS AND PANELS, ETC.

B. ALL EQUIPMENT LOCATED OUTSIDE OF PROCESS AREAS SHALL BE IDENTIFIED BY:

1. PLASTIC NAMEPLATES WITH CORROSIVE-RESISTANT MECHANICAL FASTENERS, OR ADHESIVE.

C. ALL EQUIPMENT LOCATED WITHIN PROCESS AREAS SHALL BE IDENTIFIED BY:

1. ENGRAVED NAMEPLATES WITHOUT ANY VOIDS OR HARBORAGES UNLESS HERMETICALLY SEALED TO THE ATTACHED SURFACE BY WELDING.
2. LASER ETCHED STAINLESS STEEL

D. IDENTIFY CONTROL PANELS AND MAJOR CONTROL COMPONENTS OUTSIDE PANELS WITH PLASTIC NAMEPLATES.

3.4 VALVE TAGS

A. INSTALL VALVE TAGS USING CORROSION RESISTANT CHAIN. NUMBER TAGS CONSECUTIVELY BY LOCATION.

B. IDENTIFY VALVES IN MAIN AND BRANCH PIPING WITH TAGS.

3.5 PIPE SERVICE MARKERS

A. SELF-ADHESIVE PIPE MARKERS: INSTALL IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS. INSTALL COMPLETE AROUND PIPE.

B. PIPING SHALL BE IDENTIFIED AS TO THE SERVICE OF THE PIPE.

C. PIPE LABELS SHALL BE SIZED PER THIS STANDARD. THE PIPE MUST HAVE A LABEL AT LEAST EVERY 40 FEET ON STRAIGHT RUNS.

D. FOR PIPE PENETRATIONS THROUGH A WALL, FLOOR, ROOF, ETC., A LABEL MUST BE APPLIED ON BOTH SIDES OF THE PENETRATION.

E. ON LABELS WHICH ARE NOT COMPLETELY COLOR CODED, THE USE OF ADHESIVE BANDING ALONG WITH LABELS IS REQUIRED. THE BAND MUST BE WRAPPED AROUND THE ENTIRE PIPE, AND MUST BE INSTALLED AT EACH END OF THE LABEL. BANDING IS NOT ALLOWED IN PROCESS SPACES.

3.6 ADJUSTING AND CLEANING

A. RELOCATE IDENTIFICATION MATERIALS AND DEVICES THAT HAVE BECOME VISUALLY BLOCKED BY OBSTRUCTIONS.

B. CLEAN FACE OF IDENTIFICATION DEVICES.

END OF SECTION

SECTION 21 13 13
WET-PIPE FIRE-SUPPRESSION SPRINKLER SYSTEMS

PART 1: GENERAL

1.1 SUMMARY

A. THE WORK OF THIS SECTION SHALL INCLUDE:

1. PIPING (PIPE, FITTINGS, JOINTS, AND ACCESSORIES)
2. PIPE MATERIAL TRANSITION FITTINGS
3. MISCELLANEOUS ADAPTER FITTINGS
4. FIXTURE & EQUIPMENT CONNECTIONS
5. EXPANSION JOINTS
6. PIPE PENETRATIONS
7. TESTING OF PIPING SYSTEMS
8. CLEANING AND STERILIZATION OF PIPING SYSTEMS

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. THE FOLLOWING REFERENCED SECTIONS ARE LISTED AS A MINIMUM OF ADDITIONAL REQUIREMENTS AND/OR WORK NOT INCLUDED IN THIS SECTION WHICH MAY BE REQUIRED TO BE PERFORMED UNDER OTHER DESIGNATED SECTIONS:

1. *21 00 01 – FIRE-SUPPRESSION GENERAL PROVISIONS*
2. *21 05 01 – SUPPLEMENTARY COMPONENTS FOR FIRE-SUPPRESSION PIPING*
3. *21 05 23 – GENERAL-DUTY VALVES FOR WATER-BASED FIRE-SUPPRESSION PIPING*
4. *21 05 29 – HANGERS AND SUPPORTS FOR WATER-BASED FIRE-SUPPRESSION PIPING AND EQUIPMENT.*
5. *21 05 53 – IDENTIFICATION FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT*
6. *21 07 19 – FIRE-SUPPRESSION PIPING INSULATION*

1.3 REFERENCE STANDARDS

A. ANSI / UL (AMERICAN NATIONAL STANDARDS INSTITUTE / UNDERWRITER'S LABORATORIES)

1. ANSI / UL 1821 STANDARD FOR THERMOPLASTIC SPRINKLER PIPE AND FITTINGS FOR FIRE PROTECTION SERVICE

B. ASME (AMERICAN SOCIETY OF MECHANICAL ENGINEERS)

1. B16.1 GRAY IRON PIPE FLANGES AND FLANGED FITTINGS: CLASSES 25,125, AND 250
2. B16.3 MALLEABLE IRON THREADED FITTINGS: CLASSES 150 AND 300
3. B16.4 GRAY IRON THREADED FITTINGS: CLASSES 125 AND 250
4. B16.5 PIPE FLANGES AND FLANGED FITTINGS
5. B16.9 FACTORY-MADE WROUGHT BUTTWELDING FITTINGS
6. B16.11 FORGED FITTINGS, SOCKET-WELDING AND THREADED
7. B31.1 POWER PIPING
8. B31.9 BUILDING SERVICES PIPING
9. B36.10M WELDED SEAMLESS WROUGHT STEEL PIPE

C. ASTM (ASTM INTERNATIONAL)

1. A53 / A53M STANDARD SPECIFICATION FOR PIPE, STEEL, BLACK AND HOT-DIPPED, ZINC-COATED, WELDED AND SEAMLESS
2. A106 STANDARD SPECIFICATION FOR SEAMLESS CARBON STEEL PIPE FOR HIGH-TEMPERATURE SERVICE
3. A135 STANDARD SPECIFICATION FOR ELECTRIC-RESISTANCE-WELDED STEEL PIPE
4. A234 / A234M STANDARD SPECIFICATION FOR PIPING FITTINGS OF WROUGHT CARBON STEEL AND ALLOY STEEL FOR MODERATE AND HIGH TEMPERATURE SERVICE
5. A536 STANDARD SPECIFICATION FOR DUCTILE IRON CASTINGS
6. A733 STANDARD SPECIFICATION FOR WELDED AND SEAMLESS CARBON STEEL AND AUSTENITIC STAINLESS STEEL PIPE NIPPLES
7. A795 STANDARD SPECIFICATION FOR BLACK AND HOT-DIPPED ZINC-COATED (GALVANIZED) WELDED AND SEAMLESS STEEL PIPE FOR FIRE PROTECTION USE
8. A865 STANDARD SPECIFICATION FOR THREADED COUPLINGS, STEEL, BLACK, ZINC-COATED (GALVANIZED) WELDED OR SEAMLESS, FOR USE IN STEEL PIPE JOINTS

D. FMG (FACTORY MUTUAL INSURANCE COMPANY)

1. 1630, STEEL PIPE FOR AUTOMATIC FIRE SPRINKLER SYSTEMS
2. 1635, PLASTIC PIPE AND FITTINGS FOR AUTOMATIC SPRINKLER SYSTEMS
3. 1636, FIRE RESISTANCE BARRIERS FOR USE WITH CPVC PIPE AND FITTINGS IN LIGHT HAZARD OCCUPANCIES

E. NFPA (NATIONAL FIRE PROTECTION ASSOCIATION)
1. NFPA 13 STANDARD FOR THE INSTALLATION OF SPRINKLER SYSTEMS
2. NFPA 14 STANDARD FOR THE INSTALLATION OF STANDPIPE AND HOSE SYSTEMS

F. UL (UNDERWRITER'S LABORATORIES)
1. UL 193 STANDARD FOR ALARM VALVES FOR FIRE-PROTECTION SERVICE
2. UL 213 STANDARD FOR RUBBER GASKETED FITTINGS FOR FIRE-PROTECTION SERVICE
3. UL 852 STANDARD FOR METALLIC SPRINKLER PIPE FOR FIRE PROTECTION SERVICE

1.4 SUBMITTALS

A. SUBMITTALS SHALL BE SUBMITTED IN CONFORMANCE WITH THE REQUIREMENTS OF SECTION 21 00 01 – FIRE SUPPRESSION GENERAL PROVISIONS.

B. SUBMITTALS ARE REQUIRED FOR:
1. PIPING (PIPE, FITTINGS, JOINTS, AND ACCESSORIES)
2. PIPE MATERIAL TRANSITION FITTINGS
3. MISCELLANEOUS ADAPTER FITTINGS
4. FIXTURE & EQUIPMENT CONNECTIONS
5. EXPANSION JOINTS
6. PIPE PENETRATIONS
7. TESTING OF PIPING SYSTEMS
8. CLEANING AND STERILIZATION OF PIPING SYSTEMS

1.5 TESTS

A. PERFORM ALL TESTS AS NOTED IN SCOPE OF WORK.

B. PERFORM ALL TESTS, OTHER THAN SPECIFIED HEREIN, WHICH MAY BE REQUIRED BY LEGAL AUTHORITIES OR BY AGENCIES TO WHOSE REQUIREMENTS THIS WORK IS TO CONFORM.

PART 2: PRODUCTS

2.1 MATERIALS

A. ALL MATERIALS USED IN THE INSTALLATION OF THE SPRINKLER SYSTEM SHALL BE LISTED IN THE UNDERWRITERS LABORATORIES, INC. "FIRE PROTECTION EQUIPMENT LIST". MANUFACTURER'S AND PRODUCT NAMES ARE TO ESTABLISH A QUALITY OF ITEMS; OTHER MANUFACTURERS' PRODUCTS MAY BE SUBMITTED FOR APPROVAL TO ITEMS, AND THE DECISION OF THE OWNER'S REPRESENTATIVE SHALL BE FINAL.

2.2 MANUFACTURERS

A. IN OTHER PART 2 ARTICLES WHERE TITLES BELOW INTRODUCE LISTS, THE FOLLOWING REQUIREMENTS APPLY TO PRODUCT SELECTION:
1. AVAILABLE MANUFACTURERS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, MANUFACTURERS OFFERING PRODUCTS THAT MAY BE INCORPORATED INTO THE WORK INCLUDE, BUT ARE NOT LIMITED TO, MANUFACTURERS SPECIFIED.
2. MANUFACTURERS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE PRODUCTS BY ONE OF THE MANUFACTURERS SPECIFIED.

2.3 STEEL PIPE AND FITTINGS

A. THREADED-END, STANDARD-WEIGHT STEEL PIPE: ASTM A53 / A53M, ASTM A135, OR ASTM A795, HOT-DIP GALVANIZED WHERE INDICATED AND WITH FACTORY- OR FIELD-FORMED THREADED ENDS.
1. CAST-IRON THREADED FLANGES: ASME B16.1.
2. MALLEABLE-IRON THREADED FITTINGS: ASME B16.3.
3. GRAY-IRON THREADED FITTINGS: ASME B16.4.

4. STEEL THREADED PIPE NIPPLES: ASTM A733, MADE OF ASTM A53 / A53M OR ASTM A106, SCHEDULE 40, SEAMLESS STEEL PIPE HOT-DIP GALVANIZED WHERE INDICATED. INCLUDE ENDS MATCHING JOINING METHOD.
5. STEEL THREADED COUPLINGS: ASTM A865 HOT-DIP GALVANIZED-STEEL PIPE WHERE INDICATED.

B. PLAIN-END, STANDARD-WEIGHT STEEL PIPE: ASTM A53 / A53M, ASTM A135, OR ASTM A795 HOT-DIP GALVANIZED-STEEL PIPE WHERE INDICATED.
1. LOCKING-LUG FITTINGS: UL 213, ASTM A536 DUCTILE-IRON BODY WITH RETAINER LUGS THAT REQUIRE ONE-QUARTER TURN TO SECURE PIPE IN FITTING.

C. PLAIN-END, STANDARD-WEIGHT STEEL PIPE: ASTM A53 / A53M, ASTM A135, OR ASTM A795 HOT-DIP GALVANIZED-STEEL PIPE WHERE INDICATED.
1. STEEL WELDING FITTINGS: ASTM A234 / A234M, AND ASME B16.9 OR ASME B16.11.
2. STEEL FLANGES AND FLANGED FITTINGS: ASME B16.5.

D. GROOVED-END, STANDARD-WEIGHT STEEL PIPE: ASTM A53 / A53M, ASTM A135, OR ASTM A795, HOT-DIP GALVANIZED WHERE INDICATED AND WITH FACTORY OR FIELD-FORMED, SQUARE-CUT- OR ROLL GROOVED ENDS.
1. GROOVED-JOINT PIPING SYSTEMS:
a. GROOVED-END FITTINGS: UL-LISTED AND FMG APPROVED, ASTM A536, DUCTILE-IRON CASTING WITH OD MATCHING STEEL-PIPE OD.
b. GROOVED-END-PIPE COUPLINGS: UL 213 AND AWWA C606, RIGID PATTERN, UNLESS OTHERWISE INDICATED; GASKETED FITTING MATCHING STEEL-PIPE OD. INCLUDE DUCTILE-IRON HOUSING WITH KEYS MATCHING STEEL-PIPE AND FITTING GROOVES, PRE-LUBRICATED RUBBER GASKET LISTED FOR USE WITH HOUSING, AND STEEL BOLTS AND NUTS.
1) RIGID TYPE COUPLINGS: HOUSINGS CAST WITH OFFSETTING, ANGLE-PATTERN BOLT PADS TO PROVIDE RIGIDITY AND SYSTEM SUPPORT AND HANGING IN ACCORDANCE WITH ANSI B31.1 AND B31.9.
2) FLEXIBLE TYPE COUPLINGS: USE IN LOCATIONS WHERE VIBRATION ATTENUATION AND STRESS RELIEF ARE REQUIRED.
3) FLANGE ADAPTERS: FLAT FACE, FOR DIRECT CONNECTION TO ANSI CLASS 125 OR 150 FLANGED COMPONENTS.

E. PLAIN-END, SCHEDULE 30 STEEL PIPE: ASTM A135 OR ASTM A795, WITH WALL THICKNESS LESS THAN SCHEDULE 40 AND EQUAL TO OR GREATER THAN SCHEDULE 30; OR ASTM A795 AND ASME B36.10M, SCHEDULE 30 WROUGHT-STEEL PIPE HOT-DIP GALVANIZED WHERE INDICATED.
1. LOCKING-LUG FITTINGS: UL 213, ASTM A536 DUCTILE-IRON BODY WITH RETAINER LUGS THAT REQUIRE ONE-QUARTER TURN TO SECURE PIPE IN FITTING.

F. PLAIN-END, SCHEDULE 30 STEEL PIPE: ASTM A135 OR ASTM A795, WITH WALL THICKNESS LESS THAN SCHEDULE 40 AND EQUAL TO OR GREATER THAN SCHEDULE 30; OR ASTM A795 AND ASME B36.10M, SCHEDULE 30 WROUGHT-STEEL PIPE HOT-DIP GALVANIZED WHERE INDICATED.
1. STEEL WELDING FITTINGS: ASTM A234 / A234M, AND ASME B16.9 OR ASME B16.11.
2. STEEL FLANGES AND FLANGED FITTINGS: ASME B16.5.

G. GROOVED-END, SCHEDULE 30 STEEL PIPE: ASTM A135 OR ASTM A795, WITH WALL THICKNESS LESS THAN SCHEDULE 40 AND EQUAL TO OR GREATER THAN SCHEDULE 30; OR ASTM A795 AND ASME B36.10M, SCHEDULE 30 WROUGHT-STEEL PIPE HOT-DIP GALVANIZED WHERE INDICATED; WITH FACTORY- OR FIELD-FORMED, ROLL-GROOVED ENDS.
1. GROOVED-JOINT PIPING SYSTEMS:
a. GROOVED-END FITTINGS: UL-LISTED AND FMG APPROVED, ASTM A536, DUCTILE-IRON CASTING WITH OD MATCHING STEEL-PIPE OD.
b. GROOVED-END-PIPE COUPLINGS: UL 213 AND AWWA C606, RIGID PATTERN, UNLESS OTHERWISE INDICATED; GASKETED FITTING MATCHING STEEL-PIPE OD. INCLUDE DUCTILE-IRON HOUSING WITH KEYS MATCHING STEEL-PIPE AND

FITTING GROOVES, PRE-LUBRICATED RUBBER GASKET LISTED FOR USE WITH HOUSING, AND STEEL BOLTS AND NUTS.

1) RIGID TYPE COUPLINGS: HOUSINGS CAST WITH OFFSETTING, ANGLE-PATTERN BOLT PADS TO PROVIDE RIGIDITY AND SYSTEM SUPPORT AND HANGING IN ACCORDANCE WITH ANSI B31.1 AND B31.9.
2) FLEXIBLE TYPE COUPLINGS: USE IN LOCATIONS WHERE VIBRATION ATTENUATION AND STRESS RELIEF ARE REQUIRED.
3) FLANGE ADAPTERS: FLAT FACE, FOR DIRECT CONNECTION TO ANSI CLASS 125 OR 150 FLANGED COMPONENTS.

H. GROOVED-END, THREADABLE, THINWALL STEEL PIPE: ASTM A135 OR ASTM A795, WITH WALL THICKNESS LESS THAN SCHEDULE 40 AND GREATER THAN SCHEDULE 10, AND WITH FACTORY- OR FIELD-FORMED, ROLL-GROOVED ENDS.

1. GROOVED-JOINT PIPING SYSTEMS:
   a. GROOVED-END FITTINGS: UL-LISTED AND FMG APPROVED, ASTM A536, DUCTILE-IRON CASTING WITH OD MATCHING STEEL-PIPE OD.
   b. GROOVED-END-PIPE COUPLINGS: UL 213 AND AWWA C606, RIGID PATTERN, UNLESS OTHERWISE INDICATED; GASKETED FITTING MATCHING STEEL-PIPE OD. INCLUDE DUCTILE-IRON HOUSING WITH KEYS MATCHING STEEL-PIPE AND FITTING GROOVES, PRE-LUBRICATED RUBBER GASKET LISTED FOR USE WITH HOUSING, AND STEEL BOLTS AND NUTS.
      1) RIGID TYPE COUPLINGS: HOUSINGS CAST WITH OFFSETTING, ANGLE-PATTERN BOLT PADS TO PROVIDE RIGIDITY AND SYSTEM SUPPORT AND HANGING IN ACCORDANCE WITH ANSI B31.1 AND B31.9.
      2) FLEXIBLE TYPE COUPLINGS: USE IN LOCATIONS WHERE VIBRATION ATTENUATION AND STRESS RELIEF ARE REQUIRED.
      3) FLANGE ADAPTERS: FLAT FACE, FOR DIRECT CONNECTION TO ANSI CLASS 125 OR 150 FLANGED COMPONENTS.

I. PLAIN-END, SCHEDULE 10 STEEL PIPE: ASTM A135 OR ASTM A795, SCHEDULE 10 IN NPS 5 AND SMALLER; AND NFPA 13-SPECIFIED WALL THICKNESS IN NPS 6 TO NPS 10.

1. LOCKING-LUG FITTINGS: UL 213, ASTM A536 DUCTILE-IRON BODY WITH RETAINER LUGS THAT REQUIRE ONE-QUARTER TURN TO SECURE PIPE IN FITTING.

J. GROOVED-END, SCHEDULE 10 STEEL PIPE: ASTM A135 OR ASTM A795, SCHEDULE 10 IN NPS 5 AND SMALLER; AND NFPA 13-SPECIFIED WALL THICKNESS IN NPS 6 TO NPS 10; WITH FACTORY- OR FIELD-FORMED, ROLL-GROOVED ENDS.

1. GROOVED-JOINT PIPING SYSTEMS:
   a. GROOVED-END FITTINGS: UL-LISTED AND FMG APPROVED, ASTM A536, DUCTILE-IRON CASTING WITH OD MATCHING STEEL-PIPE OD.
   b. GROOVED-END-PIPE COUPLINGS: UL 213 AND AWWA C606, RIGID PATTERN, UNLESS OTHERWISE INDICATED; GASKETED FITTING MATCHING STEEL-PIPE OD. INCLUDE DUCTILE-IRON HOUSING WITH KEYS MATCHING STEEL-PIPE AND FITTING GROOVES, PRE-LUBRICATED RUBBER GASKET LISTED FOR USE WITH HOUSING, AND STEEL BOLTS AND NUTS.
      1) RIGID TYPE COUPLINGS: HOUSINGS CAST WITH OFFSETTING, ANGLE-PATTERN BOLT PADS TO PROVIDE RIGIDITY AND SYSTEM SUPPORT AND HANGING IN ACCORDANCE WITH ANSI B31.1 AND B31.9.
      2) FLEXIBLE TYPE COUPLINGS: USE IN LOCATIONS WHERE VIBRATION ATTENUATION AND STRESS RELIEF ARE REQUIRED.
      3) FLANGE ADAPTERS: FLAT FACE, FOR DIRECT CONNECTION TO ANSI CLASS 125 OR 150 FLANGED COMPONENTS.

2.4 ALARM CHECK VALVES:

A. UL 193, DESIGNED FOR HORIZONTAL OR VERTICAL INSTALLATION, WITH BRASS OR BRONZE GROOVED SEAT WITH O-RING SEALS, SINGLE-HINGE PIN, AND LATCH DESIGN. INCLUDE TRIM SETS

FOR BYPASS, DRAIN, ELECTRICAL SPRINKLER ALARM SWITCH, PRESSURE GAGES, RETARDING CHAMBER, AND FILL-LINE ATTACHMENT WITH STRAINER.

B. INTERNAL VALVE COMPONENTS SHALL BE REPLACEABLE WITHOUT REMOVING THE VALVE FROM THE INSTALLED POSITION.

C. DRIP CUP ASSEMBLY: PIPE DRAIN WITHOUT VALVES AND SEPARATE FROM MAIN DRAIN PIPING.

D. AVAILABLE MANUFACTURERS:

1. RELIABLE AUTOMATIC SPRINKLER CO., INC.
2. TYCO FIRE & BUILDING PRODUCTS.
3. VICTAULIC FIRE PROTECTION.
4. VIKING CORP.

PART 3: EXECUTION

3.1 EXAMINATION

A. EXAMINE ROUGHING-IN FOR HOSE CONNECTIONS AND STATIONS TO VERIFY ACTUAL LOCATIONS OF PIPING CONNECTIONS BEFORE INSTALLATION.

B. EXAMINE WALLS AND PARTITIONS FOR SUITABLE THICKNESSES, FIRE- AND SMOKE-RATED CONSTRUCTION, FRAMING FOR HOSE-STATION CABINETS, AND OTHER CONDITIONS WHERE HOSE CONNECTIONS AND STATIONS ARE TO BE INSTALLED.

C. PROCEED WITH INSTALLATION ONLY AFTER UNSATISFACTORY CONDITIONS HAVE BEEN CORRECTED.

3.2 PIPING APPLICATIONS, GENERAL

A. SHOP WELD PIPE JOINTS WHERE WELDED PIPING IS INDICATED.

B. DO NOT USE WELDED JOINTS FOR GALVANIZED-STEEL PIPE.

C. FLANGES, FLANGED FITTINGS, UNIONS, NIPPLES, AND TRANSITION AND SPECIAL FITTINGS WITH FINISH AND PRESSURE RATINGS SAME AS OR HIGHER THAN SYSTEM'S PRESSURE RATING MAY BE USED IN ABOVEGROUND APPLICATIONS, UNLESS OTHERWISE INDICATED.

D. PIPING BETWEEN FIRE DEPARTMENT CONNECTIONS AND CHECK VALVES: GALVANIZED, STANDARD-WEIGHT STEEL PIPE WITH GROOVED ENDS; GROOVED-END FITTINGS; GROOVED-END-PIPE COUPLINGS; AND GROOVED JOINTS.

3.3 SPRINKLER SYSTEM PIPING APPLICATIONS

A. STANDARD-PRESSURE, WET-PIPE SPRINKLER SYSTEM, 175-PSIG MAXIMUM WORKING PRESSURE:

1. SPRINKLER-PIPING FITTING OPTION: SPECIALTY SPRINKLER FITTINGS, NPS 2-1/2 AND SMALLER, INCLUDING MECHANICAL-T AND -CROSS FITTINGS, MAY BE USED DOWNSTREAM FROM SPRINKLER ZONE VALVES.
2. NPS 1-1/2 AND SMALLER:
    a. THREADED-END, BLACK STANDARD-WEIGHT STEEL PIPE; CAST- OR MALLEABLE-IRON THREADED FITTINGS; AND THREADED JOINTS.
    b. PLAIN-END, BLACK, STANDARD-WEIGHT STEEL PIPE; STEEL WELDING FITTINGS; AND WELDED JOINTS.
    c. PLAIN-END, BLACK STANDARD-WEIGHT STEEL PIPE; LOCKING-LUG FITTINGS; AND TWIST LOCKED JOINTS.
3. NPS 2”
    a. THREADED-END, BLACK STANDARD-WEIGHT STEEL PIPE; CAST- OR MALLEABLE-IRON THREADED FITTINGS; AND THREADED JOINTS.
    b. PLAIN-END, BLACK STANDARD-WEIGHT STEEL PIPE; LOCKING-LUG FITTINGS; AND TWIST-LOCKED JOINTS.
    c. PLAIN-END, BLACK, STANDARD-WEIGHT STEEL PIPE; STEEL WELDING FITTINGS; AND WELDED JOINTS.
    d. GROOVED-END, BLACK STANDARD-WEIGHT STEEL PIPE; GROOVED-END FITTINGS; GROOVED-END-PIPE COUPLINGS; AND GROOVED JOINTS.
    e. PLAIN-END, BLACK, SCHEDULE 30 STEEL PIPE; STEEL WELDING FITTINGS; AND WELDED JOINTS.

f. GROOVED-END, BLACK SCHEDULE 30 STEEL PIPE; GROOVED-END FITTINGS; GROOVED-END-PIPE COUPLINGS; AND GROOVED JOINTS.

4. NPS 2-1/2 TO NPS 3-1/2:
   a. THREADED-END, BLACK STANDARD-WEIGHT STEEL PIPE; CAST- OR MALLEABLE-IRON THREADED FITTINGS; AND THREADED JOINTS.
   b. PLAIN-END, BLACK, STANDARD-WEIGHT STEEL PIPE; STEEL WELDING FITTINGS; AND WELDED JOINTS.
   c. GROOVED-END, BLACK STANDARD-WEIGHT STEEL PIPE; GROOVED-END FITTINGS; GROOVED-END-PIPE COUPLINGS; AND GROOVED JOINTS.
   d. PLAIN-END, BLACK, SCHEDULE 30 STEEL PIPE; STEEL WELDING FITTINGS; AND WELDED JOINTS.
   e. GROOVED-END, BLACK SCHEDULE 30 STEEL PIPE; GROOVED-END FITTINGS; GROOVED-END-PIPE COUPLINGS; AND GROOVED JOINTS.
   f. GROOVED-END, THREADABLE, THINWALL STEEL PIPE; GROOVED-END FITTINGS; GROOVED-END-PIPE COUPLINGS; AND GROOVED JOINTS.
5. NPS 4 TO NPS 8:
   a. PLAIN-END, BLACK, STANDARD-WEIGHT STEEL PIPE; STEEL WELDING FITTINGS; AND WELDED JOINTS.
   b. GROOVED-END, BLACK STANDARD-WEIGHT STEEL PIPE; GROOVED-END FITTINGS; GROOVED-END-PIPE COUPLINGS; AND GROOVED JOINTS.
   c. PLAIN-END, BLACK, SCHEDULE 30 STEEL PIPE; STEEL WELDING FITTINGS; AND WELDED JOINTS.
   d. GROOVED-END, BLACK SCHEDULE 30 STEEL PIPE; GROOVED-END FITTINGS; GROOVED-END-PIPE COUPLINGS; AND GROOVED JOINTS.
   e. GROOVED-END, THREADABLE, THINWALL STEEL PIPE; GROOVED-END FITTINGS; GROOVED-END-PIPE COUPLINGS; AND GROOVED JOINTS.
   f. GROOVED-END, SCHEDULE 10 STEEL PIPE; GROOVED-END FITTINGS; GROOVED-END-PIPE COUPLINGS; AND GROOVED JOINTS.

3.4 WATER-SUPPLY CONNECTION

A. CONNECT FIRE-SUPPRESSION PIPING TO BUILDING'S INTERIOR WATER DISTRIBUTION PIPING.

B. INSTALL SHUTOFF VALVE, CHECK VALVE, PRESSURE GAGE, AND DRAIN AT CONNECTION TO WATER SUPPLY.

3.5 PIPING INSTALLATION

A. PIPING PREPARATION
   1. REAM PIPE AND TUBE ENDS. REMOVE BURRS.
   2. REMOVE SCALE AND FOREIGN MATERIAL, FROM INSIDE AND OUTSIDE, BEFORE ASSEMBLY.
   3. PREPARE PIPING CONNECTIONS TO EQUIPMENT WITH GROOVED JOINT COUPLINGS, FLANGES OR UNIONS.
   4. DIE CUT THREADED JOINTS WITH FULL CUT STANDARD TAPER PIPE THREADS WITH RED LEAD AND LINSEED OIL OR OTHER NON TOXIC JOINT COMPOUND APPLIED TO MALE THREADS ONLY.

B. PIPE ROUTING:
   1. ROUTE PIPING IN ORDERLY MANNER, PLUMB AND PARALLEL TO BUILDING STRUCTURE. MAINTAIN GRADIENT.
   2. INSTALL PIPING TO CONSERVE BUILDING SPACE, TO NOT INTERFERE WITH USE OF SPACE AND OTHER WORK. IN GENERAL FIRE PROTECTION MAIN PIPING SHALL BE INSTALLED AS TIGHT AS POSSIBLE TO STRUCTURAL STEEL WITH BRANCH LINES INSTALLED WITHIN OPEN WEBBING OF STRUCTURAL MEMBERS WHENEVER POSSIBLE.
   3. GROUP PIPING WHENEVER PRACTICAL AT COMMON ELEVATIONS.
   4. DO NOT PENETRATE BUILDING STRUCTURAL MEMBERS UNLESS INDICATED.

5. SLOPE PIPING AND ARRANGE SYSTEMS TO DRAIN AT LOW POINTS. USE ECCENTRIC REDUCERS TO MAINTAIN TOP OF PIPE LEVEL.
6. PROVIDE SLEEVES WHEN PENETRATING FOOTINGS, FLOORS AND WALLS. SEAL PIPE AND SLEEVE PENETRATIONS TO ACHIEVE FIRE RESISTANCE EQUIVALENT TO FIRE SEPARATION REQUIRED.

C. WHEN INSTALLING MORE THAN ONE PIPING SYSTEM MATERIAL, ENSURE SYSTEM COMPONENTS ARE COMPATIBLE AND JOINED TO ENSURE THE INTEGRITY OF THE SYSTEM. PROVIDE NECESSARY JOINING FITTINGS. ENSURE FLANGES, UNION, AND COUPLINGS FOR SERVICING ARE CONSISTENTLY PROVIDED.

D. USE APPROVED FITTINGS TO MAKE CHANGES IN DIRECTION, BRANCH TAKEOFFS FROM MAINS, AND REDUCTIONS IN PIPE SIZES.

E. INSTALL UNIONS ADJACENT TO EACH VALVE IN PIPES NPS 2 AND SMALLER. UNIONS ARE NOT REQUIRED ON FLANGED DEVICES OR IN PIPING INSTALLATIONS USING GROOVED JOINTS.

F. INSTALL GROOVED JOINT COUPLINGS, FLANGES OR FLANGE ADAPTERS ON VALVES, APPARATUS, AND EQUIPMENT HAVING NPS 2-1/2 AND LARGER CONNECTIONS.

G. INSTALL SPRINKLER PIPING WITH DRAINS FOR COMPLETE SYSTEM DRAINAGE.

H. INSTALL SPRINKLER ZONE CONTROL VALVES, TEST ASSEMBLIES, AND DRAIN RISERS ADJACENT TO STANDPIPES WHEN SPRINKLER PIPING IS CONNECTED TO STANDPIPES.

I. INSTALL BALL DRIP VALVES TO DRAIN PIPING BETWEEN FIRE DEPARTMENT CONNECTIONS AND CHECK VALVES. DRAIN TO FLOOR DRAIN OR OUTSIDE BUILDING.

J. EARTHQUAKE PROTECTION: INSTALL PIPING ACCORDING TO NFPA 13 TO PROTECT FROM EARTHQUAKE DAMAGE.

K. FILL WET-PIPE SPRINKLER SYSTEM PIPING WITH WATER.

L. INSTALL FLEXIBLE CONNECTORS IN FIRE-SUPPRESSION PIPING WHERE REQUIRED.

3.6 JOINT CONSTRUCTION

A. THREADED JOINTS: COMPLY WITH NFPA 13 FOR PIPE THICKNESS AND THREADS. DO NOT THREAD PIPE SMALLER THAN NPS 8 WITH WALL THICKNESS LESS THAN SCHEDULE 40 UNLESS APPROVED BY AUTHORITIES HAVING JURISDICTION AND THREADS ARE CHECKED BY A RING GAGE AND COMPLY WITH ASME B1.20.1.

B. TWIST-LOCKED JOINTS: INSERT PLAIN-END PIPING INTO LOCKING-LUG FITTING AND ROTATE RETAINER LUG ONE-QUARTER TURN. PIPE ENDS SHALL BE CLEANED 1” FROM PIPE END OF DEBRIS, MILL SCALE, AND COATINGS.

C. PRESSURE-SEALED JOINTS: USE UL-LISTED TOOL AND PROCEDURE. INCLUDE USE OF SPECIFIC EQUIPMENT, PRESSURE-SEALING TOOL, AND ACCESSORIES. PIPE SHALL BE SQUARE CUT, +/- 0.030”, PROPERLY DEBURRED, AND CLEANED. MARK PIPE ENDS AT THE REQUIRED LOCATION USING A GAUGE SUPPLIED BY MANUFACTURER TO ENSURE FULL INSERTION INTO THE COUPLING OR FITTING DURING ASSEMBLY. INSTALL IN ACCORDANCE WITH THE MANUFACTURERS INSTRUCTIONS.

D. GROOVED JOINTS: ASSEMBLE JOINTS WITH LISTED COUPLING AND GASKET, LUBRICANT, AND BOLTS IN ACCORDANCE WITH MANUFACTURERS’ INSTRUCTIONS.

1. DUCTILE-IRON PIPE: RADIUS-CUT-GROOVE ENDS OF PIPING. USE GROOVED-END FITTINGS AND GROOVED-END-PIPE COUPLINGS.
2. STEEL PIPE: SQUARE-CUT OR ROLL-GROOVE PIPING AS INDICATED. USE GROOVED-END FITTINGS AND RIGID, GROOVED-END-PIPE COUPLINGS, UNLESS OTHERWISE INDICATED.
3. DRY-PIPE AND PREACTION SYSTEMS: USE FITTINGS AND GASKETS LISTED FOR DRY-PIPE SERVICE. IN DRY APPLICATIONS SUBJECT TO TEMPERATURES BELOW 0°F, USE PURE SILICONE GASKETS WHICH REMAIN FLEXIBLE DOWN TO -30°F AND WHICH PROVIDE A FLUSH SEAL TO PIPING MINIMIZING THE POTENTIAL FOR TRAPPED MOISTURE IN GASKET. GASKETS SHALL BE EQUAL TO VICTAULIC GRADE ‘L’ SILICONE FLUSHSEAL® GASKETS.
4. GROOVED ENDS SHALL BE CLEAN AND FREE FROM INDENTATIONS, PROJECTIONS, AND ROLL MARKS IN THE AREA FROM PIPE END TO GROOVE.

5. GASKETS SHALL BE VERIFIED AS SUITABLE FOR THE INTENDED SERVICE PRIOR TO INSTALLATION. GASKETS SHALL BE MOLDED AND PRODUCED BY THE COUPLING MANUFACTURER.
6. THE GROOVED COUPLING MANUFACTURER'S FACTORY TRAINED REPRESENTATIVE SHALL PROVIDE ON-SITE TRAINING FOR CONTRACTOR'S FIELD PERSONNEL IN THE USE OF GROOVING TOOLS, APPLICATION OF GROOVE, AND INSTALLATION OF GROOVED JOINT PRODUCTS. THE MANUFACTURER'S REPRESENTATIVE SHALL PERIODICALLY VISIT THE JOBSITE AND REVIEW INSTALLATION. CONTRACTOR SHALL REMOVE AND REPLACE ANY JOINTS DEEMED IMPROPERLY INSTALLED.

E. DISSIMILAR-METAL PIPING JOINTS: CONSTRUCT JOINTS USING DIELECTRIC FITTINGS COMPATIBLE WITH BOTH PIPING MATERIALS.
1. NPS 2 AND SMALLER: USE DIELECTRIC UNIONS, COUPLINGS, OR NIPPLES.
2. NPS 2-1/2 TO NPS 4: USE DIELECTRIC FLANGES OR NIPPLES.
3. NPS 5 AND LARGER: USE DIELECTRIC FLANGE INSULATION KITS OR NIPPLES.

3.7 INSTALLATION

A. INSTALL "INSPECTOR'S TEST CONNECTIONS" IN SPRINKLER SYSTEM PIPING, COMPLETE WITH SHUTOFF VALVE, SIZED AND LOCATED ACCORDING TO NFPA 13.
B. INSTALL SPRINKLER ZONE CONTROL VALVES, TEST ASSEMBLIES, AND DRAIN RISERS ADJACENT TO STANDPIPES WHEN SPRINKLER PIPING IS CONNECTED TO STANDPIPES.
C. INSTALL BALL DRIP VALVES TO DRAIN PIPING BETWEEN FIRE DEPARTMENT CONNECTIONS AND CHECK VALVES. DRAIN TO FLOOR DRAIN OR OUTSIDE BUILDING.
D. INSTALL ALARM DEVICES IN PIPING SYSTEMS.
E. INSTALL PRESSURE GAGES ON RISER OR FEED MAIN, AT EACH SPRINKLER TEST CONNECTION, AND AT TOP OF EACH STANDPIPE. INCLUDE PRESSURE GAGES WITH CONNECTION NOT LESS THAN NPS 1/4 AND WITH SOFT METAL SEATED GLOBE VALVE, ARRANGED FOR DRAINING PIPE BETWEEN GAGE AND VALVE. INSTALL GAGES TO PERMIT REMOVAL, AND INSTALL WHERE THEY WILL NOT BE SUBJECT TO FREEZING.
F. PRESSURIZE AND CHECK DRY-PIPE SPRINKLER SYSTEM PIPING AND AIR-PRESSURE MAINTENANCE DEVICES AND AIR COMPRESSORS.

3.8 ALARM CHECK VALVES

A. INSTALL IN VERTICAL POSITION FOR PROPER DIRECTION OF FLOW, INCLUDING BYPASS CHECK VALVE AND RETARDING CHAMBER DRAIN-LINE CONNECTION.

3.9 CONNECTIONS

A. DRAWINGS INDICATE GENERAL ARRANGEMENT OF PIPING, FITTINGS, AND SPECIALTIES.
B. CONNECT EXCESS-PRESSURE PUMPS TO THE FOLLOWING PIPING AND WIRING:
1. SPRINKLER SYSTEM, HYDRAULICALLY.
2. PRESSURE GAGES AND CONTROLS, HYDRAULICALLY.
3. ELECTRICAL POWER SYSTEM.
4. ALARM DEVICE ACCESSORIES FOR PUMP.
5. FIRE ALARM.
C. CONNECT COMPRESSED-AIR SUPPLY TO DRY-PIPE SPRINKLER PIPING.
D. CONNECT AIR COMPRESSOR TO THE FOLLOWING PIPING AND WIRING:
1. PRESSURE GAGES AND CONTROLS.
2. ELECTRICAL POWER SYSTEM.
3. FIRE ALARM DEVICES, INCLUDING LOW-PRESSURE ALARM.
E. ELECTRICAL CONNECTIONS: POWER WIRING IS SPECIFIED IN DIVISION 16.
F. CONNECT ALARM DEVICES TO FIRE ALARM.
G. GROUND EQUIPMENT ACCORDING TO DIVISION 16 SECTION "GROUNDING AND BONDING."
H. CONNECT WIRING ACCORDING TO DIVISION 16 SECTION "CONDUCTORS AND CABLES."
I. TIGHTEN ELECTRICAL CONNECTORS AND TERMINALS ACCORDING TO MANUFACTURER'S PUBLISHED TORQUE-TIGHTENING VALUES. IF MANUFACTURER'S TORQUE VALUES ARE NOT INDICATED, USE THOSE SPECIFIED IN UL 486A AND UL 486B.

3.10 CONNECTIONS

A. DRAWINGS INDICATE GENERAL ARRANGEMENT OF PIPING, FITTINGS, AND SPECIALTIES.
B. INSTALL PIPING ADJACENT TO EQUIPMENT TO ALLOW SERVICE AND MAINTENANCE.
C. CONNECT WATER-SUPPLY PIPING TO FIRE-SUPPRESSION PIPING. INCLUDE BACKFLOW PREVENTER BETWEEN POTABLE-WATER PIPING AND FIRE-SUPPRESSION PIPING.
D. INSTALL BALL DRIP VALVES AT EACH CHECK VALVE FOR FIRE DEPARTMENT CONNECTION. DRAIN TO FLOOR DRAIN OR OUTSIDE BUILDING.
E. CONNECT PIPING TO SPECIALTY VALVES, HOSE VALVES, SPECIALTIES, FIRE DEPARTMENT CONNECTIONS, AND ACCESSORIES.

3.11 FIELD QUALITY CONTROL

A. PERFORM THE FOLLOWING FIELD TESTS AND INSPECTIONS AND PREPARE TEST REPORTS:
    1. LEAK TEST PER NFPA 13: AFTER INSTALLATION, CHARGE SYSTEM AND TEST FOR LEAKS. REPAIR LEAKS AND RETEST UNTIL NO LEAKS EXIST.
    2. FLUSH CLEAN ALL PIPING UNTIL CLEAR AT THE HIGHER OF TWO VELOCITIES, 10 FT PER SECOND OR THE DESIGN VELOCITY FOR EACH SECTION. PROVISIONS FOR FLUSHING SHALL BE INSTALLED IN ACCORDANCE WITH NFPA 13.
B. REPORT TEST RESULTS PROMPTLY AND IN WRITING TO ARCHITECT AND AUTHORITIES HAVING JURISDICTION.

3.12 FIELD QUALITY CONTROL

A. PERFORM THE FOLLOWING FIELD TESTS AND INSPECTIONS AND PREPARE TEST REPORTS:
    1. TEST AND ADJUST CONTROLS AND SAFETIES. REPLACE DAMAGED AND MALFUNCTIONING CONTROLS AND EQUIPMENT.
    2. ENERGIZE CIRCUITS TO ELECTRICAL EQUIPMENT AND DEVICES.
    3. START AND RUN EXCESS-PRESSURE PUMPS.
    4. INSTALL AIR COMPRESSOR ON VIBRATION ISOLATORS.
    5. START AND RUN AIR COMPRESSORS.
    6. COORDINATE WITH FIRE ALARM TESTS. OPERATE AS REQUIRED.
    7. COORDINATE WITH FIRE-PUMP TESTS. OPERATE AS REQUIRED.
    8. VERIFY THAT EQUIPMENT HOSE THREADS ARE SAME AS LOCAL FIRE DEPARTMENT EQUIPMENT.
B. REPORT TEST RESULTS PROMPTLY AND IN WRITING TO ARCHITECT AND AUTHORITIES HAVING JURISDICTION.

3.13 DEMONSTRATION

A. ENGAGE A FACTORY-AUTHORIZED SERVICE REPRESENTATIVE TO TRAIN OWNER'S MAINTENANCE PERSONNEL TO ADJUST, OPERATE, AND MAINTAIN SPECIALTY VALVES.
B. THE TRAINING SESSION MUST INCLUDE THE NORMAL, EMERGENCY PROCEDURES AND SYSTEM MAINTENANCE OF EQUIPMENT.
C. REFER TO DIVISION 1 SECTION "CLOSEOUT PROCEDURES AND DEMONSTRATION AND TRAINING."

END OF SECTION

SECTION 21 31 13
ELECTRIC-DRIVE CENTRIFUGAL FIRE PUMPS

PART 1: GENERAL

1.1 SUMMARY

A. THE WORK OF THIS SECTION SHALL INCLUDE:
   1. ELECTRIC DRIVEN CENTRIFUGAL FIRE PUMP.
   2. FULL SERVICE FIRE-PUMP CONTROLLERS.
   3. FIRE-PUMP ACCESSORIES AND SPECIALTIES.
   4. PRESSURE-MAINTENANCE PUMPS, CONTROLLERS, ACCESSORIES, AND SPECIALTIES.
   5. ALARM PANELS.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. THE FOLLOWING REFERENCED SECTIONS ARE LISTED AS A MINIMUM OF ADDITIONAL REQUIREMENTS AND/OR WORK NOT INCLUDED IN THIS SECTION WHICH MAY BE REQUIRED TO BE PERFORMED UNDER OTHER DESIGNATED SECTIONS:
   1. *21 00 01 – FIRE-SUPPRESSION GENERAL PROVISIONS*
   2. *21 05 01 – SUPPLEMENTARY COMPONENTS FOR FIRE-SUPPRESSION PIPING*
   3. *21 05 23 – GENERAL-DUTY VALVES FOR WATER-BASED FIRE-SUPPRESSION PIPING*
   4. *21 05 29 – HANGERS AND SUPPORTS FOR WATER-BASED FIRE-SUPPRESSION PIPING AND EQUIPMENT.*
   5. *21 05 53 – IDENTIFICATION FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT*
   6. *21 07 19 – FIRE-SUPPRESSION PIPING INSULATION*

1.3 REFERENCE STANDARDS

A. ASME (AMERICAN SOCIETY OF MECHANICAL ENGINEERS)
   1. B16.1 GRAY IRON PIPE FLANGES AND FLANGED FITTINGS: CLASSES 25,125, AND 250

B. NFPA (NATIONAL FIRE PROTECTION ASSOCIATION)
   1. NFPA 13 STANDARD FOR THE INSTALLATION OF SPRINKLER SYSTEMS
   2. NFPA 20 STANDARD FOR THE INSTALLATION OF STATIONARY PUMPS FOR FIRE PROTECTION
   3. NFPA 70 NATIONAL ELECTRIC CODE

C. UL (UNDERWRITER'S LABORATORIES)
   1. UL 50 STANDARD FOR ENCLOSURES FOR ELECTRICAL EQUIPMENT, NON-ENVIRONMENTAL CONSIDERATIONS
   2. UL 218 STANDARD FOR FIRE PUMP CONTROLLERS
   3. UL 448 STANDARD FOR CENTRIFUGAL STATIONARY PUMPS FOR FIRE-PROTECTION SERVICE
   4. UL 508 STANDARD FOR INDUSTRIAL CONTROL EQUIPMENT
   5. UL 1726 STANDARD FOR AUTOMATIC DRAIN VALVES FOR STANDPIPE SYSTEMS

1.4 SUBMITTALS

A. SUBMITTALS SHALL BE SUBMITTED IN CONFORMANCE WITH THE REQUIREMENTS OF SECTION 21 00 01 – FIRE SUPPRESSION GENERAL PROVISIONS.

B. SUBMITTALS ARE REQUIRED FOR:
   1. PRODUCT DATA:
      a. FIRE PUMPS AND DRIVERS
      b. PUMP CURVES
      c. FIRE-PUMP CONTROLLERS
      d. FIRE-PUMP ACCESSORIES AND SPECIALTIES
      e. PRESSURE-MAINTENANCE PUMPS
      f. PRESSURE-MAINTENANCE-PUMP CONTROLLERS
      g. PRESSURE-MAINTENANCE-PUMP ACCESSORIES AND SPECIALTIES.
   2. SHOP DRAWING DATA: SHALL INCLUDE, BUT NOT BE LIMITED TO:
      a. FIRE PUMP SYSTEM DRAWINGS INCLUDING PLANS, ELEVATIONS, SECTIONS AND DETAILS OF PUMP, PIPING AND SYSTEM COMPONENTS.
      b. COMPLETE SYSTEM DIMENSIONS, ROUGHING-IN AND SETTING DIAGRAMS.

c. COMPLETE DESCRIPTIONS OF THE CONTROLLER, WIRING DIAGRAM, SEQUENCING DATA, INSTRUMENTATION, ALARMS.
d. POWER WIRING DETAILS WITH WIRING DIAGRAMS DIFFERENTIATING BETWEEN MANUFACTURER-INSTALLED AND FIELD-INSTALLED WIRING.

3. OPERATION AND MAINTENANCE DATA:
   a. FIRE PUMPS AND DRIVERS
   b. PRESSURE-MAINTENANCE PUMPS
   c. CONTROLLERS
   d. ACCESSORIES AND SPECIALTIES
   e. ALARM PANELS
   f. FLOWMETER SYSTEMS TO INCLUDE IN EMERGENCY, OPERATION, AND MAINTENANCE MANUALS.

1.5 PERFORMANCE REQUIREMENTS

A. PUMP, EQUIPMENT, ACCESSORY, SPECIALTY, AND PIPING PRESSURE RATING: 175-PSIG MINIMUM WORKING-PRESSURE RATING, UNLESS OTHERWISE INDICATED.

1.6 GUARANTEE:

A. THE FIRE PUMP SYSTEM SHALL BE GUARANTEED AGAINST DEFECTS IN MATERIALS OR CONSTRUCTION, UNDER NORMAL USE, FOR A PERIOD OF EIGHTEEN (18) MONTHS FROM THE DATE OF START-UP, BUT NOT TO EXCEED ONE (1) YEAR FROM SHIPMENT, WHICHEVER OCCURS FIRST.

1.7 DELIVERY, STORAGE, AND HANDLING

A. ACCEPT MATERIALS ON SITE AND PROVIDE UNLOADING FROM DELIVERY TRUCK. INSPECT FOR DAMAGE. PROVIDE RIGGING OF FIRE PUMP SYSTEM AND HOUSING ENCLOSURE INTO PLACE.

1.8 QUALITY ASSURANCE

A. SOURCE LIMITATIONS: OBTAIN FIRE PUMPS, PRESSURE-MAINTENANCE PUMPS, AND CONTROLLERS THROUGH ONE SOURCE FROM A SINGLE MANUFACTURER FOR EACH TYPE OF EQUIPMENT.
B. ELECTRICAL COMPONENTS, DEVICES, AND ACCESSORIES: LISTED AND LABELED AS DEFINED IN NFPA 70, ARTICLE 100, BY TESTING AGENCY ACCEPTABLE TO AUTHORITIES HAVING JURISDICTION, AND MARKED FOR INTENDED USE.
C. COMPLY WITH STANDARDS OF AUTHORITIES HAVING JURISDICTION PERTAINING TO MATERIALS, HOSE THREADS, AND INSTALLATION.
D. COMPLY WITH NFPA 20, "STATIONARY PUMPS FOR FIRE PROTECTION," FOR FIRE PUMPS, DRIVERS, CONTROLLERS, ACCESSORIES, AND THEIR INSTALLATION.
E. THE FIRE PUMP SYSTEM SHALL BE FMG APPROVED.

1.9 COORDINATION

A. COORDINATE SIZE AND LOCATION OF CONCRETE FLOOR SLAB, FOUNDATIONS AND EQUIPMENT PADS FOR FIRE PUMP SYSTEM AND HOUSING ENCLOSURE. COORDINATE TYPE AND LOCATION OF CAST ANCHOR-BOLT INSERTS OR OTHER ATTACHMENTS AS REQUIRED.

PART 2: PRODUCTS

2.1 GENERAL REQUIREMENTS

A. THE CONTRACTOR SHALL PROVIDE AND INSTALL A FIRE PUMP SYSTEM DESIGNED IN ACCORDANCE WITH NFPA 20. THE SYSTEM SHALL BE RATED FOR A FLOW AND PRESSURE AS REQUIRED BASED UPON AVAILABLE WATER SUPPLY AND FACILITY FIRE PROTECTION HYDRAULIC DESIGN CALCULATIONS. THE SYSTEM SHALL BE MOUNTED ON A FABRICATED STEEL BASE, AND INCLUDE ALL NECESSARY COMPONENTS SUCH THAT THE CONTRACTOR IS ONLY REQUIRED TO RUN PIPING AND POWER WIRING TO AND FROM THE SYSTEM. THE FIRE PUMP SYSTEM SHALL CONSIST OF THE EQUIPMENT SPECIFIED HEREIN.

2.2 MANUFACTURERS

A. AVAILABLE MANUFACTURERS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, MANUFACTURERS OFFERING PRODUCTS THAT MAY BE INCORPORATED INTO THE WORK INCLUDE, BUT ARE NOT LIMITED TO, MANUFACTURERS SPECIFIED.

1. A-C PUMP; ITT INDUSTRIES.
2. ARMSTRONG DARLING, INC.
3. AURORA PUMP; PENTAIR PUMP GROUP.
4. FAIRBANKS MORSE; PENTAIR PUMP GROUP.
5. PATTERSON PUMP COMPANY.
6. STERLING PEERLESS PUMP; STERLING FLUID SYSTEMS GROUP.
7. ALTERNATE MANUFACTURERS UPON ENGINEER'S APPROVAL.

2.3 FIRE PUMP

A. DESCRIPTION, GENERAL: UL, FACTORY-ASSEMBLED AND TESTED, ELECTRIC-DRIVE, CENTRIFUGAL FIRE PUMPS CAPABLE OF FURNISHING NOT LESS THAN 150 PERCENT OF RATED CAPACITY AT NOT LESS THAN 65 PERCENT OF TOTAL RATED HEAD AND WITH SHUTOFF HEAD LIMITED TO 140 PERCENT OF TOTAL RATED HEAD.
   1. FINISH: MANUFACTURER'S STANDARD RED PAINT APPLIED TO FACTORY-ASSEMBLED AND -TESTED UNIT BEFORE SHIPPING.
   2. NAMEPLATE: COMPLETE WITH CAPACITIES, CHARACTERISTICS, AND OTHER PERTINENT DATA.

B. FABRICATE BASE AND ATTACHMENT TO FIRE PUMPS, PRESSURE-MAINTENANCE PUMPS, AND CONTROLLERS WITH REINFORCEMENT TO RESIST MOVEMENT OF PUMPS AND CONTROLLERS DURING A SEISMIC EVENT WHEN THEIR BASES ARE ANCHORED TO BUILDING STRUCTURE.

C. SINGLE-STAGE, HORIZONTALLY MOUNTED, SPLIT-CASE FIRE PUMPS: DOUBLE-SUCTION TYPE WITH PUMP AND DRIVER MOUNTED ON SAME BASE AND CONNECTED WITH COUPLING.
   1. MANUFACTURERS:
      a. A-C PUMP; ITT INDUSTRIES.
      b. ARMSTRONG DARLING, INC.
      c. AURORA PUMP; PENTAIR PUMP GROUP.
      d. FAIRBANKS MORSE; PENTAIR PUMP GROUP.
      e. PATTERSON PUMP COMPANY.
      f. STERLING PEERLESS PUMP; STERLING FLUID SYSTEMS GROUP.
      g. ALTERNATE MANUFACTURERS UPON ENGINEER'S APPROVAL.
   2. PUMP: AXIALLY SPLIT CAST-IRON CASING WITH SUCTION AND DISCHARGE FLANGES MACHINED TO ASME B16.1, CLASS 125 DIMENSIONS, UNLESS OTHERWISE INDICATED.
      a. IMPELLER: CAST BRONZE OF CONSTRUCTION TO MATCH FIRE PUMP, STATICALLY AND DYNAMICALLY BALANCED, AND KEYED TO SHAFT.
      b. WEAR RINGS: REPLACEABLE, BRONZE.
      c. SHAFT AND SLEEVE: STEEL SHAFT WITH BRONZE SLEEVE.
         1) SHAFT BEARINGS: GREASE-LUBRICATED BALL BEARINGS IN CAST-IRON HOUSING.
         2) SEALS: STUFFING BOX WITH MINIMUM OF FOUR RINGS OF GRAPHITE-IMPREGNATED BRAIDED YARN AND BRONZE PACKING GLAND.
   3. COUPLING: FLEXIBLE AND CAPABLE OF ABSORBING TORSIONAL VIBRATION AND SHAFT MISALIGNMENT. INCLUDE METAL COUPLING GUARD.
   4. DRIVER: UL LISTED, NEMA MG 1, OPEN-DRIPPROOF, SQUIRREL-CAGE, INDUCTION MOTOR COMPLYING WITH NFPA 20 AND NFPA 70. INCLUDE WIRING COMPATIBLE WITH CONTROLLER USED.
      a. MANUFACTURERS:
         1) EMERSON; U.S. ELECTRICAL MOTORS.
         2) LINCOLN ELECTRIC COMPANY.
         3) MARATHON ELECTRIC, INC.
         4) ALTERNATE MANUFACTURERS UPON ENGINEER'S APPROVAL.

D. MULTISTAGE, HORIZONTALLY MOUNTED, SPLIT-CASE FIRE PUMPS: TWO-STAGE, SINGLE-SUCTION TYPE WITH PUMP AND DRIVER MOUNTED ON SAME BASE AND CONNECTED WITH COUPLING.
   1. MANUFACTURERS:

a. A-C PUMP; ITT INDUSTRIES.
b. ARMSTRONG DARLING, INC.
c. AURORA PUMP; PENTAIR PUMP GROUP.
d. FAIRBANKS MORSE; PENTAIR PUMP GROUP.
e. PATTERSON PUMP COMPANY.
f. REDDY-BUFFALOES PUMP CO.
g. STERLING PEERLESS PUMP; STERLING FLUID SYSTEMS GROUP.
h. ALTERNATE MANUFACTURERS UPON ENGINEER'S APPROVAL.

2. PUMP: AXIALLY SPLIT CAST-IRON CASING WITH SUCTION AND DISCHARGE FLANGES MACHINED TO ASME B16.1, CLASS 125 DIMENSIONS, UNLESS OTHERWISE INDICATED.
   a. IMPELLER: CAST BRONZE OF CONSTRUCTION TO MATCH FIRE PUMP, STATICALLY AND DYNAMICALLY BALANCED, AND KEYED TO SHAFT.
   b. WEAR RINGS: REPLACEABLE, BRONZE.
   c. SHAFT AND SLEEVE: STEEL SHAFT WITH BRONZE SLEEVE.
      1) SHAFT BEARINGS: GREASE-LUBRICATED BALL BEARINGS IN CAST-IRON HOUSING.
      2) SEALS: STUFFING BOX WITH MINIMUM OF FOUR RINGS OF GRAPHITE-IMPREGNATED BRAIDED YARN AND BRONZE PACKING GLAND.
3. COUPLING: FLEXIBLE AND CAPABLE OF ABSORBING TORSIONAL VIBRATION AND SHAFT MISALIGNMENT. INCLUDE METAL COUPLING GUARD.
4. DRIVER: UL-LISTED, NEMA MG 1, OPEN-DRIPPROOF, SQUIRREL-CAGE, INDUCTION MOTOR COMPLYING WITH NFPA 20 AND NFPA 70. INCLUDE WIRING COMPATIBLE WITH CONTROLLER USED.
   a. MANUFACTURERS:
      1) EMERSON; U.S. ELECTRICAL MOTORS.
      2) LINCOLN ELECTRIC COMPANY (THE).
      3) MARATHON ELECTRIC, INC.
      4) ALTERNATE MANUFACTURERS UPON ENGINEER'S APPROVAL.

2.4 FIRE-PUMP CHARACTERISTICS AND SPECIALTY DATA:

A. FIRE-PUMP NO 1:
   1. RATED CAPACITY: ASSUMED CAPACITY OF 1,500 GPM, CONTRACTOR TO VERIFY:
      a. IF PUMP IS NEEDED BASED ON FLOW TEST
      b. IF PUMP CAPACITY IS ACCURATE
   2. TOTAL RATED HEAD: TO BE CALCULATED
   3. INLET SIZE: 8" Ø NOMINAL
   4. OUTLET SIZE: 8" Ø NOMINAL
   5. OUTLET FLANGE CLASS: 250

B. SPEED: SAME AS DRIVER.

C. ELECTRIC-MOTOR DRIVER:
   1. HORESPOWER: (PROVIDED BY CONTRACTOR)
   2. RPM: (PROVIDED BY CONTRACTOR)
   3. ELECTRIC CHARACTERISTICS: 480 VOLT, 3 PHASE, 60 HZ
   4. FULL-LOAD AMPERES: (PROVIDED BY CONTRACTOR)
   5. MINIMUM CIRCUIT AMPACITY: (PROVIDED BY CONTRACTOR)
   6. MAXIMUM OVERCURRENT PROTECTION: (PROVIDED BY CONTRACTOR)
   7. MAXIMUM VOLTAGE FLUCTUATION WHILE STARTING: 15%
   8. MAXIMUM VOLTAGE FLUCTUATION WHILE RUNNING: 5%

D. TEST HEADER SIZE: 8" Ø NOMINAL
   1. HOSE VALVES REQUIRED: SIX
   2. HOSE VALVE SIZE: 2-1/2" NPS

E. RELIEF VALVE SIZE: 6" Ø NOMINAL

F. CONE SIZE: (PROVIDED BY CONTRACTOR)

G. PUMP HOUSE: CONTRACTOR TO PROVIDE ALTERNATE PRICING TO INCLUDE PACKAGED PUMP AND HOUSE.

2.5 FIRE PUMP CONTROLLER:

A. FIRE-PUMP CONTROLLERS, GENERAL: UL AND NFPA; LISTED FOR ELECTRIC-DRIVE, FIRE-PUMP SERVICE AND SERVICE ENTRANCE; COMBINED AUTOMATIC AND MANUAL OPERATION; FACTORY ASSEMBLED AND WIRED; AND FACTORY TESTED FOR CAPACITIES AND ELECTRICAL CHARACTERISTICS.

1. MANUFACTURERS:
    a. CUTLER-HAMMER.
    b. FIRETROL, INC.
    c. HUBBELL INDUSTRIAL CONTROLS, INC.
    d. JOSLYN CLARK.
    e. MASTER CONTROL SYSTEMS, INC.
    f. METRON, INC.
    g. ALTERNATE MANUFACTURERS UPON ENGINEER'S APPROVAL.
2. RATE CONTROLLERS FOR SCHEDULED FIRE-PUMP HORSEPOWER AND SHORT-CIRCUIT WITHSTAND RATING AT LEAST EQUAL TO SHORT-CIRCUIT CURRENT AVAILABLE AT CONTROLLER LOCATION. TAKE INTO ACCOUNT CABLE SIZE AND DISTANCE FROM SUBSTATION OR SUPPLY TRANSFORMERS.
    a. CIRCUIT BREAKER SHALL BE PROVIDED AND SHALL BE 480VOLT 3-PHASE
    b. ALL CONTROL PANELS SHALL BE DESIGNED, LISTED AND LABELED IN COMPLIANCE WITH THE 2011 NEC ARTICLE 409 INDUSTRIAL CONTROL PANELS. THE SYSTEM FAULT CURRENT CAPACITY AT THE INCOMING LINE TERMINAL IN THIS FACILITY SHALL BE 65KAIC AT 480 VOLTS. THE INDUSTRIAL CONTROL PANEL SCCR RATING SHALL MEET OR EXCEED THE AVAILABLE FAULT CURRENT ENERGY AT THE LINE TERMINAL OF THE EQUIPMENT.
3. ENCLOSURE: UL, TYPE 2, DRIP PROOF, INDOOR, UNLESS SPECIAL-PURPOSE ENCLOSURE IS INDICATED. INCLUDE MANUFACTURER'S STANDARD RED PAINT APPLIED TO FACTORY-ASSEMBLED AND -TESTED UNIT BEFORE SHIPPING.
4. CONTROLS, DEVICES, ALARMS, FUNCTIONS, AND OPERATIONS LISTED IN NFPA 20 AS REQUIRED FOR DRIVERS AND CONTROLLER TYPES USED, AND SPECIFIC ITEMS LISTED.
    a. ISOLATING MEANS AND CIRCUIT BREAKER.
    b. "POWER ON" PILOT LAMP.
    c. FIRE-ALARM SYSTEM CONNECTIONS FOR INDICATING MOTOR RUNNING CONDITION, LOSS-OF-LINE POWER, AND LINE-POWER PHASE REVERSAL.
    d. AUTOMATIC AND MANUAL OPERATION, AND MINIMUM RUN-TIME RELAY TO PREVENT SHORT CYCLING.
    e. WATER-PRESSURE-ACTUATED SWITCH WITH INDEPENDENT HIGH AND LOW CALIBRATED ADJUSTMENTS RESPONSIVE TO WATER PRESSURE IN FIRE-SUPPRESSION PIPING.
    f. AUTOMATIC AND MANUAL SHUTDOWN.
    g. SYSTEM PRESSURE RECORDER, ELECTRIC AC DRIVEN WITH SPRING BACKUP.
5. NAMEPLATE: COMPLETE WITH CAPACITY, CHARACTERISTICS, APPROVALS AND LISTINGS, AND OTHER PERTINENT DATA.
6. CONTROLLER SENSING PIPES: FABRICATE PIPE AND FITTINGS ACCORDING TO NFPA 20 WITH NONFERROUS-METAL SENSING PIPING, NPS 1/2, WITH GLOBE VALVES FOR TESTING CONTROLLER MECHANISM FROM SYSTEM TO PUMP CONTROLLER AS INDICATED. INCLUDE BRONZE CHECK VALVE WITH 3/32-INCH ORIFICE IN CLAPPER OR GROUND-FACE UNION WITH NONCORROSIVE DIAPHRAGM HAVING 3/32-INCH ORIFICE.
7. STARTING TYPE: SOLID STATE, SOFT START.
8. MOUNTING: FLOOR-STAND TYPE FOR FIELD ELECTRICAL CONNECTIONS.

2.6 JOCKEY PUMP:

A. PRESSURE-MAINTENANCE PUMPS, GENERAL: FACTORY-ASSEMBLED AND -TESTED PUMPS WITH ELECTRIC-MOTOR DRIVER, CONTROLLER, AND ACCESSORIES AND SPECIALTIES. INCLUDE CAST-IRON OR STAINLESS-STEEL CASING AND BRONZE OR STAINLESS-STEEL IMPELLERS, MECHANICAL SEALS, AND SUCTION AND DISCHARGE FLANGES MACHINED TO ASME B16.1, CLASS 125 DIMENSIONS UNLESS CLASS 250 FLANGES ARE INDICATED AND EXCEPT THAT CONNECTIONS MAY BE THREADED IN SIZES WHERE FLANGES ARE NOT AVAILABLE.
   1. FINISH: MANUFACTURER'S STANDARD COLOR PAINT APPLIED TO FACTORY-ASSEMBLED AND -TESTED UNIT BEFORE SHIPPING.
   2. NAMEPLATE: COMPLETE WITH CAPACITY, CHARACTERISTICS, AND OTHER PERTINENT DATA.

B. MULTISTAGE, PRESSURE-MAINTENANCE PUMPS: MULTIPLE-IMPELLER TYPE COMPLYING WITH HI 1.1-1.2 AND HI 1.3 REQUIREMENTS FOR MULTISTAGE CENTRIFUGAL PUMPS. INCLUDE BASE.
   1. MANUFACTURERS:
      a. A-C PUMP; ITT INDUSTRIES.
      b. GRUNDFOS PUMPS CORP.
      c. JACUZZI BROTHERS.
      d. PACO PUMPS, INC.
      e. STERLING PEERLESS PUMP; STERLING FLUID SYSTEMS GROUP.
      f. TACO, INC.
      g. ALTERNATE MANUFACTURERS UPON ENGINEER'S APPROVAL.
   2. DRIVER: NEMA MG 1, OPEN-DRIPPROOF, SQUIRREL-CAGE, INDUCTION MOTOR COMPLYING WITH NFPA 20 AND NFPA 70. INCLUDE WIRING COMPATIBLE WITH CONTROLLER USED.

2.7 JOCKEY PUMP CONTROLLER:

A. UL; FACTORY-ASSEMBLED, -WIRED, AND -TESTED, ACROSS-THE-LINE TYPE FOR COMBINED AUTOMATIC AND MANUAL OPERATION.
   1. MANUFACTURERS:
      a. CUTLER-HAMMER.
      b. FIRETROL, INC.
      c. HUBBELL INDUSTRIAL CONTROLS, INC.
      d. JOSLYN CLARK.
      e. MASTER CONTROL SYSTEMS, INC.
      f. METRON, INC.
      g. ALTERNATE MANUFACTURERS UPON ENGINEER'S APPROVAL.
   2. ENCLOSURE: UL AND NEMA 250, TYPE 2, WALL-MOUNTING TYPE FOR FIELD ELECTRICAL WIRING.
      a. FINISH: MANUFACTURER'S STANDARD COLOR PAINT APPLIED TO FACTORY-ASSEMBLED AND -TESTED UNIT BEFORE SHIPPING.
   3. RATE CONTROLLER FOR SCHEDULED HORSEPOWER AND INCLUDE THE FOLLOWING:
      a. FUSIBLE DISCONNECT SWITCH.
      b. PRESSURE SWITCH.
      c. HAND-OFF-AUTO SELECTOR SWITCH.
      d. PILOT LIGHT.
      e. RUNNING PERIOD TIMER.
   4. ACCESSORIES AND SPECIALTIES: MATCH PRESSURE-MAINTENANCE-PUMP SUCTION AND DISCHARGE RATINGS AS REQUIRED FOR PUMP CAPACITY RATING. INCLUDE THE FOLLOWING:
      a. CIRCULATION RELIEF VALVE.
      b. SUCTION AND DISCHARGE PRESSURE GAGES.

2.8 JOCKEY PUMP CHARACTERISTICS AND SPECIALTY DATA:

A. RATED CAPACITY: (PROVIDED BY CONTRACTOR)

B. TOTAL RATED HEAD: (PROVIDED BY CONTRACTOR)

C. PUMP SPEED: 1750 RPM.
D. ELECTRIC-MOTOR DRIVER SIZE:
1. HORSEPOWER: (PROVIDED BY CONTRACTOR)
2. RPM: (PROVIDED BY CONTRACTOR)
3. 480 VOLT, 3 PHASE, 60 HZ.
4. FULL-LOAD AMPERES: (PROVIDED BY CONTRACTOR)
5. MINIMUM CIRCUIT AMPACITY: (PROVIDED BY CONTRACTOR)
6. MAXIMUM OVERCURRENT PROTECTION: <INSERT VALUE.>

2.9 ALARM PANELS
A. DESCRIPTION: FACTORY-ASSEMBLED AND -WIRED REMOTE PANEL COMPLYING WITH UL AND REQUIREMENTS IN NFPA 20. INCLUDE AUDIBLE AND VISIBLE ALARMS MATCHING CONTROLLER TYPE.
1. MANUFACTURERS:
a. CUTLER-HAMMER.
b. FIRETROL, INC.
c. HUBBELL INDUSTRIAL CONTROLS, INC.
d. JOSLYN CLARK.
e. MASTER CONTROL SYSTEMS, INC.
f. METRON, INC.
g. ALTERNATE MANUFACTURERS UPON ENGINEER'S APPROVAL.
2. ENCLOSURE: NEMA 250, TYPE 2, REMOTE WALL-MOUNTING TYPE.
a. FINISH: MANUFACTURER'S STANDARD RED PAINT APPLIED TO FACTORY-ASSEMBLED AND -TESTED UNIT BEFORE SHIPPING.
3. FEATURES: INCLUDE MANUFACTURER'S STANDARD FEATURES AND THE FOLLOWING:
a. MOTOR-OPERATING CONDITION.
b. LOSS-OF-LINE POWER.
c. PHASE REVERSAL.
d. LOW-WATER ALARM.

2.10 ACCESSORIES:
A. FIRE PUMP ACCESSORIES INCLUDED WITH THE PACKAGE SHALL INCLUDE:
1. SUCTION AND DISCHARGE PRESSURE GAUGES.
2. AUTOMATIC AIR RELEASE VALVE.
3. CIRCULATION RELIEF VALVE.
4. ISOLATION GATE VALVE AT THE FIRE PUMP SUCTION.
5. ISOLATION VALVE AT THE FIRE PUMP DISCHARGE.
6. DISCHARGE CHECK VALVE FOR THE FIRE PUMP.
7. MAIN RELIEF VALVE AND ENCLOSED WASTE CONE (WHEN REQUIRED).
8. ECCENTRIC-TAPERED REDUCER AT SUCTION INLET.
9. CONCENTRIC-TAPERED REDUCER AT DISCHARGE OUTLET.
B. JOCKEY PUMP ACCESSORIES INCLUDED WITH THE PACKAGE SHALL INCLUDE:
1. ISOLATION GATE VALVE AT THE JOCKEY PUMP SUCTION.
2. ISOLATION VALVE AT THE JOCKEY PUMP DISCHARGE.
3. DISCHARGE CHECK VALVE FOR THE JOCKEY PUMP.
C. TEST HEADER MANIFOLD:
1. FLUSH WALL MOUNTED.
2. POLISHED BRASS FINISH WITH THE WORDS "FIRE PUMP TEST HEADER" CAST IN PLACE.
3. REQUIRED QUANTITY OF 2-1/2" NPT HOSE VALVES, CAPS AND CHAINS.
D. CITY BY-PASS LINE, COMPLETE WITH ISOLATION AND CHECK VALVES.
E. BALL DRIP VALVE: UL 1726
F. FINISH: MANUFACTURER'S STANDARD FACTORY-APPLIED RED PAINT UNLESS BRASS OR OTHER FINISH IS SPECIFIED

PART 3: EXECUTION

3.1 EXAMINATION

A. EXAMINE AREAS, CONCRETE BASES, AND CONDITIONS, WITH INSTALLER PRESENT, FOR COMPLIANCE WITH REQUIREMENTS AND OTHER CONDITIONS AFFECTING PERFORMANCE OF FIRE PUMPS.

B. EXAMINE ROUGHING-IN FOR FIRE-SUPPRESSION PIPING TO VERIFY ACTUAL LOCATIONS OF PIPING CONNECTIONS BEFORE FIRE-PUMP INSTALLATION.

C. PROCEED WITH INSTALLATION ONLY AFTER UNSATISFACTORY CONDITIONS HAVE BEEN CORRECTED.

3.2 INSTALLATION:

A. COORDINATE DIMENSIONS OF CONCRETE FLOOR SLAB AND FOUNDATIONS PER REQUIREMENTS OF PACKAGED FIRE PUMP SYSTEM AND ENCLOSURE.

B. COORDINATE LOCATIONS OF “STUB-UPS” FOR PUMP SUCTION AND DISCHARGE PIPING WITH SITE UTILITY CONTRACTOR INSTALLING SITE FIRE PROTECTION PIPING.

C. COORDINATE LOCATION OF POWER CONDUIT “STUB-UPS” WITHIN THE ENCLOSURE WITH ELECTRICAL CONTRACTOR. COORDINATE GROUNDING OF EQUIPMENT WITH ELECTRICAL CONTRACTOR. COORDINATE CONNECTION OF POWER WIRING WITH ELECTRICAL CONTRACTOR.

D. PROVIDE CRANE FOR RIGGING OF PACKAGED FIRE PUMP SYSTEM AND ENCLOSURE HOUSING INTO PLACE. SYSTEM SHALL BE SET WITH SUCH THAT NO UNDO STRESS IS APPLIED TO THE PIPING AND EQUIPMENT.

E. CONNECTIONS:

1. COORDINATE PIPING INSTALLATIONS AND SPECIALTY ARRANGEMENTS WITH SCHEMATICS ON DRAWINGS AND WITH REQUIREMENTS SPECIFIED IN DIVISION 21 SECTIONS. IF DRAWINGS ARE EXPLICIT ENOUGH, THESE REQUIREMENTS MAY BE REDUCED OR OMITTED.
2. PIPING INSTALLATION REQUIREMENTS ARE SPECIFIED IN DIVISION 21 SECTIONS. DRAWINGS INDICATE GENERAL ARRANGEMENT OF PIPING, FITTINGS, AND SPECIALTIES.
3. INSTALL PIPING ADJACENT TO PUMPS AND EQUIPMENT TO ALLOW SERVICE AND MAINTENANCE.
4. CONNECT WATER SUPPLY AND DISCHARGE PIPING TO FIRE PUMPS. CONNECT WATER SUPPLY AND DISCHARGE PIPING TO PRESSURE-MAINTENANCE PUMPS.
5. CONNECT RELIEF-VALVE DISCHARGE TO POINT OF DISPOSAL, IF REQUIRED.

3.3 ALIGNMENT

A. ALIGN SPLIT-CASE FIRE PUMP AND DRIVER SHAFTS AFTER COMPLETE UNIT HAS BEEN LEVELED ON CONCRETE BASE, GROUT HAS SET, AND ANCHOR BOLTS HAVE BEEN TIGHTENED.

B. AFTER ALIGNMENT IS CORRECT, TIGHTEN ANCHOR BOLTS EVENLY. FILL BASEPLATE COMPLETELY WITH GROUT, WITH METAL BLOCKS AND SHIMS OR WEDGES IN PLACE. TIGHTEN ANCHOR BOLTS AFTER GROUT HAS HARDENED. CHECK ALIGNMENT AND MAKE REQUIRED CORRECTIONS.

C. ALIGN PIPING CONNECTIONS.

D. ALIGN PUMP AND DRIVER SHAFTS FOR ANGULAR AND PARALLEL ALIGNMENT ACCORDING TO HI 1.4 AND TO TOLERANCES SPECIFIED BY MANUFACTURER.

E. ALIGN VERTICALLY MOUNTED, SPLIT-CASE PUMP AND DRIVER SHAFTS AFTER COMPLETE UNIT HAS BEEN MADE PLUMB ON CONCRETE BASE, GROUT HAS SET, AND ANCHOR BOLTS HAVE BEEN TIGHTENED.

3.4 CONNECTIONS

A. COORDINATE PIPING INSTALLATIONS AND SPECIALTY ARRANGEMENTS WITH SCHEMATICS ON DRAWINGS AND WITH REQUIREMENTS SPECIFIED IN DIVISION 21 SECTIONS. IF DRAWINGS ARE EXPLICIT ENOUGH, THESE REQUIREMENTS MAY BE REDUCED OR OMITTED.

B. PIPING INSTALLATION REQUIREMENTS ARE SPECIFIED IN DIVISION 21 SECTIONS. DRAWINGS INDICATE GENERAL ARRANGEMENT OF PIPING, FITTINGS, AND SPECIALTIES.

C. INSTALL PIPING ADJACENT TO PUMPS AND EQUIPMENT TO ALLOW SERVICE AND MAINTENANCE.

D. CONNECT WATER SUPPLY AND DISCHARGE PIPING TO FIRE PUMPS. CONNECT WATER SUPPLY AND DISCHARGE PIPING TO PRESSURE-MAINTENANCE PUMPS WITH FLEXIBLE CONNECTORS.
E. CONNECT RELIEF-VALVE DISCHARGE TO POINT OF DISPOSAL, IF REQUIRED.
F. CONNECT CONTROLLERS TO PUMPS.
G. CONNECTION OF FIRE-PUMP CONTROLLERS TO BUILDING FIRE-ALARM SYSTEM WILL BE BY BUILDING FIRE ALARM CONTRACTOR, PROVIDE SUPERVISION AND COORDINATION.
H. GROUNDING OF EQUIPMENT ACCORDING BY ELECTRICAL CONTRACTOR.
I. CONNECTION OF POWER WIRING BY ELECTRICAL CONTRACTOR.

3.5 FIELD QUALITY CONTROL

A. PERFORM FIELD TESTS FOR EACH FIRE PUMP WHEN INSTALLATION IS COMPLETE. COMPLY WITH OPERATING INSTRUCTIONS AND PROCEDURES IN NFPA 20 TO DEMONSTRATE COMPLIANCE WITH REQUIREMENTS. WHERE POSSIBLE, FIELD CORRECT MALFUNCTIONING EQUIPMENT, THEN RETEST TO DEMONSTRATE COMPLIANCE. REPLACE EQUIPMENT THAT CANNOT BE SATISFACTORILY CORRECTED OR THAT DOES NOT PERFORM AS INDICATED, THEN RETEST TO DEMONSTRATE COMPLIANCE. VERIFY THAT EACH FIRE PUMP PERFORMS AS INDICATED.
B. PERFORM THE FOLLOWING FIELD TESTS AND INSPECTIONS AND PREPARE TEST REPORTS:
    1. LEAK TEST: AFTER INSTALLATION, CHARGE SYSTEM AND TEST FOR LEAKS. REPAIR LEAKS AND RETEST UNTIL NO LEAKS EXIST.
    2. FINAL CHECKS BEFORE STARTUP: PERFORM THE FOLLOWING PREVENTIVE-MAINTENANCE OPERATIONS AND CHECKS:
        a. LUBRICATE OIL-LUBRICATION-TYPE BEARINGS.
        b. REMOVE GREASE-LUBRICATION-TYPE BEARING COVERS, FLUSH BEARINGS WITH KEROSENE, AND CLEAN THOROUGHLY. FILL WITH NEW LUBRICANT ACCORDING TO MANUFACTURER'S WRITTEN INSTRUCTIONS.
        c. DISCONNECT COUPLING AND CHECK ELECTRIC MOTOR FOR PROPER ROTATION. ROTATION SHALL MATCH DIRECTION OF ROTATION MARKED ON PUMP CASING.
        d. VERIFY THAT PUMP IS FREE TO ROTATE BY HAND. IF PUMP IS BOUND OR IF IT DRAGS EVEN SLIGHTLY, DO NOT OPERATE UNTIL CAUSE OF TROUBLE IS DETERMINED AND CORRECTED.
    3. STARTING PROCEDURE FOR PUMPS IS AS FOLLOWS:
        a. PRIME PUMP BY OPENING SUCTION VALVE AND CLOSING DRAINS, AND PREPARE PUMP FOR OPERATION.
        b. OPEN SEALING-LIQUID SUPPLY VALVES IF PUMP IS SO FITTED.
        c. START MOTOR.
        d. OPEN DISCHARGE VALVE SLOWLY.
        e. OBSERVE LEAKAGE FROM STUFFING BOXES AND ADJUST SEALING-LIQUID VALVE FOR PROPER FLOW TO ENSURE LUBRICATION OF PACKING. DO NOT TIGHTEN GLAND IMMEDIATELY, BUT LET PACKING RUN IN BEFORE REDUCING LEAKAGE THROUGH STUFFING BOXES.
        f. CHECK GENERAL MECHANICAL OPERATION OF PUMP AND MOTOR.
    4. TEST AND ADJUST CONTROLS AND SAFETIES. REPLACE DAMAGED AND MALFUNCTIONING CONTROLS AND EQUIPMENT.
    5. FURNISH FIRE HOSES IN NUMBER, SIZE, AND LENGTH REQUIRED TO REACH STORM DRAIN OR OTHER ACCEPTABLE LOCATION TO DISPOSE OF FIRE-PUMP TEST WATER. FIRE HOSES ARE FOR FIELD-ACCEPTANCE TESTS ONLY AND ARE NOT PROPERTY OF OWNER.

3.6 DEMONSTRATION

A. ENGAGE A FACTORY-AUTHORIZED SERVICE REPRESENTATIVE TO TRAIN OWNER'S MAINTENANCE PERSONNEL TO ADJUST, OPERATE, AND MAINTAIN FIRE PUMPS, DRIVERS, CONTROLLERS, AND PRESSURE-MAINTENANCE PUMPS. REFER TO DIVISION 1 SECTIONS

END OF SECTION

SECTION 23 00 01

MECHANICAL GENERAL PROVISIONS

PART 1: GENERAL

1.1 SUMMARY

A. THE WORK AS SHOWN, INDICATED AND SPECIFIED IN THE FOLLOWING CONSTRUCTION DRAWINGS AND SPECIFICATIONS, IDENTIFIED WITHIN THE BID PACKAGE INCORPORATES THIS SECTION BY REFERENCE AND IS INCOMPLETE WITHOUT THE PROVISIONS STATED HEREIN:

1. REFERENCE DRAWINGS PROVIDED WITH THE BID PACKAGE ARE DRAWINGS FOR WORK ISSUED UNDER SEPARATE CONTRACT UNLESS SPECIFICALLY IDENTIFED AS PART OF THIS PACKAGE; THESE DRAWINGS ARE PROVIDED FOR REFERENCE AND COORDINATION PURPOSES FOR THIS CONTRACT.

B. EXAMINE ALL DRAWINGS AND CRITERIA SHEETS AND ALL OTHER SECTIONS OF THE SPECIFICATIONS FOR REQUIREMENTS WHICH AFFECT WORK UNDER THIS SECTION WHETHER OR NOT SUCH WORK IS SPECIFICALLY MENTIONED IN THIS SECTION.

C. REFER TO ELECTRICAL NEMA CLASSIFICATION DRAWINGS FOR CLASSIFICATIONS FOR ALL CONTROL DEVICES AND CONDUIT MATERIALS AND COORESPONDING SPACES. IT SHALL BE THE REPONSIBILITY OF THIS CONTRACTOR TO OBTAIN THE LATEST VERSION OF THE NEMA DRAWINGS FROM THE CM, ARCHITECT OR ENGINEER.

D. COORDINATE WORK WITH THAT OF ALL OTHER TRADES AFFECTING OR AFFECTED BY WORK OF THIS SECTION. COOPERATE WITH SUCH TRADES TO ASSURE THE STEADY PROGRESS OF ALL WORK UNDER THE CONTRACT.

E. PROVIDE ALL MATERIAL, LABOR AND EQUIPMENT, TO COMPLETE THE WORK OF THIS SECTION IN STRICT ACCORDANCE WITH THE DESIGN ARCHITECT AND ENGINEERS PLANS AND SPECIFICATIONS, WITH ALL APPLICABLE CODES, RULES AND STANDARDS.

F. THE WORK SHALL BE COMPLETED IN ACCORDANCE WITH THE CONTRACT SCHEDULE ESTABLISHED BY THE CONSTRUCTION MANAGER AND THE GENERAL CONTRACTOR.

1.2 DEFINITIONS

A. "CONTRACTOR" REFERS TO THE CONTRACTOR RESPONSIBLE FOR FURNISHING AND INSTALLATION OF ALL WORK INDICATED ON THE DRAWINGS AND IN THE SPECIFICATIONS.

B. “ENGINEER” SHALL REFER TO “THE DENNIS GROUP, LLC (DGL)".

C. "OWNER" SHALL REFER TO THE OWNER, “THE LIVESTOCK INSTITUTE (TLI)”, OR HIS DESIGNATED REPRESENTATIVE.

D. “CONSTRUCTION MANAGER” (CM) WILL BE DESIGNATED BY OWNER.

E. “PROVIDE” IS UNDERSTOOD TO MEAN “THE CONTRACTOR SHALL FURNISH AND INSTALL” THE EQUIPMENT, MATERIALS, ACCESSORIES, TESTS, INSPECTIONS, ETC. REFERENCED.

F. RELATED WORK: THE SECTIONS REFERENCED UNDER THE PARAGRAPH “RELATED WORK SPECIFIED ELSEWARE” ARE UNDERSTOOD TO INCLUDE PROVISIONS WHICH DIRECTLY AFFECT THE WORK BEING SPECIFIED IN THE SECTION WHERE THE RELATED WORK PARAGRAPH OCCURS.

G. “CONCEALED” IS USED IN CONJUNCTION WITH PIPING, EQUIPMENT AND THE LIKE, THE WORD IS UNDERSTOOD TO MEAN HIDDEN FROM SIGHT AS IN CHASES, WITHIN WALLS, AND FURRED SPACES ABOVE SUSPENDED CEILINGS.

1. ALL PIPING, HANGERS, EQUIPMENT, ETC. THAT IS LOCATED ABOVE A SUSPENDED WALK-ON PANEL CEILING SHALL BE CONSIDERED EXPOSED.

H. “EXPOSED” IS UNDERSTOOD TO MEAN OPEN TO VIEW.

I. “PROCESS AREAS” SHALL INCLUDE ALL AREAS INVOLVED IN THE PROCESSING, PRODUCTION, PACKAGING AND STORAGE OF FOOD PRODUCTS OR AREAS SUBJECTED TO WET WASH DOWN OR PROCESSES. THE FOLLOWING ARE DEFINED AS PROCESS AREAS:

1. KILL FLOOR HIDE ON – P100
2. KILL FLOOR CLEANING – P101
3. PLANT CORRIDOR 2 – P102
4. PLANT CORRIDOR 3 – P103
5. PLANT CORRIDOR 1 – P104
6. BREAKING & FABRICATION – P105

7. CURING COOLER – P106
8. SMOKE HOUSE – P107
9. HOT PRODUCT – P108
10. PACKAGING ROOM – P109
11. INEDIBLES / HIDES DOCK – S100
12. CHEMICAL STORAGE – S101
13. CHILL COOLER – S102
14. SALES COOLER – S103
15. BLAST FREEZER – S104
16. CHILLED BOXED COOLER – S105
17. INGREDIENT STORAGE – S106
18. FROZEN BOXED FREEZER – S107
19. DRY STORAGE / DOCK – S108

J. "NON-PROCESS AREAS" SHALL INCLUDE ALL AREAS OUTSIDE OF THE "PROCESS AREAS" INCLUDING OFFICE AREAS, UTILITY ROOMS, ELECTRICAL ROOMS, ETC.

K. REFER TO THE CONTRACT CONDITIONS FOR ANY FURTHER DEFINITIONS.

1.3 CODES, STANDARDS AND PERMITS

A. PERFORM WORK IN ACCORDANCE WITH THE ACCEPTED EDITION, REVISION, AMENDMENT OR SUPPLEMENT OF APPLICABLE STATUTES, ORDINANCES, CODES OR REGULATIONS OF NATIONAL, STATE, COUNTY AND LOCAL AUTHORITIES HAVING JURISDICTION IN EFFECT ON THE DATE BIDS ARE RECEIVED. REFER TO THE ARCHITECTURAL CODE COMPLIANCE SHEET FOR APPLICABLE CODES.

B. WHERE APPROVAL STANDARDS HAVE BEEN ESTABLISHED BY OHSA, UNDERWRITER'S LABORATORIES, INTERNATIONAL MECHANICAL CODE, ICC CODES, ASME, AGA, AMCA, ASA, ASHRAE, ARI, CSA, ETL, FM, IIAR, XL-GAP, NEC, AND NFPA, THESE STANDARDS SHALL BE FOLLOWED WHETHER OR NOT INDICATED ON THE CONTRACT DRAWINGS AND SPECIFICATIONS. INCLUDE THE COST OF ALL WORK REQUIRED TO COMPLY WITH THE REQUIREMENTS OF THESE AUTHORITIES IN THE ORIGINAL PROPOSAL.

C. REQUIREMENTS IN REFERENCE SPECIFICATIONS AND STANDARDS ARE A MINIMUM FOR ALL EQUIPMENT, MATERIAL AND WORK. IN INSTANCES WHERE CAPACITIES, SIZE OR OTHER FEATURES OF EQUIPMENT, DEVICES OR MATERIALS EXCEED THESE MINIMUMS, MEET LISTED OR SPECIFIED CAPACITIES AND CRITERIA.

D. RESOLVE ANY CODE VIOLATION DISCOVERED IN CONTRACT DOCUMENTS WITH THE CONTRACTOR AND ENGINEER. MAKE ANY CORRECTION OR ADDITION NECESSARY FOR COMPLIANCE WITH APPLICABLE CODES AT NO ADDITIONAL COMPENSATION.

E. PERMITS: THE SUBCONTRACTOR SHALL OBTAIN ALL NECESSARY PERMITS REQUIRED BY THE LOCAL AUTHORITY HAVING JURISDICTION. THE SUBCONTRACTOR SHALL PAY ALL NECESSARY FEES AND CHARGES ISSUED BY THE AUTHORITY. THE SUBCONTRACTOR SHALL BE RESPONSIBLE FOR MAKING ARRANGEMENTS FOR ALL REQUIRED INSPECTIONS.

1.4 SUBMITTALS

A. SUBMITTALS SHALL BE SUBMITTED IN CONFORMANCE WITH THE FOLLOWING REQUIREMENTS:

1. MANUFACTURERS:

a. THE LISTED MANUFACTURERS WILL BE ACCEPTABLE AS LONG AS THEY COMPLY WITH THE SPECIFICATION AND SCHEDULES.

b. MANUFACTURERS LISTED AS ACCEPTABLE BUT ARE NOT SCHEDULED ON THE DRAWINGS BEAR THE BURDEN OF MEETING THE PHYSICAL, WEIGHT, PERFORMANCE, AND ELECTRICAL REQUIREMENTS OF THE SCHEDULED EQUIPMENT.

c. MANUFACTURERS WHO ARE NOT LISTED AS "ACCEPTABLE MANUFACTURERS" BEAR THE BURDEN OF PROOF TO THE CONTRACTOR AND ENGINEER THAT THEIR PRODUCTS COMPLY WITH THE DRAWINGS AND SPECIFICATIONS.

ALTERNATE MANUFACTURERS WILL NOT BE ACCEPTED UNTIL SHOP DRAWING SUBMITTAL AND APPROVAL BY ENGINEER. THE CONTRACTOR BEARS THE RESPONSIBILITY IF ALTERNATE MANUFACTURERS ARE USED FOR PREPARING BID PROPOSALS.

d. MANUFACTURERS / CONTRACTOR SHALL PROVIDE SAMPLE OF ALL COMPONENTS TO BE INSTALLED FOR OWNER REVIEW PRIOR TO INSTALLATION. THE SAMPLE SHALL BE REVIEWED AND APPROVED FOR SANITARY BENEFITS, AND QUALITY.

2. CONTRACTOR'S CERTIFICATION
   a. SUBMITTALS WILL BE SUBMITTED ONLY BY THE CONTRACTOR. INDICATE BY SIGNED STAMP THAT THE CONTRACT DOCUMENTS HAVE BEEN CHECKED, THAT THE WORK SHOWN IN THE SUBMITTALS IS IN ACCORDANCE WITH CONTRACT REQUIREMENTS AND THAT DIMENSIONS AND RELATIONSHIP WITH WORK OF OTHER TRADES HAVE BEEN CHECKED.
   b. SUBMITTALS SENT TO THE CM DIRECT FROM THE EQUIPMENT VENDOR WILL NOT BE ACCEPTED.
   c. SUBMITTALS SHALL BE SENT IN ELECTRONIC FORMAT VIA MAIL OR EMAIL.
3. PREPARATION
   a. WHERE PRODUCT DATA PUBLISHED BY THE MANUFACTURER IS PART OF A SUBMITTAL, INCLUDE ONLY INFORMATION RELEVANT TO THE PARTICULAR EQUIPMENT OR MATERIALS TO BE FURNISHED. STRIKE ALL NON-RELEVANT PRODUCTS AND PAGES. SUBMITTALS INCLUDING PRODUCTS NOT USED ON THE PROJECT WILL BE RETURNED FOR RESUBMITTAL.
   b. IN ALL CASES WHERE COMPLIANCE WITH UL, ETL, FM, XL-GAP OR OTHER SIMILAR ORGANIZATION'S STANDARDS ARE REQUIRED, PROVIDE PROPER DOCUMENTATION OF THIS COMPLIANCE WITH THE MANUFACTURER'S PUBLISHED LITERATURE OR DRAWINGS OR BY A LETTER SIGNED BY AN OFFICER OF THE COMPANY. FOR ALL EQUIPMENT, FURNISH THE MANUFACTURER'S REPRESENTATIVE NAME, CURRENT ADDRESS, AND TELEPHONE NUMBER WITH AREA CODE.
   c. INCLUDE IDENTIFYING SYMBOLS AND EQUIPMENT NUMBERS USED IN THE CONTRACT DOCUMENTS FOR ALL EQUIPMENT AND MATERIAL SUBMITTED.
   d. CROSS REFERENCE SHEET NUMBERS ON CONTRACT DRAWINGS FOR SHOP DRAWINGS. PROVIDE SHOP DRAWINGS CONSISTING OF PLANS DRAWN TO SCALE, WITH ELEVATIONS AND SECTIONS, TO SHOW CLEARLY THE LOCATION OF MAJOR ITEMS OF EQUIPMENT AND CLEARANCES FOR MAINTENANCE AND CODE REQUIREMENTS. PROVIDE CAD DRAWINGS WHEN REQUESTED.
   e. SUBMIT ONLY THE REQUESTED SUBMITTALS COMPLETE BY TYPES OF EQUIPMENT (I.E., AIR HANDLING EQUIPMENT, ETC.) LABELED WITH APPLICABLE SPECIFICATION SECTION(S) INCLUDED. EACH SUBMITTAL WILL BE HANDLED SEPARATELY. SHOULD ANY ITEM NOT BE ACCEPTABLE, THE ENTIRE SUBMITTAL WILL BE RETURNED TO THE CONTRACTOR FOR CORRECTION AND RESUBMITTAL. PARTIAL SUBMITTALS ARE UNACCEPTABLE. THE INTENT OF THIS REQUIREMENT IS THAT ALL APPROVED BOUND SETS OF DATA WILL BE IDENTICAL AND WILL CONTAIN ONLY ACCEPTABLE INFORMATION.
   f. SUBMIT A COMPLIANCE SHEET FOR EACH SUBMITTAL INDICATING THE SUBMITTAL IS IN FULL COMPLIANCE WITH THE DRAWINGS AND SPECIFICATIONS. INDICATE BY DRAWING NUMBER OR SPECIFICATION SECTION NUMBER AND PARAGRAPH NUMBERS ALL EXCEPTIONS TAKEN AND INCLUDE AN EXPLANATION.

g. BY PREPARING, APPROVING, AND SUBMITTING SHOP DRAWINGS, PRODUCT DATA AND SAMPLES, THE CONTRACTOR REPRESENTS THAT HE HAS DETERMINED AND VERIFIED ALL MATERIAL, FIELD MEASUREMENTS AND FIELD CONSTRUCTION CRITERIA RELATED THERETO, OR WILL DO SO WITH REASONABLE PROMPTNESS. IN ADDITION, THE CONTRACTOR HAS CHECKED AND COORDINATED THE INFORMATION CONTAINED WITHIN SUCH SUBMITTALS WITH THE REQUIREMENTS OF THE WORK, THE PROJECT, AND THE CONTRACT DOCUMENTS.

h. THE REVIEW OF SUBMITTALS BY THE CONTRACTOR AND ENGINEER DOES NOT RELIEVE OR MODIFY THE SUBCONTRACTOR'S RESPONSIBILITY FOR COMPLIANCE WITH THE CONTRACT DOCUMENTS. THE REQUIREMENTS OF THE CONTRACT DOCUMENTS SHALL SUPERCEDE ANY DIMENSION, QUALITY, OR QUANTITY DISCREPANCIES FOUND IN THE SUBMITTALS. IT IS CLEARLY UNDERSTOOD THAT, IN THE REVIEW PROCESS, NOTING OF SOME DISCREPANCIES BUT OVERLOOKING OTHERS DOES NOT GRANT THE SUBCONTRACTOR PERMISSION TO PROCEED IN ERROR. REGARDLESS OF ANY INFORMATION CONTAINED IN THE SUBMITTALS, THE CONTRACT DOCUMENTS GOVERN THE WORK, AND ARE NEITHER WAIVED NOR SUSPENDED IN ANY WAY BY THE REVIEW OF THE SUBMITTALS.

i. INCLUDE IN SUBMITTALS SUFFICIENT PLANS, ELEVATIONS, SECTIONS, PERFORMANCE DATA, ELECTRICAL REQUIREMENTS, DIMENSIONS, BOLT LOCATIONS, RATINGS, SOUND DATA, WEIGHTS, AND SCHEMATICS TO CLEARLY DESCRIBE THE EQUIPMENT AND TO SHOW COMPLIANCE WITH THE APPLICABLE SPECIFICATIONS AND SCHEDULES.

j. PROVIDE A COVER OR TITLE SHEET FOR THE SUBMITTAL CONTAINING THE FOLLOWING:
   1) NAME OF SUBCONTRACTOR ORIGINATING THE SUBMITTAL.
   2) NAME OF PROJECT FOR WHICH THE SUBMITTAL IS MADE.
   3) AN INDEX OF ALL ITEMS SUBMITTED INCLUDING:
      a) MARK OF EQUIPMENT ON DRAWINGS
      b) MANUFACTURER
      c) CATALOG NUMBER
      d) SPECIFICATION SECTION NUMBER
   4) DATE OF SUBMITTAL AND DATE OF EACH REVISION
   5) CONTRACTOR'S CERTIFICATION OF REVIEW
   6) CONTRACTOR'S CERTIFICATION OF COMPLIANCE

4. SUBMITTAL FORMAT
   a. ALL PRODUCT DATA SUBMITTAL SHALL BE ORGANIZED AND SUBMITTED ELECTRONICALLY IN PDF FORM.
      1) ELECTRONIC SUBMITTALS SHALL BE IN PDF FORM AND MUST BE SEPARATED BY PRODUCT, OR BOOKED MARKED BY PRODUCT.
      2) PDF'S SHALL BE GENERATED BY MANUFACTURER. IF GENERATED BY CONTRACTOR THEY SHALL BE CLEAN AND LEGIBLE. DIFFICULT TO READ SUBMITTALS WILL NOT BE ACCEPTED.
      3) PDF FILES WILL BE GIVEN APPROPRIATE FILE NAMES TO INDICATE THE PRODUCT AND REVISION OF THE SUBMITTAL AND WILL INCORPORATE A COVER SHEET INCLUDING THE PROJECT NAME, LOCATION, DATE, CONTRACTOR, SUPPLIER AND MANUFACTURER.
      4) FOR HARD COPY SUBMITTALS, NUMBERED TABS SHALL BE PROVIDED TO SEPARATE EACH PRODUCT AND A TABLE OF CONTENTS SHALL BE PROVIDED REFERENCING EACH TAB NUMBER.

5) UP TO 3 HARDCOPY SUBMITTALS WILL BE PROVIDED ON REQUEST.
6) THE COVER AND SPINE OF EACH BINDER SHALL BE LABELED WITH:
    a) PROJECT NAME
    b) PROJECT LOCATION
    c) DATE
    d) VOLUME 'X 'OF 'Y' (WHEN MULTIPLE BINDERS ARE REQUIRED).

5. SHOP DRAWINGS AND PRODUCT DATA THAT DO NOT COMPLY WITH THE REQUIREMENTS HEREIN WILL BE RETURNED FOR RE-SUBMITTAL.
6. PROVIDE ONE (1) COPY OF ALL APPROVED SHOP DRAWINGS AND PRODUCT DATA TO THE TESTING, ADJUSTING AND BALANCING SUBCONTRACTOR PRIOR TO PROJECT COMPLETION.
7. REFER TO THE CONTRACT GENERAL CONDITIONS AND/OR SUPPLEMENTAL GENERAL CONDITIONS FOR ANY ADDITIONAL OR SUPERSEDING REQUIREMENTS.

1.5 MATERIALS AND WORKMANSHIP

A. PROVIDE ALL LABOR, MATERIALS, EQUIPMENT, TOOLS AND OTHER NECESSARY ITEMS NECESSARY TO COMPLETE THE WORK AS DESCRIBED IN THIS SPECIFICATION SECTION AND AS SHOWN ON THE PLANS. THE WORK SHALL BE COMPLETED IN A MANNER CONSISTENT WITH GOOD MECHANICAL PRACTICE AND THE REQUIREMENTS OF THE MECHANICAL CODE. ANY WORK NOT ACCEPTABLE TO THE OWNER SHALL BE REMOVED AND REPLACED AS NECESSARY, AT NO COST TO THE OWNER.

B. PROVIDE NEW MATERIALS AND EQUIPMENT BY THOSE REGULARLY ENGAGED IN THE PRODUCTION AND MANUFACTURE OF SPECIFIED MATERIALS AND EQUIPMENT. THE COMMERCIALLY STANDARD ITEMS OF EQUIPMENT AND THE SPECIFIC NAMES MENTIONED HEREIN ARE INTENDED TO IDENTIFY STANDARDS OF QUALITY AND PERFORMANCE NECESSARY FOR THE PROPER FUNCTIONING OF THE WORK. USE UL LISTED AND LABELED EQUIPMENT AND MATERIALS WHERE REQUIRED BY THE LOCAL BUILDING CODE.

C. PERFORM WORK BY WORKMEN SKILLED IN THE TRADE REQUIRED FOR THE WORK. INSTALL ALL MATERIALS AND EQUIPMENT TO PRESENT A NEAT APPEARANCE WHEN COMPLETED AND IN ACCORDANCE WITH THE APPROVED RECOMMENDATIONS OF THE MANUFACTURER AND THE BEST PRACTICES OF THE TRADE AND IN CONFORMANCE WITH THE CONTRACT DOCUMENTS.

D. PROVIDE ALL LABOR, MATERIALS, TOOLS, EQUIPMENT, APPARATUSES, AND APPLIANCES ESSENTIAL TO THE COMPLETE FUNCTIONING OF THE SYSTEMS DESCRIBED OR INDICATED HEREIN, OR WHICH MAY BE REASONABLY IMPLIED AS ESSENTIAL WHETHER MENTIONED IN THE CONTRACT DOCUMENTS OR NOT.

E. ALL MATERIALS, WHERE REQUIRED BY LOCAL CODE, SHALL BE MARKED AND LABELED WITH THE NAME OF THE APPROPRIATE STANDARDS AGENCY AND THE SPECIFIC STANDARD.

F. ALL TOOLS AND EQUIPMENT TAGS SHALL BE LEGIBLE. TOOLS AND EQUIPMENT WILL BE KEPT CLEAN AND IN GOOD REPAIR. TOOLS AND EQUIPMENT WHICH ARE NOT IN COMPLIANCE WITH RELEVANT SITE AND OSHA STANDARDS AND GUIDELINES WILL BE PROMPTLY REMOVED FROM SITE AND REPLACE BY THE CONTRACTOR. CM RESERVES THE RIGHT TO REMOVE AND ITEM OR EQUIPMENT WHICH IS OUT OF COMPLIANCE.

G. DURING THE BID PROCESS THE CONTRACTOR WILL REVIEW THE SITE SPECIFIC OWNER AND CM SAFETY REQUIREMENTS IN ORDER TO ENSURE COMPLIANCE THROUGH THE EXECUTION OF THE SCOPE OF WORK.

H. ALL CONTRACTOR TOOLS AND EQUIPMENT INCLUDING CORDS AND HARNESSES WILL BE LABELED IDENTIFYING THE OWNER OR RESPONSIBLE CONTRACTOR. TOOLS, EQUIPMENT, CORDS, HARNESSES, AND GANG BOXES NOT PROPERLY IDENTIFIED WILL BE REMOVED FROM SITE.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

A. FOLLOW THE MANUFACTURER'S DIRECTIONS COMPLETELY IN THE DELIVERY, STORAGE, AND HANDLING OF EQUIPMENT AND MATERIALS.

B. STORE EQUIPMENT IN A CLEAR, DRY PLACE PROTECTED FROM OTHER CONSTRUCTION AND THE ELEMENTS. WHILE STORED MAINTAIN FACTORY WRAPPING OR TIGHTLY COVER AND PROTECT EQUIPMENT AGAINST DIRT, WATER, CONSTRUCTION DEBRIS, CHEMICAL, PHYSICAL OR WEATHER DAMAGE, TRAFFIC AND THEFT.

C. ADEQUATELY BRACE AND PACKAGE EQUIPMENT TO PREVENT BREAKAGE AND DISTORTION WHILE IN TRANSIT.

D. ALL PRODUCTS SHALL BE SUPPLIED WITH A MSDS SHEET.

1.7 CONTRACT DRAWINGS

A. THE CONTRACT DRAWINGS ARE GENERALLY DIAGRAMMATIC AND ARE INTENDED TO ENCOMPASS A SYSTEM THAT WILL NOT INTERFERE WITH THE STRUCTURAL AND ARCHITECTURAL DESIGN OF THE BUILDING. COORDINATE THE WORK TO AVOID INTERFERENCE BETWEEN PIPING, EQUIPMENT, ARCHITECTURAL, AND STRUCTURAL WORK.

B. COORDINATE WITH ARCHITECTURAL FEATURES, TRIM AND MILLWORK DETAILS, AND INSTALL EQUIPMENT IN CABINETS OR OTHER SPECIAL AREAS AS SHOWN ON THE DRAWINGS.

C. CONTRACT DRAWINGS ARE BASED ON THE EQUIPMENT SPECIFIED. MAKE ADJUSTMENTS, MODIFICATIONS OR CHANGES REQUIRED, DUE TO USE OF OTHER EQUIPMENT, WITH NO ADDITIONAL COMPENSATION FOR OR DEMANDED BY THIS CONTRACTOR OR ANY OTHER CONTRACTOR OR TRADE. ANY ADDITIONAL COMPENSATION AS A RESULT OF CHANGES IN EQUIPMENT, STRUCTURAL FRAMING, CONCRETE FOUNDATION, OR OTHER PHYSICAL CHANGES SHALL BE BORNE BY THIS CONTRACTOR WITH NO ADDITIONAL EXPENSE TO THE OWNER. FURTHERMORE ANY ENGINEERING REQUIRED AS A RESULT OF SUBSTITUTIONS OF ONE MANUFACTURER OVER ANOTHER, THE CONTRACTOR SHALL, AT NO COST TO THE OWNER, BE RESPONSIBLE FOR THE COST OF RE-ENGINEERING ANY STRUCTURAL, ELECTRICAL OR OTHER ENGINEERING ASPECT DUE TO THIS SUBSTITUTION.

D. PIPE / DUCT SIZES MAY BE SHOWN FOR THE SAME PIPE / DUCT ON MORE THAN ON PLAN. IN CASE OF SIZE DISCREPANCY THE LARGER PIPE / DUCT SHALL BE CONSIDERED CORRECT DURING THE BIDDING PROCESS. PRIOR TO CONSTRUCTION, PIPE / DUCT SIZE DISCREPANCY MUST BE FORWARDED TO AND SIZE CONFIRMED BY THE ENGINEER.

E. IN CASE OF EQUIPMENT OR SPECIFICATION DISCREPANCY THE HIGHER OF THE TWO COST ITEMS SHALL BE CONSIDERED CORRECT DURING THE BIDDING. PRIOR TO CONSTRUCTION, THE DISCREPANCY MUST BE BROUGHT TO THE ATTENTION OF THE ENGINEER AND INTENT CONFIMRED BY THE ENGINEER.

F. THE CONTRACTOR SHALL BE ISSUED BULLETINS FOR CHANGES IN SCOPE POST AWARD IN THE SAME MANNER AS THE ORIGINAL DESIGN DOCUMENTS DESCRIBED ABOVE.

1.8 RECORD DRAWINGS (I.E. AS-BUILT DRAWINGS)

A. THE CONTRACTOR SHALL MAINTAIN CURRENT AT THE SITE A SET OF HIS DRAWINGS ON WHICH HE SHALL ACCURATELY SHOW THE ACTUAL INSTALLATION OF ALL WORK PROVIDED UNDER HIS CONTRACT INDICATING HEREON ANY VARIATION FROM THE CONTRACT DRAWINGS, IN ACCORDANCE WITH THE GENERAL CONDITIONS AND DIVISION 1. CHANGES, WHETHER RESULTING FROM FORMAL CHANGE ORDERS OR OTHER INSTRUCTIONS ISSUED BY THE ENGINEER OR CONSTRUCTION MANAGER, SHALL BE RECORDED. INCLUDE CHANGES IN DUCT SIZES, LOCATION, AND DIMENSIONS ETC.

B. THE SUBCONTRACTOR SHALL INDICATE PROGRESS BY COLORING IN DUCTWORK, EQUIPMENT AND ASSOCIATED APPURTENANCES EXACTLY AS THEY ARE ERECTED. THIS PROCESS SHALL INCORPORATE BOTH THE CHANGES NOTED ABOVE AND ALL OTHER DEVIATIONS FROM THE ORIGINAL DRAWINGS WHETHER RESULTING FROM JOB CONDITIONS ENCOUNTERED OR FROM ANY OTHER CAUSES.

C. THE MARKED UP AND COLORED UP PRINTS WILL BE USED AS A GUIDE FOR DETERMINING THE PROGRESS OF THE WORK INSTALLED. THEY SHALL BE INSPECTED PERIODICALLY BY THE CM, ENGINEER AND OWNER AND THEY SHALL BE CORRECTED IMMEDIATELY IF FOUND EITHER INACCURATE OR INCOMPLETE. THIS PROCEDURE IS MANDATORY.

D. AT THE COMPLETION OF THE JOB, THESE PRINTS SHALL BE SUBMITTED TO THE CM AND ENGINEER FOR FINAL REVIEW AND COMMENT. THE PRINTS WILL BE RETURNED WITH APPROPRIATE COMMENTS AND RECOMMENDATIONS. THESE CONTRACTOR RECORD DRAWINGS, TOGETHER WITH CORRECTED PRINTS INDICATING ALL THE FORMAL CONSTRUCITON REVISIONS, ADDITIONS AND DELETIONS OF WORK, SHALL FORM THE BASIS FOR PREPARING A SET OF AS BUILT RECORD DRAWINGS.

E. THE SUBCONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING MARKED-UP AS BUILT RECORD DRAWINGS TO THE ENGINEER. THE AS-BUILT DRAWINGS SHALL CLEARLY INDICATE ANY FIELD CHANGES THAT WERE MADE DURING CONSTRUCTION TO THE BASE DESIGN. THE AS-BUILT DRAWINGS WILL BE USED BY THE ENGINEER TO UPDATE ELECTRONIC FILES FOR AS-BUILT CAD FILES TO BE TURNED OVER TO THE OWNER.

F. THE CONTRACTOR MAY USE THE COMPUTER DRAWING FILES USED FOR COORDINATION DRAWINGS. MOST RECENTLY UPDATED COMPUTER DRAWING FILES WILL BE AVAILABLE TO THE AWARDED CONTRACTOR. THE UPDATED DRAWINGS MAY NOT INCLUDE ALL CHANGES MADE DURING THE COURSE OF CONSTRUCTION AND IT SHALL BE THE CONTRACTORS RESPONSIBILITY TO UPDATE THE AS BUILT DOCUMENTS TO INCLUDE ALL CHANGES BROUGHT FORTH TO THE PROJECT RESULTING FROM BULLETINS, REQUEST FOR INFORMATION (RFI'S), CHANGE ORDERS, ETC. THE CONTRACTOR MUST REVIEW THE ENGINEERS LATEST COMPUTER FILES FOR COMPLETENESS. THE ENGINEER WILL NOT BE RESPONSIBLE FOR UPDATING THE CONTRACTORS COMPUTER FILES.

1.9 OPERATION & MAINTENANCE (O&M) MANUALS

A. FURNISH COPIES OF COMPLETE OPERATION AND MAINTENANCE INSTRUCTIONS, SERVICE MANUALS AND PARTS LIST APPLICABLE TO EACH MANUFACTURED ITEM OF EQUIPMENT FURNISHED. BIND OPERATION AND MAINTENANCE INFORMATION IN HEAVY DUTY LOOSE-LEAF BINDERS.

1. REQUIRED MINIMUMS: 3 HARDCOPY SETS AND 3 ELECTRONIC SETS ON CD, DVD OR EXTERNAL STORAGE DEVICE.

B. ORGANIZE BINDERS TO CONTAIN LIKE EQUIPMENT SUCH AS AIR HANDLERS, VAV BOXES, FANS, ETC., IN SEPARATE DIVISIONS. PROVIDE A COMPLETE DOUBLE INDEX FOR EACH BINDER TO INCLUDE:

1. AN ALPHABETIZED LIST OF THE PRODUCTS BY NAME
2. AN ALPHABETIZED LIST OF MANUFACTURERS WHOSE PRODUCTS HAVE BEEN INCORPORATED IN THE WORK, TOGETHER WITH THEIR ADDRESSES AND THE NAME, ADDRESSES AND TELEPHONE NUMBERS OF THE LOCAL SALES REPRESENTATIVE OR SUPPLIER

C. SUBMIT FOR ENGINEERS REVIEW ONE PRELIMINARY O&M MANUAL PER THE INSTRUCTIONS IN THIS SECTION FOR REVIEW AND COMMENT PRIOR TO SUBMITTING REMAINING ELECTRONIC AND HARD COPIES.

D. FOR EACH SECTION OF PRODUCT, EQUIPMENT OR SYSTEM, ORGANIZE THE DATA AS FOLLOWS:

1. FURNISH A GENERAL DESCRIPTION OF THE EQUIPMENT OR SYSTEM LISTING THE MAJOR COMPONENTS, MANUFACTURES SUGGESTED SERVICE SCHEDULE, AND OTHER GENERAL DATA.
2. FURNISH TECHNICAL DATA INCLUDING NAMEPLATE DATA, DESIGN PARAMETERS, RATINGS, CAPACITY, PERFORMANCE DATA, OPERATING CURVES, CHARACTERISTICS AND THE LIKE. CLEARLY DISTINGUISH BETWEEN INFORMATION WHICH DOES AND DOES NOT APPLY. MANUALS SUBMITTED WITH NON-APPLICABLE INFORMATION MAY BE REJECTED AT ENGINEERS' DISCRETION TO BE REVISED AND RESUBMITTED BY THE CONTRACTOR.
3. LIST WARNINGS AND CAUTIONS TO BE OBSERVED DURING BOTH INSTALLATION AND OPERATIONS.

4. FURNISH FULLY DETAILED INSTALLATION AND OPERATION INSTRUCTIONS INCLUDING SPECIAL TOOLS REQUIRED, ALIGNMENT INSTRUCTIONS, START UP, AND SHUT DOWN SEQUENCES.
5. FURNISH MAINTENANCE, SERVICE AND REPAIR INSTRUCTIONS INCLUDING MAINTENANCE AND SERVICE SCHEDULES, MATERIALS, AND METHODS FOR PERFORMING ROUTINE AND ANNUAL SERVICE.
6. FURNISH A TROUBLESHOOTING GUIDE AND CHECKLIST INDICATING COMMON FAILURES, TEST METHODS AND PROCEDURES FOR DETERMINING COMPONENT FAULT OR FAILURE.
7. FURNISH A SPARE PARTS LIST INDICATING PART AND ORDER NUMBER WITH NAME, ADDRESS, AND TELEPHONE NUMBER OF SUPPLIER. INCLUDE CURRENT PRICES OF REPLACEMENT PARTS AND SUPPLIES, AND THE DATE THAT THE PRICE LIST WAS ISSUED.
8. FURNISH DIAGRAMS INCLUDING CONTROLS, WIRING, INSTALLATION OR OPERATION OF THE EQUIPMENT OR SYSTEM.
9. FURNISH COPIES OF ALL APPROVED SUBMITTALS.
10. FURNISH COPIES OF ALL TEST REPORTS. REFER TO SPECIFICATION 23 05 93 - TESTING, ADJUSTING, AND BALANCING.

E. PROVIDE A LUBRICATION SECTION IN THE SUBMITTAL CONTAINING A CHECKLIST OR SCHEDULE SHOWING THE TYPE OF LUBRICANT TO BE USED AT EACH POINT, THE LUBRICATION INTERVALS, AND THE FREQUENCY OF LUBRICATION REPLACEMENT FOR EACH APPPLICABLE PIECE OF EQUIPMENT.

1.10 GUARANTEE

A. REFER TO THE GENERAL CONDITIONS AND SPECIAL CONDITIONS OF THE CONTRACT DOCUMENTS.

B. CONTRACTOR SHALL ACCEPT AND CARRY OUT WARRANTEE OF ALL PREPURCHASED EQUIPMENT (THAT HAS BEEN TURNED OVER TO THE CONTRACTOR) AS IF THE CONTRACTOR HAD PURCHASED THE EQUIPMENT HIMSELF.

C. CONTRACTORS WARRANTY SHALL BEGIN UPON COMPLETION OF PROJECT. ALL O&M MANUALS, OWNER TRAINING AND OUTSTANDING PUNCH LIST ITEMS MUST BE COMPLETED PRIOR TO THE WARRANTY PERIOD START DATE CONTRACTOR SHALL PROVIDE WARRANTY CERTIFICATE SIGNED AND DATED BY THE CONTRACTOR, ENGINEER, AND OWNER TO DOCUMENT THE INITIATION OF THE WARRANTY PERIOD.

1.11 SELECTIVE DEMOLITION

A. NONE REQUIRED

1.12 ALTERNATES

A. SEE BID DOCUMENTS FOR ALTERNATES.

PART 2: PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. UNLESS OTHERWISE SPECIFIED, MATERIALS AND EQUIPMENT SHALL BE NEW, IN GOOD AND CLEAN CONDITION. EQUIPMENT, MATERIALS, AND COMPONENTS SHALL BE OF THE MAKE, TYPE AND MODEL NUMBER NOTED ON DRAWINGS OR SPECIFIED. PIECES OF EQUIPMENT OF THE SAME TYPE SHALL BE BY THE SAME MANUFACTURER.

B. WHENEVER AN ITEM IS LISTED BY A SINGLE PROPRIETARY NAME, WITH OR WITHOUT MODEL NUMBER AND TYPE, IT SHALL BE FOR PURPOSE OF DESIGN ONLY, TO INDICATE CHARACTERISTICS AND QUALITY DESIRED. PROPRIETARY DESIGNATION LISTED ON DRAWINGS, OR LISTED FIRST IN SPECIFICATIONS, IS USED AS A BASIS FOR DESIGN TO ESTABLISH A STANDARD FOR QUALITY AND PERFORMANCE AND SPACE REQUIREMENTS.

C. HVAC EQUIPMENT PRODUCTS FROM DIFFERENT MANUFACTURERS ARE NEVER IDENTICAL. EQUIPMENT APPROVED AS BEING EQUAL IS INTERPRETED AS BEING EQUIVALENT IN CAPACITY, PERFORMANCE AND QUALITY. THE DIMENSIONS, WEIGHT, CONFIGURATION AND UTILITY REQUIREMENTS COULD BE QUITE DIFFERENT FROM THE EQUIPMENT USED AS THE BASIS OF DESIGN. DUE TO THESE DIFFERENCES, ADDITIONAL COORDINATION AND ADJUSTMENTS BY THE

CONTRACTOR ARE REQUIRED. FOR THE EQUIPMENT TO BE DEEMED TRULY EQUAL, THE ADDITIONAL COORDINATION AND ADJUSTMENTS BY THE CONTRACTOR SHOULD NOT INCUR ANY ADDITIONAL COST TO THE OWNER AND ANY ADDITIONAL LABOR TO THE DESIGN TEAM.

D. EQUIPMENT AND MATERIALS INDICATED OR REQUIRED TO BE INSTALLED OUTDOORS SHALL BE OF THE TYPE THAT IS DESIGNED, MANUFACTURED, LISTED OR APPROVED BY AUTHORITIES HAVING JURISDICTION FOR OUTDOOR INSTALLATION BY BEING RESISTANT TO THE ADVERSE EFFECTS OF WEATHER. ALL THE ADDITIONAL PROTECTIVE MEASURES AGAINST OUTDOOR WEATHER REQUIRED BY THE MANUFACTURERS' INSTALLATION INSTRUCTIONS AND PREVALENT PRACTICE SHALL BE PROVIDED.

PART 3: EXECUTION

3.1 GENERAL

A. THE WORK UNDER THIS CONTRACT SHALL ALSO INCLUDE ALL LABOR, MATERIALS, TOOLS, EQUIPMENT, TRANSPORTATION, INSURANCE, TEMPORARY PROTECTION, SUPERVISION AND INCIDENTAL ITEMS ESSENTIAL FOR PROPER INSTALLATION AND OPERATION, EVEN THOUGH NOT SPECIFICALLY MENTIONED OR INDICATED ON THE DRAWINGS BUT WHICH ARE USUALLY PROVIDED OR ARE ESSENTIAL FOR PROPER INSTALLATION AND OPERATION OF ALL SYSTEMS AS INDICATED ON THE DRAWINGS AND SPECIFIED IN THE CONTRACT DOCUMENTS.

B. THE SPECIFICATIONS AND DRAWINGS DESCRIBE THE MINIMUM REQUIREMENTS THAT MUST BE MET BY CONTRACTOR FOR THE INSTALLATION OF ALL WORK AS SHOWN ON THE DRAWINGS AND AS SPECIFIED ON DRAWINGS, SCHEDULES, SPECIFICATIONS AND RFQ SCOPES OF WORK.

3.2 PROJECT/SITE CONDITIONS

A. VISIT THE SITE OF THE PROPOSED CONSTRUCTION TO THOROUGHLY BECOME FAMILIAR WITH ALL DETAILS OF THE WORK AND WORKING CONDITIONS, VERIFY ALL DIMENSIONS IN THE FIELD AND ADVISE THE CM AND ENGINEER OF ANY DISCREPANCY BEFORE PERFORMING ANY WORK.

B. SAFETY MEETINGS

1. CONTRATOR SHALL BE RESPONSIBLE FOR ATTENDING ALL SAFETY AND CM MEETINGS AS REQUESTED BY THE CM. THE SUBCONTRATOR SHALL BE REQUIRED TO ATTEND MEETINGS AS REQUESTED BY CM.

C. SPACE REQUIREMENTS

1. CONSIDER SPACE LIMITATIONS IMPOSED BY CONTIGUOUS WORK IN SELECTION AND LOCATION OF EQUIPMENT AND MATERIAL. DO NOT PROVIDE EQUIPMENT OR MATERIAL THAT IS NOT SUITABLE IN THIS RESPECT.
2. CHANGES IN EQUIPMENT LOCATION OF UP TO 15 FEET TO ALLOW FOR FIELD CONDITIONS SHALL BE MADE BY THE SUBCONTRACTOR AT NO ADDITIONAL COMPENSATION, AS DIRECTED BY THE CM.
3. PROVIDE MAXIMUM POSSIBLE CLEAR HEIGHT BENEATH ALL PIPING AND DUCTWORK. INSTALL PIPING AND DUCTWORK AS HIGH AS POSSIBLE.
4. INSTALL ALL EQUIPMENT REQUIRING SERVICE SO THAT IT IS EASILY ACCESSIBLE.
5. COMPARE THE EQUIPMENT SIZES WITH THE SPACE ALLOTTED FOR INSTALLATION BEFORE INSTALLATION AND MAKE WRITTEN NOTICE OF POSSIBLE CONFLICT. DISASSEMBLE LARGE EQUIPMENT TO PERMIT INSTALLATION THROUGH NORMAL ROOM OPENINGS WHEN REQUIRED. SHOULD WRITTEN NOTICE NOT BE MADE IN A TIMELY MANNER, MAKE ADJUSTMENTS AND MODIFICATIONS NECESSARY WITHOUT ADDITIONAL COMPENSATION.
6. TIMELY PLACE ALL EQUIPMENT TOO LARGE TO FIT THROUGH FINISHED OPENINGS, STAIRWAYS, ETC.

D. SITE OBSTRUCTIONS

1. THE DRAWINGS INDICATE CERTAIN INFORMATION PERTAINING TO SURFACE AND SUBSURFACE OBSTRUCTIONS WHICH HAS BEEN TAKEN FROM AVAILABLE DRAWINGS. SUCH INFORMATION IS NOT GUARANTEED; HOWEVER, AS TO THE ACCURACY OF LOCATION OR THE COMPLETENESS OF THE INFORMATION.

2. BEFORE ANY CUTTING OR TRENCHING OPERATION IS BEGUN, VERIFY WITH THE CM, UTILITY COMPANIES, MUNICIPALITIES, AND OTHER INTERESTED PARTIES THAT ALL AVAILABLE INFORMATION HAS BEEN PROVIDED. VERIFY LOCATIONS GIVEN. THE SUBCONTRACTOR SHALL NOTIFY THE LOCAL UNDERGROUND SUPERVISORY AGENCY BEFORE ANY EXCAVATIONS AS REQUIRED BY LOCAL CODES AND ORDINANCES.
3. SHOULD BURIED OBSTRUCTION BE ENCOUNTERED, THE SUBCONTRACTOR SHALL STOP ALL WORK ON THE EXCAVATION AND NOTIFY THE CM AND SHALL NOT PROCEED UNTIL HE RECEIVES WRITTEN NOTIFICATION TO DO SO.
4. ANY UNDERGROUND UTILITIES THAT ARE KNOWN TO EXIST AS SHOWN ON THE DRAWINGS OR SHOWN TO EXIST BY THE BURIED SUPERVISORY AGENCY WHICH ARE DAMAGED SHALL BE REPAIRED TO THE SATISFACTION OF THE APPROPRIATE UTILITY COMPANY AND THE CM.
5. REFER TO THE CM GENERAL CONDITIONS AND SUPPLEMENTAL GENERAL CONDITIONS FOR PRICING ADJUSTMENT REQUIREMENTS.

E. CUTTING AND PATCHING
1. SUBMIT A WRITTEN NOTIFICATION TO CM IN ADVANCE OF CUTTING OR ALTERATIONS.
2. EXECUTE CUTTING AND DEMOLITION BY METHODS THAT WILL PREVENT DAMAGES TO OTHER WORK AND WILL PROVIDE PROPER SURFACES TO RECEIVE INSTALLATION OF REPAIRS.
3. RESTORE WORK THAT HAS BEEN CUT OR REMOVED; INSTALL NEW PRODUCTS COMPLYING WITH SPECIFIED PRODUCTS, FUNCTIONS, TOLERANCES, AND FINISHES AS STATED IN THE CONTRACT DOCUMENTS. PROVIDE HEAVY CHROME PLATED OR NICKEL PLATED ESCUTCHEON PLATES OF APPROVED PATTERN FOR ALL PENETRATIONS OF FINISHED SURFACE. SEE THE SPECIFIC WORK SPECIFICATION SECTION FOR THE APPROPRIATE ESCUTCHEON PLATES.
4. FIT WORK TIGHT TO PIPES, SLEEVES, DUCTS, AND OTHER PENETRATIONS THROUGH SURFACES. FOR FIRE RATED PENETRATIONS, PROVIDE ASSEMBLIES IN ACCORDANCE WITH UL 1479 AND ASTM E-814 UTILIZING PRODUCTS AND MATERIALS EQUAL TO THE RATING OF ALL SURFACES PENETRATED. FIELD MEASURE OR MARK ALL OPENING SIZES PRIOR TO PURCHASE OF ASSEMBLIES.

3.3 EQUIPMENT CONNECTIONS

A. CONNECTIONS TO EQUIPMENT SHALL BE MADE IN ACCORDANCE WITH THE SHOP DRAWINGS AND ROUGH-IN MEASUREMENTS FURNISHED BY THE MANUFACTURER OF THE PARTICULAR EQUIPMENT FURNISHED. ANY AND ALL ADDITIONAL CONNECTIONS NOT SHOWN ON THE DRAWINGS, BUT CALLED FOR BY THE EQUIPMENT MANUFACTURER'S SHOP DRAWINGS OR REQUIRED FOR THE SUCCESSFUL OPERATION OF THE PARTICULAR EQUIPMENT FURNISHED, SHALL BE INSTALLED BY THE CONTRACTOR AS PART OF THIS CONTRACT AND WITH NO ADDITIONAL CHARGE.

3.4 TESTS AND TESTING

A. PERFORM ALL APPLICABLE TESTS OUTLINED IN SPECIFICATION 23 05 93 - TESTING, ADJUSTING, AND BALANCING.

B. EQUIPMENT PERFORMANCE ASSURANCE TESTS
1. BEFORE OPERATING ANY EQUIPMENT OR SYSTEMS, A THOROUGH CHECK SHALL BE PERFORMED TO DETERMINE THAT SYSTEMS HAVE BEEN FLUSHED AND CLEANED AS REQUIRED AND THAT EQUIPMENT HAS BEEN PROPERLY INSTALLED, ALIGNED, LUBRICATED, AND SERVICED. FACTORY INSTRUCTIONS SHALL BE CHECKED TO VERIFY INSTALLATIONS HAVE BEEN COMPLETED AND RECOMMENDED LUBRICANTS HAVE BEEN INSTALLED IN BEARINGS, GEARBOXES, CRANKCASES, AND SIMILAR EQUIPMENT. PARTICULAR CARE SHALL BE FURNISHED IN LUBRICATING BEARINGS TO AVOID DAMAGE BY OVER-LUBRICATION AND BLOWING OUT SEALS. EQUIPMENT SHALL ALSO BE CHECKED FOR DAMAGE THAT MAY HAVE OCCURRED DURING SHIPMENT, AFTER DELIVERY, OR

DURING INSTALLATION. DAMAGED EQUIPMENT, PRODUCTS, AND MATERIALS SHALL BE REPLACED OR REPAIRED AS REQUIRED.

2. UPON COMPLETION OF THE ABOVE, ADJUST THE SYSTEM SETTINGS TO WITHIN NORMAL OPERATING CONDITIONS TO PREVENT THE SYSTEM FROM BEING DAMAGED UPON START-UP.
3. PROVIDE THE SERVICES OF COMPETENT REPRESENTATIVES OF THE MANUFACTURER CAPABLE OF CERTIFYING THAT THE EQUIPMENT IS INSTALLED ACCORDING TO THE MANUFACTURER'S RECOMMENDATIONS, IS OPERATING PROPERLY, AND TO INSTRUCT OPERATING PERSONNEL DURING START UP AND OPERATING TESTS OF THE COMPLETE MECHANICAL SYSTEMS. PROVE THE OPERATION OF EQUIPMENT TO THE SATISFACTION OF THE CM AND OWNER. GIVE AT LEAST SEVEN DAYS' NOTICE TO CM PRIOR TO BEGINNING EQUIPMENT START UP.
4. EQUIPMENT START-UP REPORTS: FOR EACH EQUIPMENT OR SYSTEM ON WHICH START-UP IS PERFORMED, SUBMIT ONE (1) DIGITAL COPY OF START-UP REPORT FOR REVIEW BY THE ENGINEER.
    a. THE START-UP REPORT SHALL INCLUDE THE MANUFACTURER'S STANDARD START-UP FORM COMPLETED AND SIGNED BY THE START-UP TECHNICIAN.
    b. CERTIFY THAT THESE SERVICES HAVE BEEN PERFORMED BY INCLUDING A PROPERLY EXECUTED INVOICE FOR THESE SERVICES OR A LETTER FROM THE MANUFACTURER.
5. PROVIDE, MAINTAIN, AND PAY COSTS FOR EQUIPMENT, INSTRUMENTS, AND OPERATING PERSONNEL AS REQUIRED FOR SPECIFIED TESTS.

3.5 ADDITIONAL WORK

A. ALL ADDITIONAL WORK AND CHANGES TO THE ORIGINAL CONTRACT MUST BE SUBMITTED IN WRITING TO THE CM / ENGINEER AND APPROVED IN WRITING BY THE CM/PM AND /OR THE OWNER PRIOR TO EXECUTION. ANY CHANGE WORK PERFORMED WITHOUT APPROVAL IS AT THE CONTRACTORS' RISK.

3.6 SERVICE

A. PROVIDE CLOTH FILTER MEDIA OVER ALL AIR OUTLETS IN AREAS WITH FINISHED CEILINGS AT INITIAL START OF FANS.
B. IMMEDIATELY PRIOR TO FINAL ACCEPTANCE OF PROJECT, INSPECT, CLEAN AND TEST ALL SYSTEMS AS DESCRIBED IN THE DRAWING AND ALL ASSOCIATED SPECIFICATIONS.
C. PLACE ALL SYSTEMS IN COMPLETE WORKING ORDER, AND CLEAN EQUIPMENT AND MATERIALS THOROUGHLY RETURNING TO "AS NEW" CONDITION PRIOR TO REQUEST FOR FINAL REVIEW.
    1. REMOVE ALL TEMPORARY / CONSTRUCTION FILTERS FROM EQUIPMENT AND PROVIDE AND INSTALL CLEAN FILTERS, INCLUDING FILTERS PROVIDED WITH OWNER PURCHASED EQUIPMENT, ON ALL EQUIPMENT PRIOR TO FINAL REVIEW.
D. REMOVE ALL EXCESS MATERIAL AND DEBRIS. CLEAN OUT ALL DUCTWORK, REMOVE METAL SHAVINGS AND ADJUST ALL DAMPERS. LEAVE ALL AREAS "BROOM CLEAN." THOROUGHLY CLEAN DUCTWORK INSIDE AND OUT BEFORE GRILLES ARE INSTALLED.

END OF SECTION

SECTION 23 05 29

HANGERS AND SUPPORTS

PART 1: GENERAL

1.1 THE WORK OF THIS SECTION SHALL INCLUDE:

A. HVAC DUCT, AND EQUIPMENT HANGERS, SUPPORTS AND ASSOCIATED ANCHORS.
B. HVAC REFRIGERANT PIPING HANGERS AND SUPPORTS
C. HVAC CONDENSATE PIPING HANGERS AND SUPPORTS
D. EQUIPMENT BASES AND SUPPORTS
E. SLEEVES AND SEALS
F. FLASHING AND SEALING EQUIPMENT AND PIPE STACKS.

1.2 WORK INCLUDED, BUT SPECIFIED ELSEWARE:

A. CONTROL CONDUIT SUPPORTS, REFER TO ELECTRICAL SPECIFICATIONS AND DETAILS.
B. REFER TO ELECTRICAL NEMA CLASSIFICATION DRAWINGS FOR ACCPTABLE MATERIALS AND SUPPORTS FOR ELECTICAL AND CONTROLS INSTALLTION.

1.3 SUBMITTALS

A. SUBMITTALS SHALL BE PROVIDED IN CONFORMANCE WITH SECTION 23 00 01 MECHANICAL GENERAL PROVISIONS.
B. SUBMIT PRODUCT DATA FOR HANGERS AND SUPPORTS USED IN ALL AREAS.
C. SUBMIT PRODUCT DATA AND COPY OF USDA LETTER OF APPROVAL FOR INCIDENTAL FOOD CONTRACT MATERIALS FOR EXPOSED HANGERS AND SUPPORTS USED IN PROCESS AREAS.

1.4 QUALITY ASSURANCE

A. HANGERS, SUPPORTS, AND MATERIALS PROVIDED ACCORDING TO THIS STANDARD SHALL MEET THE LATEST EDITION OF THE FOLLOWING STANDARDS.
    1. AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI) STANDARDS
    2. AMERICAN SOCIETY OF TESTING AND MATERIALS (ASTM)
    3. SHEET METAL AND AIR CONDITIONING CONTRACTORS ASSOCIATION (SMACNA)

1.5 SEISMIC DESIGN

A. ALL PIPING AND DUCTWORK SHALL BE HUNG AND SUPPORTED TO ACCOMMODATE THE MAXIMUM RELATIVE STRUCTURAL MOVEMENT AND SEISMIC FORCES AS DEFINED IN THE INTERNATIONAL BUILDING CODE.
B. IF APPLICABLE AND REQUIRED BY LAW, A REGISTERED STRUCTURAL ENGINEER SHALL APPROVE, STAMP, AND SIGN PIPING AND DUCTWORK HANGER DRAWINGS IN CERTAIN SEISMIC ZONES AND FOR ALL LOAD CAPACITY ISSUES.
C. ALL PIPING AND DUCTWORK SHALL BE PROVIDED WITH SEISMIC RESTRAINTS IN ACCORDANCE WITH THE APPROPRIATE SEISMIC HAZARD LEVEL (SHL) OF THE SEISMIC RESTRAINT MANUAL – GUIDELINES FOR MECHANICAL SYSTEMS, LATEST EDITION, AS PUBLISHED BY SMACNA

1.6 HANGER AND SUPPORT DESIGN

A. ALL HANGERS AND SUPPORTS IN PROCESS AREAS (REFER TO MECHANICAL GENERAL PROVISIONS) SHALL BE CONSTRUCTED FROM 304 STAINLESS STEEL. HANGERS AND SUPPORTS IN SUPPORT AREAS (ELECTRICAL ROOMS, CORRIDORS, AND CEILING VOID SPACES) MAY BE CONSTRUCTED FROM GALVANIZED STEEL.
B. STRUCTURAL TUBING, PIPES, OR FLAT STOCK ON EDGE SHOULD BE USED RATHER THAN STRUCTURAL SHAPES. OPEN ENDS SHALL BE SEALED BY WELDING. WHEN MOUNTING PIPING ON TUBULAR FRAMES, HOLES SHALL NOT BE DRILLED INTO THE INTERIOR OF THE TUBING. MOUNTING TABS OR WELDED SMOOTH ROD STUDS TO MOUNT CLAMPS SHALL BE USED TO MAINTAIN THE SEALED INTEGRITY OF THE STRUCTURAL SHAPE.
C. BOTH TUBULAR AND NON-TUBULAR SHAPES ARE ACCEPTABLE IN DRY PROCESS AREAS. THE ENTIRE SPECIFIC AREA SHOULD INCORPORATE A CONSISTENT APPROACH. ANGLE BRACING SHOULD BE TURNED AT 45 DEGREES WHENEVER POSSIBLE TO ELIMINATE THE HORIZONTAL LEDGES. NON-TUBULAR STRUCTURAL SHAPES SHALL MINIMIZE HORIZONTAL LEDGES.
D. VERTICAL HANGERS SHALL BE SMOOTH, STAINLESS STEEL RODS OR STRUCTURAL TUBING. USE OF ALL THREAD TYPE RODS IS PROHIBITED. SMOOTH STEEL ROD HANGERS SHALL BE SECURED

WITH A DOUBLE-NUT. AMOUNT OF THREADS SHALL BE ONLY AS NEEDED TO ACCOMMODATE THE DOUBLE NUT.

E. MAINTAIN 2" MINIMUM CLEARANCE BETWEEN ADJACENT PIPES AND 6" BETWEEN PIPES AND WALLS (INCLUDES INSULATION). IF INSULATED, THIS DISTANCE SHALL BE MEASURED FROM THE OUTSIDE OF THE INSULATION.

F. IN WET GMP AREAS, HORIZONTAL PIPES IN A PIPE RACK OR HANGING DUCTWORK SHALL NOT EXCEED 36" IN WIDTH. THERE SHALL BE A MINIMUM 36" HORIZONTAL GAP ON EACH SIDE TO ACCOMMODATE A PERSONNEL LIFT FOR CLEANING AND TO SERVICE VALVES AND INSTRUMENTS. THERE SHALL BE ADEQUATE DISTANCE BETWEEN LAYERS IN THE RACK TO ALLOW PIPES TO EXIT THE RACK WITH SPACE FOR ISOLATION VALVES.

G. IN DRY GMP AREAS, HORIZONTAL PIPES IN A PIPE RACK OR HANGING DUCTWORK MAY BE UP TO 60" IN WIDTH. SERVICEABLE DEVICES SHALL BE WITHIN AN 18" REACH OF A LIFT ACCESS POINT ALONG THE PIPE HANGER SYSTEM. THERE SHALL BE 36" LIFT ACCESS ALONG EACH SIDE OF THE PIPE RACK OR DUCTWORK HANGER SYSTEM TO ACCOMMODATE CLEANING. THERE SHALL BE ADEQUATE DISTANCE BETWEEN LAYERS IN THE RACK TO ALLOW PIPES TO EXIT THE RACK WITH SPACE FOR ISOLATION VALVES.

H. IN NON-GMP (SUPPORT) AREAS PIPES IN A PIPE RACK OR HANGING DUCTWORK MAY BE UP TO 60" WIDE WITH 36" OF ACCESS ON EACH SIDE TO ACCOMMODATE CLEANING OF THE PIPES OR DUCTWORK.

I. ALL CEILING AND WALL PLATES SHALL BE SEALED TO THEIR SUPPORTING STRUCTURE WITH CM APPROVED BUILDING CAULK.

PART 2: PRODUCTS

2.1 GENERAL

A. BEAM CLAMPS SHALL NOT BE USED FOR SECURING HANGERS TO STRUCTURE UNLESS APPROVED IN WRITING BY CM.

2.2 MISCELLANEOUS SUPPORTS AND HANGER RODS (PROCESS AREAS)

A. ALL SUPPORT AND HANGER MATERIALS IN PROCESS AREAS SHALL BE STAINLESS STEEL, TYPE 304.

B. SANITARY DESIGN STANDARDS FOR FOOD PRODUCTION AREAS REQUIRES THE FOLLOWING:

1. THE USE OF PRE-ENGINEERED METAL SUPPORT SYSTEMS SUCH AS KINDORF, UNISTRUT, OR B-LINE IS NOT ALLOWED DUE TO ROLLED EDGES AND SPACED SUPPORT HOLES.
2. METAL RODS SHALL BE STAINLESS STEEL END-THREADED ONLY AND NOT ALL-THREADED DESIGN. MAXIMUM OF 2 THREADS OR 0.25" OF THREADS SHALL BE EXPOSED.
3. ANGLE IRON USED FOR HANGER BARS SHALL BE INSTALLED USING THE CORNER AS THE POINT OF CONTACT (UPSIDE DOWN "V" NOT UPSIDE DOWN "L").

C. CONTROL CONDUIT SUPPORTS SHALL BE AS SHOWN ON THE ELECTRICAL DRAWINGS.

2.3 MISCELLANEOUS SUPPORTS AND HANGER RODS (CONCEALED OR NON-PROCESS AREAS)

A. STEEL STRAPS: GALVANIZED, SIZED PER SMACNA MINIMUM (OFFICE AREAS ONLY)

B. STEEL HANGER RODS: GALVANIZED, 3/8" DIA. MINIMUM, THREADED BOTH ENDS ONLY. CONTINUOUS THREADED ROD IS NOT ACCEPTABLE.

C. USE STEEL ANGLES AND RODS, ASTM A36. ANGLE INSTALLED ABOVE CEILING SHALL BE GALVANIZED.

D. MIXTURE OF SUPPORT SYSTEM MANUFACTURERS' PRODUCTS IS NOT PERMITTED.

2.4 DUCTWORK HANGERS AND SUPPORTS

A. EXPOSED PROCESS AREAS (MANUFACTURING ROOMS, CLEANING ROOMS, WET WASH AREAS – REFER TO ELECTRICAL NEMA CLASSIFICATIONS DRAWINGS FOR PROCESS ROOM DESIGNATION)

1. ALL DUCTWORK SHALL BE SUPPORTED USING STAINLESS STEEL ANGLES OR FULLY CAPPED STAINLESS TUBE SUPPORTS.
2. ALL SUPPORT ANGLES SHALL BE HUNG USING STAINLESS STEEL SMOOTH RODS THREADED BOTH ENDS ONLY. ALL THREAD RODS ARE NOT PERMITTED.

3. GRIPPLE NO.3 STAINLESS STEEL CABLES AND FASTENERS MAY BE USED TO SUPPORT DUCT FROM STRUCTURE. WHERE REQUIRED TO PREVENT SWAYING OF DUCT SYSTEM THE CONTRACTOR SHALL PROVIDE A RIGID SUPPORT.

B. EXPOSED (SUCH AS MECHANICAL ROOMS, UTILITY AREAS, AND ELECTRICAL ROOMS ETC.)
1. ALL DUCTWORK MAY BE SUPPORTED USING GALVANIZED STEEL ANGLE.
2. ALL SUPPORT ANGLES SHALL BE HUNG USING END-THREADED OR ALL-THREADED RODS. REFER TO DRAWINGS FOR DETAILS.
3. ALL DUCTWORK MAY BE SUPPORTED USING SHEET METAL STRAPS ATTACHED TO DUCTWORK PER SMACNA STANDARDS IN OFFICE AREAS ONLY.

C. ABOVE WALK-ON CEILINGS
1. ALL DUCTWORK MAY BE SUPPORTED USING PAINTED OR GALVANIZED STEEL ANGLE
2. ALL SUPPORT ANGLES SHALL BE HUNG USING END-THREADED OR ALL-THREADED RODS. REFER TO DRAWINGS FOR DETAILS.

D. OFFICE AREAS
1. ALL DUCTWORK MAY BE SUPPORTED USING SHEET METAL STRAPS ATTACHED TO DUCTWORK PER SMACNA STANDARDS.

E. ROOF SUPPORTED DUCTWORK
1. ALL SUPPORTS SHALL BE OF GALVANIZED STEEL. SUPPORTS AND BASES SHALL BE FABRICATED BY CONTRACTOR AS DETAILED WITHIN THE DRAWINGS.
a. SLEEPER BASE: SUPPORTS SHALL BE OF GALVANIZED STEEL. BASE SHALL BE FNW PIPE SUPPORT ETHAFOAM 400 PLANK SYSTEM.
b. FIXED BASE: SUPPORTS SHALL BE FABRICATED GALVANIZED STEEL TUBE AND ANGLE. REFER TO DRAWINGS FOR DETAILS.

2.5 FAN COIL UNITS

A. ALL SUSPENDED FAN COIL UNITS SHALL BE SUPPORTED FROM STRUCTURE.
B. UNIT SHALL BE SUSPENDED WITH 3/8” GALVANIZED SOLID ROD WITH END THREADES ONLY.
C. ALL SUSPENDED FAN COIL UNITS SHALL HAVE NEOPRENE VIBRATION ISOLATION PUCKS, AND WHERE REQUIRED ANTI-SWAY BRACING SHALL BE PROVIDED TO SECURE THE UNIT TO THE STRUCTURE.
D. ALL SUSPENDED FAN COIL UNITS SHALL BE SECURED TO STRUCTURE (CONCRETE PLANK SYSTEM, OR STRUCTURAL STEEL). UNITS SHALL NOT BE SUSPENDED FROM IMP CEILING.

2.6 FABRIC DUCT HANGERS AND SUPPORTS

A. ALL FABRIC DUCTS SHALL BE SUPPORTED USING SUSPENSION CABLE. CABLE SHALL DIAMETER SHALL BE AS RECOMMENDED BY FABRIC DUCT MANUFACTURER.
B. SUSPENSION CABLE ANCHORING POST SHALL BE SECURED TO STRUCTURE (CONCRETE PLANK SYSTEM, OR STRUCTURAL STEEL). LENGTH OF DROP POST SHALL BE AS REQUIRED TO HANG FABRIC DUCT AT SPECIFIED ELEVATION. POSTS SHALL NOT BE FASTENED TO IMP CEILING.
C. CABLE SUSPENSION POST SHALL BE FABRICATED FROM 2” SCHEDULE 10 POST AND DROP PIPE, AND 4”X4”X1/8” STAINLESS STEEL BASE TO BE FASTENED TO STRUCTURE.
D. CABLE CONNECTION EYELET SHALL BE WELDED TO ANCHORING POST. ANCHORING POST SHALL BE LOCATED AT BEGINNING AND END OF FABRIC DUCT AS A MINIMUM. INTERMEDIATE SUPPORTS SHALL BE AS REQUIRED TO PREVENT SAG AND AS SPECIFIED BY THE FABRIC DUCT MANUFACTURER.
E. TURN BUCKLES SHALL BE PROVIDED FOR TENSIONING OF THE SUSPENSION CABLE.

2.7 ANCHORS AND INSERTS

A. CONCRETE ANCHORS SHALL NOT BE USED TO SUPPORT PIPING FROM CONCRETE CEILINGS OR WALLS WITHOUT THE PRIOR APPROVAL OF THE CM.
B. WHERE HANGER WEIGHT IS EXCESSIVE OR VIBRATION IS ANTICIPATED, THROUGH BOLTING TO THE CEILING SHALL BE UTILIZED.
C. BEFORE SUPPORTING NEW LOADS FROM EXISTING HANGERS, THE HANGERS SHALL BE INSPECTED AND ANALYZED FOR THE PROPOSED LOADS, BY A STRUCTURAL ENGINEER.

D. ALL NEW HANGER DESIGNS MUST BE REVIEWED AND APPROVED BY A STRUCTURAL ENGINEER.

E. IN ALL CASES, IT SHALL BE DETERMINED THAT THERE IS SUFFICIENT STRENGTH IN THE BUILDING CONSTRUCTION BEFORE DRILLING HOLES FOR HANGERS AND HANGER SYSTEMS. A DETERMINATION BY A STRUCTURAL ENGINEER AND APPROVAL BY THE CM SHALL BE MADE IF THROUGH-THE-WALL, THROUGH-THE-CEILING BOLTS FOR HANGERS, OR CONCRETE ANCHORS WILL BE USED.

F. INSERTS: PROVIDE MALLEABLE IRON CASE OF GALVANIZED STEEL SHELL AND EXPANDER PLUG FOR THREADED CONNECTION WITH LATERAL ADJUSTMENT, TOP SLOT FOR REINFORCING RODS, LUGS FOR ATTACHING TO FORMS; SIZE INSERTS TO SUIT THREADED HANGER RODS. WEDGE ANCHOR WITH ROD COUPLER (BOTH STAINLESS STEEL) MAY BE USED AS ALTERNATE.

G. INSULATED PANELS: PROVIDE STAINLESS STEEL "FAB-LOK" TYPE ANCHORS FOR ATTACHMENTS TO INSULATED PANELS.

H. CONCRETE CEILING PLANKS: WHERE ATTACHMENT TO CONCRETE FLOORS IS NECESSARY, THE TYPE OF CONCRETE ANCHOR TO BE USED IS “HILTI”. CONCRETE ANCHORS SHALL NOT BE USED TO SUPPORT PIPING FROM CEILINGS OR WALLS WITHOUT PRIOR APPROVAL BY THE ENGINEER. “HILTI” ADHESIVE TYPE CONCRETE ANCHORS ARE TO BE USED TO SUPPORT PIPING OR EQUIPMENT SUBJECT TO VIBRATION DURING OPERATION. IN ALL CASES, IT SHALL BE DETERMINED THAT THERE IS SUFFICIENT STRENGTH IN THE BUILDING CONSTRUCTION BEFORE DRILLING HOLES. A DETERMINATION BY THE ENGINEER SHALL BE MADE IF THROUGH-THE-WALL BOLTS SHOULD BE USED INSTEAD OF CONCRETE ANCHORS.

I. HILITI ANCHORS SHALL BE INSTALLED AS SHOWN IN DETAILS.

J. NOTES:

1. INTERNALLY THREADED INSERTS SHALL BE [HIS CARBON STEEL, HIS-R STAINLESS STEEL] AS MANUFACTURED BY HILTI INC. OR AND EQUAL APPROVED BY THE ENGINEER INSTALLED IN ACCORDANCE WITH THE MANUFACTURER’S SPECIFICATIONS.
2. THREADED ANCHORS SHALL BE [HAS-E CARBON STEEL, HAS –R 304 STAINLESS STEEL] AS MANUFACTURED BY HILTI INC. OR AND APPROVED EQUAL INSTALLED IN ACCORDANCE WITH THE MANUFACTURER SPECIFICATIONS.
3. ADHESIVE FOR [INTERNALLY THREADED INSERTS, THREADED ROD ANCHORS] SHALL BE HIT-HY 150 MAX AS MANUFACTURED BY HILTI INC. OR AN EQUAL APPROVED BY THE ENGINEER INSTALLED IN ACCORDANCE WITH THE MANUFACTURER’S SPECIFICATIONS.
4. ALL ALLOWABLE LOADS LISTED IN THE TABLE ARE UNFACTORED SERVICE LOADS.
5. ALL ALLOWABLE LOADS ARE BASED ON A MINIMUM CONCRETE COMPRESSIVE STRENGTH (F’C) OF 4000 PSI.
6. ALL ALLOWABLE LOADS ARE THE CAPACITY OF THE PROPERLY INSTALLED [INTERNALLY THREADED INSERTS, THREADED ROD ANCHORS]. THE ACTUAL LOADS MUST NOT EXCEED THE CAPACITY OF [THE THREADED ROD USED IN THE INSERT, THE HEX COUPLING NUT AND THREADED ROD ATTACHED TO THE THREADED ROD ANCHOR].
7. ALLOWABLE LOADS ARE FOR INDIVIDUAL ANCHORS. CLOSELY SPACED ANCHORS OR ANCHORS LOCATED CLOSE TO AN EDGE OF THE CONCRETE WILL RESULT IN REDUCED ALLOWABLE LOAD CAPACITY.
8. ALLOWABLE LOADS ARE TENSION LOADS ONLY. IF SHEAR LOADS ARE PRESENT ALLOWABLE TENSION LOAD WILL BE REDUCED.

2.8 HARDWARE

A. ALL HARDWARE AND FASTENERS SHALL MATCH THE SYSTEM MATERIALS FOR THE LOCATION OF INSTALLATION.

B. EXPOSED PROCESS AREAS: STAINLESS STEEL

C. EXPOSED NON-PROCESS: GALVANIZED STEEL.

2.9 FLASHING

A. METAL FLASHING: 26-GAUGE GALVANIZED STEEL

B. FLEXIBLE FLASHING: 47-MIL THICK SHEET BUTYL; COMPATIBLE WITH ROOFING

C. CAPS: STEEL, 22-GAUGE MINIMUM; USE 16-GAUGE AT FIRE RESISTANT ELEMENTS

2.10 EQUIPMENT BASES AND SUPPORTS

A. PREFABRICATED CURBS ARE TO BE FURNISHED WITH ROOF-MOUNTED EQUIPMENT. CONTRACTOR SHALL BE RESPONSIBLE FOR COORDINATING EXACT LOCATION. CURBS SHALL BE INSULATED WITH CLOSED CELL INSULATION AND LINED WITH GALVANIZED SHEET. NO FIBERGLASS INSULATION SHALL BE ALLOWED. CONTRACTOR SHALL BE RESPONSIBLE TO REPLACE ANY CURB PROVIDED WITH FIBERGLASS INSULATION.

B. PROVIDE TEMPLATES, ANCHOR BOLTS, AND ACCESSORIES FOR MOUNTING AND ANCHORING EQUIPMENT.

C. FINISHED ROOF CURB HEIGHT SHALL BE A MINIMUM 24 INCHES ABOVE ROOF DECK.

1. WHERE CURB ACCESS PANELS ARE REQUIRED THE CURB HEIGHT SHALL BE EXTENDED BY 18 INCHES.

D. PROVIDE GALVANIZED OR CADMIUM-PLATED WEDGE ANCHORS FOR ALL EQUIPMENT PLACED ON CONCRETE PADS OR CONCRETE SLABS, OF THE SIZE AND NUMBER RECOMMENDED BY THE EQUIPMENT MANUFACTURER.

2.11 SLEEVES

A. PROVIDE SLEEVES FOR DUCTS THROUGH NON-FIRE RATED FLOORS, BEAMS, WALLS, ABOVE GRADE (PROCESS AREAS): 16-GAUGE TYPE 304 STAINLESS STEEL.

B. PROVIDE FIRE-STOP COMPOUND AT ALL PENETRATIONS OF FLOOR SLABS OR FIREWALLS SUCH THAT FIRE RATING INTEGRITY OF BARRIER IS NOT LESSENED.

C. CAULK: CAULK ALL SLEEVES WATER AND AIRTIGHT FOR ROUGH-IN.

1. FINISH CAULKING ON EXPOSED AND EXTERIOR SURFACES SHALL BE BY OTHERS.

2.12 EXTERIOR FINISHES

A. PROVIDE GALVANIZED OR CADMIUM-PLATED STEEL MATERIALS FOR ALL HANGERS AND SUPPORTS THAT ARE OUTSIDE OR EXPOSED TO THE WEATHER. WIRE BRUSH, PRIME, AND PAINT ALL WELDS AND SAW CUTS WITH ZINC-RICH PRIMER PAINT.

2.13 MANUFACTUERS

A. ALLOWABLE MANUFACTURER OF PRODUCTS SHALL BE:

1. CONTRACTOR FABRICATED SUPPORT SYSTEM WITH CM APPROVAL
2. ADSCO
3. B-LINE
4. BEHRINGER
5. FEE & MASON
6. GATEWAY
7. GRIPPLE
8. ITT GRINNELL
9. METRAFLEX
10. MIRO INDUSTRIES
11. PIPE PIER
12. STAUFF

PART 3: EXECUTION

3.1 DUCTWORK HANGERS AND SUPPORTS

A. DUCTWORK HANGERS SHALL BE SPACED AS REQUIRED TO PREVENT SLACK AND NOT MORE THAN 10' O.C.

B. PROCESS AREAS:

1. ALL EXPOSED DUCTWORK IN PROCESS AREAS SHALL BE SUPPORTED USING STAINLESS STEEL ANGLES AND END-THREADED RODS. ALL NON-VERTICAL COMPONENTS SHALL BE OF A SHAPE AND ARRANGED IN SUCH A POSITION THAT NO FLAT SURFACE IS EXPOSED THAT WILL COLLECT DUST, DIRT OR DEBRIS.
2. SUPPORTS MAY BE ATTACHED TO DUCTWORK USING POP RIVETS OR SCREWS APPLIED FROM THE INTERIOR SUCH THAT HEADS ONLY ARE EXPOSED IN THE INTERIOR.

3. HANGER RODS SHALL BE END THREADED ONLY, WITH MAXIMUM EXPOSED 2 THREADS OR 0.25".
4. GRIPPLE HANGERS SHALL BE INSTALLED PER MANUFACTURERS INSTRUCITONS TO SUPPORT SYSTEMS WEIGHT.

C. CONCEALED SPACES:
1. DUCTWORK LOCATED ABOVE "WALK-ON CEILING" OVER PROCESS AREA NEED NOT BE CONSIDERED WITHIN PROCESS AREA AND SHALL BE SUPPORTED AS BELOW.
2. INSTALL GALVANIZED STEEL ANGLE. ALL CUT ENDS TO BE PRIMED AND PAINTED.
3. INSTALL HANGER RODS OF ALL-THREAD, OR THREADED ONE END ONLY, WITH NUT AND JAM NUT.

D. EXPOSED (SUCH AS MECHANICAL ROOMS, UTILITY AREAS, ELECTRICAL ROOMS, ETC.)
1. INSTALL SUPPORTS USING GALVANIZED ANGLE.
2. INSTALL HANGER RODS OF ALL-THREAD, OR THREADED ENDS ONLY, WITH NUT AND JAM NUT.

E. OFFICE AREAS:
1. INSTALL SUPPORTS USING SHEET METAL STRAPS OR ALL THREADED RODS AND STEEL SUPPORTS, SIZED PER SMACNA MINIMUM, ATTACHED TO DUCTWORK.

3.2 FLASHING

A. INSTALL FLEXIBLE FLASHING AND METAL COUNTER FLASHING WHERE SLEEVES, PIPING AND DUCTWORK PENETRATE WEATHER OR WATERPROOFED WALLS, FLOORS, AND ROOFS.

B. FLEXIBLE SHEET FLASH AND COUNTER FLASH ALL CURBS FOR MECHANICAL EQUIPMENT ON ROOF WITH SHEET METAL; SEAL WATERTIGHT. SEALING METHOD SHALL PREVENT WATER INFILTATION UNDER ALL WEATHER CONDITIONS.

C. ALL ROOF PENETRATION FLASHING AND COUNTER FLASHING SHALL COMPLETELY SEAL THE BUILDING'S INTERIOR FROM EXTERIOR. THERE SHALL BE NO VISIBLE LIGHT, OR MEANS OF WATER/INSECT INFILTRATION INTO THE BUILDING VIA THE PENETRATION.

3.3 HVAC EQUIPMENT BASES AND SUPPORTS

A. CONSTRUCT SUPPORT OF GALVANIZED STEEL MEMBERS. BRACE AND FASTEN WITH FLANGES BOLTED TO STRUCTURE.

B. GROUTING: PLACE GROUT UNDER SUPPORTS FOR EQUIPMENT AND MAKE SMOOTH BEARING SURFACE.

C. PROVIDE VIBRATION ISOLATION ON EQUIPMENT BASES AND SUPPORTS WHEN HANGING EQUIPMENT WITH AN INTERNAL MOTOR.

3.4 SLEEVES

A. PROVIDE AND INSTALL SLEEVES FOR ALL PIPE PENETRATIONS THROUGH WALLS, ROOF OR SLAB ABOVE GRADE.

B. SET SLEEVES IN POSITION IN FORM WORK. INSTALL REINFORCING AROUND SLEEVES.

C. SLEEVES TO BE FLUSH WITH FINISHED FLOOR LEVEL. CAULK SLEEVES FULL DEPTH AND PROVIDE FLOOR PLATE.

D. WHERE PIPING OR DUCTWORK PENETRATES FLOOR, CEILING OR WALL, CLOSE OFF SPACE BETWEEN PIPE OR DUCT AND ADJACENT WORK WITH FIRE STOPPING INSULATION AND SEAL AIR TIGHT. PROVIDE CLOSE FITTING METAL COLLAR OR ESCUTCHEON COVERS AT BOTH SIDES OF PENETRATION. WHEN PENETRATION IS THROUGH A FIRE RATED FLOOR OR WALL, PROVIDE FIRE-SAFE INSULATION SO THAT THE ASSEMBLY WHEN COMPLETE IS UL LISTED AND EQUALS THE FIRE RATING OF CONSTRUCTION PENETRATED BY THE SLEEVE.

E. INSTALL PERMANENT STAINLESS STEEL TRIM AT FINISHED SURFACES (ESCUTCHEONS ARE NOT ACCEPTABLE).

F. INSTALL SLEEVE ASSEMBLY FOR WALLS BELOW GRADE WITH 1/4 INCH THICK PLATE LOCATED IN THE MIDDLE OF THE WALL.

G. NEATLY CUT HOLES IN EXISTING WALLS, FLOORS AND ROOFS FOR PLACEMENT OF SLEEVES. PLACE SLEEVE AND GROUT, AND CAULK ANNULAR SPACE TO PROVIDE FINISHED APPEARANCE. FINAL FINSH CAULKING SHALL BE BY OTHERS.

H. INSTALL PIPE IN SLEEVE SO THAT NEITHER THE PIPE NOR ITS INSULATION TOUCHES THE SLEEVE AT ANY POINT.

I. SEAL SPACE BETWEEN PIPE AND SLEEVE WATERTIGHT FOR ALL SLEEVES PENETRATING THE ROOF.

3.5 ANCHOR BOLTS

A. LOCATE POSITION OF ANCHOR BOLTS BY MEANS OF SUITABLE TEMPLATES.

B. WHEN EQUIPMENT IS PLACED ON VIBRATION ISOLATORS, SECURE EQUIPMENT TO THE ISOLATOR AND THE ISOLATOR TO THE FLOOR, PAD OR SUPPORT AS RECOMMENDED BY THE VIBRATION ISOLATOR MANUFACTURER. UNLOCK AND “FLOAT” ALL VIBRATION ISOLATORS AFTER EQUIPMENT IS INSTALLED AND CONNECTED.

C. ALL ANCHORS SHALL BE INSTALLED TO ANCHOR MANUFACTURES’ RECOMMENDATIONS FOR ASSOCIATED LOAD BEARING WEIGHT.

3.6 METAL FABRICATION

A. CUT, DRILL, AND FIT MISCELLANEOUS METAL FABRICATIONS FOR HEAVY-DUTY STEEL TRAPEZES AND EQUIPMENT SUPPORTS.

B. FIT EXPOSED CONNECTIONS TOGETHER TO FORM HAIRLINE JOINTS. FIELD-WELD CONNECTIONS THAT CANNOT BE SHOP-WELDED BECAUSE OF SHIPPING SIZE LIMITATIONS.

C. FIELD WELDING: COMPLY WITH AWS D1.1 PROCEDURES FOR SHIELDED METAL ARC WELDING, APPEARANCE AND QUALITY OF WELDS, AND METHODS USED IN CORRECTING WELDING WORK, AND WITH THE FOLLOWING:

1. USE MATERIALS AND METHODS THAT MINIMIZE DISTORTION AND DEVELOP STRENGTH AND CORROSION RESISTANCE OF BASE METALS.
2. OBTAIN FUSION WITHOUT UNDERCUT OR OVERLAP.
3. REMOVE WELDING FLUX IMMEDIATELY.
4. FINISH WELDS AT EXPOSED CONNECTIONS SO NO ROUGHNESS SHOWS AFTER FINISHING AND CONTOURS OF WELDED SURFACES MATCH ADJACENT CONTOURS.

3.7 PAINTING

A. TOUCHING UP: CONTRACTOR SHALL CLEAN FIELD WELDS AND ABRADED AREAS OF SHOP PAINT. PAINT EXPOSED AREAS IMMEDIATELY AFTER ERECTING HANGERS AND SUPPORTS. USE SAME MATERIALS AS USED FOR SHOP PAINTING. COMPLY WITH SSPC-PA 1 REQUIREMENTS FOR TOUCHING UP FIELD-PAINTED SURFACES.

1. APPLY PAINT BY BRUSH OR SPRAY TO PROVIDE A MINIMUM DRY FILM THICKNESS OF 2.0 MILS.

B. GALVANIZED SURFACES: CONTRACTOR SHALL CLEAN WELDS, BOLTED CONNECTIONS, AND ABRADED AREAS AND APPLY GALVANIZING-REPAIR PAINT TO COMPLY WITH ASTM A 780.

END OF SECTION

SECTION 23 05 48

Vibration, Seismic, and Sound Control

PART 1: GENERAL

1.1 THE WORK OF THIS SECTION SHALL INCLUDE: REDUCTION OR ELIMINATION OF EXCESSIVE NOISE OR VIBRATION WITHIN BUILDING DUE TO OPERATION OF EQUIPMENT, MACHINERY, PIPING, AND DUCTWORK AS SPECIFIED.

- A. INERTIA BASES
- B. VIBRATION ISOLATION
- C. DUCT SOUND ATTENUATORS
- D. CROSS-TALK SILENCERS
- E. DUCTWORK LAGGING
- F. SEISMIC SNUBBERS
- G. ALL MECHANICAL EQUIPMENT, PIPING AND DUCTWORK AS NOTED ON THE EQUIPMENT SCHEDULE OR IN THE SPECIFICATION SHALL BE MOUNTED ON VIBRATION ISOLATORS TO PREVENT THE TRANSMISSION OF VIBRATION AND MECHANICALLY TRANSMITTED SOUND TO THE BUILDING STRUCTURE. VIBRATION ISOLATORS SHALL BE SELECTED IN ACCORDANCE WITH THE WEIGHT DISTRIBUTION SO AS TO PRODUCE REASONABLY UNIFORM DEFLECTIONS.
- H. ALL ISOLATORS AND ISOLATION MATERIALS SHALL BE OF THE SAME MANUFACTURER AND SHALL BE CERTIFIED BY THE MANUFACTURER.
- I. IT IS THE INTENT OF THE SEISMIC PORTION OF THIS SPECIFICATION TO KEEP ALL MECHANICAL AND ELECTRICAL BUILDING SYSTEM COMPONENTS IN PLACE DURING A SEISMIC EVENT.
- J. ALL SUCH SYSTEMS MUST BE INSTALLED IN STRICT ACCORDANCE WITH SEISMIC CODES, COMPONENT MANUFACTURERS AND BUILDING CONSTRUCTION STANDARDS. WHENEVER A CONFLICT OCCURS BETWEEN THE MANUFACTURERS OR CONSTRUCTION STANDARDS, THE MOST STRINGENT SHALL APPLY.
- K. THIS SPECIFICATION IS CONSIDERED TO BE MINIMUM REQUIREMENTS FOR SEISMIC CONSIDERATION AND IS NOT INTENDED AS A SUBSTITUTE FOR LEGISLATED, MORE STRINGENT, NATIONAL, STATE OR LOCAL CONSTRUCTION REQUIREMENTS.
- L. ANY VARIANCE OR NON-COMPLIANCE WITH THESE SPECIFICATION REQUIREMENTS SHALL BE CORRECTED BY THE CONTRACTOR IN AN APPROVED MANNER.
- M. SEISMIC RESTRAINTS SHALL BE DESIGNED IN ACCORDANCE WITH SEISMIC FORCE LEVELS AS NOTED ON THE SEISMIC CRITERIA SECTION OF THE STRUCTURAL DRAWINGS.

1.2 WORK INCLUDED BUT SPECIFIED ELSEWARE:

- A. SECTION 23 05 48 – HANGERS AND SUPPORTS
- B. SECTION 23 31 00 – DUCTWORK
- C. SECTION 23 33 00 – DUCTWORK ACCESSORIES: PRODUCT REQUIREMENTS FOR BOTH SOLID AND FLEXIBLE DUCT CONNECTORS FOR DUCT SILENCERS SPECIFIED FOR PLACEMENT BY THIS SECTION.

1.3 CODES AND STANDARDS:

- A. REFER TO 4730S1.001 FOR APPLICABLE SEICMIC CODES AND STANDARDS.
- B. NFPA, PAMPHLET 13
- C. SMACNA SEISMIC RESTRAINT MANUAL: GUIDELINES FOR MECHANICAL SYSTEMS
- D. VISCMA
  1. INSTALLING SEISMIC RESTRAINTS FOR MECHANICAL EQUIPMENT.
  2. INSTALLING SEISMIC RESTRAINTS FOR DUCT AND PIPE

1.4 SEISMIC REQUIREMENTS:

- A. REFER TO SEISMIC RESTRAINT MANUAL: GUIDELINES FOR MECHANICAL SYSTEMS, PUBLISHED BY SMACNA AND APPROVED BY DSA, FOR MINIMUM SEISMIC RESTRAINTS REQUIRED ON MECHANICAL COMPONENTS DESIGN AND CONSTRUCTION DETAILS.
- B. PROVIDE SEISMIC RESTRAINTS FOR MECHANICAL EQUIPMENT OR COMPONENTS SPECIFIED. WHERE EQUIPMENT IS SPECIFIED WITH PROPRIETARY NAMES, DESIGN FOR SEISMIC RESTRAINTS IS FOR FIRST PROPRIETARY NAME LISTED.

C. PROVIDE RESTRAINTS, BRACING AND ANCHORAGE AS REQUIRED FOR THE MECHANICAL EQUIPMENT, ELECTRICAL EQUIPMENT AND COMPONENTS SPECIFIED IN THE CONTRACT DOCUMENTS. RESTRAINTS, BRACING AND ANCHORAGE SHALL BE INSTALLED TO RESIST THE TOTAL DESIGN EARTHQUAKE OR WIND LOADS IN ANY DIRECTION IN ACCORDANCE WITH CBC AND SMACNA GUIDELINES.

D. PROVIDE RESTRAINTS, BRACING, AND ANCHORAGE FOR THE MECHANICAL EQUIPMENT AND COMPONENTS.

E. FOR RIGIDLY MOUNTED LIQUID FILLED STEEL PIPE, COMPLY WITH THE FOLLOWING:
   1. PROVISIONS OF NFPA PAMPHLET 13, SECTION FOR SWAY BRACING.
   2. PROVISIONS OF NFPA PAMPHLET 13, SECTION FOR EARTHQUAKE PROTECTION.
   3. HANGER SPACING AS SPECIFIED IN SECTION 23 0513 UNDER HANGER SPACING SCHEDULE.
   4. SMACNA SEISMIC RESTRAINT MANUAL: GUIDELINES FOR MECHANICAL SYSTEMS AND APPROVAL BY DSA.

F. FOR FLEXIBLY MOUNTED LIQUID FILLED STEEL PIPE, COMPLY WITH THE FOLLOWING:
   1. PROVISIONS OF VISCMA (VIBRATION ISOLATION AND SEISMIC CONTROL MANUFACTURER'S ASSOCIATION) SEISMIC CONTROL DEVICE INSTALLATION, BEST PRACTICES MANUALS.
   2. INSTALLER MAY PROVIDE A DSA OR OSHPD APPROVED SYSTEM SUCH AS THE SMACNA SEISMIC RESTRAINT MANUAL WITH ADDENDUM NO. 1, THE MASON INDUSTRIES SEISMIC RESTRAINT GUIDELINES OR OTHER PROPRIETARY PRE-APPROVED SYSTEM.

G. FOR DUCTWORK AND OTHER MECHANICAL EQUIPMENT RESTRAINTS, COMPLY WITH SMACNA SEISMIC RESTRAINT MANUAL: GUIDELINES FOR SEISMIC MECHANICAL SYSTEMS.

1.5 SUBMITTALS

A. SECTION 23 00 01 – MECHANICAL GENERAL PROVISIONS: SUBMITTAL PROCEDURES.

B. SHOP DRAWINGS: INDICATE INERTIA BASES AND LOCATE VIBRATION ISOLATORS, WITH STATIC AND DYNAMIC LOAD ON EACH. INDICATE ASSEMBLY, MATERIALS, THICKNESS, DIMENSIONAL DATA, PRESSURE LOSSES, ACOUSTICAL PERFORMANCE, LAYOUT, AND CONNECTION DETAILS FOR SOUND ATTENUATION PRODUCTS FABRICATED FOR THIS PROJECT.

C. PRODUCT DATA: SUBMIT SCHEDULE OF VIBRATION ISOLATOR TYPE WITH LOCATION AND LOAD ON EACH. PROVIDE CATALOG INFORMATION INDICATING, MATERIALS, DIMENSIONAL DATA, PRESSURE LOSSES, AND ACOUSTICAL PERFORMANCE FOR STANDARD SOUND ATTENUATION PRODUCTS.

D. DESIGN DATA: PROVIDE ENGINEERING CALCULATIONS MAXIMUM ROOM SOUND LEVELS ARE NOT EXCEEDED.

E. TEST REPORTS: INDICATE DYNAMIC INSERTION LOSS AND NOISE GENERATION VALUES OF SILENCERS.

F. MANUFACTURER'S INSTALLATION INSTRUCTIONS: SUBMIT SPECIAL PROCEDURES AND SETTING DIMENSIONS. INDICATE INSTALLATION REQUIREMENTS THAT MAINTAIN INTEGRITY OF SOUND ISOLATION.

G. MANUFACTURER'S CERTIFICATE: CERTIFY THAT ISOLATORS MEET OR EXCEED SPECIFIED REQUIREMENTS.

H. MANUFACTURER'S FIELD REPORTS: INDICATE SOUND ISOLATION INSTALLATION IS COMPLETE AND IN ACCORDANCE WITH INSTRUCTIONS.

I. THE MANUFACTURER OF VIBRATION ISOLATION AND SEISMIC RESTRAINTS SHALL PROVIDE SUBMITTALS FOR PRODUCTS AS FOLLOWS:
   1. DESCRIPTIVE DATA:
      a. CATALOG CUTS OR DATA SHEETS ON VIBRATION ISOLATORS AND SPECIFIC RESTRAINTS DETAILING COMPLIANCE WITH THE SPECIFICATION.

b. DETAILED SCHEDULES OF FLEXIBLE AND RIGIDLY MOUNTED EQUIPMENT, SHOWING VIBRATION ISOLATORS AND SEISMIC RESTRAINTS BY REFERENCING NUMBERED DESCRIPTIVE DRAWINGS.

2. SHOP DRAWINGS:
   a. SUBMIT FABRICATION DETAILS FOR EQUIPMENT BASES INCLUDING DIMENSIONS, STRUCTURAL MEMBER SIZES AND SUPPORT POINT LOCATIONS.
   b. PROVIDE ALL DETAILS OF SUSPENSION AND SUPPORT FOR CEILING SUSPENDED EQUIPMENT.
   c. WHERE WALLS, FLOORS, SLABS OR SUPPLEMENTARY STEEL WORK ARE USED FOR SEISMIC RESTRAINT LOCATIONS, DETAILS OF ACCEPTABLE ATTACHMENT METHODS FOR DUCTS, CONDUIT AND PIPE MUST BE INCLUDED AND APPROVED BEFORE THE CONDITION IS ACCEPTED FOR INSTALLATION. RESTRAINT MANUFACTURERS= SUBMITTALS MUST INCLUDE SPACING, STATIC LOADS AND SEISMIC LOADS AT ALL ATTACHMENT AND SUPPORT POINTS.
   d. PROVIDE SPECIFIC DETAILS OF SEISMIC RESTRAINTS AND ANCHORS; INCLUDE NUMBER, SIZE AND LOCATIONS FOR EACH PIECE OF EQUIPMENT.
3. SEISMIC CERTIFICATION AND ANALYSIS:
   a. SEISMIC RESTRAINT CALCULATIONS MUST BE PROVIDED FOR ALL CONNECTIONS OF EQUIPMENT TO THE STRUCTURE. CALCULATIONS MUST BE STAMPED BY A REGISTERED PROFESSIONAL ENGINEER WITH AT LEAST FIVE YEARS OF SEISMIC DESIGN EXPERIENCE, LICENSED IN THE STATE OF THE JOB LOCATION.
   b. ALL RESTRAINING DEVICES SHALL HAVE A PREAPPROVAL NUMBER FROM CALIFORNIA OSHPD OR SOME OTHER RECOGNIZED GOVERNMENT AGENCY SHOWING MAXIMUM RESTRAINT RATINGS. PREAPPROVALS BASED ON INDEPENDENT TESTING ARE PREFERRED TO PREAPPROVALS BASED ON CALCULATIONS. WHERE PREAPPROVED DEVICES ARE NOT AVAILABLE, SUBMITTALS BASED ON INDEPENDENT TESTING ARE PREFERRED. CALCULATIONS (INCLUDING THE COMBINING OF TENSILE AND SHEAR LOADINGS) TO SUPPORT SEISMIC RESTRAINT DESIGNS MUST BE STAMPED BY A REGISTERED PROFESSIONAL ENGINEER WITH AT LEAST FIVE YEARS OF SEISMIC DESIGN EXPERIENCE AND LICENSED IN THE STATE OF THE JOB LOCATION. TESTING AND CALCULATIONS MUST INCLUDE BOTH SHEAR AND TENSILE LOADS AS WELL AS ONE TEST OR ANALYSIS AT 45E TO THE WEAKEST MODE.
   c. ANALYSIS MUST INDICATE CALCULATED DEAD LOADS, STATIC SEISMIC LOADS AND CAPACITY OF MATERIALS UTILIZED FOR CONNECTIONS TO EQUIPMENT AND STRUCTURE. ANALYSIS MUST DETAIL ANCHORING METHODS, BOLT DIAMETER, EMBEDMENT AND/OR WELDED LENGTH. ALL SEISMIC RESTRAINT DEVICES SHALL BE DESIGNED TO ACCEPT, WITHOUT FAILURE, THE FORCES ACTING THROUGH THE EQUIPMENT CENTER OF GRAVITY. OVERTURNING MOMENTS MAY EXCEED FORCES AT GROUND LEVEL.

1.6 PERFORMANCE REQUIREMENTS AND MANUFACTURERS RESPONSIBILITY

A. MANUFACTURER'S RESPONSIBILITY:

1. MANUFACTURER OF VIBRATION ISOLATION AND SEISMIC CONTROL EQUIPMENT SHALL HAVE THE FOLLOWING RESPONSIBILITIES:
   a. DETERMINE VIBRATION ISOLATION AND SEISMIC RESTRAINT SIZES AND LOCATIONS.
   b. PROVIDE VIBRATION ISOLATION AND SEISMIC RESTRAINTS FOR EQUIPMENT AND COMPONENTS.
   c. PROVIDE CALCULATIONS AND MATERIALS IF REQUIRED FOR RESTRAINT OF UNISOLATED EQUIPMENT.

d. PROVIDE INSTALLATION INSTRUCTIONS, DRAWINGS AND TRAINED FIELD SUPERVISION TO INSURE PROPER INSTALLATION AND PERFORMANCE.

B. PROVIDE VIBRATION ISOLATION ON MOTOR DRIVEN EQUIPMENT OVER 0.5 HP, PLUS CONNECTED PIPING AND DUCTWORK.

1. PROVIDE MINIMUM STATIC DEFLECTION OF ISOLATORS FOR EQUIPMENT AS INDICATED.

a. UNDER 20 HP.

1) UNDER 400 RPM: 1 INCH
2) 400 600 RPM: 1 INCH
3) 600 800 RPM: 0.5 INCH
4) 800 900 RPM: 0.2 INCH
5) 1100 1500 RPM: 0.14 INCH
6) OVER 1500 RPM: 0.1 INCH

b. USE CONCRETE INERTIA BASES FOR FANS HAVING STATIC PRESSURE IN EXCESS OF 3.5 INCH WC OR MOTORS IN EXCESS OF 40 HP, AND ON BASE MOUNTED PUMPS OVER 10 HP.

c. MAINTAIN SOUND LEVEL OF SPACES AT LEVELS NOT TO EXCEED THOSE LISTED BELOW BY UTILIZING ACOUSTICAL DEVICES.

d. MAINTAIN ROOMS AT FOLLOWING MAXIMUM SOUND LEVELS, IN NOISE CRITERIA (NC) AS DEFINED BY ASHRAE HANDBOOK.

1) OFFICES

a) EXECUTIVE	25
b) CONFERENCE ROOMS	25
c) PRIVATE	30
d) OPEN PLAN AREAS	35
e) COMPUTER/BUSINESS MACHINE AREAS	40
f) PUBLIC CIRCULATION	45

1.7 QUALIFICATIONS

A. MANUFACTURER: COMPANY SPECIALIZING IN MANUFACTURING PRODUCTS SPECIFIED IN THIS SECTION WITH MINIMUM THREE YEARS DOCUMENTED EXPERIENCE.

B. INSTALLER: COMPANY SPECIALIZING IN PERFORMING WORK OF THIS SECTION WITH MINIMUM THREE YEARS DOCUMENTED EXPERIENCE.

C. DESIGN APPLICATION OF DUCT SILENCERS, ACOUSTIC HOUSINGS, SEISMIC SNUBBERS UNDER DIRECT SUPERVISION OF A PROFESSIONAL ENGINEER EXPERIENCED IN DESIGN OF THIS WORK AND LICENSED AT THE PLACE WHERE THE PROJECT IS LOCATED.

1.8 FIELD MEASUREMENTS

A. VERIFY FIELD MEASUREMENTS PRIOR TO FABRICATION.

B. SEISMIC FORCE LEVELS:

1. REFER TO 4730S1.001 FOR APPLICABLE FORCE LEVELS TO BE USED ON THIS PROJECT.

PART 2: PRODUCTS

2.1 INTENT: UNLESS SPECIFICALLY CALLED OUT HEREIN, ALL VIBRATION ISOLATORS AND SEISMIC RESTRAINTS DESCRIBED IN THIS SECTION SHALL BE THE PRODUCT OF A SINGLE MANUFACTURER. MASON INDUSTRIES' PRODUCTS ARE THE BASIS OF THESE SPECIFICATIONS; PRODUCTS OF OTHER MANUFACTURERS ARE ACCEPTABLE PROVIDED THEIR SYSTEMS STRICTLY COMPLY WITH THE SPECIFICATION AND HAVE THE APPROVAL OF THE SPECIFYING ENGINEER.

A. FOR THE PURPOSES OF THIS PROJECT, FAILURE IS DEFINED AS THE DISCONTINUANCE OF ANY ATTACHMENT POINT BETWEEN EQUIPMENT OR STRUCTURE, VERTICAL PERMANENT DEFORMATION GREATER THAN 1/8" AND/OR HORIZONTAL PERMANENT DEFORMATION GREATER THAT 1/4".

B. CURB MOUNTED ROOFTOP EQUIPMENT SHALL BE MOUNTED ON SPRING ISOLATION CURBS. THE LOWER MEMBER SHALL CONSIST OF A SHEET METAL OR STRUCTURAL STEEL SECTIONS CONTAINING ADJUSTABLE AND REMOVABLE STEEL SPRINGS THAT SUPPORT THE UPPER

FLOATING SECTION. THE UPPER FRAME MUST PROVIDE CONTINUOUS SUPPORT FOR THE EQUIPMENT AND MUST BE CAPTIVE SO AS TO RESILIENTLY RESIST WIND AND SEISMIC FORCES. ALL DIRECTIONAL NEOPRENE SNUBBER BUSHINGS SHALL BE A MINIMUM OF 1/4" THICK. STEEL SPRINGS SHALL BE LATERALLY STABLE AND REST ON 1/4" THICK NEOPRENE ACOUSTICAL PADS. HARDWARE MUST BE PLATED AND THE SPRINGS PROVIDED WITH A RUST RESISTANT FINISH. THE CURBS WATERPROOFING SHALL CONSIST OF A CONTINUOUS FLEXIBLE FLASHING NAILED OVER THE LOWER CURBS WATERPROOFING. ALL SPRING LOCATIONS SHALL HAVE ACCESSIBILITY TO ADJUST SPRINGS. LOWER CURBS SHALL HAVE PROVISION FOR 2" OF INSULATION. THE ROOF CURBS SHALL BE BUILT TO SEISMICALLY CONTAIN THE ROOFTOP UNIT. THE UNIT MUST BE SOLIDLY FASTENED TO THE TOP FLOATING RAIL, AND THE LOWER SECTION ANCHORED TO THE ROOF STRUCTURE. CURB SHALL HAVE ANCHORAGE PRE-APPROVAL FROM OSHPD IN THE STATE OF CALIFORNIA ATTESTING TO THE MAXIMUM CERTIFIED HORIZONTAL AND VERTICAL LOAD RATINGS. CURB SHALL BE TYPE SRSC OR RMSS AS MANUFACTURED BY MASON INDUSTRIES, INC

2.2 RECTANGULAR DUCT SILENCERS

A. MANUFACTURERS:
   1. IAC MODEL HLFS, OR OWNER / ENGINEER APPROVED EQUAL.

B. DESCRIPTION:
   1. OUTER CASING 22 GAUGE SHEET METAL.
   2. INTERIOR PARTITIONS MINIMUM 26 GAUGE PERFORATED SHEET METAL.
   3. SOUND ABSORBING INORGANIC GLASS FIBER FILL MATERIAL. FILL SHALL BE TOTALLY ENCAPSULATED IN POLYMER FILM 1.5 MIL THICKNESS.
   4. FABRICATE IN ACCORDANCE WITH SMACNA HVAC DUCT CONSTRUCTION STANDARDS METAL AND FLEXIBLE.
   5. FLAMESPREAD CLASSIFICATION OF 20. SMOKE DEVELOPMENT RATING OF 20.

C. PERFORMANCE RATING:
   1. REFER TO DRAWINGS:

2.3 VIBRATION ISOLATORS

A. RESTRAINED SPRING ISOLATORS:
   1. SPRING ISOLATORS:
      a. FOR EXTERIOR AND HUMID AREAS: PROVIDE HOT DIPPED GALVANIZED HOUSINGS AND NEOPRENE COATED SPRINGS.
      b. CODE: COLOR CODE SPRINGS FOR LOAD CARRYING CAPACITY.
   2. SPRINGS: MINIMUM HORIZONTAL STIFFNESS EQUAL TO 75 PERCENT VERTICAL STIFFNESS, WITH WORKING DEFLECTION BETWEEN 0.3 AND 0.6 OF MAXIMUM DEFLECTION.
   3. SPRING MOUNTS: PROVIDE WITH LEVELING DEVICES, MINIMUM 0.25 INCH THICK NEOPRENE SOUND PADS, AND ZINC CHROMATE PLATED HARDWARE.
   4. SOUND PADS: SIZE FOR MINIMUM DEFLECTION OF 0.05 INCH; MEET REQUIREMENTS FOR NEOPRENE PAD ISOLATORS.
   5. RESTRAINT: PROVIDE HEAVY MOUNTING FRAME AND LIMIT STOPS.

B. CLOSED SPRING ISOLATORS:
   1. SPRING ISOLATORS:
      a. FOR EXTERIOR AND HUMID AREAS: PROVIDE HOT DIPPED GALVANIZED HOUSINGS AND NEOPRENE COATED SPRINGS.
      b. CODE: COLOR CODE SPRINGS FOR LOAD CARRYING CAPACITY.
   2. TYPE: CLOSED SPRING MOUNT WITH TOP AND BOTTOM HOUSING SEPARATED WITH NEOPRENE RUBBER STABILIZERS.
   3. SPRINGS: MINIMUM HORIZONTAL STIFFNESS EQUAL TO 75 PERCENT VERTICAL STIFFNESS, WITH WORKING DEFLECTION BETWEEN 0.3 AND 0.6 OF MAXIMUM DEFLECTION.

4. HOUSINGS: INCORPORATE NEOPRENE ISOLATION PAD MEETING REQUIREMENTS FOR NEOPRENE PAD ISOLATORS, AND NEOPRENE SIDE STABILIZERS WITH MINIMUM 0.25 INCH CLEARANCE.

C. RESTRAINED CLOSED SPRING ISOLATORS:
1. SPRING ISOLATORS:
a. FOR EXTERIOR AND HUMID AREAS: PROVIDE HOT DIPPED GALVANIZED HOUSINGS AND NEOPRENE COATED SPRINGS.
b. CODE: COLOR CODE SPRINGS FOR LOAD CARRYING CAPACITY.
2. TYPE: CLOSED SPRING MOUNT WITH TOP AND BOTTOM HOUSING SEPARATED WITH NEOPRENE RUBBER STABILIZERS.
3. SPRINGS: MINIMUM HORIZONTAL STIFFNESS EQUAL TO 75 PERCENT VERTICAL STIFFNESS, WITH WORKING DEFLECTION BETWEEN 0.3 AND 0.6 OF MAXIMUM DEFLECTION.
4. HOUSINGS: INCORPORATE NEOPRENE ISOLATION PAD MEETING REQUIREMENTS FOR NEOPRENE PAD ISOLATORS, AND NEOPRENE SIDE STABILIZERS WITH MINIMUM 0.25 INCH CLEARANCE AND LIMIT STOPS.

D. SPRING HANGER:
1. SPRING ISOLATORS:
a. FOR EXTERIOR AND HUMID AREAS: PROVIDE HOT DIPPED GALVANIZED HOUSINGS AND NEOPRENE COATED SPRINGS.
b. CODE: COLOR CODE SPRINGS FOR LOAD CARRYING CAPACITY.
2. SPRINGS: MINIMUM HORIZONTAL STIFFNESS EQUAL TO 75 PERCENT VERTICAL STIFFNESS, WITH WORKING DEFLECTION BETWEEN 0.3 AND 0.6 OF MAXIMUM DEFLECTION.
3. HOUSINGS: INCORPORATE [NEOPRENE ISOLATION PAD MEETING REQUIREMENTS FOR NEOPRENE PAD ISOLATORS] [RUBBER HANGER WITH THREADED INSERT].
4. MISALIGNMENT: CAPABLE OF 20 DEGREE HANGER ROD MISALIGNMENT.

E. SEISMIC SNUBBERS:
1. TYPE: NON DIRECTIONAL AND DOUBLE ACTING UNIT CONSISTING OF INTERLOCKING STEEL MEMBERS RESTRAINED BY NEOPRENE ELEMENTS.
2. NEOPRENE ELEMENTS: REPLACEABLE, MINIMUM OF 0.75 INCH THICK.
3. CAPACITY: 4 TIMES LOAD ASSIGNED TO MOUNT GROUPINGS AT 0.4 INCH DEFLECTION.
4. ATTACHMENT POINTS AND FASTENERS: CAPABLE OF WITHSTANDING 3 TIMES RATED LOAD CAPACITY OF SEISMIC SNUBBER.

2.4 VIBRATION ISOLATION AND SEISMIC RESTRAINT OF DUCTWORK

A. VIBRATION ISOLATION OF DUCTWORK
1. ALL DISCHARGE RUNS FOR A DISTANCE OF 50' FROM THE CONNECTED EQUIPMENT SHALL BE ISOLATED FROM THE BUILDING STRUCTURE BY MEANS OF SPECIFICATION 10 HANGERS OR SPECIFICATION 5 FLOOR ISOLATORS. SPRING DEFLECTION SHALL BE A MINIMUM OF 0.75".
2. ALL DUCT RUNS HAVING AIR VELOCITY OF 1000 FPM OR MORE SHALL BE ISOLATED FROM THE BUILDING STRUCTURE BY SPECIFICATION 11 HANGERS OR 5 FLOOR SUPPORTS. SPRING DEFLECTION SHALL BE A MINIMUM OF 0.75".

B. SEISMIC RESTRAINT OF DUCTWORK
1. SEISMICALLY RESTRAIN ALL DUCTWORK WITH SPECIFICATION 12 OR 13 RESTRAINTS AS LISTED BELOW:
a. RESTRAIN RECTANGULAR DUCTS WITH CROSS SECTIONAL AREA OF 6 SQ.FT. OR LARGER
b. RESTRAIN ROUND DUCTS WITH DIAMETERS OF 28" OR LARGER
c. RESTRAIN FLAT OVAL DUCTS THE SAME AS RECTANGULAR DUCTS OF THE SAME NOMINAL SIZE

2. TRANSVERSE RESTRAINTS SHALL OCCUR AT 30' (9MM) INTERVALS OR AT BOTH ENDS OF THE DUCT RUN IF LESS THAN THE SPECIFIED INTERVAL. TRANSVERSE RESTRAINTS SHALL BE INSTALLED AT EACH DUCT TURN AND AT EACH END OF A DUCT RUN.
3. LONGITUDINAL RESTRAINTS SHALL OCCUR AT 60' (18M) INTERVALS WITH AT LEAST ONE RESTRAINT PER DUCT RUN. TRANSVERSE RESTRAINTS FOR ONE DUCT SECTION MAY ALSO ACT AS A LONGITUDINAL RESTRAINT FOR A DUCT SECTION CONNECTED PERPENDICULAR TO IT IF THE RESTRAINTS ARE INSTALLED WITHIN 4' (1.2M) OF THE INTERSECTION OF THE DUCTS AND IF THE RESTRAINTS ARE SIZED FOR THE LARGER DUCT. DUCT JOINTS SHALL CONFORM TO SMACNA DUCT CONSTRUCTION STANDARDS.
4. THE DUCTWORK MUST BE REINFORCED AT THE RESTRAINT LOCATIONS. REINFORCEMENT SHALL CONSIST OF AN ADDITIONAL ANGLE ON TOP OF THE DUCTWORK THAT IS ATTACHED TO THE SUPPORT HANGER RODS. DUCTWORK IS TO BE ATTACHED TO BOTH UPPER ANGLE AND LOWER TRAPEZE.
5. A GROUP OF DUCTS MAY BE COMBINED IN A LARGER FRAME SO THAT THE COMBINED WEIGHTS AND DIMENSIONS OF THE DUCTS ARE LESS THAN OR EQUAL TO THE MAXIMUM WEIGHT AND DIMENSIONS OF THE DUCT FOR WHICH BRACING DETAILS ARE SELECTED.
6. WALLS, INCLUDING GYPSUM BOARD NON BEARING PARTITIONS, WHICH HAVE DUCTS RUNNING THROUGH THEM MAY REPLACE A TYPICAL TRANSVERSE BRACE. PROVIDE CHANNEL FRAMING AROUND DUCTS AND SOLID BLOCKING BETWEEN THE DUCT AND FRAME.
7. CONNECTION TO THE STRUCTURE MUST BE MADE WITH A NON-FRICTION CONNECTION (I.E. NO CLAMPS)
8. HANGER LOCATIONS THAT ALSO HAVE SEISMIC RESTRAINTS ATTACHED MUST HAVE SPECIFICATION 10A TYPE RW REBOUND WASHERS

C. DUCTWORK EXCLUSIONS
1. RECTANGULAR AND SQUARE AND DUCTS THAT ARE LESS THAN 6 SQUARE FEET IN CROSS SECTIONAL AREA
2. OVAL DUCTS THAT ARE LESS THAN 6 SQUARE FEET IN CROSS SECTIONAL AREA BASED ON NOMINAL SIZE.
3. ROUND DUCT LESS THAN 28" IN DIAMETER.
4. ALL TRAPEZED DUCTWORK WHERE THE DISTANCE FROM THE SUSPENSION POINT TO THE TRAPEZE MEMBER IS 12" OR LESS
5. DUCTWORK HUNG WITH STRAPS WHERE THE TOP OF THE DUCT IS 12" OR LESS FROM THE SUSPENSION POINT AND THE STRAP HAS 2 #10 SHEET METAL SCREWS WITHIN 2" OF THE TOP OF THE DUCT
6. IF ANY SUSPENSION LOCATION IN THE RUN EXCEEDS THE ABOVE, THE ENTIRE RUN MUST BE BRACED

2.5 CROSS TALK SILENCERS, RETURN AIR TRANSFER

A. DESCRIPTION:
1. DUCT SECTIONS FOR RETURN AIR GRILLES DISCHARGING TO RETURN AIR PLENUM, LOCATED IN SOUND SENSITIVE AREAS INCLUDING CONFERENCE ROOMS AND PRIVATE OFFICES, AND WHERE SHOWN ON PLANS.
2. CROSS-TALK SILENCERS SHALL INCLUDE A MINIMUM OF TWO (2) RECTANGULAR ELBOWS TO CREATE EITHER A “U” SHAPED OR “Z” SHAPED CONFIGURATION.
3. SHEET METAL OUTER AND INNER CASING, SOUND ABSORBING FILL MATERIAL CONSTRUCTION. FABRICATE IN ACCORDANCE WITH SMACNA HVAC DUCT CONSTRUCTION STANDARDS METAL AND FLEXIBLE.

B. CONFIGURATION: RECTANGULAR, LINED WITH SPLITTERS WITH RADIUS NOSED AND CONTOURED TAILS.

C. MATERIALS:

1. OUTER CASING: MINIMUM 22 GAGE THICK GALVANIZED STEEL WITH MASTIC FILLED LOCK FORMED SEAMS, 3 INCH LONG, 11 GAGE SLIP JOINT ON BOTH ENDS.
2. INNER CASING AND SPLITTERS: MINIMUM 24 GAGE THICK PERFORATED GALVANIZED STEEL.
3. FILL: GLASS FIBER OR INORGANIC MINERAL FIBER OF MINIMUM 4 LB/CU FT DENSITY.

D. RATING:

1. STATIC PRESSURE DROP AT 400 FPM FACE VELOCITY: MAXIMUM OF .05 IN W.C. PER 100 FEET OF DUCT.

PART 3: EXECUTION

3.1 EXAMINATION

A. VERIFY THAT ALL EQUIPMENT, DUCTWORK AND PIPING THAT IS INSTALLED BEFORE WORK IN THIS SECTION BEGINS IS AS SHOWN ON THE PROJECT DRAWINGS.

3.2 EXISTING WORK (N.I.C.)

A. ENSURE ACCESS TO PIPING AND DUCTWORK AND OTHER INSTALLATIONS WHICH REMAIN ACTIVE AND WHICH REQUIRE ACCESS. MODIFY INSTALLATION OR PROVIDE ACCESS PANEL AS APPROPRIATE.

B. EXTEND EXISTING PIPING AND DUCTWORK INSTALLATIONS USING MATERIALS AND METHODS [COMPATIBLE WITH EXISTING ELECTRICAL INSTALLATIONS, OR] AS SPECIFIED.

3.3 INSTALLATION

A. GENERAL:

1. PROVIDE ISOLATORS, FLEXIBLE PIPE CONNECTORS, FLEXIBLE ELECTRICAL CONDUIT AND FLEXIBLE DUCT CONNECTORS AT ALL MOVING MECHANICAL SYSTEM COMPONENTS TO PREVENT TRANSMISSION OF VIBRATION NOISE TO ANY PART OF BUILDING WHETHER INDICATED ON THE DRAWINGS OR NOT.
2. INSTALL ISOLATORS TO SUIT IMPOSED LOAD AND THE VIBRATION FREQUENCY TO BE ABSORBED. ISOLATOR UNITS SHALL FURNISH ADEQUATE STRENGTH AND FLEXIBILITY TO EXHIBIT PROPER RESILIENCY UNDER MACHINE LOAD AND IMPACT WITHOUT PERMITTING EXCESSIVE MOVEMENT WHEN STARTING.
3. WHERE COMMERCIAL VIBRATION ISOLATOR AND SEISMIC RESTRAINT UNITS ARE SPECIFIED, FURNISH MANUFACTURER'S STANDARD CATALOG PRODUCTS WITH PRINTED LOADING RATINGS, OR PROVIDE SUBSTANTIATING CALCULATIONS
4. ALL VIBRATION ISOLATORS AND SEISMIC RESTRAINT SYSTEMS MUST BE INSTALLED IN STRICT ACCORDANCE WITH THE MANUFACTURERS WRITTEN INSTRUCTIONS AND ALL CERTIFIED SUBMITTAL DATA.
5. INSTALLATION OF VIBRATION ISOLATORS AND SEISMIC RESTRAINTS MUST NOT CAUSE ANY CHANGE OF POSITION OF EQUIPMENT, PIPING OR DUCTWORK RESULTING IN STRESSES OR MISALIGNMENT.
6. NO RIGID CONNECTIONS BETWEEN EQUIPMENT AND THE BUILDING STRUCTURE SHALL BE MADE THAT DEGRADES THE NOISE AND VIBRATION CONTROL SYSTEM HEREIN SPECIFIED.
7. THE CONTRACTOR SHALL NOT INSTALL ANY EQUIPMENT, PIPING, DUCT OR CONDUIT WHICH MAKES RIGID CONNECTIONS WITH THE BUILDING UNLESS ISOLATION IS NOT SPECIFIED. BUILDING INCLUDES, BUT IS NOT LIMITED TO, SLABS, BEAMS, COLUMNS, STUDS AND WALLS.
8. ANY CONFLICTS WITH OTHER TRADES WHICH WILL RESULT IN RIGID CONTACT WITH EQUIPMENT OR PIPING DUE TO INADEQUATE SPACE OR OTHER UNFORESEEN CONDITIONS SHOULD BE BROUGHT TO THE ARCHITECTS/ENGINEERS ATTENTION PRIOR TO INSTALLATION. CORRECTIVE WORK NECESSITATED BY CONFLICTS AFTER INSTALLATION SHALL BE AT THE RESPONSIBLE CONTRACTORS EXPENSE.
9. BRING TO THE ARCHITECTS/ENGINEERS ATTENTION ANY DISCREPANCIES BETWEEN THE SPECIFICATIONS AND THE FIELD CONDITIONS OR CHANGES REQUIRED DUE TO SPECIFIC

EQUIPMENT SELECTION, PRIOR TO INSTALLATION. CORRECTIVE WORK NECESSITATED BY DISCREPANCIES AFTER INSTALLATION SHALL BE AT THE RESPONSIBLE CONTRACTORS EXPENSE.

10. CORRECT, AT NO ADDITIONAL COST, ALL INSTALLATIONS WHICH ARE DEEMED DEFECTIVE IN WORKMANSHIP AND MATERIALS AT THE CONTRACTORS EXPENSE.
11. AIR HANDLING EQUIPMENT AND CENTRIFUGAL FANS SHALL BE PROTECTED AGAINST EXCESSIVE DISPLACEMENT WHICH RESULTS FROM HIGH AIR THRUST IN RELATION TO THE EQUIPMENT WEIGHT.
12. ALL MECHANICAL EQUIPMENT SHALL BE VIBRATION ISOLATED AND SEISMICALLY RESTRAINED.

B. DUCT SILENCERS:
   1. SHALL BE INSTALLED LEVEL AND TRUE.
   2. SUPPORT DUCT SILENCERS INDEPENDENTLY OF THE COMPANION DUCTWORK.
   3. SILENCERS INLETS AND OUTLETS SHALL BE TEMPORARILY CAPPED WHEN IN STORAGE TO PREVENT ACCUMULATION OF DEBRIS.
   4. INLET AND OUTLET TRANSITIONS SHALL BE AS RECOMMENDED BY THE MANUFACTURER.
   5. RECTANGULAR SILENCER SIZES SCHEDULED THAT ARE NON-STANDARD MODULE SIZES, SHALL BE BUILT UP IN BANKS FROM STANDARD MODULE SIZES.
   6. SILENCERS SHALL BE ATTACHED TO COMPANION DUCTWORK WITH FLANGED CONNECTION.

C. INSTALL CROSS TALK SILENCERS IN SOUND SENSITIVE AREAS INCLUDING CONFERENCE ROOMS AND PRIVATE OFFICES WALL. CAULK WALL PENETRATIONS.

D. LAG DUCTWORK, WHERE SOUND SPECIFICATION IS NOT MET, BY WRAPPING WITH INSULATION AND COVERING. APPLY COVERING TO BE AIRTIGHT. DO NOT ATTACH COVERING RIGIDLY TO DUCTWORK.

E. INSTALL ISOLATION FOR MOTOR DRIVEN EQUIPMENT.
   1. BASES:
   2. SET STEEL BASES FOR 1-INCH CLEARANCE BETWEEN HOUSEKEEPING PAD AND BASE.
   3. SET CONCRETE INERTIA BASES FOR 2-INCH CLEARANCE BETWEEN HOUSEKEEPING PAD AND BASE.
   4. ADJUST EQUIPMENT LEVEL.

F. INSTALL SPRING HANGERS WITHOUT BINDING ON SUSPENDED INLINE FANS.

G. PROVIDE SEISMIC SNUBBERS ON ROOF MOUNTED UTILITY FANS.

3.4 FIELD QUALITY CONTROL

A. INSPECT ISOLATED EQUIPMENT AFTER INSTALLATION AND SUBMIT REPORT. INCLUDE STATIC DEFLECTIONS.

B. ARRANGE FOR THE SERVICES OF A CERTIFIED REPRESENTATIVE OF ISOLATION MANUFACTURER TO VISIT THE PROJECT SITE FOR INSPECTING INSTALLATION OF DEVICES. IN THE EVENT THE ISOLATORS DO NOT MEET SPECIFIED REQUIREMENTS PERFORM NECESSARY REVISIONS. SUBMIT A WRITTEN REPORT TO THE ARCHITECT, SIGNED BY ABOVE REPRESENTATIVE, INDICATING ALL DEVICES ARE PROPERLY INSTALLED AND ARE OPERATING AS SPECIFIED OR REQUIRED BY ISOLATION MANUFACTURER.

C. AFTER START UP, FINAL CORRECTIONS AND BALANCING OF SYSTEMS TAKE OCTAVE BAND SOUND MEASUREMENTS OVER FULL AUDIO FREQUENCY RANGE IN AREAS ADJACENT TO MECHANICAL EQUIPMENT ROOMS, DUCT AND PIPE SHAFTS, AND OTHER CRITICAL LOCATIONS, AS DIRECTED. PROVIDE ONE THIRD OCTAVE BAND MEASUREMENTS OF ARTIFICIAL SOUND SOURCES IN AREAS INDICATED AS HAVING CRITICAL REQUIREMENTS. SUBMIT COMPLETE REPORT OF TEST RESULTS INCLUDING SOUND CURVES.

END OF SECTION

SECTION 23 05 53

MECHANICAL INDENTIFICATION

PART 1: GENERAL

1.1 THE WORK OF THIS SECTION SHALL INCLUDE:

A. WORK INCLUDED: APPLIES TO CONTRACTOR APPLIED IDENTIFICATION OF MECHANICAL SYSTEM'S VISUAL IDENTIFICATION LABELS, SIGNS, AND/OR TAGS. INCLUDED, BUT NOT LIMITED TO, THE FOLLOWING DEVICES AND/OR COMPONENTS:

1. MECHANICAL HVAC EQUIPMENT (RTU, AHU, VAV, ETC.) – ALL SCHEDULED EQUIPMENT
2. DUCTWORK
3. MOTOR OPERATED DAMPERS
4. CONTROL DEVISES
5. CONTROL VALVES
6. FILTER HOUSINGS
7. REFRIGERANT PIPING
8. CONDENSATE DRAIN PIPING

1.2 NOT INCLUDED IN THIS SECTION:

A. ELECTRICAL POWER EQUIPMENT IDENTIFICATION.
B. PROCESS EQUIPMENT IDENTIFICATION.
C. DATA PLATE IDENTIFICATION APPLIED BY AN EQUIPMENT MANUFACTURE.

1.3 QUALITY ASSURANCE

A. ASME A13.1 - SCHEME FOR THE IDENTIFICATION OF PIPING SYSTEMS.

1.4 SUBMITTALS

A. SUBMIT SAMPLES OF PRODUCTS, TAGS, LABELS AND PAINT DATA.
B. SUBMIT EQUIPMENT CHARTS AND SCHEDULES INCLUDING TAG NUMBER, LOCATION, TYPE, MANUFACTURER'S NAME, AND MODEL NUMBER.
C. SUBMIT PRODUCT DATA AND INSTALLATION INSTRUCTIONS FOR EACH ITEM SPECIFIED.

1.5 MISCELLANEOUS

A. CONTRACTOR SHALL PROVIDE A MINIMUM OF 15 % EXCESS OVER THE AMOUNT USED BY THE CONTRACTOR OF ALL IDENTIFICATION MATERIALS TO THE OWNER.

PART 2: PRODUCTS

2.1 MANUFACTURERS

A. ALL SELF-ADHESIVE LABELS USED IN THE FACILITY SHALL BE BRADY B 946 SELF-STICKING VINYL, SETON, OR OWNER APPROVED EQUAL.
B. SIGNS USED IN PRODUCTION AREAS OF THE FACILITY SHALL BE BRADY B 120 OR OWNER APPROVED EQUAL.

2.2 EQUIPMENT NAMEPLATES

A. DESCRIPTION: LAMINATED THREE-LAYER PLASTIC WITH ENGRAVED BLACK LETTERS ON LIGHT CONTRASTING BACKGROUND COLOR MINIMUM 2 INCHES HIGH BY 4 INCHES WIDE. SECURE TO EQUIPMENT WITH ADHESIVE.
B. ALL COMPONENT TAGS SHALL AS MANUFACTURED BY MARKING SERVICES, INCORPORATED (MSI) OR EQUAL BE ATTACHED TO DEVICE WITH WIRE MSI #15747 CRIMPED WITH SWAG #15746, SEE BELOW
    1. MARKING SERVICES, INCORPORATED OR APPROVED EQUAL
        a. PH: 800.234.0135 (WWW.MARKSERV.COM)
C. TAPE MARKERS:
    1. FLEXIBLE, VINYL FILM TAPE WITH PRESSURE SENSITIVE ADHESIVE BACKING AND PRINTED MARKINGS.
    2. EQUIPMENT MARKERS SHALL BE HAVE 3.5" INCH SYMBOLS AND LETTERS FOR INTERIOR APPLICATIONS AND EXTERIOR APPLICATIONS.

2.3 DUCT AND DUCT ACCESSORIES SERVICE MARKERS

A. TAPE MARKERS:
    1. FLEXIBLE, VINYL FILM TAPE WITH PRESSURE SENSITIVE ADHESIVE BACKING AND PRINTED MARKINGS.

2. DIRECTION OF FLOW ARROWS SHALL BE PROVIDED FOR DUCTWORK.
3. DUCTWORK SERVICE MARKERS SHALL BE HAVE 2.5”-3.5” INCH SYMBOLS AND LETTERS.

B. COLOR AND LETTERING FOR PIPING / DUCT SYSTEMS TO CONFORM TO ASME A13.1, UNLESS THERE IS AN EXISTING PLANT STANDARD, WHICH SHALL BE FOLLOWED.

2.4 IDENTIFICATION OF AIR CONDITIONING EQUIPMENT

A. PROVIDE IDENTIFICATION MARKERS TO LOCATE AIR CONDITIONING EQUIPMENT ABOVE T-BAR CEILINGS. INSTALL 3/4 INCH TO ONE INCH DIAMETER COLORED SELF-ADHESIVE DOTS TO T-BAR CEILING GRID INDICATING POINT OF ACCESS. THE FOLLOWING IDENTIFICATION MARKERS SHALL BE RECORDED ON THE PROJECT RECORD DOCUMENTS:
   1. FIRE DAMPER AND COMBINATION FIRE/SMOKE FIRE DAMPER: RED.
   2. MANUAL VOLUME DAMPERS, RELIEF DAMPERS, MOTORIZED VOLUME DAMPERS: BLUE.
      a. SUPPLY AIR: FULL DOT.
      b. RETURN AIR: HALF DOT.
   3. FAN COIL UNIT: GREEN.
   4. FILTER LOCATION IF SEPARATE FROM FAN COIL: YELLOW.

PART 3: EXECUTION

3.1 EXAMINATION AND PREPARATION

A. DEGREASE AND CLEAN SURFACES TO RECEIVE ADHESIVE FOR IDENTIFICATION MATERIALS.
B. EQUIPMENT MUST BE PAINTED AND INSULATED PER SPECIFICATIONS BEFORE INSTALLING IDENTIFICATION.

3.2 INSTALLATION

A. SIGNS, NAMEPLATES, IDENTIFICATION TAGS, AND LIKE SHALL BE SECURED TO THE EQUIPMENT. METHOD OF SECURING EACH TYPE SHALL BE APPROVED BY PLANT MANAGER.
B. INSTALL IDENTIFYING DEVICES AFTER COMPLETION OF COVERINGS AND PAINTING.
C. IDENTIFICATION SHALL BE INSTALLED SO AS NOT TO CREATE VOIDS OR HARBORAGES, INCLUDING INACCESSIBLE SPACES BEHIND TAGS OR LABELS. ALL SPACES MUST BE EASILY ACCESSIBLE FOR CLEANING OR MUST BE HERMETICALLY SEALED.
D. INSTALLATION OF MECHANICAL IDENTIFICATION LABELS, SIGNS, AND/OR TAGS IS TO BE COORDINATED WITH OTHER CRAFTS TO INSURE PROPER AND TIMELY INSTALLATION.
E. PAINTING SHALL BE ALLOWED FOR IDENTIFICATION IN NON-PROCESS AREAS.
F. MECHANICAL EQUIPMENT
   1. ALL MECHANICAL EQUIPMENT LOCATED OUTSIDE OF PROCESS AREAS SHALL BE IDENTIFIED BY:
      a. PLASTIC NAMEPLATES / LABELS WITH CORROSIVE-RESISTANT MECHANICAL FASTENERS, OR ADHESIVE.
   2. ALL MECHANICAL EQUIPMENT LOCATED WITHIN PROCESS AREAS SHALL BE IDENTIFIED BY:
      a. ENGRAVED NAMEPLATES WITHOUT ANY VOIDS OR HARBORAGES UNLESS HERMETICALLY SEALED TO THE ATTACHED SURFACE BY WELDING.
      b. LASER ETCHED STAINLESS STEEL
   3. IDENTIFY CONTROL PANELS AND MAJOR CONTROL COMPONENTS OUTSIDE PANELS WITH PLASTIC NAMEPLATES.
   4. HAND HELD ETCHING IS UNACCEPTABLE.
G. DUCTWORK
   1. IDENTIFY DUCTWORK INCLUDING PROCESS DUCTWORK, CONCEALED OR EXPOSED, WITH PLASTIC TAPE MARKERS. THE LETTERS SHALL BE AT LEAST THREE (3) INCHES HIGH AND THE FLOW ARROW SHALL BE AT LEAST SIX (6) INCHES LONG.
   2. ALL DUCTWORK SHALL BE IDENTIFIED AS TO THE HVAC UNIT SERVING THE DUCT, SERVICE (SUPPLY, RETURN, EXHAUST) AND THE DIRECTION OF THE FLOW.

3. INSTALL IN CLEAR VIEW AND ALIGN WITH AXIS OF DUCTWORK. LOCATE IDENTIFICATION NOT TO EXCEED 50 FEET ON STRAIGHT RUNS, ADJACENT TO EACH SIDE OF PENETRATION OF STRUCTURE OR ENCLOSURE, AND AT EACH OBSTRUCTION.
4. NO PAINTING IS ALLOWED IN PROCESS SPACES.

3.3 SCHEDULES

A. THE FOLLOWING EQUIPMENT AND AIR DUCT SYSTEMS SHALL BE IDENTIFIED AS SPECIFIED HEREIN UNLESS THERE IS AN EXISTING FACILITY STANDARD WHICH TAKES PRECEDENCE:

1. HVAC SUPPLY AIR – BLUE / WHITE LETTERING.
2. HVAC RETURN AIR – GREEN / WHITE LETTERING.
3. HVAC EXHAUST AIR – WHITE / BLACK LETTERING.
4. HVAC FUME HOOD EXHAUST - WHITE / BLACK LETTERING.
5. HVAC EQUIPMENT, VALVES, DAMPERS, SMOKE DETECTOR AND ACCESSORIES – WHITE / BLUE LETTERING.
6. HVAC REFRIGERANT PIPING – YELLOW / BLACK LETTERING
7. HVAC CONDENSATE DRAIN PIPING – WHITE / BLUE LETTERING.

END OF SECTION

SECTION 23 05 93

TESTING, ADJUSTING, & BALANCING

PART 1: GENERAL

1.1 THE SCOPE OF THIS SECTION SHALL INCLUDE

A. THE WORK UNDER THIS CONTRACT SHALL ALSO INCLUDE ALL LABOR, MATERIALS, TOOLS, EQUIPMENT, TRANSPORTATION, INSURANCE, TEMPORARY PROTECTION, SUPERVISION AND INCIDENTAL ITEMS ESSENTIAL FOR PROPER INSTALLATION AND OPERATION, EVEN THOUGH NOT SPECIFICALLY MENTIONED OR INDICATED ON THE DRAWINGS BUT WHICH ARE USUALLY PROVIDED OR ARE ESSENTIAL FOR PROPER INSTALLATION AND OPERATION OF ALL SYSTEMS AS INDICATED ON THE DRAWINGS AND SPECIFIED HEREIN.

B. THE WORK SHALL BE COMPLETED IN ACCORDANCE WITH THE CONTRACT SCHEDULE ESTABLISHED BY THE CONSTRUCTION MANAGER AND THE GENERAL CONTRACTOR.

C. THE SPECIFICATIONS AND DRAWINGS DESCRIBE THE MINIMUM REQUIREMENTS THAT MUST BE MET BY CONTRACTOR FOR THE INSTALLATION OF ALL WORK AS SHOWN ON THE DRAWINGS AND AS SPECIFIED HEREIN.

D. WORK INCLUDED:

1. THIS SECTION INCLUDES ALL AIR TESTING, ADJUSTING AND BALANCING FOR THE ENTIRE PROJECT. THIS WORK WILL BE SUBCONTRACTED BY THE CONTRACTOR. INCLUDED ARE THE FOLLOWING TOPICS:
    a. SAMPLE REPORT.
    b. FILTERS
    c. CONSTANT VOLUME ROOFTOP UNITS
    d. VARIABLE AIR VOLUME ROOFTOP UNITS
    e. TERMINAL HEATING AND COOLING UNITS
    f. AIR COILS
    g. EXHAUST FANS
    h. SUPPLY FANS
    i. AIR FILTERS
    j. AIR TERMINAL UNITS
    k. AIR INLETS AND OUTLETS
    l. LOUVERS
    m. ELECTRIC UNIT HEATERS
    n. FAN COIL UNITS
    o. DAMPERS/DIFFUSERS
    p. CONTROL SYSTEMS VERIFICATION.

1.2 REFERENCE

A. APPLICABLE PROVISIONS OF THE GENERAL CONDITIONS, SUPPLEMENTARY GENERAL CONDITIONS AND GENERAL REQUIREMENTS IN DIVISION 1 GOVERN WORK UNDER THIS SECTION.

1.3 REFERENCE STANDARDS

A. AABC - NATIONAL STANDARDS FOR TESTING AND BALANCING HEATING, VENTILATING, AND AIR CONDITIONING SYSTEMS, CURRENT EDITION.

B. ASHRAE HANDBOOK - HVAC SYSTEMS AND APPLICATIONS, TESTING ADJUSTING AND BALANCING.

C. NEBB - PROCEDURAL STANDARDS FOR TESTING ADJUSTING BALANCING OF ENVIRONMENTAL SYSTEMS, CURRENT EDITION.

1.4 DESCRIPTION

A. THE CONTRACTOR SHALL AWARD A SUBCONTRACT TO A 3RD PARTY INDEPENDENT TEST AND BALANCE AGENCY TO PERFORM ALL TESTING, ADJUSTING, AND BALANCING OF ALL AIR SYSTEMS REQUIRED FOR THIS PROJECT. WORK RELATED TO THE TESTING, ADJUSTING, AND BALANCING THAT MUST BE PERFORMED BY THE CONTRACTOR IS SPECIFIED IN OTHER SECTION OF THESE SPECIFICATIONS.

B. THE 3RD PARTY AGENCY SHALL SPECIALIZE IN TESTING, ADJUSTING AND BALANCING OF SYSTEMS SPECIFIED IN THIS SPECIFICATION AND MECHANCIAL DRAWINGS. THE AGENCY SHALL HAVE A MINIMUM OF 5 YEARS DOCUMENTED EXPERIENCE CERTIFED BY AABC AND NEBB. ALL

WORK SHALL BE PERFORMED UNDER THE SUPERVISION OF AN NEBB OR AABCCERTIFIED TEST AND BALANCE ENGINEER.

C. PROVIDE TOTAL MECHANICAL SYSTEMS TESTING, ADJUSTING AND BALANCING. REQUIREMENTS INCLUDE THE BALANCE OF AIR DISTRIBUTION, ADJUSTMENT OF NEW AND EXISTING SYSTEMS TO PROVIDE DESIGN QUANTITIES INDICATED ON THE DRAWINGS, ELECTRICAL MEASUREMENT AND VERIFICATION OF PERFORMANCE OF ALL EQUIPMENT, ALL IN ACCORDANCE WITH STANDARDS PUBLISHED BY AABC OR NEBB.

D. TEST, ADJUST AND BALANCE ALL AIR SYSTEMS SO THAT EACH ROOM, PIECE OF EQUIPMENT OR TERMINAL DEVICE IS USING THE QUANTITIES INDICATED ON THE DRAWINGS AND IN THE SPECIFICATIONS.

E. ACCOMPLISH TESTING, ADJUSTING AND BALANCING WORK IN A TIMELY MANNER THAT ALLOWS PARTIAL OCCUPANCY OF MAJOR AREAS, OCCUPANCY OF ONE PART OF THE BUILDING WHEN THE BUILDING IS UNDER CONSTRUCTION OR RENOVATION, AND COMPLETION OF THE ENTIRE PROJECT IN THE TIME STATED IN THE INSTRUCTION TO BIDDERS AND IN ACCORDANCE WITH THE COMPLETION SCHEDULE ESTABLISHED FOR THIS PROJECT.

F. THE TEST AND BALANCE AGENCY IS ENCOURAGED TO MAKE PERIODIC SITE VISITS TO MAKE SURE THAT PROVISIONS ARE BEING MADE TO ACCOMPLISH THE SPECIFIED TESTING, ADJUSTING AND BALANCING WORK. IF PROBLEMS ARE FOUND, HANDLE AS SPECIFIED IN PART 3 UNDER DEFICIENCIES.

1.5 RELATED WORK

A. SECTION 23 00 01 - MECHANICAL GENERAL PROVISIONS, SHOP DRAWINGS TO BE GIVEN TO THE TEST AND BALANCE AGENCY AND FOR COORDINATION BETWEEN THE DIVISION 23 CONTRACTOR(S) AND THE FIRM(S) PERFORMING THE WORK IN THIS SECTION.

B. DIVISION 23 DRAWINGS AND SPECIFICATIONS WHICH DEFINE THE SCOPE OF THE SYSTEMS TO BE BALANCED. REFER TO CONSTRUCTION BULLETINS FOR PROPOSED CHANGES AND TO CHANGE ORDERS FOR CHANGES THAT HAVE BEEN ACCEPTED.

C. DRAWINGS AND SPECIFICATIONS WHICH DEFINE THE SCOPE OF THE ELECTRICAL SYSTEMS THAT SERVE THE MECHANICAL EQUIPMENT.

1.6 PRE-INSTALLATION MEETING

A. TEST AND BALANCE AGENCY WILL BE REQUIRED TO ATTEND A PRE-INSTALLATION MEETING WITH ALL OTHER PROJECT CONTRACTORS BEFORE THE CONSTRUCTION PROCESS IS STARTED. THE TEST AND BALANCE AGENCY SHOULD BE PREPARED TO GIVE INPUT ON THE TIME REQUIREMENTS FOR THE WORK REQUIRED IN THIS SECTION. THE BALANCE AGENCY SHALL TURN THE SAMPLE BALANCE REPORT OVER TO ENGINEER FOR REVIEW AND COMMENTS PERTAINING TO SPECIFIC FACILITY.

1.7 PRE-BALANCE CONFERENCE

A. PRIOR TO BEGINNING TESTING, ADJUSTING AND BALANCING, SCHEDULE AND CONDUCT A CONFERENCE WITH THE ARCHITECT/ENGINEER, CONSTRUCTION MANAGER, AND THE MECHANICAL SYSTEM AND TEMPERATURE CONTROL SYSTEM INSTALLING CONTRACTORS. THE OBJECTIVE IS FINAL COORDINATION AND VERIFICATION OF SYSTEM OPERATION AND READINESS FOR TESTING, ADJUSTING AND BALANCING PROCEDURES AND SCHEDULING PROCEDURES WITH THE ABOVE MENTIONED PARTIES. INDICATE WORK REQUIRED TO BE COMPLETED PRIOR TO TESTING, ADJUSTING, AND BALANCING AND IDENTIFY THE PARTY RESPONSIBLE FOR COMPLETION OF THAT WORK.

1.8 SUBMITTALS

A. SUBMIT TESTING, ADJUSTING AND BALANCING REPORTS BEARING THE SEAL AND SIGNATURE OF THE NEBB OR AABC CERTIFIED TEST AND BALANCE SUPERVISOR. THE REPORTS TO BE CERTIFIED PROOF THAT THE SYSTEMS HAVE BEEN TESTED, ADJUSTED AND BALANCED IN ACCORDANCE WITH THE REFERENCED STANDARDS; ARE AN ACCURATE REPRESENTATION OF HOW THE SYSTEMS HAVE BEEN INSTALLED AND ARE OPERATING; AND ARE AN ACCURATE RECORD OF ALL FINAL QUANTITIES MEASURED TO ESTABLISH NORMAL OPERATING VALUES OF THE SYSTEMS.

B. SUBMISSION: SUBMIT A DRAFT REPORT TO THE OWNER/ENGINEER WITHIN TWO WEEKS OF BEGINNING THE TESTING FOR REVIEW AND COMMENTS. COMMENTS SHALL BE INCORPORATED INTO REPORT AS REQUIRED. SUBMIT THREE (3) COMPLETE SETS OF REPORTS AND ONE (1) ELECTRONIC VERSION. IF INFORMATION IS INCOMPLETE OR FURTHER TESTING, ADJUSTING AND BALANCING IS DEEMED NECESSARY, RESUBMIT THREE (3) FINAL COMPLETE SETS AND ONE (1) ELECTRONIC VERSION. DISTRIBUTION OF SUBMITTALS WILL BE TO THE ENGINEER.

C. FORMAT: BIND REPORT FORMS IN THREE-RING BINDERS OR PORTFOLIO BINDERS. LABEL EDGE OR FRONT WITH LABEL IDENTIFYING PROJECT NAME, PROJECT NUMBER AND DESCRIPTIVE TITLE OF CONTENTS. DIVIDE THE CONTENTS OF THE REPORT INTO THE BELOW LISTED DIVISIONS, SEPARATED BY DIVIDER TABS:

1. GENERAL INFORMATION
2. SUMMARY
3. AIR SYSTEMS
4. SPECIAL SYSTEMS
5. BUILDING AIR FLOW PROFILE.

D. CONTENTS: PROVIDE THE FOLLOWING MINIMUM INFORMATION, FORMS AND DATA:

1. GENERAL INFORMATION: INSIDE COVER SHEET IDENTIFYING TEST AND BALANCE AGENCY, CONTRACTOR, ARCHITECT, ENGINEER, PROJECT NAME AND PROJECT NUMBER. INCLUDE ADDRESSES, CONTACT NAMES AND TELEPHONE NUMBERS. ALSO INCLUDE A CERTIFICATION SHEET CONTAINING THE PE SEAL AND SIGNATURE OF THE TEST AND BALANCE SUPERVISOR.
2. SUMMARY: PROVIDE SUMMARY SHEET DESCRIBING MECHANICAL SYSTEM DEFICIENCIES. DESCRIBE OBJECTIONABLE NOISE OR DRAFTS FOUND DURING TESTING, ADJUSTING AND BALANCING. PROVIDE RECOMMENDATIONS FOR CORRECTING UNSATISFACTORY PERFORMANCES AND INDICATE WHETHER MODIFICATIONS REQUIRED ARE WITHIN THE SCOPE OF THE CONTRACT, ARE DESIGN RELATED OR INSTALLATION RELATED. LIST INSTRUMENTATION USED DURING TESTING, ADJUSTING AND BALANCING PROCEDURES.
3. THE REMAINDER OF THE REPORT TO CONTAIN THE APPROPRIATE STANDARD NEBB OR AABC FORMS FOR EACH RESPECTIVE ITEM AND SYSTEM. FILL OUT FORMS COMPLETELY. WHERE INFORMATION CANNOT BE OBTAINED OR IS NOT APPLICABLE INDICATE SAME.

E. REFER TO RELATED WORK IN THIS SECTION FOR ADDITIONAL REQUIREMENTS.

PART 2: PRODUCTS

2.1 INSTRUMENTATION

A. PROVIDE ALL REQUIRED INSTRUMENTATION TO OBTAIN PROPER MEASUREMENTS. APPLICATION OF INSTRUMENTS AND ACCURACY OF INSTRUMENTS AND MEASUREMENTS TO BE IN ACCORDANCE WITH THE REQUIREMENTS OF NEBB OR AABC STANDARDS AND INSTRUMENT MANUFACTURER'S SPECIFICATIONS.

B. ALL INSTRUMENTS USED FOR MEASUREMENTS SHALL BE ACCURATE, AND CALIBRATION HISTORIES FOR EACH INSTRUMENT TO BE AVAILABLE FOR EXAMINATION BY THE OWNER/ENGINEER UPON REQUEST. CALIBRATION AND MAINTENANCE OF ALL INSTRUMENTS TO BE IN ACCORDANCE WITH THE REQUIREMENTS OF NEBB OR AABC STANDARDS.

PART 3: EXECUTION

3.1 WEEKLY REPORTS

A. SUBMIT TO THE CONSTRUCTION MANAGER WEEKLY WORK ACTIVITY REPORTS WHEN TESTING AND BALANCING WORK IS PERFORMED. REPORTS SHALL INCLUDE DESCRIPTION OF EACH DAY'S ACTIVITIES, TAB TECHNICIANS ON SITE, PERSONS FROM CONTRACTOR ASSISTING, AND DESCRIPTION (INCLUDING NECESSARY ACTION) OF ANY SYSTEM DEFICIENCIES.

3.2 PRELIMINARY PROCEDURES

A. OBTAIN PRE-CONSTRUCTION MEETING REPORT, APPLICABLE CONSTRUCTION BULLETINS, APPLICABLE CHANGE ORDERS AND APPROVED SHOP DRAWINGS OF EQUIPMENT, OUTLETS/INLETS AND TEMPERATURE CONTROLS.

B. CHECK FILTERS FOR CLEANLINESS, DAMPERS AND VALVES FOR CORRECT POSITIONING, EQUIPMENT FOR PROPER ROTATION AND BELT TENSION, TEMPERATURE CONTROLS FOR COMPLETION OF INSTALLATION AND HYDRONIC SYSTEMS FOR PROPER CHARGE AND PURGING OF AIR.

1. PROVIDE AND REPLACE DIRTY FILTERS TO ACHIEVE CORRECT BALANCING VALUES FOR THE SYSTEM AS INSTALLED.

C. NOTIFY CONSTRUCTION MANAGER ON A DAILY BASIS DURING BALANCING. IDENTIFY DEFICIENCIES PREVENTING COMPLETION OF TESTING, ADJUSTING AND BALANCING PROCEDURES. DO NOT PROCEED UNTIL SYSTEMS ARE FULLY OPERATIONAL WITH ALL COMPONENTS NECESSARY FOR COMPLETE TESTING, ADJUSTING AND BALANCING. INSTALLING CONTRACTORS ARE REQUIRED TO PROVIDE PERSONNEL TO CHECK AND VERIFY SYSTEM COMPLETION, READINESS FOR BALANCING AND ASSIST BALANCING AGENCY IN PROVIDING SPECIFIED SYSTEM PERFORMANCE.

3.3 PERFORMING TESTING, ADJUSTING AND BALANCING

A. PERFORM TESTING, ADJUSTING AND BALANCING PROCEDURES ON EACH SYSTEM IDENTIFIED, IN ACCORDANCE WITH THE DETAILED PROCEDURES OUTLINED IN THE REFERENCED STANDARDS EXCEPT AS MAY BE MODIFIED BELOW.

B. UNLESS SPECIFICALLY INSTRUCTED IN WRITING OR AS SPECIFIED IN THE BID DOCUMENTS, ALL WORK IN THIS SPECIFICATION SECTION IS TO BE PERFORMED DURING THE NORMAL WORKDAY.

C. IN AREAS CONTAINING CEILINGS, REMOVE CEILING TILE TO ACCOMPLISH BALANCING WORK; REPLACE TILE WHEN WORK IS COMPLETE AND PROVIDE NEW TILE FOR ANY TILE THAT ARE DAMAGED BY THIS PROCEDURE. IF THE CEILING CONSTRUCTION IS SUCH THAT ACCESS PANELS ARE REQUIRED FOR THE WORK OF THIS SECTION AND THE PANELS HAVE NOT BEEN PROVIDED, INFORM THE OWNER'S PROJECT REPRESENTATIVE.

D. CUT INSULATION, DUCTWORK AND PIPING FOR INSTALLATION OF TEST PROBES TO THE MINIMUM EXTENT NECESSARY FOR ADEQUATE PERFORMANCE OF PROCEDURES. PATCH USING MATERIALS IDENTICAL TO THOSE REMOVED, MAINTAINING VAPOR BARRIER INTEGRITY AND PRESSURE RATING OF SYSTEMS.

E. IN AIR SYSTEMS EMPLOYING FILTERS, BLANK OFF SUFFICIENT FILTER AREA TO SIMULATE A PRESSURE DROP THAT IS MIDWAY BETWEEN THAT OF A CLEAN FILTER AND THAT OF A DIRTY FILTER.

F. MEASURE AND RECORD SYSTEM MEASUREMENTS AT THE FAN AND/OR PUMP TO DETERMINE TOTAL FLOW. ADJUST EQUIPMENT AS REQUIRED TO YIELD SPECIFIED TOTAL FLOW AT TERMINALS. PROCEED TAKING MEASUREMENTS IN MAINS AND BRANCHES AS REQUIRED FOR FINAL TERMINAL BALANCING. PERFORM TERMINAL BALANCING TO SPECIFIED FLOWS BALANCING BRANCH DAMPERS, DEFLECTORS, EXTRACTORS AND VALVES PRIOR TO ADJUSTMENT OF TERMINALS.

G. MEASURE AND RECORD STATIC AIR PRESSURE CONDITIONS ACROSS FANS, COILS AND FILTERS. INDICATE IN REPORT IF COOLING COIL MEASUREMENTS WERE MADE ON A WET OR DRY COIL AND IF FILTER MEASUREMENTS WERE MADE ON A CLEAN OR DIRTY FILTER. SPOT CHECK STATIC AIR PRESSURE CONDITIONS DIRECTLY AHEAD OF TERMINAL UNITS.

H. ADJUST OUTSIDE AIR, RETURN AIR AND RELIEF AIR DAMPERS FOR DESIGN CONDITIONS AT BOTH THE MINIMUM AND MAXIMUM SETTINGS AND RECORD BOTH SETS OF DATA. BALANCE MODULATING DAMPERS AT EXTREME CONDITIONS AND RECORD BOTH SETS OF DATA. BALANCE VARIABLE AIR VOLUME SYSTEMS AT MAXIMUM AIR FLOW RATE, FULL COOLING, AND MINIMUM FLOW RATE, FULL HEATING; RECORD ALL DATA.

I. ADJUST REGISTER, GRILLE AND DIFFUSER VANES AND ACCESSORIES TO ACHIEVE PROPER AIR DISTRIBUTION PATTERNS AND UNIFORM SPACE TEMPERATURES FREE FROM OBJECTIONABLE NOISE AND DRAFTS WITHIN THE CAPABILITIES OF THE INSTALLED SYSTEM.

J. PROVIDE FAN AND MOTOR DRIVE SHEAVE ADJUSTMENTS NECESSARY TO OBTAIN DESIGN PERFORMANCE. INCLUDE IN SCOPE OF SERVICES DRIVE CHANGES SPECIFICALLY NOTED ON DRAWINGS, IF ANY. IF WORK OF THIS SECTION INDICATES THAT ANY DRIVE OR MOTOR IS INADEQUATE FOR THE APPLICATION, ADVISE THE OWNER'S PROJECT REPRESENTATIVE BY GIVING THE REPRESENTATIVE PROPERLY SIZED MOTOR/DRIVE INFORMATION (IN ACCORDANCE WITH MANUFACTURERS ORIGINAL SERVICE FACTOR AND INSTALLED MOTOR HORSEPOWER REQUIREMENTS); MAKE SURE THAT ANY CHANGE WILL KEEP THE DUCT/PIPING SYSTEM WITHIN ITS DESIGN LIMITATIONS WITH RESPECT SPEED OF THE DEVICE AND PRESSURE CLASSIFICATION OF THE DISTRIBUTION SYSTEM. TIME AND MATERIAL FOR MOTOR/DRIVE CHANGES WILL BE CONSIDERED A REIMBURSABLE EXPENSE AND WILL REQUIRE AN ITEMIZED COST BREAKDOWN OF ALL TIME AND DRIVE CHANGES SUBMITTED TO OWNER'S PROJECT REPRESENTATIVE; PRIOR AUTHORIZATION IS NEEDED BEFORE THIS WORK IS STARTED.

K. AREAS OR ROOMS DESIGNED TO MAINTAIN POSITIVE, NEGATIVE OR BALANCED AIR PRESSURES WITH RESPECT TO ADJACENT SPACES, AS INDICATED BY THE DESIGN AIR QUANTITIES, REQUIRE SPECIAL ATTENTION. ADJUST FAN DRIVES, DISTRIBUTION DAMPERS, TERMINALS AND CONTROLS TO MAINTAIN INDICATED PRESSURE RELATIONSHIP. ALL ROOMS WITH OPEN PRODUCT SHALL BE MAINTAINED AT POSITIVE PRESSURE. UTILITY, SANITATION AND STORAGE ROOMS SHALL BE AT NEGATIVE PRESSURE.
    1. ROOM STATIC PRESSURES SHALL BE RECORDED WITH RESPECT TO ADJACENT SPACES.
    2. IN PROCESS SPACES WHERE PROCESS EQUIPMENT HAS AN EFFECT ON NORMAL OPERATING CONDITIONS OF HVAC EQUIPMENT THE BALANCING CONTRACTOR SHALL WORK WITH THE CM/OWNER TO HAVE REQUIRED PROCESS EQUIPMENT RUNNING DURING BALANCING. IN INSTANCES WHERE PROCESS EQUIPMENT IS OPERATIONAL INTERMITTENTLY, THE BALANCING CONTRACTOR SHALL BALANCE EQUIPMENT AND VERIFY PROPER OPERATION AT BOTH PROCESS SCENARIOS. CONTRACTOR SHALL CONFIRM THAT THE HVAC EQUIPMENT RESPONDS TO THE DESIGN AND PROCESS EQUIPMENT CONDITIONS.

L. FINAL AIR SYSTEM MEASUREMENTS TO BE WITHIN THE FOLLOWING RANGE OF SPECIFIED CFM:
    1. FANS, RTUS -5% TO +10%
    2. SUPPLY GRILLES, REGISTERS, DIFFUSERS -2% TO +10%
    3. RETURN/EXHAUST GRILLES, REGISTERS -10% TO+2%
    4. OUTSIDE AIR -2% TO +5%

M. ELECTRIC FAN COIL UNITS, ELECTRIC UNIT HEATERS AND ELECTRIC DUCT HEATERS SHALL BE TESTED TO DETERMINE MAXIMUM AIR TEMPERATURE RISE ACROSS THE COILS. MEASURE AND RECORD ENTERING AIR TEMPERATURE, LEAVING AIR TEMPERATURE, AIR VOLUME FLOW, AND AMPERAGE DRAW ACROSS EACH LEG OF THE COIL ELECTRICAL FEED.

N. STEAM / GAS UNIT HEATERS SHALL BE TESTED TO DETERMINE MAXIMUM AIR TEMPERATURE RISE. MEASURE AND RECORD ENTERING AIR TEMPERATURE, LEAVING AIR TEMPERATURE AND AIR VOLUME FLOW. MEASURE AND RECORD AMPERAGE DRAW OF THE BLOWER FAN.

O. CONTACT THE TEMPERATURE CONTROL CONTRACTOR FOR ASSISTANCE IN OPERATION AND ADJUSTMENT OF CONTROLS DURING TESTING, ADJUSTING AND BALANCING PROCEDURES. CYCLE CONTROLS AND VERIFY PROPER OPERATION AND SETPOINTS. INCLUDE IN REPORT DESCRIPTION OF TEMPERATURE CONTROL OPERATION AND ANY DEFICIENCIES FOUND.

P. PERMANENTLY MARK EQUIPMENT SETTINGS, INCLUDING DAMPER AND VALVE POSITIONS, CONTROL SETTINGS, AND SIMILAR DEVICES ALLOWING SETTINGS TO BE RESTORED. SET AND LOCK MEMORY STOPS.

Q. LEAVE SYSTEMS IN PROPER WORKING ORDER, REPLACING BELT GUARDS, CLOSING ACCESS DOORS AND ELECTRICAL BOXES, AND RESTORING TEMPERATURE CONTROLS TO NORMAL OPERATING SETTINGS.

3.4 PROCESS BUILDING AIRFLOW

A. THE MANUFACTURING SPACES SHALL BE BALANCE TO ACHIEVE THE AIR FLOW DIRECTION AND OR ROOM PRESSURE AS DESCRIBED AND SHOWN ON PLANS. THE BALANCING CONTRACTOR SHALL PROVIDE TESTING AND VERIFICATION OF AIR FLOW WHILE THE FACILITY IS IN PRODUCTION AND IN A SHUT DOWN STATE. THE FOLLOWING CRITICAL RELATIVE AIR FLOW/ PRESSURES SHALL BE ACHIEVED THROUGH THE BALANCING CONTRACTOR:

1. REFER TO MECHANICAL QUALITY PLAN (M9.001) FOR REFERENCE FOR SPACE PRESSURE CLASSIFICATIONS AND MORE INFORMATION.

B. THE TAB CONTRACTOR SHALL MAKE NECESSARY ADJUSTMENTS TO EQUIPMENT TO ACHIEVE THE DESIRED AIR FLOW PATTERN. THE SYSTEMS REQUIRING ADJUSTMENT SHALL BE RETESTED AND VERIFIED TO HAVE THE PROPER AIR FLOW. THIS STEP SHALL BE REPEATED UNTIL THE DESIRED RESULT IS ACCOMPLISHED.

C. THE TAB CONTRACTOR SHALL INCLUDE THE AIR FLOW VALIDATION DOCUMENTATION WITH AIR BALANCE REPORT.

3.5 DEFICIENCIES

A. CONTRACTOR TO CORRECT ANY INSTALLATION DEFICIENCIES FOUND BY THE TEST AND BALANCE AGENCY THAT WERE SPECIFIED AND/OR SHOWN ON THE CONTRACT DOCUMENTS TO BE PERFORMED AS PART OF THAT DIVISION OF WORK. TEST AND BALANCE AGENCY WILL NOTIFY THE CONSTRUCTION MANAGER OF THESE ITEMS AND INSTRUCTIONS WILL BE ISSUED TO THE CONTRACTOR FOR CORRECTION OF THE DEFICIENT WORK. ALL CORRECTIVE WORK TO BE DONE AT NO COST TO THE OWNER/ENGINEER.

END OF SECTION

SECTION 23 07 00

MECHANICAL INSULATION

PART 1: GENERAL

1.1 THE WORK OF THIS SECTION SHALL INCLUDE:

A. THIS SECTION PROVIDES FOR THE FURNISHING AND INSTALLING OF THERMAL AND ACOUSTIC INSULATION APPLIED EXTERNALLY OR INTERNALLY TO DUCTWORK AND AIR HANDLING DEVICES.

B. ALL INSULATION PROVIDED MUST COMPLY WITH THE 2012 INTERNATIONAL ENERGY CONSERVATION CODE AND 2009 INTERNATIONAL MECHANICAL CODE AND ASHRAE 90.1.

C. WORK INCLUDED:

1. DUCTWORK AND EQUIPMENT INSULATION
2. INSULATION JACKETS

1.2 SUBMITTALS

A. SHOP DRAWINGS AND PRODUCT DATA

1. SUBMIT MANUFACTURER'S DESCRIPTIVE PRODUCT DATA SHEETS ON CATALOGED ITEMS TO BE USED.
2. SUBMIT SHOP DRAWINGS SHOWING DETAILS OF DUCTWORK INSULATION AND DUCTWORK INSULATION COVERINGS.
3. SUBMIT DATA ON ANY SPECIAL INSTALLATION REQUIREMENTS.
4. SUBMIT DUCTWORK SCHEDULE STATING EXACTLY WHICH AIR UNIT DUCTWORK (AHU, DEH, ETC.) BOTH SUPPLY AND RETURN/EXHAUST IS INSULATED AND JACKETED WITH TYPE OF PRODUCT.
5. SUBMIT DUCTWORK SCHEDULE STATING EXACTLY WHICH FAN UNIT DUCTWORK (EF, FAN, ETC.) IS INSULATED AND JACKETED WITH TYPE OF PRODUCT.
6. SUBMIT STATEMENT OF COMPLIANCE WITH THE CURRENT INTERNATIONAL ENERGY CONSERVATION CODE AND/OR LOCAL ENERGY CODE HAVING JURISDICTION.

1.3 QUALITY ASSURANCE

A. APPLICATOR: COMPANY SPECIALIZING IN DUCTWORK INSULATION APPLICATION WITH THREE YEARS MINIMUM EXPERIENCE.

B. MATERIALS: UL LISTED; FLAME SPREAD/FUEL CONTRIBUTED/SMOKE DEVELOPED RATING OF 25/50/50 IN ACCORDANCE WITH ASTM E84.

C. ASHRAE 90.1

D. NFPA 90A, 90B AND 225

1.4 ENVIRONMENTAL REQUIREMENTS

A. MAINTAIN AMBIENT TEMPERATURES AND CONDITIONS REQUIRED BY MANUFACTURERS OF ADHESIVES, MASTICS, AND INSULATION CEMENTS.

B. MAINTAIN TEMPERATURE BEFORE, DURING, AND AFTER INSTALLATION FOR MINIMUM OF 24 HOURS.

1.5 PRODUCT DELIVERY, STORAGE & HANDLING

A. DELIVER INSULATION PRODUCTS TO THE SITE IN UNBROKEN SHIPPING CARTONS BEARING A LABEL INDICATION THE CONTENTS AND THE APPROPRIATE ASTM, NFPA, AND UL FLAME AND SMOKE HAZARD RATINGS AS SPECIFIED HEREIN FOR THE VARIOUS INSULATION PRODUCTS.

B. DELIVER AND STORE INSULATION PRODUCTS PROTECTED FROM THE WEATHER. STORE INSULATION ON THE SITE ELEVATED OFF WET AND OTHERWISE CONTAMINATING SURFACES.

C. ALL PRODUCTS MUST BE SUPPLIED WITH AN MSDS SHEET.

PART 2: PRODUCTS

2.1 GENERAL

A. ALL INSULATION PRODUCTS SPECIFIED HEREIN MAY OR MAY NOT BE REQUIRED AS PART OF THIS PROJECT. SEE INSULATION SCHEDULE IN THE HVAC SCHEDULE DRAWINGS FOR SPECIFIC PRODUCTS TO BE USED.

B. ALL INSULATION PRODUCTS SHALL BE AS MANUFACTURED BY THE FOLLOWING:

1. ARMACELL, LLC
2. DOW CHEMICAL
3. ELLIOT FOAM

4. JOHN MANVILLE
5. NOMACO, INC
6. APPROVED EQUAL.

C. ALL INSULATION SHALL BE INSTALLED BY A QUALIFIED INSULATION SUB CONTRACTOR WHO IS THOROUGHLY EXPERIENCED IN THIS TYPE OF WORK, WHO HAS ADEQUATE FACILITIES AND EQUIPMENT FOR ERECTING SAME; WHO IS ACCEPTABLE TO THE ENGINEER.

D. ALL PRODUCTS MEET THE SURFACE BURNING CHARACTERISTICS AND LIMITED COMBUSTIBILITY REQUIREMENTS OF NFPA 90A AND 90B STANDARDS AND FHA, AS TESTED BY UL. FACED MATERIALS ARE TESTED AS COMPOSITE PRODUCTS (INSULATION, ADHESIVE AND FACING). UL GUIDE NO. 40 U8.3. CARD R3711. FIRE HAZARD CLASSIFICATION 25/50.

2.2 GLASS FIBER, FLEXIBLE BLANKET

A. INSULATION: ASTM C553; FLEXIBLE, NONCOMBUSTIBLE BLANKET.
1. 'K' VALUE : ASTM C518, 0.27 AT 75 DEGREES F.
2. MAXIMUM SERVICE TEMPERATURE: 250 DEGREES F.
3. MAXIMUM MOISTURE ABSORPTION: <0.2 PERCENT BY VOLUME.
4. DENSITY: 1.5 LB/CU FT.

B. VAPOR BARRIER JACKET:
1. ALUMINUM FOIL FACING, REINFORCED WITH FIBER GLASS SCRIM LAMINATED TO UL RATED KRAFT.
2. MOISTURE VAPOR TRANSMISSION: ASTM E96; 0.02 PERM.
3. SECURE WITH PRESSURE SENSITIVE TAPE.

C. VAPOR BARRIER TAPE:
1. FOIL FACED REINFORCED WITH GLASS FIBER YARN AND BONDED TO KRAFT, WITH PRESSURE SENSITIVE RUBBER BASED ADHESIVE SHALL COMPLY WITH SMACNA STANDARDS AFTS-100-73 AND AFTS-101-73
2. TIE WIRE: ANNEALED STEEL, 16 GAGE.

2.3 GLASS FIBER, RIGID

A. INSULATION: ASTM C612; RIGID, NONCOMBUSTIBLE BLANKET.
1. 'K' VALUE : ASTM C518, 0.24 AT 75 DEGREES F .
2. MAXIMUM SERVICE TEMPERATURE: 250 DEGREES F .
3. MAXIMUM MOISTURE ABSORPTION: 0.20 PERCENT BY VOLUME.
4. DENSITY: MINIMUM 4.5 LB/CU FT.

B. VAPOR BARRIER JACKET:
1. ALUMINUM FOIL FACING, REINFORCED WITH FIBER GLASS SCRIM LAMINATED TO UL RATED KRAFT.
2. MOISTURE VAPOR TRANSMISSION: ASTM E96; 0.04 PERM.
3. SECURE WITH PRESSURE SENSITIVE TAPE.

C. VAPOR BARRIER TAPE:
1. FOIL FACED REINFORCED WITH GLASS FIBER YARN AND BONDED TO KRAFT, WITH PRESSURE SENSITIVE RUBBER BASED ADHESIVE SHALL COMPLY WITH SMACNA STANDARDS AFTS-100-73 AND AFTS-101-73

2.4 CLOSED CELL ELASTOMERIC, FLEXIBLE

A. MANUFACTURER: TYPE NH ARMAFLEX AS MANUFACTURED BY ARMACELL.

B. INSULATION: FLEXIBLE CLOSED CELL ELASTOMERIC SELF ADHESIVE SHEET.
1. 'K' VALUE: ASTM C518, 0.27 AT 75 DEGREES F.
2. MAXIMUM SERVICE TEMPERATURE: 180 DEGREES F.
3. MAXIMUM MOISTURE ABSORPTION: 0.2 % BY VOLUME.
4. WATER VAPOR TRANSMISSION: LESS THAN 0.08 PERM-IN.
5. DENSITY RANGE: 3.0-6.0 LB/CU FT.
6. INSULATION SHALL BE COMPATIBLE WITH THE FLEX CLAD JACKETING SYSTEMS AND EQUAL.

C. ADHESIVE: MANUFACTURERS SUPPLIED PRODUCT FOR BUTT JOINTS.
   1. ALL ADHESIVES MUST MEET REQUIREMENTS FOR VOC LIMITS (G/L).
      a. ADHESIVE VOC LIMIT (G/L) – 250

D. FINISH: WHITE WATER BASED LATEX ENAMEL PAINT FORMULATED SPECIFICALLY FOR INSULATION MATERIAL.
   1. ALL PAINTS MUST MEET REQUIREMENTS FOR VOC LIMITS (G/L).
      a. FLAT PAINT VOC LIMIT (G/L) - 50
      b. NON-FLAT PAINT VOC LIMIT (G/L) - 150

2.5 POLYISOCYANURATE RIGID INSULATION

A. INSULATION:
   1. POLYISOCYANURATE FOAM SEGMENTS MANUFACTURED WITH HCFC 141B BLOWING AGENT AND BONDED TO TRILAMINATE FOIL FACERS ON TOP AND BOTTOM SURFACES DURING THE MANUFACTURING PROCESS.
   2. MIN. THICKNESS OF 2.0 INCHES AND MIN. R-VALUE OF 14.4.
   3. INSULATION SHALL BE INSTALLED AS A SEPARATION LAYER OVER THE EXISTING SUBSTRATE AND/OR TO OBTAIN THE DESIRED THERMAL VALUE.
   4. INSULATION SHALL BE COMPATIBLE WITH THE FLEX CLAD JACKETING SYSTEMS AND EQUAL.

B. PHYSICAL PROPERTIES:
   1. THERMAL PERFORMANCE – ASTM C 518.
   2. WATER ABSORPTION - ASTM C 209 – < 1% VOLUME.
   3. DIMENSIONAL STABILITY - ASTM D 2126 - 2% MAX. 7 DAYS (LENGTH AND WIDTH).
   4. COMPREHENSIVE STRENGTH - ASTM D 1621 - 20 PSI.
   5. MOISTURE VAPOR TRANSMISSION ASTM E 96 - ASTM E 96 - < 1 PERM SERVICE TEMPERATURE - -100°F TO 250°F.
   6. FLAME SPREAD (FOAM CORE) - ASTM E 84 – 25.
   7. SMOKE DEVELOPED (FOAM CORE) - ASTM E 84 – 200.

C. COMPONENTS:
   1. IMPALE FASTENERS.
   2. ADHESIVE - APPLY ADHESIVE ACCORDING TO ADHESIVE MANUFACTURER'S RECOMMENDATIONS.
      a. ALL ADHESIVES MUST MEET REQUIREMENTS FOR VOC LIMITS (G/L).
      b. ADHESIVE VOC LIMIT (G/L) - 250
   3. CAULKING SEALANT - APPLY CAULKING SEALANT ACCORDING TO SEALANT MANUFACTURER'S SPECIFICATIONS.
      a. ALL SEALANTS MUST MEET REQUIREMENTS FOR VOC LIMITS (G/L).
      b. SEALANTS VOC LIMIT (G/L) - 250
   4. TAPE - WATER RESISTANT ALUMINUM FOIL OR POLYESTER TAPE.
   5. ONE WAY MOISTURE VENT - BLACK-PIGMENTED ABS PLASTIC RESIN ONE WAY ROOF VENT FOR USE WITH EPDM SINGLE PLY ROOFING SYSTEMS, MODEL GRAY CAP FP-10 ROOF VENT AS MANUFACTURED BY JOHNS MANVILLE INTERNATIONAL.

2.6 ENGINEERED POLYMER FOAM INSULATION, FLEXIBLE

A. MANUFACTURER: TYPE IMCOLOCK OR IMCOSHEET AS MANUFACTURED BY IMCOA

B. INSULATION: FLEXIBLE ENGINEERED POLYMER FOAM INSULATION (EPFI) SHEET.
   1. 'K' VALUE: ASTM C518, 0.25 AT 75 DEGREES F.
   2. MAXIMUM SERVICE TEMPERATURE: 210 DEGREES F.
   3. MAXIMUM MOISTURE ABSORPTION: 0.0 % BY VOLUME.
   4. WATER VAPOR TRANSMISSION: LESS THAN 0.0 PERM-IN.
   5. DENSITY RANGE: 1.5 LB/CU FT.

C. ADHESIVE: MANUFACTURERS RECOMMENDED CONTACT ADHESIVES FOR SURFACE ADHESION TO DUCT.

1. ALL ADHESIVES MUST MEET REQUIREMENTS FOR VOC LIMITS (G/L).
    a. ADHESIVE VOC LIMIT (G/L) – 250

D. SEAMS/BUTT JOINTS: MANUFACTURERS THERMAL FUSING SYSTEM UTILIZING THERMOPLASTIC WELDING RODS SHALL BE USED FOR JOINING SHEET INSULATION SEAMS AND BUTT JOINTS VAPOR TIGHT.

E. LINER FASTENERS: GALVANIZED STEEL, WELDED WITH INTEGRAL HEAD.

2.7 INSULATION JOINT AND SEAM SEALANTS

A. ALL SEALANTS MUST MEET REQUIREMENTS FOR VOC LIMITS (G/L).
1. SEALANTS VOC LIMIT (G/L) - 250

2.8 JACKETS

A. ALUMINUM JACKET
1. MANUFACTURE: MFM MODEL FLEX-CLAD 400 OR ALUMAGAURD 60
2. WATER VAPOR TRANSMISSION: 0.009 PERMS
3. FINISH: EMBOSSED
4. JOINING: 6-INCH LAPS.
5. FITTINGS: FIELD FABRICATED SHAPED FITTING COVERS.
6. ADHESION: SELF ADHERING SYSTEM

B. PVC PLASTIC JACKET.
1. ASTM D1784, ONE PIECE MOLDED TYPE FITTING COVERS AND SHEET MATERIAL.
    a. THICKNESS: 20 MIL.
    b. CONNECTIONS: BRUSH ON WELDING ADHESIVE.
    c. TEMPERATURE LIMITS: 0 DEGREES F TO 150 DEGREES F
    d. FLAME SPREAD/ SMOKE DEVELOPED: 25/50 OR LESS.
    e. MOISTURE VAPOR TRANSMISSION: ASTM E96; 0.002 PERM-INCHES.
    f. FINISH: WHITE, GLOSS.
2. COVERING ADHESIVE MASTIC:
    a. COMPATIBLE WITH INSULATION.
    b. MUST MEET REQUIREMENTS FOR VOC LIMITS OF 250 G/L.
3. DUCTWORK AND PIPING PVC JACKETING REQUIRED FOR DUCTWORK SERVING PROCESS AREAS, SHALL BE USDA APPROVED SYSTEM.

C. EPDM JACKET
1. MANUFACTURER: ULTRAGARD .060 WHITE EPDM ROOFING MEMBRANE AS MANUFACTURED BY JOHNS MANVILLE INTERNATIONAL INC.
2. MEMBRANE: SHALL BE A WHITE, CURED EPDM (ETHYLENE PROPYLENE DIENEMONOMER) SHEET DESIGNED FOR USE AS A SINGLE PLY MEMBRANE IN CERTAIN MECHANICALLY FASTENED AND FULLY ADHERED ROOFING SYSTEMS.
3. PHYSICAL PROPERTIES:
    a. THICKNESS - ASTM D 412 - 60 MIL.
    b. TENSILE STRENGTH - ASTM D 412 - 1460 PSI.
    c. TEAR RESISTANCE - ASTM D 624, DIE C - 185 PSI.
    d. ELONGATION - ASTM D 412 - 420%.
    e. BRITTLE POINT - ASTM D 746 - -75°F.
    f. COLOR – WHITE.
    g. WEIGHT - 41 LBS./100 SQ. FT.
    h. OZONE RESISTANCE - ASTM D 1149 - NO CRACKS.
    i. RESISTANCE TO WEATHERING - ASTM D 4637 - NO CRACKS/NO CRAZING
4. RELATED MATERIALS:
    a. THE FOLLOWING PRODUCTS AND SUPPLIES SHALL BE SUPPLIED BY THE MEMBRANE MANUFACTURER FOR USE WITH THEIR EPDM ROOFING MEMBRANE SYSTEMS:
        1) EXPANSION JOINT COVERS.

2) TAPE PRIMER/WASH.
3) BONDING CEMENT.
4) LAP CEMENT.
5) SEAM TAPE.
6) PEEL AND STICK TAPE.
7) FLASHING.
8) LAP CAULK.
9) SEALING MASTIC.
10) SEALER.
11) FASTENERS/ANCHORS

D. JACKETING JOINT AND SEAM SEALANTS
1. ALL SEALANTS MUST MEET REQUIREMENTS FOR VOC LIMITS (G/L).
a. SEALANTS VOC LIMIT (G/L) – 250

PART 3: EXECUTION

3.1 PREPARATION

A. INSTALL EXTERIOR MATERIALS AFTER DUCTWORK HAS BEEN TESTED, INSPECTED, AND APPROVED.
B. CLEAN SURFACES PRIOR TO APPLICATION OF ADHESIVES. SURFACES SHALL BE OIL FREE AND PREPARED TO MANUFACTURER'S INSTRUCTIONS.

3.2 INSTALLATION

A. GENERAL:
1. INSTALL MATERIALS IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS.
a. INSULATION SHALL BE SECURED TO DUCT PER MANUFACTURERS INSTRUCTIONS. THE INSULATION JACKETING SHALL NOT BE USED UNDER ANY CIRCUMSTANCE AS A MEANS TO SECURE INSULATION TO DUCTWORK.
2. REGARDLESS OF INSULATION SCHEDULED THE CONTRACTOR SHALL PROVIDE INSULATION ON EXTERIOR OF ALL SUPPLY AIR, RETURN AIR DUCTS AND EXHAUST AIR DUCTS WITHIN 10 FEET OF EXTERIOR.
3. WHERE INSULATION JACKET IS SCHEDULED THE CONTRACTOR SHALL PROVIDE INSULATION AT A MINIMUM THICKNESS TO COVER THE WIDTH OF THE DUCT FLANGE (FLANGE SECTION PROTRUDING FROM DUCTWORK) AND MAINTAIN A SMOOTH AND FLAT INSULATION JACKET. AT A POINT WHERE THE JACKET IS NO LONGER SPECIFIED THE MINIMUM INSULATION THICKNESS SHALL BE INSTALLED AND THE FLANGE SECTIONS SHALL HAVE A STEPPED INSULATION PIECE.

B. INSULATION APPLICATION FOR EXTERIOR OF DUCT IN INTERIOR OF BUILDING:
1. SECURE INSULATION WITH VAPOR BARRIER USING WIRES AND SEAL JACKET JOINTS WITH VAPOR BARRIER ADHESIVE OR TAPE TO MATCH JACKET.
2. INSTALL WITHOUT SAG ON UNDERSIDE OF DUCTWORK. USE 4" WIDE STRIPS OF ADHESIVE ON 8" CENTERS OR MECHANICAL FASTENERS WHERE NECESSARY TO PREVENT SAGGING. SEAL VAPOR BARRIER PENETRATIONS BY MECHANICAL FASTENERS WITH VAPOR BARRIER ADHESIVE. STOP AND POINT INSULATION AROUND ACCESS DOORS AND DAMPER OPERATORS TO ALLOW OPERATION WITHOUT DISTURBING WRAPPING.
3. STAGER JOINTS ON MULTI LAYER INSULATION.
4. INSULATE STANDING SEAMS AND STIFFENERS WHICH PROTRUDE THROUGH THE INSULATION.
5. COVER SEAMS, JOINTS, PIN PENETRATIONS AND OTHER BREAKS.

C. EXTERIOR INSULATION APPLICATIONS FOR EXTERIOR OF DUCT:
1. PROVIDE INSULATION WITH VAPOR BARRIER JACKET. COVER WITH OUTDOOR ROOFING MEMBRANE JACKET FINISHED AS SPECIFIED WITH SEAMS LOCATED ON BOTTOM

CORNERS OF HORIZONTAL DUCT SECTION. LAP JACKET IN DIRECTION OF SLOPE TO PREVENT WATER INTRUSION.

2. EXTERIOR MEMBRANE ROOFING JACKET APPLICATIONS:
    a. INSTALL AS PER MANUFACTURER'S INSTRUCTIONS FOR INSTALLATION INCLUDING CUTTING, LAPPING, ADHERING AND SPLICING RECOMMENDATIONS, AND AS FOLLOWS:
        1) SPECIAL PRECAUTIONS SHALL BE TAKEN WHEN JACKETING IS INSTALLED IS COLD WEATHER AND SHADOWED AREAS. WHERE REQUIRED USE MFG RECOMMENDED SPRAY ADHESIVES AND FOIL FACED INSULATION.
            a) WHEN INSTALLING MEMBRANE IN COOLER WEATHER, IT IS REQUIRED THAT LIQUIDS SUCH AS ADHESIVES AND SEALANTS, ETC. BE STORED AT TEMPERATURES OF 50 DEGREES F OR WARMER PRIOR TO USE. SURFACE TEMPERATURES SHOULD BE 40 DEGREES F OR HIGHER DURING APPLICATION OF SEALANTS AND ADHESIVES.
        2) JACKET SEAMS LOCATED ON BOTTOM CORNERS OF HORIZONTAL DUCT SECTION.
        3) LAP JACKET IN DIRECTION OF SLOPE TO PREVENT WATER INTRUSION.
        4) LAPPING OF JACKET ON VERTICAL FACE OF DUCT (IF REQUIRED) SHALL BE DONE WITH LAP JOINT IN VERTICAL PLANE.
        5) INSTALL MANUFACTURERS ONE-WAY AIR VENTS ON BOTTOM SIDE OF DUCT AT A MINIMUM OF EVERY 10 FEET OF DUCT
3. IF FIBERGLASS INSULATION IS PROVIDED IN OR ON ANY CONTRACTOR SUPPLIED EQUIPMENT THE MC SHALL REMOVE THE FIBERGLASS INSULATION AND REPLACE WITH CLOSED CELL INSULATION AT THE MC EXPENSE.

3.3 SCHEDULES

A. SEE INSULATION SCHEDULE IN THE HVAC SCHEDULES DRAWINGS FOR LIST OF SPECIFIC INSULATION PRODUCTS, THICKNESSES AND COVERINGS FOR VARIOUS SERVICES INCLUDED IN THIS PROJECT.

END OF SECTION

SECTION 23 09 13

HVAC INSTRUMENTATION

PART 1: GENERAL

1.1 THE SCOPE OF THIS SECTION SHALL INCLUDE

A. ALL HVAC AUTOMATIC TEMPERATURE CONTROL INSTRUMENTATION AND DEVICES, INCLUDING BUT NOT LIMITED TO THE FOLLOWING:

1. TRANSFORMERS, RELAYS, THERMOSTATS, HUMIDISTATS, CONTROL VALVES, AUTOMATIC DAMPERS, DAMPER OPERATORS, TIME CLOCKS AND ALL MISCELLANEOUS ACCESSORIES AND DEVICES IN ACCORDANCE WITH DRAWINGS AND SPECIFICATIONS.

1.2 RELATED SECTIONS

A. SECTION 23 09 93 – SEQUENCE OF OPERATION

1.3 SUBMITTALS FOR REVIEW

A. PRODUCT DATA: PROVIDE DESCRIPTION AND ENGINEERING DATA FOR EACH CONTROL SYSTEM COMPONENT. INCLUDE SIZING AS REQUESTED. PROVIDE DATA FOR EACH SYSTEM COMPONENT

B. SHOP DRAWINGS: INDICATE COMPLETE OPERATING DATA, SYSTEM DRAWINGS, WIRING DIAGRAMS, AND WRITTEN DETAILED OPERATIONAL DESCRIPTION OF SEQUENCES. SUBMIT SCHEDULE OF VALVES INDICATING SIZE, FLOW, AND PRESSURE DROP FOR EACH VALVE. FOR AUTOMATIC DAMPERS INDICATE ARRANGEMENT, VELOCITIES, AND STATIC PRESSURE DROPS FOR EACH SYSTEM.

1.4 REGULATORY REQUIREMENTS

A. PRODUCTS REQUIRING ELECTRICAL CONNECTION: LISTED AND CLASSIFIED BY UNDERWRITERS LABORATORIES INC AS SUITABLE FOR THE PURPOSE SPECIFIED AND INDICATED.

B. AMCA 500 TEST METHODS FOR LOUVERS, DAMPERS AND SHUTTERS.

C. NEMA DC 3 LOW VOLTAGE ROOM THERMOSTATS.

D. NFPA 70 NATIONAL ELECTRICAL CODE.

E. NFPA 90A INSTALLATION OF AIR CONDITIONING AND VENTILATION SYSTEMS.

PART 2: PRODUCTS

2.1 ELECTRIC DAMPER

A. GENERAL: PROVIDE SMOOTH PROPORTIONAL CONTROL WITH SUFFICIENT POWER FOR AIR VELOCITIES 20 PERCENT GREATER THAN MAXIMUM DESIGN VELOCITY AND TO PROVIDE TIGHT SEAL AGAINST MAXIMUM SYSTEM PRESSURES.

B. THE ACTUATOR SHALL HAVE MECHANICAL OR ELECTRONIC STALL PROTECTION TO PREVENT DAMAGE TO THE ACTUATOR THROUGHOUT THE ROTATION OF THE ACTUATOR.

C. DAMPER ACTUATORS WITHIN THE ENGINE ROOM, SHALL BE POWER CLOSED AND SPRING RETURN OPEN FOR POWER-FAILURE/SAFETY APPLICATIONS, AN INTERNAL MECHANICAL, SPRING-RETURN MECHANISM SHALL BE BUILT INTO THE ACTUATOR HOUSING.

D. PROPORTIONAL ACTUATORS SHALL ACCEPT A 0 TO 10 VDC OR 0 TO 20 MA CONTROL SIGNAL AND PROVIDE A 2 TO 10 VDC OR 4 TO 20 MA OPERATING RANGE FEED BACK FOR POSITION INDICATION.

E. ALL 24 VAC/VDC ACTUATORS SHALL OPERATE ON CLASS 2 WIRING

F. ALL NON-SPRING-RETURN ACTUATORS SHALL HAVE AN EXTERNAL MANUAL GEAR RELEASE TO ALLOW MANUAL POSITIONING OF THE DAMPER/VALVE WHEN THE ACTUATOR IS NOT POWERED. SPRING-RETURN ACTUATORS WITH MORE THAN 60 IN.-LB TORQUE CAPACITY SHALL HAVE A MANUAL CRANK FOR THIS PURPOSE.

G. PROVIDE WITH AUXILIARY END SWITCH WHERE PROOF OR FINAL POSITION IS REQUIRED.

2.2 BINARY TEMPERATURE DEVICES

A. LOW-VOLTAGE SPACE THERMOSTAT SHALL BE 24 V, BIMETAL-OPERATED, MERCURY-SWITCH TYPE, WITH EITHER ADJUSTABLE OR FIXED ANTICIPATION HEATER, CONCEALED SETPOINT ADJUSTMENT, 25°F TO 85°F SET POINT RANGE, 2°F MAXIMUM DIFFERENTIAL, AND VENTED ABS PLASTIC LOCKING COVER.

B. LINE-VOLTAGE SPACE THERMOSTAT SHALL BE BIMETAL-ACTUATED, OPEN CONTACT TYPE, OR BELLOWS-ACTUATED, ENCLOSED, SNAP-SWITCH TYPE OR EQUIVALENT SOLID-STATE TYPE, WITH HEAT ANTICIPATOR, UL LISTED FOR ELECTRICAL RATING, CONCEALED SETPOINT ADJUSTMENT,

55°F TO 85°F SETPOINT RANGE, 2°F MAXIMUM DIFFERENTIAL, AND VENTED METAL LOCKING COVER.

C. LOW-LIMIT THERMOSTATS. LOW-LIMIT AIRSTREAM THERMOSTATS SHALL BE UL LISTED, VAPOR PRESSURE TYPE, WITH AN ELEMENT OF 20 FT MINIMUM LENGTH. ELEMENT SHALL RESPOND TO THE LOWEST TEMPERATURE SENSED BY ANY 1 FT SECTION. THE LOW-LIMIT THERMOSTAT SHALL BE MANUAL RESET ONLY.

D. WASHDOWN AREAS: DEVICES LOCATED WITHIN WASHDOWN OR WET AREAS SHALL BE NEMA 4X RATED.

2.3 LINE VOLTAGE THERMOSTAT

A. LINE VOLTAGE SPACE THERMOSTAT SHALL BE 120 VAC (OR 24 VAC WHERE REQUIRED), SINGLE STAGE, ELECTRONIC TEMPERATURE CONTROLS WITH A SINGLE-POLE, DOUBLE-THROW (SPDT) OUTPUT RELAY AND DISPLAY.

1. THERMOSTAT TO HAVE HEATING AND COOLING MODES, ADJUSTABLE SETPOINT AND DIFFERENTIAL, AND ADJUSTABLE ANTI-SHORT CYCLE DELAY, AND A TEMPERATURE OFFSET FUNCTION. THE SET POINT RANGE IS -30 TO 212F.
2. PROVIDE WITH NEMA 1 OR NEMA 4X ENCLOSURE. REFER TO NEMA DRAWINGS FOR ENCLOSURE REQUIREMENTS.
3. PROVIDE WITH JOHNSON CONTROL A99 TEMPERATURE SENSOR.
4. THERMOSTAT SHALL BE EQUAL TO JOHNSON CONTROL A419.

2.4 TEMPERATURE SENSORS

A. SPACE TEMPERATURE SENSOR SHALL BE WALL MOUNTED. SENSOR SHALL BE 2 WIRE, 1000 OHM PLATINUM RTD TYPE. SENSOR SHALL BE AS MANUFACTURED BY KELE OR EQUAL.

1. SPACE SENSORS FOR VAV TERMINALS SHALL HAVE OCCUPANCY OVERRIDE BUTTON AND +/- 3ºF SLIDE CONTROL. SENSOR SHALL HAVE PLASTIC VENTILATED ENCLOSURE. SPACE TEMPERATURE SENSOR FOR VAV TERMINAL SHALL BE OF THE SAME MANUFACTURER AS THE VAV CONTROLLER. SENSOR SHALL HAVE PORT FOR LAPTOP CONNECTION.
2. SPACE TEMPERATURE SENSORS IN UTILITY AREAS SHALL HAVE A STAINLESS STEEL INSULATED PLATE.

B. SUPPLY, RETURN AND MIXED AIR TEMPERATURE SENSOR SHALL BE MOUNTED WITHIN AIR HANDLING UNIT. SENSOR SHALL BE 2 WIRE, 1000 OHM PLATINUM RTD AVERAGING TYPE. SENSOR SHALL HAVE A BENDABLE COPPER CASE TO CRISSCROSS DUCT OR PLENUM. SENSOR SHALL BE AS MANUFACTURED BY KELE OR EQUAL.

C. OUTSIDE AIR TEMPERATURE SENSOR SHALL BE MOUNTED IN OUTSIDE AIR INTAKE SECTION. SENSOR SHALL BE 2 WIRE, 1000 OHM PLATINUM RTD TYPE. SENSORS SHALL BE MOUNTED IN SHADE ENCLOSURE. SENSOR SHALL BE AS MANUFACTURED BY KELE OR EQUAL.

D. TEMPERATURE SENSORS SHALL HAVE AN ACCURACY OF +/- 0.65ºF AT 70ºF.

E. WASHDOWN AREAS: DEVICES LOCATED WITHIN WASHDOWN OR WET AREAS SHALL BE NEMA 4X RATED. MOUNT SENSOR IN WATERPROOF BOX WITH STAINLESS STEEL COVER PLATE.

2.5 HUMIDITY SENSORS

A. RANGE:

1. IN GENERAL DUCT AND ROOM SENSORS SHALL HAVE A SENSING RANGE OF 20% TO 80%.
2. SENSORS FOR HIGH HUMIDITY AREAS SHALL HAVE A SENSING RANGE OF 20% TO 95%.

B. ELEMENTS:

1. IN GENERAL DUCT AND ROOM SENSORS ACCURATE WITHIN 5 PERCENT FULL RANGE WITH LINEAR OUTPUT.
2. SENSORS FOR HIGH HUMIDITY AREAS SHALL BE ACCURATE TO WITHIN 1 PERCENT FULL RANGE WITH LINEAR OUTPUT.

C. DUCT SENSORS SHALL BE PROVIDED WITH A SAMPLING CHAMBER.

D. OUTDOOR AIR HUMIDITY SENSORS SHALL HAVE A SENSING RANGE OF 20% TO 95% RH. THEY SHALL BE SUITABLE FOR AMBIENT CONDITIONS OF -40°F TO 170°F.

E. HUMIDITY SENSOR'S DRIFT SHALL NOT EXCEED 1% OF FULL SCALE PER YEAR.
F. WASHDOWN AREAS: DEVICES LOCATED WITHIN WASHDOWN OR WET AREAS SHALL BE NEMA 4X RATED.

2.6 PRESSURE TRANSDUCERS

A. DIFFERENTIAL PRESSURE TRANSDUCERS SHALL BE FOR ROOM OR DUCT APPLICATIONS TO MEASURE DIFFERENTIAL AIR STATIC PRESSURE. TRANSDUCER SHALL HAVE LINEAR 4-20 MA OUTPUT SIGNAL. ZERO AND SPAN SHALL BE FIELD ADJUSTABLE.
B. INPUT POWER SHALL BE 24VDC.
C. TRANSDUCER SENSING ELEMENTS SHALL WITHSTAND CONTINUOUS OPERATING CONDITIONS OF POSITIVE OR NEGATIVE PRESSURE 50% GREATER THAN CALIBRATED SPAN WITHOUT DAMAGE.
D. PRESSURE TRANSDUCERS SHALL BE INSTALLED IN SPACES OF VAV SYSTEMS AND SHALL MONITOR SPACE PRESSURE FOR ALL ECONOMIZER EQUIPPED AIR HANDLING UNITS.
E. RANGE OF TRANSDUCER SHALL SUIT APPLICATION.
F. WASHDOWN AREAS: DEVICES LOCATED WITHIN WASHDOWN OR WET AREAS SHALL BE NEMA 4X RATED.

2.7 DIFFERENTIAL PRESSURE TRANSMITTER

A. THE DIFFERENTIAL PRESSURE TRANSMITTER SHALL BE UTILIZED FOR MEASURING AND REPORTING DUCT/BUILDING STATIC PRESSURE, ROOM-TO-ROOM DIFFERENTIAL PRESSURE OR AIR FLOW VELOCITIES/VOLUMES. THE TRANSMITTER MICRO-MACHINED SILICON PIEZORESISTIVE PRESSURE SENSOR SHALL BE SPECIFICALLY DEVELOPED FOR LOW DIFFERENTIAL PRESSURE. THE SENSOR SHALL PROVIDE FIVE-POINT ERROR CORRECTION OVER THE COMPENSATED TEMPERATURE RANGE FOR ACCURACY, REPEATABILITY AND STABILITY.
B. THE DIFFERENTIAL PRESSURE TRANSMITTER SHALL BE BAPI ZPS SERIES (OR APPROVED EQUAL) WITH STAINLESS STEEL PRESSURE SENSOR, NEMA 4 ENCLOSURE AND LCD SCREEN.

2.8 DIFFERENTIAL PRESSURE TYPE SWITCHES

A. AIR OR WATER SERVICE SHALL BE UL LISTED, SPDT SNAP-ACTING, PILOT DUTY RATED (125 VA MINIMUM), NEMA 1 ENCLOSURE, WITH SCALE RANGE AND DIFFERENTIAL SUITABLE FOR INTENDED APPLICATION OR AS SHOWN.
B. DIFFERENTIAL PRESSURE SWITCHES SHALL BE INSTALLED AT AIR HANDLING UNITS FILTER BANK.

2.9 INDOOR AIR QUALITY SENSORS

A. INDOOR AIR QUALITY SENSORS SHALL MEASURE CO2 IN PPM. SENSORS SHALL BE DUCT OR SPACE MOUNTED.

2.10 FLOW SWITCHES

A. FLOW-PROVING SWITCHES SHALL BE EITHER PADDLE OR DIFFERENTIAL PRESSURE TYPE, AS SHOWN.
B. PADDLE TYPE SWITCHES (WATER SERVICE ONLY) SHALL BE UL LISTED, SPDT SNAP-ACTING WITH PILOT DUTY RATING (125 VA MINIMUM) AND SHALL HAVE ADJUSTABLE SENSITIVITY WITH NEMA 1 ENCLOSURE UNLESS OTHERWISE SPECIFIED.
C. DIFFERENTIAL PRESSURE TYPE SWITCHES (AIR OR WATER SERVICE) SHALL BE UL LISTED, SPDT SNAPACTING, PILOT DUTY RATED (125 VA MINIMUM), NEMA 1 ENCLOSURE, WITH SCALE RANGE AND DIFFERENTIAL SUITABLE FOR INTENDED APPLICATION OR AS SPECIFIED.

2.11 RELAYS

A. CONTROL RELAYS SHALL BE UL LISTED PLUG-IN TYPE WITH DUST COVER AND LED "ENERGIZED" INDICATOR. CONTACT RATING, CONFIGURATION, AND COIL VOLTAGE SHALL BE SUITABLE FOR APPLICATION.
B. TIME DELAY RELAYS SHALL BE UL LISTED SOLID-STATE PLUG-IN TYPE WITH ADJUSTABLE TIME DELAY. DELAY SHALL BE ADJUSTABLE ±200% (MINIMUM) FROM SET POINT SHOWN ON PLANS. CONTACT RATING, CONFIGURATION, AND COIL VOLTAGE SHALL BE SUITABLE FOR APPLICATION. PROVIDE NEMA 1 ENCLOSURE WHEN NOT INSTALLED IN LOCAL CONTROL PANEL.

2.12 OVERRIDE TIMERS

A. OVERRIDE TIMERS SHALL BE SPRING-WOUND LINE VOLTAGE, UL LISTED, WITH CONTACT RATING AND CONFIGURATION AS REQUIRED BY APPLICATION. PROVIDE 0-TO-6-HOUR CALIBRATED DIAL UNLESS OTHERWISE SPECIFIED. TIMER SHALL BE SUITABLE FOR FLUSH MOUNTING ON CONTROL PANEL FACE AND LOCATED ON LOCAL CONTROL PANELS OR WHERE SHOWN.

2.13 CURRENT TRANSMITTERS

A. AC CURRENT TRANSMITTERS SHALL BE THE SELF-POWERED, COMBINATION SPLIT-CORE CURRENT TRANSFORMER TYPE WITH BUILT-IN RECTIFIER AND HIGH-GAIN SERVO AMPLIFIER WITH 4 TO 20 MA TWO-WIRE OUTPUT. UNIT RANGES SHALL BE 10 A, 20 A, 50 A, 100 A, 150 A, AND 200 A FULL SCALE, WITH INTERNAL ZERO AND SPAN ADJUSTMENT AND ±1% FULL-SCALE ACCURACY AT 500 OHM MAXIMUM BURDEN.

B. TRANSMITTER SHALL MEET OR EXCEED ANSI/ISA S50.1 REQUIREMENTS AND SHALL BE UL/CSA RECOGNIZED.

C. UNIT SHALL BE SPLIT-CORE TYPE FOR CLAMP-ON INSTALLATION ON EXISTING WIRING.

2.14 CURRENT TRANSFORMERS

A. AC CURRENT TRANSFORMERS SHALL BE UL/CSA RECOGNIZED AND COMPLETELY ENCASED (EXCEPT FOR TERMINALS) IN APPROVED PLASTIC MATERIAL.

B. TRANSFORMERS SHALL BE AVAILABLE IN VARIOUS CURRENT RATIOS AND SHALL BE SELECTED FOR ±1% ACCURACY AT 5 A FULL-SCALE OUTPUT.

C. TRANSFORMERS SHALL BE FIXED-CORE OR SPLIT-CORE TYPE FOR INSTALLATION ON NEW OR EXISTING WIRING, RESPECTIVELY.

2.15 VOLTAGE TRANSMITTERS

A. AC VOLTAGE TRANSMITTERS SHALL BE SELF-POWERED SINGLE-LOOP (TWO-WIRE) TYPE, 4 TO 20 MA OUTPUT WITH ZERO AND SPAN ADJUSTMENT.

B. RANGES SHALL INCLUDE 100 TO 130 VAC, 200 TO 250 VAC, 250 TO 330 VAC, AND 400 TO 600 VAC FULL-SCALE, ADJUSTABLE, WITH ±1% FULL-SCALE ACCURACY WITH 500 OHM MAXIMUM BURDEN.

C. TRANSMITTERS SHALL BE UL/CSA RECOGNIZED AT 600 VAC RATING AND MEET OR EXCEED ANSI/ISA S50.1 REQUIREMENTS.

2.16 VOLTAGE TRANSFORMERS

A. AC VOLTAGE TRANSFORMERS SHALL BE UL/CSA RECOGNIZED, 600 VAC RATED, COMPLETE WITH BUILT-IN FUSE PROTECTION.

B. TRANSFORMERS SHALL BE SUITABLE FOR AMBIENT TEMPERATURES OF 40°F TO 130°F AND SHALL PROVIDE ±0.5% ACCURACY AT 24 VAC AND A 5 VA LOAD.

C. WINDINGS (EXCEPT FOR TERMINALS) SHALL BE COMPLETELY ENCLOSED WITH METAL OR PLASTIC MATERIAL.

2.17 POWER MONITORS

A. POWER MONITORS SHALL BE THE THREE-PHASE TYPE FURNISHED WITH THREE-PHASE DISCONNECT/SHORTING SWITCH ASSEMBLY, UL LISTED VOLTAGE TRANSFORMERS, AND UL LISTED SPLIT-CORE CURRENT TRANSFORMERS.

B. THEY SHALL PROVIDE A SELECTABLE RATE PULSE OUTPUT FOR KWH READING AND A 4 TO 20 MA OUTPUT FOR KW READING. THEY SHALL OPERATE WITH 5 A CURRENT INPUTS WITH A MAXIMUM ERROR OF ±2% AT 1.0 POWER FACTOR OR ±2.5% AT 0.5 POWER FACTOR.

2.18 CURRENT SWITCHES

A. CURRENT-OPERATED SWITCHES SHALL BE SELF-POWERED, SOLID-STATE WITH ADJUSTABLE TRIP CURRENT. THE SWITCHES SHALL BE SELECTED TO MATCH THE CURRENT OF THE APPLICATION AND OUTPUT REQUIREMENTS OF THE DDC SYSTEM.

2.19 HAND/OFF/AUTO SWITCH (HOA SWITCH)

A. THREE POSITION ROTARY OR TOGGLE SWITCH TO BE MOUNTED TO THE WALL.

B. THE HAND POSITION SHALL ENERGIZE THE SYSTEM THAT THE SWITCH CONTROLS. THE OFF POSITION SHALL TURN OFF ALL MOTORS AND CLOSE ALL DAMPERS OF THE SYSTEM THAT ARE CONTROLLED BY THE SWITCH. THE AUTO POSITION SHALL BE CONTROLLED BY A SENSOR DESCRIBED ON DRAWINGS OR SPECIFICATIONS.

C. WASHDOWN AREAS: SWITCHES LOCATED WITHIN WASHDOWN OR WET AREAS SHALL BE NEMA 4X RATED.

2.20 LOCAL CONTROL PANELS

A. ALL INDOOR CONTROL CABINETS SHALL BE FULLY ENCLOSED NEMA 1 CONSTRUCTION WITH (HINGED DOOR) KEY-LOCK LATCH AND REMOVABLE SUBPANELS. A SINGLE KEY SHALL BE COMMON TO ALL FIELD PANELS AND SUBPANELS. ANY CONTROL PANELS TO BE INSTALLED IN WASHDOWN OR WET AREA SHALL BE IN NEMA 4X TYPE ENCLOSURE.

B. INTERCONNECTIONS BETWEEN INTERNAL AND FACE MOUNTED DEVICES SHALL BE PREWIRED WITH COLOR CODED STRANDED CONDUCTORS NEATLY INSTALLED IN PLASTIC TROUGHS AND/OR TIE-WRAPPED. TERMINALS FOR FIELD CONNECTIONS SHALL BE UL LISTED FOR 600 VOLT SERVICE, INDIVIDUALLY IDENTIFIED PER CONTROL/ INTERLOCK DRAWINGS, WITH ADEQUATE CLEARANCE FOR FIELD WIRING. CONTROL TERMINATIONS FOR FIELD CONNECTION SHALL BE INDIVIDUALLY IDENTIFIED PER CONTROL DRAWINGS.

C. PROVIDE ON/OFF POWER SWITCH WITH OVERCURRENT PROTECTION FOR CONTROL POWER SOURCES TO EACH LOCAL PANEL.

2.21 WIRING AND RACEWAYS

A. PROVIDE COPPER WIRING, CONDUIT AND RACEWAYS AS SPECIFIED IN THE APPLICABLE SECTIONS OF DIVISION 16.

B. ELECTRICAL CONTRACTOR WILL BE INSTALLING POWER AND DATA TRAY ABOVE IMP CEILING IN THE PRODUCTION AREA. HVAC CONTROL CONTRACTOR MAY USE THE CABLE TRAY FOR CONTROL WIRING

C. ALL INSULATED WIRE TO BE COPPER CONDUCTORS, UL LABELED FOR 90°C MINIMUM SERVICE.

2.22 WALL SWITCH

A. SWITCHES SHALL BE TWO POSITION TWIST TYPE FOR START AND STOP. SWITCHED SHALL BE SIMILAR TO ALLEN BRADLEY 800. SWITCHES SHALL BE WITHIN WASHDOWN OR WET AREAS AND SHALL BE NEMA 4X RATED.

B. ENGINE ROOM EXHAUST FAN SWITCHES SHALL BE ON ONLY BREAK GLASS TYPE. SWITCH ENCLOSURE SHALL BE SUITED FOR OUTDOOR MOUNTING.

PART 3: EXECUTION

3.1 EXAMINATION

A. VERIFY THAT SYSTEMS ARE READY TO RECEIVE WORK.

B. BEGINNING OF INSTALLATION MEANS INSTALLER ACCEPTS EXISTING CONDITIONS.

C. SEQUENCE WORK TO ENSURE INSTALLATION OF COMPONENTS IS COMPLEMENTARY TO INSTALLATION OF SIMILAR COMPONENTS IN OTHER SYSTEMS.

D. COORDINATE INSTALLATION OF SYSTEM COMPONENTS WITH INSTALLATION OF MECHANICAL SYSTEMS EQUIPMENT SUCH AS AIR HANDLING UNITS AND AIR TERMINAL UNITS.

E. ENSURE INSTALLATION COMPONENTS ARE COMPLEMENTARY TO INSTALLATION OF SIMILAR COMPONENTS.

F. COORDINATE INSTALLATION OF SYSTEM COMPONENTS WITH INSTALLATION OF MECHANICAL SYSTEMS EQUIPMENT SUCH AS AIR HANDLING UNITS AND AIR TERMINAL UNITS.

3.2 GENERAL

A. INSTALL IN ACCORDANCE WITH MANUFACTURERS INSTRUCTIONS.

B. CHECK AND VERIFY LOCATION OF THERMOSTATS AND HUMIDISTATS AND OTHER EXPOSED CONTROL SENSORS WITH PLANS AND ROOM DETAILS BEFORE INSTALLATION. LOCATE SPACE SENSORS 54 INCHES ABOVE FLOOR IN OFFICE SPACE. ALIGN WITH LIGHTING SWITCHES.

C. MOUNT FREEZE PROTECTION THERMOSTATS USING FLANGES AND ELEMENT HOLDERS.

D. MOUNT OUTDOOR RESET THERMOSTATS AND OUTDOOR SENSORS INDOORS, WITH SENSING ELEMENTS OUTDOORS

E. PROVIDE SEPARABLE SOCKETS FOR LIQUIDS AND FLANGES FOR AIR BULB ELEMENTS.

F. PROVIDE ISOLATION TWO POSITION DAMPERS OF PARALLEL BLADE CONSTRUCTION.

G. INSTALL DAMPER MOTORS ON OUTSIDE OF DUCT IN WARM AREAS. DO NOT INSTALL MOTORS IN LOCATIONS AT OUTDOOR TEMPERATURES.

H. MOUNT CONTROL PANELS ADJACENT TO ASSOCIATED EQUIPMENT ON VIBRATION FREE WALLS OR FREE STANDING ANGLE IRON SUPPORTS. ONE CABINET MAY ACCOMMODATE MORE THAN ONE SYSTEM IN SAME EQUIPMENT ROOM. PROVIDE ENGRAVED PLASTIC NAMEPLATES FOR INSTRUMENTS AND CONTROLS INSIDE CABINET AND ENGRAVED PLASTIC NAMEPLATES ON CABINET FACE.

I. INSTALL "HAND/OFF/AUTO" SELECTOR SWITCHES TO OVERRIDE AUTOMATIC INTERLOCK CONTROLS WHEN SWITCH IS IN "HAND" POSITION.

J. PROVIDE CONDUIT AND ELECTRICAL WIRING IN ACCORDANCE WITH SECTION 16180. ELECTRICAL MATERIAL AND INSTALLATION SHALL BE IN ACCORDANCE WITH APPROPRIATE REQUIREMENTS OF DIVISION 16.

3.3 INSTALLATION OF SENSORS

A. INSTALL SENSORS IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS.

B. MOUNT SENSORS RIGIDLY AND ADEQUATELY FOR THE ENVIRONMENT WITHIN WHICH THE SENSOR OPERATES.

C. ROOM TEMPERATURE SENSORS SHALL BE INSTALLED ON CONCEALED JUNCTION BOXES PROPERLY SUPPORTED BY THE WALL FRAMING.

D. ALL WIRES ATTACHED TO SENSORS SHALL BE AIR SEALED IN THEIR RACEWAYS OR IN THE WALL TO STOP AIR TRANSMITTED FROM OTHER AREAS AFFECTING SENSOR READINGS.

E. SENSORS USED IN MIXING PLENUMS AND HOT AND COLD DECKS SHALL BE OF THE AVERAGING TYPE. AVERAGING SENSORS SHALL BE INSTALLED IN A SERPENTINE MANNER VERTICALLY ACROSS THE DUCT. EACH BEND SHALL BE SUPPORTED WITH A CAPILLARY CLIP.

F. LOW-LIMIT SENSORS USED IN MIXING PLENUMS SHALL BE INSTALLED IN A SERPENTINE MANNER HORIZONTALLY ACROSS DUCT. EACH BEND SHALL BE SUPPORTED WITH A CAPILLARY CLIP. PROVIDE 1 FT OF SENSING ELEMENT FOR EACH 1 FT2 OF COIL AREA.

G. ALL PIPE-MOUNTED TEMPERATURE SENSORS SHALL BE INSTALLED IN WELLS. INSTALL ALL LIQUID TEMPERATURE SENSORS WITH HEAT-CONDUCTING FLUID IN THERMAL WELLS.

H. INSTALL OUTDOOR AIR TEMPERATURE SENSORS ON NORTH WALL, COMPLETE WITH SUN SHIELD AT DESIGNATED LOCATION.

I. DIFFERENTIAL AIR STATIC PRESSURE.

1. SUPPLY DUCT STATIC PRESSURE: PIPE THE HIGH PRESSURE TAP TO THE DUCT USING A PITOT TUBE. PIPE THE LOW-PRESSURE PORT TO A TEE IN THE HIGH PRESSURE TAP TUBING OF THE CORRESPONDING BUILDING STATIC PRESSURE SENSOR (IF APPLICABLE) OR TO THE LOCATION OF THE DUCT HIGH-PRESSURE TAP AND LEAVE OPEN TO THE PLENUM.
2. RETURN DUCT STATIC PRESSURE: PIPE THE HIGH PRESSURE TAP TO THE DUCT USING A PITOT TUBE. PIPE THE LOW-PRESSURE PORT TO A TEE IN THE LOW PRESSURE TAP TUBING OF THE CORRESPONDING BUILDING STATIC PRESSURE SENSOR.
3. BUILDING STATIC PRESSURE: PIPE THE LOW-PRESSURE PORT OF THE PRESSURE SENSOR TO THE STATIC PRESSURE PORT LOCATED ON THE OUTSIDE OF THE BUILDING THROUGH A HIGH-VOLUME ACCUMULATOR. PIPE THE HIGH-PRESSURE PORT TO A LOCATION BEHIND A THERMOSTAT COVER.
4. THE PIPING TO THE PRESSURE PORTS ON ALL PRESSURE TRANSDUCERS SHALL CONTAIN A CAPPED TEST PORT LOCATED ADJACENT TO THE TRANSDUCER.
5. ALL PRESSURE TRANSDUCERS, OTHER THAN THOSE CONTROLLING VAV BOXES, SHALL BE LOCATED IN FIELD DEVICE PANELS, NOT ON THE EQUIPMENT MONITORED OR ON DUCTWORK. MOUNT TRANSDUCERS IN A LOCATION ACCESSIBLE FOR SERVICE WITHOUT USE OF LADDERS OR SPECIAL EQUIPMENT.

6. ALL AIR AND WATER DIFFERENTIAL PRESSURE SENSORS SHALL HAVE GAUGE TEES MOUNTED ADJACENT TO THE TAPS. WATER GAUGES SHALL ALSO HAVE SHUTOFF VALVES INSTALLED BEFORE THE TEE.

J. FLOW SWITCH INSTALLATION
   1. USE CORRECT PADDLE FOR PIPE DIAMETER.
   2. ADJUST FLOW SWITCH IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS.

K. ACTUATORS
   1. MOUNT AND LINK CONTROL DAMPER ACTUATORS ACCORDING TO MANUFACTURER'S INSTRUCTIONS.
      a. TO COMPRESS SEALS WHEN SPRING-RETURN ACTUATORS ARE USED ON NORMALLY CLOSED DAMPERS, POWER ACTUATOR TO APPROXIMATELY 5° OPEN POSITION, MANUALLY CLOSE THE DAMPER, AND THEN TIGHTEN THE LINKAGE.
      b. CHECK OPERATION OF DAMPER/ACTUATOR COMBINATION TO CONFIRM THAT ACTUATOR MODULATES DAMPER SMOOTHLY THROUGHOUT STROKE TO BOTH OPEN AND CLOSED POSITIONS.
      c. PROVIDE ALL MOUNTING HARDWARE AND LINKAGES FOR ACTUATOR INSTALLATION.
   2. ELECTRIC/ELECTRONIC
      a. DAMPERS: ACTUATORS SHALL BE DIRECT-MOUNTED ON DAMPER SHAFT OR JACKSHAFT UNLESS SHOWN AS A LINKAGE INSTALLATION. FOR LOW-LEAKAGE DAMPERS WITH SEALS, THE ACTUATOR SHALL BE MOUNTED WITH A MINIMUM 5° AVAILABLE FOR TIGHTENING THE DAMPER SEALS. ACTUATORS SHALL BE MOUNTED FOLLOWING MANUFACTURER'S RECOMMENDATIONS.
      b. VALVES: ACTUATORS SHALL BE CONNECTED TO VALVES WITH ADAPTERS APPROVED BY THE ACTUATOR MANUFACTURER. ACTUATORS AND ADAPTERS SHALL BE MOUNTED FOLLOWING THE ACTUATOR MANUFACTURER'S RECOMMENDATIONS.

END OF SECTION

SECTION 23 09 23

DIRECT DIGITAL CONTROL (DDC) SYSTEM

PART 1: GENERAL

1.1 THE WORK OF THIS SECTION SHALL INCLUDE:

A. FURNISH A TOTALLY NATIVE BACNET-BASED SYSTEM, INCLUDING A MICROSOFT 7 OR 10 COMPATIBLE OPERATOR'S WORKSTATION. THE OPERATOR'S WORKSTATION, ALL BUILDING CONTROLLERS, APPLICATION CONTROLLERS, AND ALL INPUT/OUTPUT DEVICES SHALL COMMUNICATE USING THE PROTOCOLS AND NETWORK STANDARDS AS DEFINED BY ANSI/ASHRAE STANDARD 135–2008, BACNET. IN OTHER WORDS, ALL WORKSTATIONS AND CONTROLLERS, INCLUDING UNITARY CONTROLLERS, SHALL BE NATIVE BACNET DEVICES. NO GATEWAYS SHALL BE USED FOR COMMUNICATION TO CONTROLLERS INSTALLED UNDER THIS SECTION. GATEWAYS MAY BE USED FOR COMMUNICATION TO EXISTING SYSTEMS OR TO SYSTEMS INSTALLED UNDER OTHER SECTIONS.

B. PROVIDE ALL NECESSARY BACNET-COMPLIANT HARDWARE AND SOFTWARE TO MEET THE SYSTEM'S FUNCTIONAL SPECIFICATIONS. PROVIDE PROTOCOL IMPLEMENTATION CONFORMANCE STATEMENT (PICS) FOR WINDOWS-BASED CONTROL SOFTWARE AND EVERY CONTROLLER IN SYSTEM, INCLUDING UNITARY CONTROLLERS.

C. PREPARE INDIVIDUAL HARDWARE LAYOUTS, INTERCONNECTION DRAWINGS, AND SOFTWARE CONFIGURATION FROM PROJECT DESIGN DATA.

D. IMPLEMENT THE DETAILED DESIGN FOR ALL ANALOG AND BINARY OBJECTS, SYSTEM DATABASES, GRAPHIC DISPLAYS, LOGS, AND MANAGEMENT REPORTS BASED ON CONTROL DESCRIPTIONS, LOGIC DRAWINGS, CONFIGURATION DATA, AND BID DOCUMENTS.

E. DESIGN, PROVIDE, AND INSTALL ALL EQUIPMENT CABINETS, PANELS, DATA COMMUNICATION NETWORK CABLES NEEDED, AND ALL ASSOCIATED HARDWARE.

F. PROVIDE AND INSTALL ALL INTERCONNECTING CABLES BETWEEN SUPPLIED CABINETS, APPLICATION CONTROLLERS, AND INPUT/OUTPUT DEVICES.

G. PROVIDE AND INSTALL ALL INTERCONNECTING CABLES BETWEEN ALL OPERATOR'S TERMINALS AND PERIPHERAL DEVICES (SUCH AS PRINTERS, ETC.) SUPPLIED UNDER THIS SECTION.

H. PROVIDE COMPLETE MANUFACTURER'S SPECIFICATIONS FOR ALL ITEMS THAT ARE SUPPLIED. INCLUDE VENDOR NAME OF EVERY ITEM SUPPLIED.

I. PROVIDE SUPERVISORY SPECIALISTS AND TECHNICIANS AT THE JOB SITE TO ASSIST IN ALL PHASES OF SYSTEM INSTALLATION, STARTUP, AND COMMISSIONING.

J. PROVIDE A COMPREHENSIVE OPERATOR AND TECHNICIAN TRAINING PROGRAM AS DESCRIBED HEREIN.

K. PROVIDE AS-BUILT DOCUMENTATION, OPERATOR'S TERMINAL SOFTWARE, DIAGRAMS, AND ALL OTHER ASSOCIATED PROJECT OPERATIONAL DOCUMENTATION (SUCH AS TECHNICAL MANUALS) ON APPROVED MEDIA, THE SUM TOTAL OF WHICH ACCURATELY REPRESENTS THE FINAL SYSTEM.

L. PROVIDE NEW SENSORS, DAMPERS, VALVES, AND INSTALL ONLY NEW ELECTRONIC ACTUATORS. NO USED COMPONENTS SHALL BE USED AS ANY PART OR PIECE OF INSTALLED SYSTEM.

M. THE FOLLOWING EQUIPMENT (AS SCHEDULES ON THE MECHANICAL DRAWINGS) SHALL BE INCLUDED AS PART OF THE DDC BAS:

1. AHU-01
2. RTU-01 & ASSOCIATED VAVS
3. RTU-02
4. RTU-03
5. RTU-04
6. RTU-05
7. RTU-06
8. SF-01
9. SF-02
10. EF-01
11. EF-02
12. EF-03

13. EF-04
14. EF-05
15. EF-06
16. EF-07
17. EF-08
18. GV-01 (MOTORIZED DAMPER)
19. EUH-01
20. EUH-02
21. EUH-03
22. EUH-04
23. EUH-05
24. L-01 (MOTORIZED DAMPER)
25. CU-01
26. CU-02
27. CU-03
28. CU-04
29. CU-05
30. CU-06
31. CU-07
32. CU-08
33. CU-09
34. CU-10 (BY AHU-01 EM – SEE PROCESS AHU SPEC)
35. EVAP-01
36. EVAP-02
37. EVAP-03
38. EVAP-04
39. EVAP-05
40. EVAP-06
41. EVAP-07
42. EVAP-08
43. EVAP-09
44. EVAP-10
45. EVAP-11
46. EVAP-12
47. EVAP-13
48. EVAP-14
49. EVAP-15
50. EVAP-16

1.2 RELATED SECTIONS

A. DIVISION 1 SPECIFICATIONS
B. DIVISION 23 MECHANICAL SPECIFICATIONS
C. ELECTRICAL SPECIFICATIONS

1.3 SYSTEM DESCRIPTION

A. A DISTRIBUTED LOGIC CONTROL SYSTEM COMPLETE WITH ALL SOFTWARE AND HARDWARE FUNCTIONS SHALL BE PROVIDED AND INSTALLED. SYSTEM SHALL BE COMPLETELY BASED ON ANSI/ASHRAE STANDARD 135-2008, BACNET AND ACHIEVED LISTING UNDER THE BACNET TESTING LABORATORIES BACNET - ADVANCED WORKSTATION SOFTWARE (B-AWS). THIS SYSTEM IS TO CONTROL ALL MECHANICAL EQUIPMENT, INCLUDING ALL UNITARY EQUIPMENT SUCH AS VAV BOXES, AC UNITS, ETC., AND ALL AIR HANDLERS, AND ANY OTHER LISTED EQUIPMENT USING NATIVE BACNET-COMPLIANT COMPONENTS. NON-BACNET-COMPLIANT OR PROPRIETARY

EQUIPMENT OR SYSTEMS (INCLUDING GATEWAYS) SHALL NOT BE ACCEPTABLE AND ARE SPECIFICALLY PROHIBITED.

B. OPERATOR'S WORKSTATION SOFTWARE SHALL USE MICROSOFT WINDOWS 7 OR 10 AS THE COMPUTER OPERATING SYSTEM. THE ENERGY MANAGEMENT AND CONTROL SYSTEM (EMCS) APPLICATION PROGRAM SHALL BE WRITTEN TO COMMUNICATE SPECIFICALLY UTILIZING BACNET PROTOCOLS. SOFTWARE FUNCTIONS DELIVERED ON THIS PROJECT SHALL INCLUDE PASSWORD PROTECTION, SCHEDULING (INCLUDING OPTIMUM START), ALARMING, LOGGING OF HISTORICAL DATA, FULL GRAPHICS INCLUDING ANIMATION, AFTER-HOURS BILLING PROGRAM, DEMAND LIMITING, AND A FULL SUITE OF FIELD ENGINEERING TOOLS INCLUDING GRAPHICAL PROGRAMMING AND APPLICATIONS. SYSTEMS USING OPERATING SYSTEMS OTHER THAN THAT DESCRIBED ABOVE ARE STRICTLY PROHIBITED. ALL SOFTWARE REQUIRED TO PROGRAM APPLICATION SPECIFIC CONTROLLERS AND ALL FIELD LEVEL DEVICES AND CONTROLLERS WILL BE LEFT WITH THE OWNER. ALL SOFTWARE PASSWORDS REQUIRED TO PROGRAM AND MAKE FUTURE CHANGES TO THE SYSTEM WILL ALSO BECOME THE PROPERTY OF THE OWNER. ALL SOFTWARE REQUIRED TO MAKE ANY PROGRAM CHANGES ANYWHERE IN THE SYSTEM, ALONG WITH SCHEDULING AND TRENDING APPLICATIONS, WILL BE LEFT WITH THE OWNER. ALL SOFTWARE PASSWORDS REQUIRED TO PROGRAM AND MAKE FUTURE CHANGES TO SCHEDULES, TRENDS AND RELATED PROGRAM CHANGES WILL ALSO BECOME THE PROPERTY OF THE OWNER. ALL SOFTWARE REQUIRED FOR ALL FIELD ENGINEERING TOOLS INCLUDING GRAPHICAL PROGRAMMING AND APPLICATIONS WILL BE LEFT WITH THE OWNER. ALL SOFTWARE PASSWORDS REQUIRED TO PROGRAM AND MAKE FUTURE CHANGES TO FIELD ENGINEERING TOOLS, INCLUDING GRAPHICAL PROGRAMMING AND APPLICATIONS WILL BE LEFT WITH THE OWNER. IN ADDITION, PROVIDE THE MONITORING OF THE FOLLOWING SYSTEMS:

1. AS NOTED

C. BUILDING CONTROLLERS SHALL INCLUDE COMPLETE ENERGY MANAGEMENT SOFTWARE, INCLUDING SCHEDULING BUILDING CONTROL STRATEGIES WITH OPTIMUM START AND LOGGING ROUTINES. ALL ENERGY MANAGEMENT SOFTWARE AND FIRMWARE SHALL BE RESIDENT IN FIELD HARDWARE AND SHALL NOT BE DEPENDENT ON THE OPERATOR'S TERMINAL. OPERATOR'S TERMINAL SOFTWARE IS TO BE USED FOR ACCESS TO FIELD-BASED ENERGY MANAGEMENT FUNCTIONS ONLY. PROVIDE ZONE-BY-ZONE DIRECT DIGITAL LOGIC CONTROL OF SPACE TEMPERATURE, SCHEDULING, RUNTIME ACCUMULATION, EQUIPMENT ALARM REPORTING, OVERRIDE TIMERS FOR AFTER-HOURS USAGE, AND AUTOMATIC TEMPERATURE RESET BASED ON OUTSIDE AIR CONDITIONS.

D. ROOM SENSORS SHALL BE PROVIDED WITH DIGITAL READOUT THAT ALLOW THE USER TO VIEW ROOM TEMPERATURE, VIEW OUTSIDE AIR TEMPERATURE, ADJUST THE ROOM SETPOINT WITHIN PRESET LIMITS AND SET DESIRED OVERRIDE TIME. USER SHALL ALSO BE ABLE TO START AND STOP UNIT FROM THE DIGITAL SENSOR. INCLUDE ALL NECESSARY WIRING AND FIRMWARE SUCH THAT ROOM SENSOR INCLUDES FIELD SERVICE MODE. FIELD SERVICE MODE SHALL ALLOW A TECHNICIAN TO BALANCE VAV ZONES AND ACCESS ANY PARAMETER IN ZONE CONTROLLER DIRECTLY FROM THE ROOM SENSOR. FIELD SERVICE MODE SHALL HAVE THE ABILITY TO BE LOCKED OUT.

E. ALL APPLICATION CONTROLLERS FOR EVERY TERMINAL UNIT (VAV, ETC.) AIR HANDLER AND ANY OTHER PIECE OF CONTROLLED EQUIPMENT SHALL BE FULLY PROGRAMMABLE. APPLICATION CONTROLLERS SHALL BE MOUNTED NEXT TO CONTROLLED EQUIPMENT AND COMMUNICATE WITH BUILDING CONTROLLER THROUGH BACNET LAN.

1.4 APPROVED MANUFACTURERS

A. THE BASE BID SHALL BE THE BACTALK SYSTEM FROM ALERTON. OTHER MANUFACTURERS MAY BID BASED UPON MEETING ALL REQUIREMENTS OF THE SPECIFICATION AND RECEIVING APPROVAL FROM THE ENGINEER 30 DAYS PRIOR TO BID. A PARAGRAPH-BY-PARAGRAPH COMPARISON OF BASED BID SPECIFIED SYSTEM VERSUS ALTERNATIVE SYSTEM—ALONG WITH THREE REFERENCES OF SIMILAR PROJECTS (INCLUDE PROJECT NAME, CONTACT, PHONE

NUMBER, LOCATION, CONSULTANT, VALUE OF CONTRACT, AND A BRIEF DESCRIPTION OF THE CONTROL SYSTEM AND HOW IT OPERATES—SHALL BE SUBMITTED 45 DAYS PRIOR TO BID FOR REVIEW PROCESS. IF APPROVED, OTHER MANUFACTURERS' BIDS SHALL BE SHOWN AS AN ADD OR DEDUCT ON THE BID FORM.

B. APPROVED MANUFACTURERS:
   1. ALERTON
   2. HONEYWELL
   3. JCI
   4. TRANE
   5. APPROVED EQUAL

1.5 REFERENCE STANDARDS

A. THE LATEST EDITION OF THE FOLLOWING STANDARDS AND CODES IN EFFECT AND AMENDED AS OF SUPPLIER'S PROPOSAL DATE, AND ANY APPLICABLE SUBSECTIONS THEREOF, SHALL GOVERN DESIGN AND SELECTION OF EQUIPMENT AND MATERIAL SUPPLIED:
   1. AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR CONDITIONING ENGINEERS (ASHRAE).
   2. ANSI/ASHRAE STANDARD 135-2008, BACNET
   3. UNIFORM BUILDING CODE (UBC), INCLUDING LOCAL AMENDMENTS
   4. NATIONAL ELECTRICAL CODE (NEC).
   5. FCC PART 15, SUBPART J, CLASS A
   6. EMC DIRECTIVE 89/336/EEC (EUROPEAN CE MARK)
   7. UNDERWRITERS LABORATORIES, INC. (UL)
      a. UL 864 - CONTROL UNITS AND ACCESSORIES FOR FIRE ALARM SYSTEMS
      b. UL 916 - ENERGY MANAGEMENT EQUIPMENT
   8. CITY, COUNTY, STATE, AND FEDERAL REGULATIONS AND CODES IN EFFECT AS OF CONTRACT DATE.
   9. EXCEPT AS OTHERWISE INDICATED, THE SYSTEM SUPPLIER SHALL SECURE AND PAY FOR ALL PERMITS, INSPECTIONS, AND CERTIFICATIONS REQUIRED FOR HIS WORK, AND ARRANGE FOR NECESSARY APPROVALS BY THE GOVERNING AUTHORITIES.

1.6 SUBMITTALS

A. SUBMIT UNDER PROVISIONS OF SECTION 15050 – MECHANICAL GENERAL PROVISIONS.

B. PRODUCT DATA: MANUFACTURER'S DATA SHEETS ON EACH PRODUCT TO BE USED, INCLUDING:
   1. PREPARATION INSTRUCTIONS AND RECOMMENDATIONS.
   2. STORAGE AND HANDLING REQUIREMENTS AND RECOMMENDATIONS.
   3. INSTALLATION METHODS.

C. DRAWINGS:
   1. THE SYSTEM SUPPLIER SHALL SUBMIT ENGINEERED DRAWINGS, CONTROL SEQUENCE, AND BILL OF MATERIALS FOR APPROVAL.
   2. DRAWINGS SHALL BE SUBMITTED IN THE FOLLOWING STANDARD SIZES: 11 X 17 INCH (ANSI B).
   3. COMPLETE SETS (ELECTRONIC COPIES) OF SUBMITTAL DRAWINGS SHALL BE PROVIDED.
   4. DRAWINGS SHALL BE AVAILABLE ON CD-ROM.

D. SYSTEM DOCUMENTATION: INCLUDE THE FOLLOWING IN SUBMITTAL PACKAGE:
   1. SYSTEM CONFIGURATION DIAGRAMS IN SIMPLIFIED BLOCK FORMAT.
   2. INPUT/OUTPUT OBJECT LISTINGS AND AN ALARM POINT SUMMARY LISTING
   3. ELECTRICAL DRAWINGS THAT SHOW SYSTEM INTERNAL AND EXTERNAL CONNECTION POINTS, TERMINAL BLOCK LAYOUTS, AND TERMINAL IDENTIFICATION.
   4. COMPLETE BILL OF MATERIALS, VALVE SCHEDULE AND DAMPER SCHEDULE.
   5. MANUFACTURER'S INSTRUCTIONS AND DRAWINGS FOR INSTALLATION, MAINTENANCE, AND OPERATION OF PURCHASED ITEMS.

6. OVERALL SYSTEM OPERATION AND MAINTENANCE INSTRUCTIONS - INCLUDING PREVENTIVE MAINTENANCE AND TROUBLESHOOTING INSTRUCTIONS.
7. FOR SYSTEM ELEMENTS-OPERATOR'S WORKSTATIONS, BUILDING CONTROLLERS, APPLICATION CONTROLLERS, ROUTERS, AND REPEATERS-PROVIDE BACNET PROTOCOL IMPLEMENTATION CONFORMANCE STATEMENTS (PICS) AS PER ANSI/ASHRAE STANDARD 135.
8. PROVIDE COMPLETE DESCRIPTION AND DOCUMENTATION OF ANY PROPRIETARY (NON-BACNET) SERVICES AND/OR OBJECTS USED IN THE SYSTEM.
9. A LIST OF FUNCTIONS AVAILABLE AND A SAMPLE OF FUNCTION BLOCK PROGRAMMING THAT SHALL BE PART OF DELIVERED SYSTEM.

E. PROJECT MANAGEMENT: VENDOR SHALL PROVIDE DETAILED PROJECT DESIGN AND INSTALLATION SCHEDULE WITH TIME MARKINGS AND DETAILS FOR HARDWARE ITEMS AND SOFTWARE DEVELOPMENT PHASES. SCHEDULE SHALL SHOW ALL THE TARGET DATES FOR TRANSMISSION OF PROJECT INFORMATION AND DOCUMENTS, AND SHALL INDICATE TIMING AND DATES FOR SYSTEM INSTALLATION, DEBUGGING, AND COMMISSIONING.

1.7 QUALITY ASSURANCE

A. THE BUILDING AUTOMATION SYSTEM (BAS) SYSTEM SHALL BE DESIGNED, INSTALLED, COMMISSIONED, AND SERVICED BY MANUFACTURER AUTHORIZED AND TRAINED PERSONNEL. SYSTEM PROVIDER SHALL HAVE AN IN-PLACE SUPPORT FACILITY WITHIN 2 HOURS RESPONSE TIME OF THE SITE WITH TECHNICAL STAFF, SPARE PARTS INVENTORY, AND NECESSARY TEST AND DIAGNOSTIC EQUIPMENT.

B. THE CONTRACTOR SHALL PROVIDE FULL-TIME, ON-SITE, EXPERIENCED PROJECT MANAGER FOR THIS WORK, RESPONSIBLE FOR DIRECT SUPERVISION OF THE DESIGN, INSTALLATION, START-UP AND COMMISSIONING OF THE BAS SYSTEM.

C. THE CONTRACTOR SHALL BE REGULARLY ENGAGED IN THE DESIGN, INSTALLATION AND MAINTENANCE OF BAS SYSTEMS AND SHALL HAVE DEMONSTRATED TECHNICAL EXPERTISE AND EXPERIENCE IN THE DESIGN, INSTALLATION AND MAINTENANCE OF BAS SYSTEMS SIMILAR IN SIZE AND COMPLEXITY TO THIS PROJECT. BIDDERS SHALL PROVIDE A LIST OF AT LEAST 10 PROJECTS, SIMILAR IN SIZE AND SCOPE TO THIS PROJECT COMPLETED WITHIN THE PAST 3 YEARS.

D. MATERIALS AND EQUIPMENT SHALL BE MANUFACTURER'S LATEST STANDARD DESIGN THAT COMPLIES WITH THE SPECIFICATION REQUIREMENTS.

E. ALL BAS PEER-TO-PEER NETWORK CONTROLLERS, CENTRAL SYSTEM CONTROLLERS AND LOCAL USER DISPLAYS SHALL BE UL LISTED UNDER STANDARD UL 916, CATEGORY PAZX.

F. ALL ELECTRONIC EQUIPMENT SHALL CONFORM TO THE REQUIREMENTS OF FCC REGULATION, PART 15, GOVERNING RADIO FREQUENCY ELECTROMAGNETIC INTERFERENCE AND BE SO LABELED.

G. CONTROL SYSTEM SHALL BE ENGINEERED, PROGRAMMED AND SUPPORTED COMPLETELY BY REPRESENTATIVE'S LOCAL OFFICE THAT MUST BE WITHIN 100 MILES OF PROJECT SITE.

1.8 DELIVERY, STORAGE AND HANDLING

A. DELIVER, STORE AND HANDLE MATERIALS AND PRODUCTS IN STRICT COMPLIANCE WITH MANUFACTURER'S INSTRUCTIONS AND RECOMMENDATIONS AND INDUSTRY STANDARDS.

B. STORE MATERIALS IN MANUFACTURER'S ORIGINAL SEALED, LABELED PACKAGING UNTIL READY FOR INSTALLATION AND IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS. PROTECT FROM DAMAGE.

1.9 PROJECT CONDITIONS

A. MAINTAIN ENVIRONMENTAL CONDITIONS (TEMPERATURE, HUMIDITY AND VENTILATION) WITHIN LIMITS RECOMMENDED BY MANUFACTURER FOR OPTIMUM RESULTS. DO NOT INSTALL PRODUCTS UNDER ENVIRONMENTAL CONDITIONS OUTSIDE MANUFACTURER'S ABSOLUTE LIMITS.

1.10 WARRANTY

A. WARRANTY SHALL COVER COSTS FOR PARTS, LABOR, ASSOCIATED TRAVEL, AND EXPENSES FOR A PERIOD OF ONE YEAR FROM COMPLETION OF SYSTEM ACCEPTANCE. HARDWARE AND

SOFTWARE PERSONNEL SUPPORTING THIS WARRANTY AGREEMENT SHALL PROVIDE ON-SITE OR OFF-SITE SERVICE IN A TIMELY MANNER AFTER FAILURE NOTIFICATION TO THE VENDOR. THE MAXIMUM ACCEPTABLE RESPONSE TIME TO PROVIDE THIS SERVICE AT THE SITE SHALL BE 24 HOURS, MONDAY THROUGH FRIDAY AND 48 HOURS ON SATURDAY AND SUNDAY. WARRANTY SHALL APPLY EQUALLY TO BOTH HARDWARE AND SOFTWARE.

PART 2: PRODUCTS

2.1 OPERATORS WORKSTATION

A. GENERAL STRUCTURE OF WORKSTATION INTERACTION SHALL BE A STANDARD CLIENT/SERVER RELATIONSHIP. SERVER SHALL BE USED TO ARCHIVE DATA AND STORE SYSTEM DATABASE. CLIENTS SHALL ACCESS SERVER FOR ALL ARCHIVED DATA. EACH CLIENT SHALL INCLUDE FLEXIBILITY TO ACCESS GRAPHICS FROM SERVER OR LOCAL DRIVE. SERVER SHALL SUPPORT A MINIMUM OF 50 SIMULTANEOUS CLIENTS.

B. BACNET CONFORMANCE:

1. OPERATOR WORK STATION SHALL BE APPROVED BY THE BTL AS MEETING THE BACNET ADVANCED WORK STATION REQUIREMENTS.
2. PLEASE REFER TO THIS SPECIFICATION, BACNET FUNCTIONAL GROUPS, IN THE BACNET STANDARD, FOR A COMPLETE LIST OF THE SERVICES THAT MUST BE DIRECTLY SUPPORTED TO PROVIDE EACH OF THE FUNCTIONAL GROUPS LISTED ABOVE. ALL PROPRIETARY SERVICES, IF USED IN THE SYSTEM, SHALL BE THOROUGHLY DOCUMENTED AND PROVIDED AS PART OF THE SUBMITTAL DATA. ALL NECESSARY TOOLS SHALL BE SUPPLIED FOR WORKING WITH PROPRIETARY INFORMATION.
3. STANDARD BACNET OBJECT TYPES ACCESSED BY THE WORKSTATION SHALL INCLUDE AS A MINIMUM: ANALOG VALUE, ANALOG INPUT, ANALOG OUTPUT, BINARY VALUE, BINARY INPUT, BINARY OUTPUT, CALENDAR, DEVICE, EVENT ENROLLMENT, FILE, NOTIFICATION CLASS, PROGRAM, AND SCHEDULE OBJECT TYPES. ALL PROPRIETARY OBJECT TYPES, IF USED IN THE SYSTEM, SHALL BE THOROUGHLY DOCUMENTED AND PROVIDED AS PART OF THE SUBMITTAL DATA. ALL NECESSARY TOOLS SHALL BE SUPPLIED FOR WORKING WITH PROPRIETARY INFORMATION.
4. THE OPERATOR'S WORKSTATION SHALL COMPLY WITH ANNEX J OF THE BACNET SPECIFICATION FOR IP CONNECTIONS. MUST SUPPORT REMOTE CONNECTION TO SERVER USING A THICK CLIENT APPLICATION. THIS DEVICE SHALL USE ETHERNET TO CONNECT TO THE IP INTERNETWORK, WHILE USING THE SAME ETHERNET LAN FOR NON-IP COMMUNICATIONS TO OTHER BACNET DEVICES ON THE LAN. MUST SUPPORT INTEROPERABILITY ON WIDE AREA NETWORKS (WANS) AND CAMPUS AREA NETWORKS (CANS). WORKSTATION SHALL SUPPORT FOREIGN DEVICE REGISTRATION TO ALLOW TEMPORARY WORKSTATION CONNECTION TO IP NETWORK.

C. DISPLAYS:

1. OPERATOR'S WORKSTATION SHALL DISPLAY ALL DATA ASSOCIATED WITH PROJECT AS CALLED OUT ON DRAWINGS AND/OR OBJECT TYPE LIST SUPPLIED. GRAPHIC FILES SHALL BE CREATED USING DIGITAL, FULL COLOR PHOTOGRAPHS OF SYSTEM INSTALLATION, AUTOCAD OR VISIO DRAWING FILES OF FIELD INSTALLATION DRAWINGS AND WIRING DIAGRAMS FROM AS-BUILT DRAWINGS. OPERATOR'S WORKSTATION SHALL DISPLAY ALL DATA USING THREE-DIMENSIONAL GRAPHIC REPRESENTATIONS OF ALL MECHANICAL EQUIPMENT. SYSTEM SHALL BE CAPABLE OF DISPLAYING GRAPHIC FILE, TEXT, AND DYNAMIC OBJECT DATA TOGETHER ON EACH DISPLAY AND SHALL INCLUDE ANIMATION. INFORMATION SHALL BE LABELED WITH DESCRIPTORS AND SHALL BE SHOWN WITH THE APPROPRIATE ENGINEERING UNITS. ALL INFORMATION ON ANY DISPLAY SHALL BE DYNAMICALLY UPDATED WITHOUT ANY ACTION BY THE USER. WORKSTATION SHALL ALLOW USER TO CHANGE ALL FIELD-RESIDENT EMCS FUNCTIONS ASSOCIATED WITH THE PROJECT, SUCH AS SETPOINTS, WEEKLY SCHEDULES, EXCEPTION SCHEDULES, ETC., FROM ANY SCREEN, NO MATTER IF THAT SCREEN SHOWS ALL TEXT OR A COMPLETE

GRAPHIC DISPLAY. THIS SHALL BE DONE WITHOUT ANY REFERENCE TO OBJECT ADDRESSES OR OTHER NUMERIC/MNEMONIC INDICATIONS.

2. ALL DISPLAYS AND PROGRAMMING SHALL BE GENERATED AND CUSTOMIZED BY THE LOCAL EMCS SUPPLIER AND INSTALLER. SYSTEMS REQUIRING FACTORY DEVELOPMENT OF GRAPHICS OR PROGRAMMING OF DDC LOGIC ARE SPECIFICALLY PROHIBITED.
3. BINARY OBJECTS SHALL BE DISPLAYED AS ACTIVE/INACTIVE/NULL OR WITH CUSTOMIZED TEXT SUCH AS HAND-OFF-AUTO. TEXT SHALL BE JUSTIFIED LEFT, RIGHT OR CENTER AS SELECTED BY THE USER. ALSO, ALLOW BINARY OBJECTS TO BE DISPLAYED AS INDIVIDUAL CHANGE-OF-STATE GRAPHIC OBJECTS ON THE DISPLAY SCREEN SUCH THAT THEY OVERLAY THE SYSTEM GRAPHIC. EACH BINARY OBJECT DISPLAYED IN THIS MANNER SHALL BE ASSIGNED UP TO THREE GRAPHIC FILES FOR DISPLAY WHEN THE POINT IS ON, OFF OR IN ALARM. FOR BINARY OUTPUTS, TOGGLE THE OBJECT'S COMMANDED STATUS WHEN THE GRAPHIC ITEM IS SELECTED WITH THE SYSTEM MOUSE. SIMILARLY, ALLOW THE WORKSTATION OPERATOR TO TOGGLE THE BINARY OBJECT'S STATUS BY SELECTING WITH THE MOUSE, FOR EXAMPLE, A GRAPHIC OF A SWITCH OR LIGHT, WHICH THEN DISPLAYS A DIFFERENT GRAPHIC (SUCH AS AN "ON" SWITCH OR LIGHTED LAMP. ADDITIONALLY, ALLOW BINARY OBJECTS TO BE DISPLAYED AS AN ANIMATED GRAPHIC. ANIMATED GRAPHIC OBJECTS SHALL BE DISPLAYED AS A SEQUENCE OF MULTIPLE GRAPHICS TO SIMULATE MOTION. FOR EXAMPLE, WHEN A PUMP IS IN THE OFF CONDITION, DISPLAY A STATIONARY GRAPHIC OF THE PUMP. WHEN THE OPERATOR SELECTS THE PUMP GRAPHIC WITH THE MOUSE, THE REPRESENTED OBJECT'S STATUS IS TOGGLED AND THE GRAPHIC OF THE PUMP'S IMPELLER ROTATES IN A TIME-BASED ANIMATION. THE OPERATOR SHALL BE ABLE TO CLICK AN ANIMATED GRAPHICAL OBJECT OR SWITCH IT FROM THE OFF POSITION TO ON, OR ON TO OFF. ALLOW OPERATOR TO CHANGE GRAPHIC FILE ASSIGNMENT AND ALSO CREATE NEW AND ORIGINAL GRAPHICS ONLINE. SYSTEM SHALL BE SUPPLIED WITH A LIBRARY OF STANDARD GRAPHICS, WHICH MAY BE USED UNALTERED OR MODIFIED BY THE OPERATOR. SYSTEMS THAT DO NOT ALLOW CUSTOMIZATION OR CREATION OF NEW GRAPHIC OBJECTS BY THE OPERATOR (OR WITH THIRD-PARTY SOFTWARE) SHALL NOT BE ALLOWED.
4. ANALOG OBJECTS SHALL BE DISPLAYED WITH OPERATOR MODIFIABLE UNITS. ANALOG INPUT OBJECTS MAY ALSO BE DISPLAYED AS INDIVIDUAL GRAPHIC ITEMS ON THE DISPLAY SCREEN AS AN OVERLAY TO THE SYSTEM GRAPHIC. EACH ANALOG INPUT OBJECT MAY BE ASSIGNED A MINIMUM OF FIVE GRAPHIC FILES, EACH WITH HIGH/LOW LIMITS FOR AUTOMATIC SELECTION AND DISPLAY OF THESE GRAPHICS. AS AN EXAMPLE, A GRAPHIC REPRESENTATION OF A THERMOMETER WOULD RISE AND FALL IN RESPONSE TO EITHER THE ROOM TEMPERATURE OR ITS DEVIATION FROM THE CONTROLLING SETPOINT. ANALOG OUTPUT OBJECTS, WHEN SELECTED WITH THE MOUSE, SHALL BE DISPLAYED AS A PROMPTED DIALOG (TEXT ONLY) BOX. SELECTION FOR DISPLAY TYPE SHALL BE INDIVIDUAL FOR EACH OBJECT. ANALOG OBJECT VALUES MAY BE CHANGED BY SELECTING EITHER THE "INCREASE" OR "DECREASE" ARROW IN THE ANALOG OBJECT SPINNER BOX WITHOUT USING THE KEYPAD. PRESSING THE BUTTON ON THE RIGHT SIDE OF THE ANALOG OBJECT SPINNER BOX ALLOWS DIRECT ENTRY OF AN ANALOG VALUE AND ACCESSES VARIOUS MENUS WHERE THE ANALOG VALUE MAY BE USED, SUCH AS TRENDLOGS.
5. ANALOG OBJECTS MAY ALSO BE ASSIGNED TO A SYSTEM GRAPHIC, WHERE THE COLOR OF THE DEFINED OBJECT CHANGES BASED ON THE ANALOG OBJECT'S VALUE. FOR EXAMPLE, GRAPHICAL THERMOSTAT DEVICE SERVED BY A SINGLE CONTROL ZONE WOULD CHANGE COLOR WITH RESPECT TO THE TEMPERATURE OF THE ZONE OR ITS DEVIATION FROM SETPOINT. ALL EDITING AND AREA ASSIGNMENT SHALL BE CREATED OR MODIFIED ONLINE USING SIMPLE ICON TOOLS.

6. A CUSTOMIZED MENU LABEL (PUSH-BUTTON) SHALL BE USED FOR DISPLAY SELECTION. MENU ITEMS ON A DISPLAY SHALL ALLOW PENETRATION TO LOWER LEVEL DISPLAYS OR ADDITIONAL MENUS. DYNAMIC POINT INFORMATION AND MENU LABEL PUSHBUTTONS MAY BE MIXED ON THE SAME DISPLAY TO ALLOW SUB-DISPLAYS TO EXIST FOR EACH ITEM. EACH DISPLAY MAY BE PROTECTED FROM VIEWING UNLESS OPERATOR HAS APPROPRIATE SECURITY LEVEL. A SECURITY LEVEL MAY BE ASSIGNED TO EACH DISPLAY AND SYSTEM OBJECT. THE MENU LABEL SHALL NOT APPEAR ON THE GRAPHIC IF THE OPERATOR DOES NOT HAVE THE APPROPRIATE SECURITY LEVEL.
7. THE BAS DISPLAYS SHALL HAVE THE ABILITY TO LINK TO CONTENT OUTSIDE OF THE BAS SYSTEM. SUCH CONTENT SHALL INCLUDE BUT IS NOT LIMITED TO: LAUNCHING EXTERNAL FILES IN THEIR NATIVE APPLICATIONS (FOR EXAMPLE, A MICROSOFT WORD DOCUMENT) AND LAUNCHING A WEB BROWSER RESOLVING TO A SPECIFIED WEB ADDRESS.
8. THE BAS SYSTEM SHALL HAVE THE ABILITY TO RUN MULTIPLE, CONCURRENT DISPLAYS WINDOWS SHOWING CONTINUOUSLY UPDATED DATA.

D. PASSWORD PROTECTION:
1. PROVIDE SECURITY SYSTEM THAT PREVENTS UNAUTHORIZED USE UNLESS OPERATOR IS LOGGED ON. ACCESS SHALL BE LIMITED TO OPERATOR'S ASSIGNED FUNCTIONS WHEN USER IS LOGGED ON. THIS INCLUDES DISPLAYS AS OUTLINED ABOVE.
2. EACH OPERATOR'S TERMINAL SHALL PROVIDE SECURITY FOR A MINIMUM OF 200 USERS. EACH USER SHALL HAVE AN INDIVIDUAL USER ID, USER NAME, AND PASSWORD. ENTRIES ARE ALPHANUMERIC CHARACTERS ONLY AND ARE CASE SENSITIVE (EXCEPT FOR USER ID). USER ID SHALL BE 0–8 CHARACTERS, USER NAME SHALL BE 0–29 CHARACTERS, AND PASSWORD SHALL BE 4–8 CHARACTERS LONG. EACH SYSTEM USER SHALL BE ALLOWED INDIVIDUAL ASSIGNMENT OF ONLY THOSE CONTROL FUNCTIONS, MENU ITEMS, AND USER SPECIFIC SYSTEM START DISPLAY, AS WELL RESTRICTED ACCESS TO DISCRETE BACNET DEVICES TO WHICH THAT USER REQUIRES ACCESS. ALL PASSWORDS, USER NAMES, AND ACCESS ASSIGNMENTS SHALL BE ADJUSTABLE ONLINE AT THE OPERATOR'S TERMINAL. USERS SHOULD HAVE THE CAPABILITY TO BE ASSIGNED TO SPECIFIC USER TYPE "GROUPS" THAT CAN SHARE THE SAME ACCESS LEVELS TO SPEED SETUP. USERS WHO ARE MEMBERS OF MULTIPLE "GROUPS" SHALL HAVE THE ABILITY TO ACTIVATE/DEACTIVATE MEMBERSHIP TO THOSE GROUPS WHILE USING THE BAS (WITHOUT LOGOUT). USERS SHALL ALSO HAVE A SET SECURITY LEVEL, WHICH DEFINES ACCESS TO DISPLAYS AND INDIVIDUAL OBJECTS THE USER MAY CONTROL. SYSTEM SHALL INCLUDE 10 SEPARATE AND DISTINCT SECURITY LEVELS FOR ASSIGNMENT TO USERS.
3. SYSTEM SHALL INCLUDE AN AUTO LOGOUT FEATURE THAT SHALL AUTOMATICALLY LOGOUT USER WHEN THERE HAS BEEN NO KEYBOARD OR MOUSE ACTIVITY FOR A SET PERIOD OF TIME. TIME PERIOD SHALL BE ADJUSTABLE BY SYSTEM ADMINISTRATOR. AUTO LOGOUT MAY BE ENABLED AND DISABLED BY SYSTEM ADMINISTRATOR. OPERATOR TERMINAL SHALL DISPLAY MESSAGE ON SCREEN THAT USER IS LOGGED OUT AFTER AUTO LOGOUT OCCURS.
4. THE SYSTEM SHALL PERMIT THE ASSIGNMENT OF AN EFFECTIVE DATE RANGE, AS WELL AS AN EFFECTIVE TIME OF DAY, WHICH THE USER IDS ARE PERMITTED TO AUTHENTICATE.

E. OPERATOR ACTIVITY LOG:
1. OPERATOR ACTIVITY LOG THAT TRACKS ALL OPERATOR CHANGES AND ACTIVITIES SHALL BE INCLUDED WITH SYSTEM. SYSTEM SHALL TRACK WHAT IS CHANGED IN THE SYSTEM, WHO PERFORMED THIS CHANGE, DATE AND TIME OF SYSTEM ACTIVITY, AND VALUE OF THE CHANGE BEFORE AND AFTER OPERATOR ACTIVITY. OPERATOR SHALL BE ABLE TO DISPLAY ALL ACTIVITY, SORT THE CHANGES BY USER AND ALSO BY OPERATION. OPERATOR SHALL BE ABLE TO PRINT THE OPERATOR ACTIVITY LOG DISPLAY.

2. LOG SHALL BE GATHERED AND ARCHIVED TO HARD DRIVE ON OPERATOR'S WORKSTATION AS NEEDED. OPERATOR SHALL BE ABLE TO EXPORT DATA FOR DISPLAY AND SORTING IN A SPREADSHEET.
3. ANY DISPLAYED DATA THAT IS CHANGEABLE BY THE OPERATOR MAY BE SELECTED USING THE RIGHT MOUSE BUTTON AND THE OPERATOR ACTIVITY LOG SHALL THEN BE SELECTABLE ON THE SCREEN. SELECTION OF THE OPERATOR ACTIVITY LOG USING THIS METHOD SHALL SHOW ALL OPERATOR CHANGES OF JUST THAT DISPLAYED DATA.

F. SCHEDULING:
1. OPERATOR'S WORKSTATION SHALL SHOW ALL INFORMATION IN EASY-TO-READ DAILY FORMAT INCLUDING CALENDAR OF THIS MONTH AND NEXT. ALL SCHEDULES SHALL SHOW ACTUAL ON/OFF TIMES FOR DAY BASED ON SCHEDULING PRIORITY. PRIORITY FOR SCHEDULING SHALL BE EVENTS, HOLIDAYS AND DAILY, WITH EVENTS BEING THE HIGHEST.
2. HOLIDAY AND SPECIAL EVENT SCHEDULES SHALL DISPLAY DATA IN CALENDAR FORMAT. OPERATOR SHALL BE ABLE TO SCHEDULE HOLIDAYS AND SPECIAL EVENTS DIRECTLY FROM THESE CALENDARS.
3. OPERATOR SHALL BE ABLE TO CHANGE ALL INFORMATION FOR A GIVEN WEEKLY OR EXCEPTION SCHEDULE IF LOGGED ON WITH THE APPROPRIATE SECURITY ACCESS.
4. SYSTEM SHALL INCLUDE A SCHEDULE WIZARD FOR SET UP OF SCHEDULES. WIZARD SHALL WALK USER THROUGH ALL STEPS NECESSARY FOR SCHEDULE GENERATION. WIZARD SHALL HAVE ITS OWN PULL-DOWN SELECTION FOR STARTUP OR MAY BE STARTED BY RIGHT-CLICKING ON VALUE DISPLAYED ON GRAPHIC AND THEN SELECTING SCHEDULE.
5. SCHEDULING SHALL INCLUDE OPTIMUM START BASED ON OUTSIDE AIR TEMPERATURE, CURRENT HEATING/COOLING SETPOINTS, INDOOR TEMPERATURE AND HISTORY OF PREVIOUS STARTS. EACH AND EVERY INDIVIDUAL ZONE SHALL HAVE OPTIMUM START TIME INDEPENDENTLY CALCULATED BASED ON ALL PARAMETERS LISTED. USER SHALL INPUT SCHEDULES TO SET TIME THAT OCCUPIED SETPOINT IS TO BE ATTAINED. OPTIMUM START FEATURE SHALL CALCULATE THE STARTUP TIME NEEDED TO MATCH ZONE TEMPERATURE TO SETPOINT. USER SHALL BE ABLE TO SET A LIMIT FOR THE MAXIMUM STARTUP TIME ALLOWED.
6. ANY DISPLAYED DATA THAT IS CHANGEABLE BY THE OPERATOR MAY BE SELECTED USING THE RIGHT MOUSE BUTTON AND THE SCHEDULE SHALL THEN BE SELECTABLE ON THE SCREEN. SELECTION OF THE SCHEDULE USING THIS METHOD SHALL ALLOW THE VIEWING OF THE ASSIGNED SCHEDULE OR LAUNCH THE SCHEDULE WIZARD TO ALLOW THE POINT TO BE SCHEDULED.

G. ALARM INDICATION AND HANDLING:
1. OPERATOR'S WORKSTATION SHALL PROVIDE AUDIBLE, VISUAL, PRINTED, AND EMAIL MEANS OF ALARM INDICATION. THE ALARM DIALOG BOX SHALL ALWAYS BECOME THE TOP DIALOG BOX REGARDLESS OF THE APPLICATION(S) CURRENTLY RUNNING. PRINTOUT OF ALARMS SHALL BE SENT TO THE ASSIGNED TERMINAL AND PORT. ALARM NOTIFICATION CAN BE FILTERED BASED ON THE USER ID'S AUTHORIZATION LEVEL.
2. SYSTEM SHALL PROVIDE LOG OF ALARM MESSAGES. ALARM LOG SHALL BE ARCHIVED TO THE HARD DISK OF THE SYSTEM OPERATOR'S TERMINAL. EACH ENTRY SHALL INCLUDE A DESCRIPTION OF THE EVENT-INITIATING OBJECT GENERATING THE ALARM. DESCRIPTION SHALL BE AN ALARM MESSAGE OF AT LEAST 256 CHARACTERS IN LENGTH. ENTRY SHALL INCLUDE TIME AND DATE OF ALARM OCCURRENCE, TIME AND DATE OF OBJECT STATE RETURN TO NORMAL, TIME AND DATE OF ALARM ACKNOWLEDGMENT, AND IDENTIFICATION OF OPERATOR ACKNOWLEDGING ALARM.
3. ALARM MESSAGES SHALL BE IN USER-DEFINABLE TEXT (ENGLISH OR OTHER SPECIFIED LANGUAGE) AND SHALL BE DELIVERED EITHER TO THE OPERATOR'S TERMINAL, CLIENT

OR THROUGH REMOTE COMMUNICATION USING EMAIL (AUTHENTICATED SMTP SUPPORTED).

4. SYSTEM SHALL INCLUDE AN ALARM WIZARD FOR SET UP OF ALARMS. WIZARD SHALL WALK USER THROUGH ALL STEPS NECESSARY FOR ALARM GENERATION. WIZARD SHALL HAVE ITS OWN PULL-DOWN SELECTION FOR STARTUP OR MAY BE STARTED BY RIGHT-CLICKING ON VALUE DISPLAYED ON GRAPHIC AND THEN SELECTING ALARM SETUP.
5. ANY DISPLAYED DATA THAT IS CHANGEABLE BY THE OPERATOR MAY BE SELECTED USING THE RIGHT MOUSE BUTTON AND THE ALARM SHALL THEN BE SELECTABLE ON THE SCREEN. SELECTION OF THE ALARM USING THIS METHOD SHALL ALLOW THE VIEWING OF THE ALARM HISTORY OR LAUNCH THE ALARM WIZARD TO ALLOW THE CREATION OF A NEW ALARM.

H. TRENDLOG INFORMATION:

1. SYSTEM SERVER SHALL PERIODICALLY GATHER HISTORICALLY RECORDED DATA STORED IN THE BUILDING CONTROLLERS AND STORE THE INFORMATION IN THE SYSTEM DATABASE. STORED RECORDS SHALL BE APPENDED WITH NEW SAMPLE DATA, ALLOWING RECORDS TO BE ACCUMULATED. SYSTEMS THAT WRITE OVER STORED RECORDS SHALL NOT BE ALLOWED UNLESS LIMITED FILE SIZE IS SPECIFIED. SYSTEM DATABASE SHALL BE CAPABLE OF STORING UP TO 50 MILLION RECORDS BEFORE NEEDING TO ARCHIVE DATA. SAMPLES MAY BE VIEWED AT THE OPERATOR'S WORKSTATION. OPERATOR SHALL BE ABLE TO VIEW ALL TRENDED RECORDS, BOTH STORED AND ARCHIVED. ALL TRENDLOG RECORDS SHALL BE DISPLAYED IN STANDARD ENGINEERING UNITS.
2. SOFTWARE THAT IS CAPABLE OF GRAPHING THE TREND LOGGED OBJECT DATA SHALL BE INCLUDED. SOFTWARE SHALL BE CAPABLE OF CREATING TWO-AXIS (X, Y) GRAPHS THAT DISPLAY UP TO 10 OBJECT TYPES AT THE SAME TIME IN DIFFERENT COLORS. GRAPHS SHALL SHOW OBJECT VALUES RELATIVE TO TIME. EACH TRENDLOG SHALL SUPPORT A CUSTOM SCALE SETTING FOR THE GRAPH VIEW THAT IS TO BE STORED CONTINUOUSLY. SYSTEM SHALL BE CAPABLE OF TRENDING ON AN INTERVAL DETERMINED BY A POLLING RATE, OR CHANGE-OF-VALUE.
3. OPERATOR SHALL BE ABLE TO CHANGE TRENDLOG SETUP INFORMATION. THIS INCLUDES THE INFORMATION TO BE LOGGED AS WELL AS THE INTERVAL AT WHICH IT IS TO BE LOGGED. ALL INPUT, OUTPUT, AND VALUE OBJECT TYPES IN THE SYSTEM MAY BE LOGGED. ALL OPERATIONS SHALL BE PASSWORD PROTECTED. SETUP AND VIEWING MAY BE ACCESSED DIRECTLY FROM ANY AND ALL GRAPHICS ON WHICH OBJECT IS DISPLAYED.
4. SYSTEM SHALL INCLUDE A TREND WIZARD FOR SETUP OF LOGS. WIZARD SHALL WALK USER THROUGH ALL NECESSARY STEPS. WIZARD SHALL HAVE ITS OWN PULL-DOWN SELECTION FOR STARTUP, OR MAY BE STARTED BY RIGHT-CLICKING ON VALUE DISPLAYED ON GRAPHIC, AND THEN SELECTING TRENDLOGS FROM THE DISPLAYED MENU.
5. SYSTEM SHALL BE CAPABLE OF USING MICROSOFT SQL AS THE SYSTEM DATABASE.
6. ANY DISPLAYED DATA THAT IS CHANGEABLE BY THE OPERATOR MAY BE SELECTED USING THE RIGHT MOUSE BUTTON AND THE TRENDLOG SHALL THEN BE SELECTABLE ON THE SCREEN. SELECTION OF THE TRENDLOG USING THIS METHOD SHALL ALLOW THE VIEWING OF THE TRENDLOG VIEW OR LAUNCH THE TRENDLOG WIZARD TO ALLOW THE CREATION OF A NEW TREND.

I. ENERGY LOG INFORMATION:

1. SYSTEM SERVER SHALL BE CAPABLE OF PERIODICALLY GATHERING ENERGY LOG DATA STORED IN THE FIELD EQUIPMENT AND ARCHIVE THE INFORMATION. ARCHIVE FILES SHALL BE APPENDED WITH NEW DATA, ALLOWING DATA TO BE ACCUMULATED. SYSTEMS THAT WRITE OVER ARCHIVED DATA SHALL NOT BE ALLOWED UNLESS LIMITED FILE SIZE

IS SPECIFIED. DISPLAY ALL ENERGY LOG INFORMATION IN STANDARD ENGINEERING UNITS.

2. ALL DATA SHALL BE STORED IN DATABASE FILE FORMAT FOR DIRECT USE BY THIRD-PARTY PROGRAMS. OPERATION OF SYSTEM SHALL STAY COMPLETELY ONLINE DURING ALL GRAPHING OPERATIONS.
3. OPERATOR SHALL BE ABLE TO CHANGE THE ENERGY LOG SETUP INFORMATION AS WELL. THIS INCLUDES THE METERS TO BE LOGGED, METER PULSE VALUE, AND THE TYPE OF ENERGY UNITS TO BE LOGGED. ALL METERS MONITORED BY THE SYSTEM MAY BE LOGGED. SYSTEM SHALL SUPPORT USING FLOW AND TEMPERATURE SENSORS FOR BTU MONITORING.
4. SYSTEM SHALL DISPLAY ARCHIVED DATA IN TABULAR FORMAT FORM FOR BOTH CONSUMPTION AND PEAK VALUES. DATA SHALL BE SHOWN IN HOURLY, DAILY, WEEKLY, MONTHLY AND YEARLY FORMATS. IN EACH FORMAT, THE USER SHALL BE ABLE TO SELECT A SPECIFIC PERIOD OF DATA TO VIEW.

J. DEMAND LIMITING:
1. SYSTEM SHALL INCLUDE DEMAND LIMITING PROGRAM THAT INCLUDES TWO TYPES OF LOAD SHEDDING. ONE TYPE OF LOAD SHEDDING SHALL SHED/RESTORE EQUIPMENT IN BINARY FASHION BASED ON ENERGY USAGE WHEN COMPARED TO SHED AND RESTORE SETTINGS. THE OTHER TYPE OF SHEDDING SHALL ADJUST OPERATOR SELECTED CONTROL SETPOINTS IN AN ANALOG FASHION BASED ON ENERGY USAGE WHEN COMPARED TO SHED AND RESTORE SETTINGS. SHEDDING MAY BE IMPLEMENTED INDEPENDENTLY ON EACH AND EVERY ZONE OR PIECE OF EQUIPMENT CONNECTED TO SYSTEM.
2. BINARY SHEDDING SHALL INCLUDE MINIMUM OF FIVE (5) PRIORITY LEVELS OF EQUIPMENT SHEDDING. ALL LOADS IN A GIVEN PRIORITY LEVEL SHALL BE SHED BEFORE ANY LOADS IN A HIGHER PRIORITY LEVEL ARE SHED. LOAD SHEDDING WITHIN A GIVEN PRIORITY LEVEL SHALL INCLUDE TWO METHODS. IN ONE, THE LOADS SHALL BE SHED/RESTORED IN A "FIRST OFF-FIRST ON" MODE, AND IN THE OTHER THE LOADS ARE JUST SHED/RESTORED IN A "FIRST OFF-LAST ON" (LINEAR) FASHION.
3. ANALOG SHED PROGRAM SHALL GENERATE A RAMP THAT IS INDEPENDENTLY USED BY EACH INDIVIDUAL ZONE OR INDIVIDUAL CONTROL ALGORITHM TO RAISE THE APPROPRIATE COOLING SETTING AND LOWER APPROPRIATE HEATING SETTING TO REDUCE ENERGY USAGE.
4. STATUS OF EACH AND EVERY LOAD SHED PROGRAM SHALL BE CAPABLE OF BEING DISPLAYED ON EVERY OPERATOR TERMINAL CONNECTED TO SYSTEM. STATUS OF EACH LOAD ASSIGNED TO AN INDIVIDUAL SHED PROGRAM SHALL BE DISPLAYED ALONG WITH ENGLISH DESCRIPTION OF EACH LOAD.

K. TENANT ACTIVITY (NOT APPLICABLE):
1. SYSTEM SHALL INCLUDE PROGRAM THAT MONITORS AFTER-HOURS OVERRIDES BY TENANTS, LOGS THAT DATA, AND GENERATES A BILL BASED ON USAGE AND RATE CHARGED FOR EACH TENANT SPACE. TENANT ACTIVITY PROGRAM SHALL BE ABLE TO ASSIGN MULTIPLE ZONES, FROM A LIST OF EVERY ZONE CONNECTED TO SYSTEM, TO A PARTICULAR TENANT. EVERY ZONE IS MONITORED FOR AFTER-HOUR OVERRIDE USAGE AND THAT DATA LOGGED IN SERVER. OPERATOR MAY THEN GENERATE A BILL BASED ON THE USAGE FOR EACH TENANT AND THE RATE CHARGED FOR ANY OVERTIME USE.
2. CONFIGURATION SHALL INCLUDE ENTRY OF THE FOLLOWING INFORMATION FOR USE IN LOGGING AND BILLING:
    a. TENANT'S CONTACT NAME AND ADDRESS
    b. ONE OR MULTIPLE TENANT ZONES THAT MAKE UP A TOTAL TENANT SPACE, INCLUDING A SEPARATE BILLING RATE FOR EACH SEPARATE ZONE
    c. MINIMUM AND MAXIMUM VALUES AN EVENT DURATION AND EVENT LIMIT

d. PROPERTY MANAGEMENT INFORMATION
e. OVERALL BILLING RATE
f. SEASONAL ADJUSTMENTS OR SURCHARGE TO BILLING RATE
g. BILLING NOTIFICATION TYPE SUCH INCLUDING, BUT NOT LIMITED TO PRINTER, FILE AND EMAIL
h. BILLING FORM TEMPLATE

3. LOGGING SHALL INCLUDE RECORDING THE FOLLOWING INFORMATION FOR EACH AND EVERY TENANT EVENT:
   a. ZONE DESCRIPTION
   b. TIME THE EVENT BEGINS
   c. TOTAL OVERRIDE TIME
   d. LIMITS SHALL BE APPLIED TO OVERRIDE TIME
4. A TENANT BILL SHALL BE GENERATED FOR A SPECIFIC PERIOD USING ALL THE ENTERED CONFIGURATION DATA AND THE LOGGED DATA. USER WITH APPROPRIATE SECURITY LEVEL SHALL BE ABLE TO VIEW AND OVERRIDE BILLING INFORMATION. USER SHALL BE ABLE TO SELECT A BILLING PERIOD TO VIEW AND BE ABLE TO DELETE EVENTS FROM BILLING AND EDIT A SELECTED TENANT ACTIVITY EVENT'S OVERRIDE TIME.

L. REPORTS:
1. SYSTEM SERVER SHALL BE CAPABLE OF PERIODICALLY PRODUCING REPORTS OF TRENDLOGS, ALARM HISTORY, TENANT ACTIVITIES, DEVICE SUMMARY, ENERGY LOGS, AND OVERRIDE POINTS. THE FREQUENCY, CONTENT, AND DELIVERY ARE TO BE USER ADJUSTABLE.
2. ALL REPORTS SHALL BE CAPABLE OF BEING DELIVERED IN MULTIPLE FORMATS INCLUDING TEXT- AND COMMA-SEPARATED VALUE (CSV) FILES. THE FILES CAN BE PRINTED, EMAILED, OR SAVED TO A FOLDER, EITHER ON THE SERVER HARD DRIVE OR ON ANY NETWORK DRIVE LOCATION.

M. CONFIGURATION / SETUP:
1. PROVIDE MEANS FOR OPERATOR TO DISPLAY AND CHANGE SYSTEM CONFIGURATION. THIS SHALL INCLUDE, BUT NOT BE LIMITED TO, SYSTEM TIME, DAY OF THE WEEK, DATE OF DAYLIGHT SAVINGS SET FORWARD/SET BACK, PRINTER TERMINATION, PORT ADDRESSES, MODEM PORT AND SPEED, ETC. ITEMS SHALL BE MODIFIED USING UNDERSTANDABLE TERMINOLOGY WITH SIMPLE MOUSE/CURSOR KEY MOVEMENTS.

N. FIELD ENGINEERING TOOLS:
1. OPERATOR'S WORKSTATION SOFTWARE SHALL INCLUDE FIELD ENGINEERING TOOLS FOR PROGRAMMING ALL CONTROLLERS SUPPLIED. ALL CONTROLLERS SHALL BE PROGRAMMED USING GRAPHICAL TOOLS THAT ALLOW THE USER TO CONNECT FUNCTION BLOCKS ON SCREEN THAT PROVIDE SEQUENCING OF ALL CONTROL LOGIC. FUNCTION BLOCKS SHALL BE REPRESENTED BY GRAPHICAL DISPLAYS THAT ARE EASILY IDENTIFIED AND DISTINCT FROM OTHER TYPES OF BLOCKS. GRAPHICAL PROGRAMMING THAT USES SIMPLE RECTANGLES AND SQUARES IS NOT ACCEPTABLE.
2. USER SHALL BE ABLE TO SELECT A GRAPHICAL FUNCTION BLOCK FROM MENU AND PLACE ON SCREEN. PROVIDE ZOOM IN AND ZOOM OUT CAPABILITIES. FUNCTION BLOCKS SHALL BE DOWNLOADED TO CONTROLLER WITHOUT ANY REENTRY OF DATA.
3. PROGRAMMING TOOLS SHALL INCLUDE A REAL-TIME OPERATION MODE. FUNCTION BLOCKS SHALL DISPLAY REAL-TIME DATA AND BE ANIMATED TO SHOW STATUS OF DATA INPUTS AND OUTPUTS WHEN IN REAL-TIME OPERATION. ANIMATION SHALL SHOW CHANGE OF STATUS ON LOGIC DEVICES AND COUNTDOWN OF TIMER DEVICES IN GRAPHICAL FORMAT.
4. FIELD ENGINEERING TOOLS SHALL ALSO INCLUDE A DATABASE MANAGER OF APPLICATIONS THAT INCLUDE LOGIC FILES FOR CONTROLLERS AND ASSOCIATED GRAPHICS. OPERATOR SHALL BE ABLE TO SELECT UNIT TYPE, INPUT/OUTPUT

CONFIGURATION AND OTHER ITEMS THAT DEFINE UNIT TO BE CONTROLLED. SUPPLY MINIMUM OF 250 APPLICATIONS AS PART OF WORKSTATION SOFTWARE.

5. FIELD ENGINEERING TOOL SHALL INCLUDE DEVICE MANAGER FOR DETECTION OF DEVICES CONNECTED ANYWHERE ON THE BACNET NETWORK BY SCANNING OF THE ENTIRE NETWORK. THIS FUNCTION SHALL DISPLAY DEVICE INSTANCE, NETWORK IDENTIFICATION, MODEL NUMBER, AND DESCRIPTION OF CONNECTED DEVICES. IT SHALL RECORD AND DISPLAY SOFTWARE FILE LOADED INTO EACH CONTROLLER. A COPY OF EACH FILE SHALL BE STORED ON THE COMPUTER'S HARD DRIVE. IF NEEDED, THIS FILE SHALL BE DOWNLOADED TO THE APPROPRIATE CONTROLLER USING THE MOUSE.
6. SYSTEM SHALL AUTOMATICALLY NOTIFY THE USER WHEN A DEVICE THAT IS NOT IN THE DATABASE IS ADDED TO THE NETWORK.
7. SYSTEM SHALL INCLUDE BACKUP/RESTORE FUNCTION THAT WILL BACK UP ENTIRE SYSTEM TO SELECTED MEDIUM AND THEN RESTORE SYSTEM FROM THAT MEDIA. THE SYSTEM SHALL BE CAPABLE OF CREATING A BACKUP FOR THE PURPOSE OF INSTANTIATING A NEW CLIENT PC.
8. THE SYSTEM SHALL PROVIDE A MEANS TO SCAN, DETECT, INTERROGATE, AND EDIT 3RD PARTY BACNET DEVICES AND BACNET OBJECTS WITHIN THOSE DEVICES.

O. WORKSTATION HARDWARE:

1. PROVIDE OPERATOR'S WORKSTATION AT LOCATION DIRECTED BY THE OWNER/CM/ENGINEER.
2. WORKSTATION/SERVER COMPUTER MINIMUM REQUIREMENTS
   a. PC PROCESSOR OF 2.5 GHZ DUAL-CORE OR BETTER
   b. 8 GB RAM OR BETTER
   c. 500 GB HARD DISK OR BETTER
   d. HIGH-PERFORMANCE GRAPHICS ADAPTER
   e. ETHERNET 10/100/1000 NETWORK INTERFACE CARD
   f. KEYBOARD, MONITOR, MOUSE, USB PORT AND CD-ROM
   g. WINDOWS XP PROFESSIONAL; VISTA BUSINESS, ULTIMATE, OR ENTERPRISE; SERVER 2003; OR WINDOWS 7
   h. MODEM, 56KBM MINIMUM

P. SOFTWARE:

1. AT THE CONCLUSION OF PROJECT, CONTRACTOR SHALL LEAVE WITH OWNER A CD OR DVD ROM THAT INCLUDES THE COMPLETE SOFTWARE OPERATION SYSTEM AND PROJECT GRAPHICS, SETPOINTS, SYSTEM PARAMETERS, ETC. THIS BACKUP SHALL ALLOW THE OWNER HOW TO COMPLETELY RESTORE THE SYSTEM IN THE CASE OF A COMPUTER MALFUNCTION.

2.2 WEB INTERFACE:

A. GENERAL: BAS SUPPLIER SHALL PROVIDE WEB-BASED ACCESS TO THE SYSTEM AS PART OF STANDARD INSTALLATION. USER SHALL BE ABLE TO ACCESS DISPLAYS OF REAL-TIME DATA THAT ARE PART OF THE BAS USING A STANDARD WEB BROWSER. WEB BROWSER SHALL TIE INTO THE NETWORK THROUGH OWNER-SUPPLIED ETHERNET NETWORK CONNECTION. WEB PAGE HOST SHALL BE A SEPARATE DEVICE THAT RESIDES ON THE BAS BACNET NETWORK, BUT IS NOT THE BAS SERVER FOR THE CONTROL SYSTEM. BAS SERVER SHALL BE A SEPARATE COMPUTER FROM THE WEB PAGE HOST DEVICE TO ENSURE DATA AND SYSTEM INTEGRITY. THE WEB PAGE SOFTWARE SHALL NOT REQUIRE A PER-USER LICENSING FEE OR ANNUAL FEES. THE WEB PAGE HOST SHALL BE ABLE TO SUPPORT ON AVERAGE 50 SIMULTANEOUS USERS WITH THE ABILITY TO EXPAND THE SYSTEM TO ACCOMMODATE AN UNLIMITED NUMBER OF USERS.

B. BROWSER TECHNOLOGY: BROWSER SHALL BE STANDARD VERSION OF MICROSOFT INTERNET EXPLORER V6.0 OR LATER, FIREFOX V2.0 OR LATER AND SAFARI V2.0 OR LATER (ON MAC OS X). PDA BROWSER CONNECTION SHALL BE POCKET PC 2003, WINDOWS MOBILE 5.0, OR BLACKBERRY. NO SPECIAL VENDOR-SUPPLIED SOFTWARE SHALL BE NEEDED ON COMPUTERS RUNNING

BROWSER. DISPLAYS SHALL BE VIEWABLE AND THE WEB PAGE HOST SHALL DIRECTLY ACCESS REAL-TIME DATA FROM THE BAS BACNET NETWORK. DATA SHALL BE DISPLAYED IN REAL-TIME AND UPDATE AUTOMATICALLY WITHOUT USER INTERACTION. USER SHALL BE ABLE TO CHANGE DATA ON DISPLAYS IF LOGGED IN WITH THE APPROPRIATE USER NAME AND PASSWORD.

C. COMMUNICATIONS:
   1. WEB PAGE HOST SHALL INCLUDE TWO ETHERNET NETWORK CONNECTIONS. ONE NETWORK CONNECTION SHALL BE DEDICATED TO BAS BACNET NETWORK AND SHALL BE USED TO GATHER REAL-TIME DATA FROM THE BACNET DEVICES THAT FORM THE BAS. THIS NETWORK SHALL COMMUNICATE USING BACNET, ALLOWING THE WEB PAGE HOST TO GATHER DATA DIRECTLY FROM UNITS ON THE LOCAL LAN OR FROM OTHER PROJECTS CONNECTED OVER A WAN. THIS NETWORK SHALL ALSO PROVIDE THE CONNECTION TO THE BAS SERVER FOR WEB PAGE GENERATION.
   2. THE SECOND ETHERNET CONNECTION SHALL PROVIDE THE PHYSICAL CONNECTION TO THE INTERNET OR AN IP-BASED WAN. IT SHALL BE THE PORT THAT IS USED FOR THE BROWSER TO RECEIVE WEB PAGES AND DATA FROM THE WEB PAGE HOST. THE WEB PAGE HOST SHALL ACT AS A PHYSICAL BARRIER BETWEEN BAS NETWORK AND THE WAN OR INTERNET CONNECTION THAT ALLOWS BROWSER TO RECEIVE WEB PAGES AND DATA. THE TWO SEPARATE NETWORK CONNECTIONS PROVIDE FOR A PHYSICAL BARRIER TO PREVENT RAW BACNET TRAFFIC BEING EXPOSED ON IP NETWORK.
   3. THE WEB PAGE HOST SHALL PROVIDE FOR COMPLETE ISOLATION OF THE IP AND BACNET NETWORKS BY NOT ROUTING NETWORKING PACKETS BETWEEN THE TWO NETWORKS.
   4. BAS BACNET ETHERNET NETWORK SHALL BE PROVIDED AND INSTALLED BY THE BAS SUPPLIER. OWNER SHALL PROVIDE AND INCUR ANY MONTHLY CHARGES OF WAN/INTERNET CONNECTION.

D. DISPLAY DATA:
   1. WEB PAGE GRAPHICS SHOWN ON BROWSER SHALL BE REPLICAS OF THE BAS DISPLAYS. USER SHALL NEED NO ADDITIONAL TRAINING TO UNDERSTAND INFORMATION PRESENTED ON WEB PAGES WHEN COMPARED TO WHAT IS SHOWN ON BAS DISPLAYS. WEB PAGE DISPLAYS SHALL INCLUDE ANIMATION JUST AS BAS DISPLAYS. FANS SHALL TURN, PILOT LIGHTS SHALL BLINK, COILS SHALL CHANGE COLORS, AND SO ON.
   2. REAL-TIME DATA SHALL BE SHOWN ON BROWSER WEB PAGES. THIS DATA SHALL BE DIRECTLY GATHERED USING THE BACNET NETWORK AND AUTOMATICALLY UPDATED ON BROWSER WEB PAGE DISPLAYS WITHOUT ANY USER ACTION. DATA ON THE BROWSER SHALL AUTOMATICALLY REFRESH AS CHANGES ARE DETECTED WITHOUT RE-DRAWING THE COMPLETE DISPLAY.
   3. IT SHALL BE POSSIBLE FOR USER FROM BROWSER WEB PAGE TO CHANGE DATA IF THE USER IS LOGGED ON WITH THE APPROPRIATE PASSWORD. CLICKING ON A BUTTON OR TYPING IN A NEW VALUE SHALL CHANGE DIGITAL DATA. USING PULL-DOWN MENUS OR TYPING IN A NEW VALUE SHALL CHANGE ANALOG DATA.
   4. DATA DISPLAYS SHALL BE NAVIGATED USING PUSHBUTTONS ON THE DISPLAYS THAT ARE SIMPLY CLICKED ON WITH THE MOUSE TO SELECT A NEW DISPLAY. ALTERNATIVELY, THE STANDARD BACK AND FORWARD BUTTONS OF THE BROWSER CAN BE USED FOR DISPLAY NAVIGATION.

E. TIME SCHEDULES ADJUSTMENT:
   1. WEB ACCESS SHALL ALLOW USER TO VIEW AND EDIT ALL SCHEDULES IN THE SYSTEM. THIS INCLUDES STANDARD, HOLIDAY AND EVENT SCHEDULES AS DESCRIBED IN BAS SPECIFICATION. DISPLAY OF SCHEDULES SHALL SHOW INTERACTION OF ALL SCHEDULES ON A SINGLE DISPLAY SO USER SEES AN OVERVIEW OF HOW ALL WORK TOGETHER. USER SHALL BE ABLE TO EDIT SCHEDULES FROM THIS DISPLAY.
   2. DISPLAY OF ALL THREE SCHEDULES MUST SHOW ALL ON TIMES FOR STANDARD, HOLIDAY AND EVENT SCHEDULES IN DIFFERENT COLORS ON A GIVEN DAY. IN ADDITION,

OFF TIMES FOR EACH MUST ALSO BE SHOWN IN ADDITIONAL COLORS. USER SHALL BE ABLE TO SELECT FROM STANDARD CALENDAR WHAT DAYS ARE TO BE SCHEDULED AND SAME DISPLAY SHALL SHOW ALL POINTS AND ZONES AFFECTED. USER SHALL BE ABLE TO SET TIME FOR ONE DAY AND SELECT ALL DAYS OF THE WEEK THAT SHALL BE AFFECTED AS A RECURRENCE OF THAT SAME SCHEDULE FOR THAT GIVEN DAY.

3. SCHEDULE LIST SHALL SHOW ALL SCHEDULES CURRENTLY DEFINED. THIS LIST SHALL INCLUDE ALL STANDARD, HOLIDAY AND EVENT SCHEDULES. IN ADDITION, USER SHALL BE ABLE TO SELECT A LIST THAT SHOWS ALL SCHEDULED POINTS AND ZONES.

F. LOGGING INFORMATION: USER SHALL USE STANDARD BROWSER TECHNOLOGY TO VIEW ALL TRENDLOGS IN SYSTEM. USER SHALL BE ABLE TO VIEW LOGGED DATA IN TABULAR FORM OR GRAPHICAL FORMAT. USER SHALL BE ABLE TO ADJUST TIME INTERVAL OF LOGGED DATA VIEWED AND SHALL BE ABLE TO ADJUST Y AXIS OF DATA VIEWED IN GRAPHICAL FORMAT. USER SHALL ALSO BE ABLE TO DOWNLOAD DATA THROUGH THE WEB INTERFACE TO LOCAL COMPUTER. DATA SHALL BE IN CSV FORMAT.

G. ALARM HANDLING: WEB INTERFACE SHALL DISPLAY ALARMS AS THEY OCCUR. USER SHALL BE ABLE TO ACKNOWLEDGE ALARMS USING BROWSER TECHNOLOGY. IN ADDITION, USER SHALL BE ABLE TO VIEW HISTORY OF ALARM OCCURRENCE OVER A USER-SELECTED TIME FRAME. IN ADDITION, THOSE ALARMS MAY BE FILTERED FOR VIEWING PER USER-SELECTED OPTIONS. A SINGLE SELECTION SHALL DISPLAY ALL ALARMS THAT HAVE NOT BEEN ACKNOWLEDGED.

H. WEB PAGE GENERATION: WEB PAGES SHALL BE AUTOMATICALLY GENERATED FROM THE BAS DISPLAYS THAT RESIDE ON THE BAS SERVER. USER SHALL ACCESS WEB PAGE HOST THROUGH THE NETWORK AND SHALL INITIATE A WEB PAGE GENERATION UTILITY THAT AUTOMATICALLY TAKES THE BAS DISPLAYS AND TURNS THEM INTO WEB PAGES. THE WEB PAGES GENERATED ARE AUTOMATICALLY INSTALLED ON THE WEB PAGE HOST FOR ACCESS USING ANY COMPUTER'S STANDARD BROWSER. ANY SYSTEM THAT REQUIRES USE OF AN HTML EDITOR FOR GENERATION OF WEB PAGES SHALL NOT BE CONSIDERED.

I. PASSWORD SECURITY AND ACTIVITY LOG: ACCESS THROUGH WEB BROWSER SHALL UTILIZE THE SAME HIERARCHICAL SECURITY SCHEME AS BAS SYSTEM. USER SHALL BE ASKED TO LOG ON ONCE THE BROWSER MAKES CONNECTION TO WEB PAGE HOST. ONCE THE USER LOGS IN, ANY AND ALL CHANGES THAT ARE MADE SHALL BE TRACKED BY THE BAS SYSTEM. THE USER SHALL BE ABLE TO CHANGE ONLY THOSE ITEMS HE OR SHE HAS AUTHORITY TO CHANGE. A USER ACTIVITY REPORT SHALL SHOW ANY AND ALL ACTIVITY OF THE USERS WHO HAVE LOGGED IN TO THE SYSTEM, REGARDLESS OF WHETHER THOSE CHANGES WERE MADE USING A BROWSER OR THROUGH THE BAS WORKSTATION.

J. BACNET COMMUNICATION: WEB SERVER SHALL DIRECTLY COMMUNICATE TO ALL DEVICES ON THE BAS NETWORK USING BACNET PROTOCOL. NO INTERMEDIATE DEVICES SHALL BE NECESSARY FOR BACNET COMMUNICATION.

2.3 BUILDING CONTROLLER:

A. GENERAL REQUIREMENTS:

1. BACNET CONFORMANCE

a. BUILDING CONTROLLER SHALL BE APPROVED BY THE BTL (BACNET TESTING LABORATORY) AS MEETING THE BACNET BUILDING CONTROLLER REQUIREMENTS.

b. PLEASE REFER TO SECTION 22.2, BACNET FUNCTIONAL GROUPS, IN THE BACNET STANDARD, FOR A COMPLETE LIST OF THE SERVICES THAT MUST BE DIRECTLY SUPPORTED TO PROVIDE EACH OF THE FUNCTIONAL GROUPS LISTED ABOVE. ALL PROPRIETARY SERVICES, IF USED IN THE SYSTEM, SHALL BE THOROUGHLY DOCUMENTED AND PROVIDED AS PART OF THE SUBMITTAL DATA. ALL NECESSARY TOOLS SHALL BE SUPPLIED FOR WORKING WITH PROPRIETARY INFORMATION.

2. BUILDING CONTROLLER SHALL BE OF MODULAR CONSTRUCTION SUCH THAT VARIOUS MODULES MAY BE SELECTED TO FIT THE SPECIFIC REQUIREMENTS OF A GIVEN PROJECT. AT A MINIMUM, MODULES SHALL CONSIST OF A POWER SUPPLY MODULE, A BACNET ETHERNET-MS/TP (MASTER SLAVE TOKEN PASSING) MODULE, A BACNET MS/TP-ONLY MODULE, AND A MODEM MODULE FOR TELEPHONE COMMUNICATION. THOSE PROJECTS THAT REQUIRE SPECIAL INTERFACES MAY USE MODBUS MODULES AS NEEDED. HOWEVER, ALL ETHERNET COMMUNICATIONS AND ALL CONTROLLERS—INCLUDING CENTRAL PLANT CONTROLLERS, ADVANCED APPLICATION CONTROLLERS AND UNITARY CONTROLLERS—SUPPLIED BY BAS MANUFACTURER SHALL UTILIZE THE BACNET PROTOCOL STANDARD.
3. MODULES SHALL BE SELECTED TO FIT THE PARTICULAR PROJECT APPLICATION. UP TO SEVEN MODULES SHALL BE POWERED BY A SINGLE POWER SUPPLY MODULE. ALL MODULES SHALL BE PANEL-MOUNTED ON DIN RAIL FOR EASE OF ADDITION AND SHALL BE INTERCONNECTED USING A SIMPLE PLUG-IN CABLE. A MODULE IN THE MIDDLE SHALL BE REPLACEABLE WITHOUT REMOVING ANY OTHER MODULES.
4. ALL MODULES SHALL BE CAPABLE OF PROVIDING GLOBAL CONTROL STRATEGIES FOR THE SYSTEM BASED ON INFORMATION FROM ANY OBJECTS IN THE SYSTEM, REGARDLESS IF THE OBJECT IS DIRECTLY MONITORED BY THE BUILDING CONTROLLER MODULE OR BY ANOTHER CONTROLLER. THE SOFTWARE PROGRAM IMPLEMENTING THESE STRATEGIES SHALL BE COMPLETELY FLEXIBLE AND USER-DEFINABLE. ALL SOFTWARE TOOLS NECESSARY FOR PROGRAMMING SHALL BE PROVIDED AS PART OF PROJECT SOFTWARE. ANY SYSTEMS UTILIZING FACTORY PRE-PROGRAMMED GLOBAL STRATEGIES THAT CANNOT BE MODIFIED BY FIELD PERSONNEL ON-SITE, USING A WAN OR DOWNLOADED THROUGH REMOTE COMMUNICATIONS ARE NOT ACCEPTABLE. CHANGING GLOBAL STRATEGIES USING FIRMWARE CHANGES IS ALSO UNACCEPTABLE.
5. PROGRAMMING SHALL BE OBJECT-ORIENTED USING CONTROL FUNCTION BLOCKS, AND SUPPORT DDC FUNCTIONS, 1000 ANALOG VALUES AND 1000 BINARY VALUES. ALL FLOWCHARTS SHALL BE GENERATED AND AUTOMATICALLY DOWNLOADED TO CONTROLLER. PROGRAMMING TOOL SHALL BE SUPPLIED AND BE RESIDENT ON WORKSTATION. THE SAME TOOL SHALL BE USED FOR ALL CONTROLLERS.
6. PROVIDE MEANS TO GRAPHICALLY VIEW INPUTS AND OUTPUTS TO EACH PROGRAM BLOCK IN REAL-TIME AS PROGRAM IS EXECUTING. THIS FUNCTION MAY BE PERFORMED USING THE OPERATOR'S WORKSTATION OR FIELD COMPUTER.
7. CONTROLLER SHALL HAVE SUFFICIENT MEMORY TO ENSURE HIGH PERFORMANCE AND DATA RELIABILITY. BATTERY SHALL PROVIDE POWER FOR ORDERLY SHUTDOWN OF CONTROLLER AND STORAGE OF DATA IN NONVOLATILE FLASH MEMORY. BATTERY BACKUP SHALL MAINTAIN REAL-TIME CLOCK FUNCTIONS FOR A MINIMUM OF 20 DAYS.
8. GLOBAL CONTROL ALGORITHMS AND AUTOMATED CONTROL FUNCTIONS SHALL EXECUTE USING 64-BIT PROCESSOR.

B. SCHEDULES:
   1. EACH BUILDING CONTROLLER MODULE SHALL SUPPORT A MINIMUM OF 80 BACNET SCHEDULE OBJECTS AND 80 BACNET CALENDAR OBJECTS.
   2. BUILDING CONTROLLER MODULES SHALL PROVIDE NORMAL SEVEN-DAY SCHEDULING, HOLIDAY SCHEDULING AND EVENT SCHEDULING.
   3. LOGGING CAPABILITIES
      a. EACH BUILDING CONTROLLER SHALL LOG AS MINIMUM 320 VALUES. ANY OBJECT IN THE SYSTEM (REAL OR CALCULATED) MAY BE LOGGED. SAMPLE TIME INTERVAL SHALL BE ADJUSTABLE AT THE OPERATOR'S WORKSTATION.
      b. LOGS MAY BE VIEWED BOTH ON-SITE OR OFF-SITE USING WAN OR REMOTE COMMUNICATION

c. BUILDING CONTROLLER SHALL PERIODICALLY UPLOAD TRENDED DATA TO NETWORKED OPERATOR'S WORKSTATION FOR LONG-TERM ARCHIVING IF DESIRED.
d. ARCHIVED DATA STORED IN DATABASE FORMAT SHALL BE AVAILABLE FOR USE IN THIRD-PARTY SPREADSHEET OR DATABASE PROGRAMS.

C. ALARM GENERATION
1. ALARMS MAY BE GENERATED WITHIN THE SYSTEM FOR ANY OBJECT CHANGE OF VALUE OR STATE (EITHER REAL OR CALCULATED). THIS INCLUDES THINGS SUCH AS ANALOG OBJECT VALUE CHANGES, BINARY OBJECT STATE CHANGES, AND VARIOUS CONTROLLER COMMUNICATION FAILURES.
2. EACH ALARM MAY BE DIALED OUT AS NOTED ELSEWHERE.
3. ALARM LOG SHALL BE PROVIDED FOR ALARM VIEWING. LOG MAY BE VIEWED ON-SITE AT THE OPERATOR'S TERMINAL OR OFF-SITE USING REMOTE COMMUNICATIONS.
4. CONTROLLER MUST BE ABLE TO HANDLE UP TO 320 ALARM SETUPS STORED AS BACNET EVENT ENROLLMENT OBJECTS, WITH SYSTEM DESTINATION AND ACTIONS INDIVIDUALLY CONFIGURABLE.

D. DEMAND LIMITING
1. DEMAND LIMITING OF ENERGY SHALL BE A BUILT-IN, USER-CONFIGURABLE FUNCTION. EACH CONTROLLER MODULE SHALL SUPPORT SHEDDING OF UP TO 200 LOADS USING A MINIMUM OF TWO TYPES OF SHED PROGRAMS.
2. LOAD SHEDDING PROGRAMS IN BUILDING CONTROLLER MODULES SHALL OPERATE AS DEFINED IN HEREIN.

E. TENANT ACTIVITY LOG (NOT APPLICABLE)
1. TENANT ACTIVITY LOGGING SHALL BE SUPPORTED BY BUILDING CONTROLLER MODULE. EACH INDEPENDENT MODULE SHALL SUPPORT A MINIMUM OF 80 ZONES.
2. TENANT ACTIVITY LOGGING SHALL FUNCTION AS DEFINED IN THIS SPECIFICATION.

F. ETHERNET – MS/TP MODULE:
1. ETHERNET – MS/TP MODULE SHALL SUPPORT EVERY FUNCTION AS LISTED UNDER PARAGRAPH A, GENERAL REQUIREMENTS, OF THIS SECTION AND THE FOLLOWING.
2. ALL COMMUNICATION WITH OPERATOR'S WORKSTATION AND ALL APPLICATION CONTROLLERS SHALL BE THROUGH BACNET. BUILDING CONTROLLER ETHERNET – MS/TP MODULE SHALL INCORPORATE AS A MINIMUM, THE FUNCTIONS OF A 2-WAY BACNET ROUTER. CONTROLLER SHALL ROUTE BACNET MESSAGES BETWEEN THE HIGH-SPEED LAN (ETHERNET 10/100MHZ) AND MS/TP LAN. ETHERNET – MS/TP MODULE SHALL ALSO ROUTE MESSAGES FROM ALL OTHER BUILDING CONTROLLER MODULES ONTO THE BACNET ETHERNET NETWORK.
a. MS/TP LAN MUST BE SOFTWARE-CONFIGURABLE FROM 9.6 TO 76.8KBPS.
b. THE RJ-45 ETHERNET CONNECTION MUST ACCEPT EITHER 10BASE-T OR 100BASE-TX BACNET OVER TWISTED PAIR CABLE (UTP).
3. BACNET CONFORMANCE:
a. ETHERNET – MS/TP MODULE SHALL, AS A MINIMUM, SUPPORT MS/TP AND ETHERNET BACNET LAN TYPES. IT SHALL COMMUNICATE DIRECTLY USING THESE BACNET LANS AS A NATIVE BACNET DEVICE AND SHALL SUPPORT SIMULTANEOUS ROUTING FUNCTIONS BETWEEN ALL SUPPORTED LAN TYPES. GLOBAL CONTROLLER SHALL BE APPROVED BY THE BACNET TESTING LABORATORY (BTL) AS MEETING THE BACNET BUILDING CONTROLLER REQUIREMENTS.
b. ALL PROPRIETARY OBJECT TYPES, IF USED IN THE SYSTEM, SHALL BE THOROUGHLY DOCUMENTED AND PROVIDED AS PART OF THE SUBMITTAL DATA. ALL NECESSARY TOOLS SHALL BE SUPPLIED FOR WORKING WITH PROPRIETARY INFORMATION.

c. THE BUILDING CONTROLLER SHALL COMPLY WITH ANNEX J OF THE BACNET SPECIFICATION FOR IP CONNECTIONS. THIS DEVICE SHALL USE ETHERNET TO CONNECT TO THE IP INTERNETWORK, WHILE USING THE SAME ETHERNET LAN FOR NON-IP COMMUNICATIONS TO OTHER BACNET DEVICES ON THE LAN. MUST SUPPORT INTEROPERABILITY ON WANS AND CANS AND FUNCTION AS A BACNET BROADCAST MANAGEMENT DEVICE (BBMD).

G. MS/TP MODULE:
   1. MS/TP MODULE SHALL SUPPORT EVERY FUNCTION AS LISTED UNDER PARAGRAPH A, GENERAL REQUIREMENTS, OF THIS SECTION AND THE FOLLOWING.
   2. BUILDING CONTROLLER MS/TP MODULE COMMUNICATIONS SHALL BE THOUGH BACNET MS/TP LAN TO ALL ADVANCED APPLICATION AND APPLICATION-SPECIFIC CONTROLLERS. MS/TP MODULE SHALL ALSO ROUTE MESSAGES TO ETHERNET - MS/TP MODULE FOR COMMUNICATION OVER WAN.
      a. MS/TP LAN MUST BE SOFTWARE CONFIGURABLE FROM 9.6 TO 76.8KBPS
      b. CONFIGURATION SHALL BE THROUGH RS-485 CONNECTION.
   3. BACNET CONFORMANCE:
      a. MS/TP MODULE SHALL BE APPROVED BY THE BTL (BACNET TESTING LABORATORY) AS MEETING THE BACNET BUILDING CONTROLLER REQUIREMENTS. MS/TP MODULE SHALL AS A MINIMUM SUPPORT MS/TP BACNET LAN TYPE. IT SHALL COMMUNICATE DIRECTLY USING THIS BACNET LAN AS A NATIVE BACNET DEVICE AND SHALL SUPPORT SIMULTANEOUS ROUTING FUNCTIONS BETWEEN ALL SUPPORTED LAN TYPES.
      b. STANDARD BACNET OBJECT TYPES SUPPORTED SHALL INCLUDE, AS A MINIMUM, ANALOG VALUE, BINARY VALUE, CALENDAR, DEVICE, FILE, GROUP, NOTIFICATION CLASS, PROGRAM, AND SCHEDULE OBJECT TYPES. ALL PROPRIETARY OBJECT TYPES, IF USED IN THE SYSTEM, SHALL BE THOROUGHLY DOCUMENTED AND PROVIDED AS PART OF THE SUBMITTAL DATA. ALL NECESSARY TOOLS SHALL BE SUPPLIED FOR WORKING WITH PROPRIETARY INFORMATION.

H. POWER SUPPLY MODULE:
   1. POWER SUPPLY MODULE SHALL POWER UP TO SEVEN BUILDING CONTROLLER MODULES. INPUT FOR POWER SHALL ACCEPT BETWEEN 17¬–30VAC, 47–65HZ.
   2. POWER SUPPLY MODULE SHALL INCLUDE RECHARGEABLE BATTERY FOR ORDERLY SHUTDOWN OF CONTROLLER MODULES INCLUDING STORAGE OF ALL DATA IN FLASH MEMORY AND FOR CONTINUOUS OPERATION OF REAL-TIME CLOCKS FOR MINIMUM OF 20 DAYS.

I. TUX MODULE:
   1. TUX MODULE SHALL SUPPORT EVERY FUNCTION AS LISTED UNDER PARAGRAPH A, GENERAL REQUIREMENTS, OF THIS SECTION AND THE FOLLOWING.
   2. BUILDING CONTROLLER TUX MODULE COMMUNICATIONS SHALL BE THROUGH ALERTON TUX TRUNK TO UP TO 64 ALERTON TUXS. TUX MODULE SHALL CONVERT TUX DATA INTO BACNET OBJECTS AND CREATE VIRTUAL BACNET DEVICES FOR EVERY TUX CONNECTED TO THE TUX MODULE. TUX MODULE SHALL ALSO ROUTE MESSAGES TO ETHERNET – MS/TP MODULE FOR BACNET ETHERNET COMMUNICATION OVER WAN.
      a. TUX MODULE SHALL SUPPORT TUX COMMUNICATION AT 4800 AND 9600 BAUD.
      b. CONFIGURATION SHALL BE THROUGH RS-485 OR 232 CONNECTION.
   3. BACNET TRANSLATION:
      a. ALL TUX DATA SHALL BE AUTOMATICALLY TRANSLATED INTO BACNET OBJECTS BY THE TUX MODULE. NO CONFIGURATION BY THE USER SHALL BE NECESSARY. PREDEFINED BACNET OBJECTS SHALL BE AUTOMATICALLY ASSIGNED FOR EACH TYPE OF TUX CONTROLLER CONNECTED.

b. EVERY TUX CONTROLLER SHALL BECOME A VIRTUAL BACNET DEVICE FOR EASE OF USE WITH THE BACNET WORKSTATION FOR CONFIGURATION AND OPERATION.
c. STANDARD BACNET OBJECT TYPES SUPPORTED SHALL INCLUDE, AS A MINIMUM, ANALOG VALUE, BINARY VALUE, CALENDAR, DEVICE, FILE, GROUP, NOTIFICATION CLASS, PROGRAM AND SCHEDULE OBJECT TYPES. ALL PROPRIETARY OBJECT TYPES, IF USED IN THE SYSTEM, SHALL BE THOROUGHLY DOCUMENTED AND PROVIDED AS PART OF THE SUBMITTAL DATA. ALL NECESSARY TOOLS SHALL BE SUPPLIED FOR WORKING WITH PROPRIETARY INFORMATION.

2.4 AIR HANDLER APPLICATION CONTROLLERS

A. PROVIDE ONE OR MORE NATIVE BACNET APPLICATION CONTROLLERS FOR EACH AIR HANDLER / ROOFTOP UNIT AND PROVIDE NATIVE BACNET APPLICATION CONTROLLERS AS NEEDED FOR ADDITIONAL EQUIPMENT CONTROL THAT ADEQUATELY COVER ALL OBJECTS LISTED IN OBJECT LIST. ALL CONTROLLERS SHALL INTERFACE TO BUILDING CONTROLLER THROUGH EITHER MS/TP LAN USING BACNET PROTOCOL, OR ETHERNET LAN USING BACNET OVER ETHERNET OR BACNET TCP/IP. NO GATEWAYS SHALL BE USED. CONTROLLERS SHALL INCLUDE INPUT, OUTPUT AND SELF-CONTAINED LOGIC PROGRAM AS NEEDED FOR COMPLETE CONTROL OF UNITS. CONTROLLERS SHALL BE FULLY PROGRAMMABLE USING GRAPHICAL PROGRAMMING BLOCKS. PROGRAMMING TOOL SHALL BE RESIDENT ON OPERATOR WORKSTATION AND BE THE SAME TOOL AS USED FOR THE BUILDING CONTROLLER. NO AUXILIARY OR NON-BACNET CONTROLLERS SHALL BE USED.

B. BACNET CONFORMANCE:
1. APPLICATION CONTROLLERS SHALL BE APPROVED BY THE BTL AS MEETING THE BACNET ADVANCED APPLICATION CONTROLLER REQUIREMENTS.
2. PLEASE REFER TO SECTION 22.2, BACNET FUNCTIONAL GROUPS, IN THE BACNET STANDARD, FOR A COMPLETE LIST OF THE SERVICES THAT MUST BE DIRECTLY SUPPORTED TO PROVIDE EACH OF THE FUNCTIONAL GROUPS LISTED ABOVE. ALL PROPRIETARY SERVICES, IF USED IN THE SYSTEM, SHALL BE THOROUGHLY DOCUMENTED AND PROVIDED AS PART OF THE SUBMITTAL DATA. ALL NECESSARY TOOLS SHALL BE SUPPLIED FOR WORKING WITH PROPRIETARY INFORMATION.
3. STANDARD BACNET OBJECT TYPES SUPPORTED SHALL INCLUDE, AS A MINIMUM, ANALOG INPUT, ANALOG OUTPUT, ANALOG VALUE, BINARY INPUT, BINARY OUTPUT, BINARY VALUE, MULTI-STATE VALUES, DEVICE, FILE, AND PROGRAM OBJECT TYPES. ALL PROPRIETARY OBJECT TYPES, IF USED IN THE SYSTEM, SHALL BE THOROUGHLY DOCUMENTED AND PROVIDED AS PART OF THE SUBMITTAL DATA. ALL NECESSARY TOOLS SHALL BE SUPPLIED FOR WORKING WITH PROPRIETARY INFORMATION.

C. APPLICATION CONTROLLERS SHALL INCLUDE UNIVERSAL INPUTS WITH 12-BIT RESOLUTION THAT ACCEPT 3K AND 10K THERMISTORS, 0–10VDC, PLATINUM 1000 OHM RTD, 0–5VDC, 4–20MA AND DRY CONTACT SIGNALS. ANY INPUT ON A CONTROLLER MAY BE EITHER ANALOG OR DIGITAL WITH A MINIMUM OF THREE INPUTS THAT ACCEPT PULSES. CONTROLLER SHALL ALSO INCLUDE SUPPORT AND MODIFIABLE PROGRAMMING FOR INTERFACE TO INTELLIGENT ROOM SENSOR WITH DIGITAL DISPLAY. CONTROLLER SHALL INCLUDE BINARY AND ANALOG OUTPUTS ON BOARD. ANALOG OUTPUTS WITH 12-BIT RESOLUTION SHALL SUPPORT EITHER 0–10VDC OR 0–20MA. BINARY OUTPUTS SHALL HAVE LED INDICATION OF STATUS. SOFTWARE SHALL INCLUDE SCALING FEATURES FOR ANALOG OUTPUTS. APPLICATION CONTROLLER SHALL INCLUDE 20VDC VOLTAGE SUPPLY FOR USE AS POWER SUPPLY TO EXTERNAL SENSORS.
1. ALL OUTPUTS MUST HAVE ONBOARD HAND-OFF-AUTO (HOA) SWITCHES AND A STATUS INDICATOR LIGHT. HOA SWITCH POSITION SHALL BE MONITORED. EACH ANALOG OUTPUT SHALL INCLUDE A POTENTIOMETER FOR MANUALLY ADJUSTING THE OUTPUT WHEN THE HOA SWITCH IS IN THE HAND POSITION. THE POSITION OF EACH AND EVERY HOA SWITCH SHALL BE AVAILABLE SYSTEM WIDE AS A BACNET OBJECT PROPERTY.

D. ALL PROGRAM SEQUENCES SHALL BE STORED ON BOARD APPLICATION CONTROLLER IN EEPROM. NO BATTERIES SHALL BE NEEDED TO RETAIN LOGIC PROGRAM. ALL PROGRAM SEQUENCES SHALL BE EXECUTED BY CONTROLLER UP TO 20 TIMES PER SECOND (MINIMUM OF 10 TIMES PER SECOND) AND CAPABLE OF MULTIPLE PID LOOPS FOR CONTROL OF MULTIPLE DEVICES. ALL CALCULATIONS SHALL BE COMPLETED USING FLOATING-POINT MATH AND SYSTEM SHALL SUPPORT DISPLAY OF ALL INFORMATION IN FLOATING-POINT NOMENCLATURE AT OPERATOR'S TERMINAL.
    1. THE FOLLOWING CONTROL BLOCKS SHALL BE SUPPORTED:
        a. NATURAL LOG
        b. EXPONENTIAL
        c. LOG BASE 10
        d. X TO THE POWER OF Y
        e. NTH SQUARE ROOT OF X
        f. 5TH ORDER POLYNOMIAL EQUATIONS
        g. ASTRONOMICAL CLOCK (SUNRISE/SUNSET CALCULATION)
        h. TIME BASED SCHEDULES

E. PROGRAMMING OF APPLICATION CONTROLLER SHALL BE COMPLETELY MODIFIABLE IN THE FIELD OVER INSTALLED BACNET LANS OR REMOTELY USING MODEM INTERFACE. OPERATOR SHALL PROGRAM LOGIC SEQUENCES BY GRAPHICALLY MOVING FUNCTION BLOCKS ON SCREEN AND TYING BLOCKS TOGETHER ON SCREEN. APPLICATION CONTROLLER SHALL BE PROGRAMMED USING PROGRAMMING TOOLS AS DESCRIBED IN OPERATOR'S TERMINAL SECTION.

F. APPLICATION CONTROLLER SHALL INCLUDE SUPPORT FOR INTELLIGENT ROOM SENSOR (SEE APPLICABLE SECTION) DISPLAY ON INTELLIGENT ROOM SENSOR SHALL BE PROGRAMMABLE AT APPLICATION CONTROLLER AND INCLUDE AN OPERATING MODE AND A FIELD SERVICE MODE. ALL BUTTON FUNCTIONS AND DISPLAY DATA SHALL BE PROGRAMMABLE TO SHOW SPECIFIC CONTROLLER DATA IN EACH MODE, BASED ON WHICH BUTTON IS PRESSED ON THE SENSOR. SEE SEQUENCE OF OPERATION FOR SPECIFIC DISPLAY REQUIREMENTS AT INTELLIGENT ROOM SENSOR.

G. SCHEDULES:
    1. THE CONTROLLER SHALL SUPPORT A MINIMUM OF 3 BACNET SCHEDULE OBJECTS AND HAVE A REAL TIME CLOCK ON BOARD WITH BATTERY BACKUP TO MAINTAIN TIME THROUGH A POWER LOSS.

H. LOGGING CAPABILITIES:
    1. CONTROLLER SHALL SUPPORT A MINIMUM OF 50 TRENDLOGS. ANY OBJECT IN THE CONTROLLER (REAL OR CALCULATED) MAY BE LOGGED. SAMPLE TIME INTERVAL SHALL BE ADJUSTABLE AT THE OPERATOR'S WORKSTATION.
    2. CONTROLLER SHALL PERIODICALLY UPLOAD TRENDED DATA TO SYSTEM SERVER FOR LONG-TERM ARCHIVING IF DESIRED. ARCHIVED DATA STORED IN (MS JET DATABASE OR SQL) DATABASE FORM AND SHALL BE AVAILABLE FOR USE IN THIRD-PARTY SPREADSHEET OR DATABASE PROGRAMS.

I. ALARM GENERATION:
    1. ALARMS MAY BE GENERATED WITHIN THE CONTROLLER FOR ANY OBJECT CHANGE OF VALUE OR STATE (EITHER REAL OR CALCULATED). THIS INCLUDES THINGS SUCH AS ANALOG OBJECT VALUE CHANGES, AND BINARY OBJECT STATE CHANGES.
    2. ALARM LOG SHALL BE PROVIDED FOR ALARM VIEWING. LOG MAY BE VIEWED ON-SITE AT THE OPERATOR'S TERMINAL OR OFF-SITE USING REMOTE COMMUNICATIONS.
    3. CONTROLLER MUST BE ABLE TO HANDLE UP TO 25 ALARM SETUPS STORED AS BACNET EVENT ENROLLMENT OBJECTS, WITH SYSTEM DESTINATION AND ACTIONS INDIVIDUALLY CONFIGURABLE.

J. THE CONTROLLER PROCESSOR SHALL BE A 64-BIT PROCESSOR.

K. THE PACKAGING OF THE CONTROLLER SHALL PROVIDE OPERABLE DOORS TO COVER THE TERMINALS ONCE INSTALLATION IS COMPLETE. THE HOUSING OF THE CONTROLLER SHALL PROVIDE FOR DIN RAIL MOUNTING AND ALSO FULLY ENCLOSE CIRCUIT BOARD.

2.5 TERMINAL UNIT APPLICATION CONTROLLERS

A. PROVIDE ONE NATIVE BACNET APPLICATION CONTROLLER FOR EACH PIECE OF UNITARY MECHANICAL EQUIPMENT THAT ADEQUATELY COVERS ALL OBJECTS LISTED IN OBJECT LIST FOR UNIT. ALL CONTROLLERS SHALL INTERFACE TO BUILDING CONTROLLER THROUGH MS/TP LAN USING BACNET PROTOCOL. NO GATEWAYS SHALL BE USED. CONTROLLERS SHALL INCLUDE INPUT, OUTPUT AND SELF-CONTAINED LOGIC PROGRAM AS NEEDED FOR COMPLETE CONTROL OF UNIT.

B. BACNET CONFORMANCE:

1. APPLICATION CONTROLLERS SHALL, AS A MINIMUM, SUPPORT MS/TP BACNET LAN TYPES. THEY SHALL COMMUNICATE DIRECTLY USING THIS BACNET LAN AT 9.6, 19.2, 38.4 AND 76.8 KBPS, AS A NATIVE BACNET DEVICE. APPLICATION CONTROLLERS SHALL BE APPROVED BY THE BTL AS MEETING THE BACNET APPLICATION SPECIFIC CONTROLLER REQUIREMENTS AND SUPPORT ALL BACNET SERVICES NECESSARY TO PROVIDE THE FOLLOWING BACNET FUNCTIONAL GROUPS:
    a. FILES FUNCTIONAL GROUP
    b. REINITIALIZE FUNCTIONAL GROUP
    c. DEVICE COMMUNICATIONS FUNCTIONAL GROUP
2. PLEASE REFER TO SECTION 22.2, BACNET FUNCTIONAL GROUPS IN THE BACNET STANDARD, FOR A COMPLETE LIST OF THE SERVICES THAT MUST BE DIRECTLY SUPPORTED TO PROVIDE EACH OF THE FUNCTIONAL GROUPS LISTED ABOVE. ALL PROPRIETARY SERVICES, IF USED IN THE SYSTEM, SHALL BE THOROUGHLY DOCUMENTED AND PROVIDED AS PART OF THE SUBMITTAL DATA. ALL NECESSARY TOOLS SHALL BE SUPPLIED FOR WORKING WITH PROPRIETARY INFORMATION.
3. STANDARD BACNET OBJECT TYPES SUPPORTED SHALL INCLUDE, AS A MINIMUM, ANALOG INPUT, ANALOG OUTPUT, ANALOG VALUE, BINARY INPUT, BINARY OUTPUT, BINARY VALUE, DEVICE, FILE, AND PROGRAM OBJECT TYPES. ALL PROPRIETARY OBJECT TYPES, IF USED IN THE SYSTEM, SHALL BE THOROUGHLY DOCUMENTED AND PROVIDED AS PART OF THE SUBMITTAL DATA. ALL NECESSARY TOOLS SHALL BE SUPPLIED FOR WORKING WITH PROPRIETARY INFORMATION.

C. APPLICATION CONTROLLERS SHALL INCLUDE UNIVERSAL INPUTS WITH 10-BIT RESOLUTION THAT CAN ACCEPT 3K AND 10K THERMISTORS, 0–5VDC, 4–20MA, DRY CONTACT SIGNALS AND A MINIMUM OF 3 PULSE INPUTS. ANY INPUT ON CONTROLLER MAY BE EITHER ANALOG OR DIGITAL. CONTROLLER SHALL ALSO INCLUDE SUPPORT AND MODIFIABLE PROGRAMMING FOR INTERFACE TO INTELLIGENT ROOM SENSOR. CONTROLLER SHALL INCLUDE BINARY OUTPUTS ON BOARD WITH ANALOG OUTPUTS AS NEEDED.

D. ALL PROGRAM SEQUENCES SHALL BE STORED ON BOARD CONTROLLER IN EEPROM. NO BATTERIES SHALL BE NEEDED TO RETAIN LOGIC PROGRAM. ALL PROGRAM SEQUENCES SHALL BE EXECUTED BY CONTROLLER 10 TIMES PER SECOND AND SHALL BE CAPABLE OF MULTIPLE PID LOOPS FOR CONTROL OF MULTIPLE DEVICES. PROGRAMMING OF APPLICATION CONTROLLER SHALL BE COMPLETELY MODIFIABLE IN THE FIELD OVER INSTALLED BACNET LANS OR REMOTELY THROUGH MODEM INTERFACE. OPERATOR SHALL PROGRAM LOGIC SEQUENCES BY GRAPHICALLY MOVING FUNCTION BLOCKS ON SCREEN AND TYING BLOCKS TOGETHER ON SCREEN. APPLICATION CONTROLLER SHALL BE PROGRAMMED USING SAME PROGRAMMING TOOLS AS BUILDING CONTROLLER AND AS DESCRIBED IN OPERATOR WORKSTATION SECTION. ALL PROGRAMMING TOOLS SHALL BE PROVIDED AND INSTALLED AS PART OF SYSTEM.

E. APPLICATION CONTROLLER SHALL INCLUDE SUPPORT FOR INTELLIGENT ROOM SENSOR (SEE APPLICABLE SECTION) DISPLAY ON ROOM SENSOR SHALL BE PROGRAMMABLE AT CONTROLLER AND INCLUDE AN OPERATING MODE AND A FIELD SERVICE MODE. ALL BUTTON FUNCTIONS AND

DISPLAY DATA SHALL BE PROGRAMMABLE TO SHOW SPECIFIC CONTROLLER DATA IN EACH MODE BASED ON WHICH BUTTON IS PRESSED ON THE SENSOR. SEE SEQUENCE OF OPERATION FOR SPECIFIC DISPLAY REQUIREMENTS AT INTELLIGENT ROOM SENSOR.

2.6 VAV BOX CONTROLLERS—SINGLE DUCT

A. PROVIDE ONE NATIVE BACNET APPLICATION CONTROLLER FOR EACH VAV BOX THAT ADEQUATELY COVERS ALL OBJECTS LISTED IN OBJECT LIST FOR UNIT. ALL CONTROLLERS SHALL INTERFACE TO BUILDING CONTROLLER THROUGH MS/TP LAN USING BACNET PROTOCOL. NO GATEWAYS SHALL BE USED. CONTROLLERS SHALL INCLUDE ON BOARD CFM FLOW SENSOR, INPUTS, OUTPUTS AND PROGRAMMABLE, SELF-CONTAINED LOGIC PROGRAM AS NEEDED FOR CONTROL OF UNITS.

B. BACNET CONFORMANCE:

1. APPLICATION CONTROLLERS SHALL, AT A MINIMUM, SUPPORT MS/TP BACNET LAN TYPES. THEY SHALL COMMUNICATE DIRECTLY THROUGH THIS BACNET LAN AT 9.6, 19.2, 38.4 AND 76.8 KBPS, AS A NATIVE BACNET DEVICE. APPLICATION CONTROLLERS SHALL BE APPROVED BY THE BTL AS MEETING THE BACNET APPLICATION SPECIFIC CONTROLLER REQUIREMENTS.
2. PLEASE REFER TO SECTION 22.2, BACNET FUNCTIONAL GROUPS, IN THE BACNET STANDARD, FOR A COMPLETE LIST OF THE SERVICES THAT MUST BE DIRECTLY SUPPORTED TO PROVIDE EACH OF THE FUNCTIONAL GROUPS LISTED ABOVE. ALL PROPRIETARY SERVICES, IF USED IN THE SYSTEM, SHALL BE THOROUGHLY DOCUMENTED AND PROVIDED AS PART OF THE SUBMITTAL DATA. ALL NECESSARY TOOLS SHALL BE SUPPLIED FOR WORKING WITH PROPRIETARY INFORMATION.
3. STANDARD BACNET OBJECT TYPES SUPPORTED SHALL INCLUDE, AS A MINIMUM, ANALOG INPUT, ANALOG OUTPUT, ANALOG VALUE, BINARY INPUT, BINARY OUTPUT, BINARY VALUE, DEVICE, FILE, AND PROGRAM OBJECT TYPES. ALL PROPRIETARY OBJECT TYPES, IF USED IN THE SYSTEM, SHALL BE THOROUGHLY DOCUMENTED AND PROVIDED AS PART OF THE SUBMITTAL DATA. ALL NECESSARY TOOLS SHALL BE SUPPLIED FOR WORKING WITH PROPRIETARY INFORMATION.

C. APPLICATION CONTROLLERS SHALL INCLUDE UNIVERSAL INPUTS WITH 10-BIT RESOLUTION THAT CAN ACCEPT 3K AND 10K THERMISTORS, 0–5 VDC, AND DRY CONTACT SIGNALS. INPUTS ON CONTROLLER MAY BE EITHER ANALOG OR DIGITAL. CONTROLLER SHALL ALSO INCLUDE SUPPORT AND MODIFIABLE PROGRAMMING FOR INTERFACE TO INTELLIGENT ROOM SENSOR WITH DIGITAL DISPLAY. CONTROLLER SHALL ALSO INCLUDE BINARY OUTPUTS ON BOARD. FOR APPLICATIONS USING VARIABLE SPEED PARALLEL FANS, PROVIDE A SINGLE ANALOG OUTPUT SELECTABLE FOR 0-10 V OR 0-20 MA CONTROL SIGNALS. APPLICATION CONTROLLER SHALL INCLUDE MICROPROCESSOR DRIVEN FLOW SENSOR FOR USE IN PRESSURE INDEPENDENT CONTROL LOGIC. ALL BOXES SHALL BE CONTROLLED USING PRESSURE-INDEPENDENT CONTROL ALGORITHMS AND ALL FLOW READINGS SHALL BE IN CFM.

D. ALL PROGRAM SEQUENCES SHALL BE STORED ON BOARD APPLICATION CONTROLLER IN EEPROM. NO BATTERIES SHALL BE NEEDED TO RETAIN LOGIC PROGRAM. ALL PROGRAM SEQUENCES SHALL BE EXECUTED BY CONTROLLER 10 TIMES PER SECOND AND SHALL BE CAPABLE OF MULTIPLE PID LOOPS FOR CONTROL OF MULTIPLE DEVICES. PROGRAMMING OF APPLICATION CONTROLLER SHALL BE COMPLETELY MODIFIABLE IN THE FIELD OVER INSTALLED BACNET LANS OR REMOTELY USING MODEM INTERFACE. OPERATOR SHALL PROGRAM LOGIC SEQUENCES BY GRAPHICALLY MOVING FUNCTION BLOCKS ON SCREEN AND TYING BLOCKS TOGETHER ON SCREEN. APPLICATION CONTROLLER SHALL BE PROGRAMMED USING THE SAME PROGRAMMING TOOL AS BUILDING CONTROLLER AND AS DESCRIBED IN OPERATOR'S WORKSTATION SECTION. ALL PROGRAMMING TOOLS SHALL BE PROVIDED AS PART OF SYSTEM.

E. APPLICATION CONTROLLER SHALL INCLUDE SUPPORT FOR INTELLIGENT ROOM SENSOR (SEE APPLICABLE SECTION) DISPLAY ON ROOM SENSOR SHALL BE PROGRAMMABLE AT APPLICATION CONTROLLER AND INCLUDE AN OPERATING MODE AND A FIELD SERVICE MODE. ALL BUTTON

FUNCTIONS AND DISPLAY DATA SHALL BE PROGRAMMABLE TO SHOW SPECIFIC CONTROLLER DATA IN EACH MODE BASED ON WHICH BUTTON IS PRESSED ON THE SENSOR. SEE SEQUENCE OF OPERATIONS FOR SPECIFIC DISPLAY REQUIREMENTS FOR INTELLIGENT ROOM SENSOR.

F. ON BOARD FLOW SENSOR SHALL BE MICROPROCESSOR-DRIVEN AND PRE-CALIBRATED AT THE FACTORY. PRE-CALIBRATION SHALL BE AT 16 FLOW POINTS AS A MINIMUM. ALL FACTORY CALIBRATION DATA SHALL BE STORED IN NON-VOLATILE MEMORY. CALIBRATION DATA SHALL BE FIELD ADJUSTABLE TO COMPENSATE FOR VARIATIONS IN VAV BOX TYPE AND INSTALLATION. ALL CALIBRATION PARAMETERS SHALL BE ADJUSTABLE THROUGH INTELLIGENT ROOM SENSOR. OPERATOR'S WORKSTATION, PORTABLE COMPUTERS, AND SPECIAL HAND-HELD FIELD TOOLS SHALL NOT BE NEEDED FOR FIELD CALIBRATION.

G. PROVIDE DUCT TEMPERATURE SENSOR AT DISCHARGE OF EACH VAV BOX THAT IS CONNECTED TO CONTROLLER FOR REPORTING BACK TO OPERATOR'S WORKSTATION.

2.7 AUXILIARY CONTROL DEVICES

A. TEMPERATURE SENSORS:

1. ALL TEMPERATURE SENSORS TO BE SOLID-STATE ELECTRONIC, INTERCHANGEABLE WITH HOUSING APPROPRIATE FOR APPLICATION. WALL SENSORS TO BE INSTALLED AS INDICATED ON DRAWINGS. MOUNT 48 INCHES ABOVE FINISHED FLOOR. DUCT SENSORS TO BE INSTALLED SUCH THAT THE SENSING ELEMENT IS IN THE MAIN AIR STREAM. IMMERSION SENSORS TO BE INSTALLED IN WELLS PROVIDED AND INSTALLED BY CONTRACTOR. IMMERSION WELLS SHALL BE FILLED WITH THERMAL COMPOUND BEFORE INSTALLATION OF IMMERSION SENSORS. OUTSIDE AIR SENSORS SHALL BE INSTALLED AWAY FROM EXHAUST OR RELIEF VENTS, NOT IN AN OUTSIDE AIR INTAKE, AND IN A LOCATION THAT IS IN THE SHADE MOST OF THE DAY.

B. INTELLIGENT ROOM SENSOR WITH LCD READOUT:

1. SENSOR SHALL CONTAIN A BACKLIT LCD DIGITAL DISPLAY AND USER FUNCTION KEYS ALONG WITH TEMPERATURE SENSOR. CONTROLLER SHALL FUNCTION AS ROOM CONTROL UNIT AND ALLOW OCCUPANT TO RAISE AND LOWER SETPOINT, AND ACTIVATE TERMINAL UNIT FOR OVERRIDE USE—ALL WITHIN LIMITS AS PROGRAMMED BY BUILDING OPERATOR. SENSOR SHALL ALSO ALLOW SERVICE TECHNICIAN ACCESS TO HIDDEN FUNCTIONS AS DESCRIBED IN SEQUENCE OF OPERATION.
2. THE INTELLIGENT ROOM SENSOR SHALL SIMULTANEOUSLY DISPLAY ROOM SETPOINT, ROOM TEMPERATURE, OUTSIDE TEMPERATURE, AND FAN STATUS (IF APPLICABLE) AT EACH CONTROLLER. THIS UNIT SHALL BE PROGRAMMABLE, ALLOWING SITE DEVELOPERS THE FLEXIBILITY TO CONFIGURE THE DISPLAY TO MATCH THEIR APPLICATION. THE SITE DEVELOPER SHOULD BE ABLE TO PROGRAM THE UNIT TO DISPLAY TIME-OF-DAY, ROOM HUMIDITY AND OUTDOOR HUMIDITY. UNIT MUST HAVE THE CAPABILITY TO SHOW TEMPERATURES IN DEGREES FAHRENHEIT OR CENTIGRADE.
3. OVERRIDE TIME MAY BE SET AND VIEWED IN HALF-HOUR INCREMENTS. OVERRIDE TIME COUNTDOWN SHALL BE AUTOMATIC, BUT MAY BE RESET TO ZERO BY OCCUPANT FROM THE SENSOR. TIME REMAINING SHALL BE DISPLAYED. DISPLAY SHALL SHOW THE WORD "OFF" IN UNOCCUPIED MODE UNLESS A FUNCTION BUTTON IS PRESSED.
4. SEE SEQUENCE OF OPERATION FOR SPECIFIC OPERATION OF LCD DISPLAYS AND FUNCTION KEYS IN FIELD SERVICE MODE AND IN NORMAL OCCUPANT MODE. PROVIDE INTELLIGENT ROOM SENSORS AS SPECIFIED IN POINT LIST.
5. FIELD SERVICE MODE SHALL BE CUSTOMIZABLE TO FIT DIFFERENT APPLICATIONS. IF INTELLIGENT ROOM SENSOR IS CONNECTED TO VAV CONTROLLER, VAV BOX SHALL BE BALANCED AND ALL AIR FLOW PARAMETERS SHALL BE VIEWED AND SET FROM THE INTELLIGENT ROOM SENSOR WITH NO COMPUTER OR OTHER FIELD SERVICE TOOL NEEDED.

C. WALL SENSOR:

1. STANDARD WALL SENSOR SHALL USE SOLID-STATE SENSOR IDENTICAL TO INTELLIGENT ROOM SENSOR AND SHALL BE PACKAGED IN AESTHETICALLY PLEASING ENCLOSURE. SENSOR SHALL PROVIDE OVERRIDE FUNCTION, WARMER/COOLER LEVER FOR SET POINT ADJUSTMENT AND PORT FOR PLUG-IN OF FIELD SERVICE TOOL FOR FIELD ADJUSTMENTS. OVERRIDE TIME SHALL BE STORED IN CONTROLLER AND BE ADJUSTABLE ON A ZONE-BY-ZONE BASIS. ADJUSTMENT RANGE FOR WARMER/COOLER LEVER SHALL ALSO BE STORED IN EEPROM ON CONTROLLER. ALL PROGRAMMABLE VARIABLES SHALL BE AVAILABLE TO FIELD SERVICE TOOL THROUGH WALL SENSOR PORT.

D. FIELD SERVICE TOOL:
   1. FIELD SERVICE TOOL SHALL ALLOW TECHNICIAN TO VIEW AND MODIFY ALL SETPOINTS AND TUNING PARAMETERS STORED IN APPLICATION CONTROLLER. IN ADDITION, TECHNICIAN SHALL BE ABLE TO VIEW STATUS OF ALL INPUTS AND OUTPUTS ON DIGITAL READOUT. EACH PIECE OF DATA SHALL HAVE A DATA CODE ASSOCIATED WITH IT THAT IS CUSTOMIZABLE.
   2. FIELD SERVICE TOOL SHALL PLUG INTO WALL SENSOR AND PROVIDE ALL THE SPECIFIED FUNCTIONALITY. OPERATOR WORKSTATION SHALL INCLUDE THE CAPABILITY TO DISABLE OPERATION OF THE FIELD SERVICE TOOL.
   3. PROVIDE 3 FIELD SERVICE TOOLS FOR THIS PROJECT.

E. NETWORK CONNECTION TOOL:
   1. NETWORK CONNECTION TOOL SHALL ALLOW TECHNICIAN TO CONNECT A LAPTOP TO ANY MS/TP NETWORK OR AT ANY MS/TP DEVICE AND VIEW AND MODIFY ALL INFORMATION THROUGHOUT THE ENTIRE BACNET NETWORK. LAPTOP CONNECTION TO TOOL SHALL BE THROUGH ETHERNET OR PTP.
   2. PROVIDE QUICK CONNECT TO MS/TP LAN AT EACH CONTROLLER. TOOL SHALL BE ABLE TO ADJUST TO ALL MS/TP BAUD RATES SPECIFIED IN THE BACNET STANDARD.
   3. PROVIDE 3 NETWORK CONNECTION TOOLS FOR THIS PROJECT.

2.8 ELECTRONIC ACTUATORS AND VALVES

A. QUALITY ASSURANCE FOR ACTUATORS AND VALVES
   1. UL LISTED STANDARD 873 AND C.S.A. CLASS 4813 02 CERTIFIED.
   2. NEMA 2 RATED ENCLOSURES FOR INSIDE MOUNTING, PROVIDE WITH WEATHER SHIELD FOR OUTSIDE MOUNTING.
   3. FIVE-YEAR MANUFACTURER'S WARRANTY. TWO-YEAR UNCONDITIONAL AND THREE-YEAR PRODUCT DEFECT FROM DATE OF INSTALLATION

B. EXECUTION DETAILS FOR ACTUATORS AND VALVES
   1. FURNISH A FREEZE-STAT AND INSTALL "HARD WIRE" INTERLOCK TO DISCONNECT THE MECHANICAL SPRING RETURN ACTUATOR POWER CIRCUIT FOR FAIL-SAFE OPERATION. USE OF THE CONTROL SIGNAL TO DRIVE THE ACTUATORS CLOSED IS NOT ACCEPTABLE.
   2. EACH DDC ANALOG OUTPUT POINT SHALL HAVE AN ACTUATOR FEEDBACK SIGNAL, INDEPENDENT OF CONTROL SIGNAL, WIRED AND TERMINATED IN THE CONTROL PANEL FOR TRUE POSITION INFORMATION AND TROUBLESHOOTING. OR THE ACTUATOR FEEDBACK SIGNAL MAY BE WIRED TO THE DDC AS AN ANALOG INPUT FOR TRUE ACTUATOR POSITION STATUS.
   3. VAV BOX DAMPER ACTUATION SHALL BE FLOATING TYPE OR ANALOG (2–10VDC, 4–20MA).
   4. BOOSTER-HEAT VALVE ACTUATION SHALL BE FLOATING TYPE OR ANALOG (2-10VDC, 4-20MA).
   5. PRIMARY VALVE CONTROL SHALL BE ANALOG (2–10VDC, 4–20MA).

C. ACTUATORS FOR DAMPER AND CONTROL VALVES 0.5–6 INCHES SHALL BE ELECTRIC UNLESS OTHERWISE SPECIFIED, PROVIDE ACTUATORS AS FOLLOWS:
   1. UL LISTED STANDARD 873 AND CANADIAN STANDARDS ASSOCIATION CLASS 481302 SHALL CERTIFY ACTUATORS.

2. NEMA 2 RATED ACTUATOR ENCLOSURES FOR INSIDE MOUNTING. USE ADDITIONAL WEATHER SHIELD TO PROTECT ACTUATOR WHEN MOUNTED OUTSIDE.
3. FIVE-YEAR MANUFACTURER'S WARRANTY. TWO-YEAR UNCONDITIONAL AND THREE YEAR PRODUCT DEFECT FROM DATE OF INSTALLATION.
4. MECHANICAL SPRING SHALL BE PROVIDED WHEN SPECIFIED. CAPACITORS OR OTHER NON-MECHANICAL FORMS OF FAIL-SAFE ARE NOT ACCEPTABLE.
5. POSITION INDICATOR DEVICE SHALL BE INSTALLED AND MADE VISIBLE TO THE EXPOSED SIDE OF THE ACTUATOR. FOR DAMPER SHORT SHAFT MOUNTING, A SEPARATE INDICATOR SHALL BE PROVIDED TO THE EXPOSED SIDE OF THE ACTUATOR.
6. OVERLOAD PROTECTION: ACTUATORS SHALL PROVIDE PROTECTION AGAINST ACTUATOR BURNOUT BY USING AN INTERNAL CURRENT LIMITING CIRCUIT OR DIGITAL MOTOR ROTATION SENSING CIRCUIT. CIRCUIT SHALL INSURE THAT ACTUATORS CANNOT BURN OUT DUE TO STALLED DAMPER OR MECHANICAL AND ELECTRICAL PARALLELING. END SWITCHES TO DEACTIVATE THE ACTUATOR AT THE END OF ROTATION ARE ACCEPTABLE ONLY FOR BUTTERFLY VALVE ACTUATORS.
7. A PUSHBUTTON GEARBOX RELEASE SHALL BE PROVIDED FOR ALL NON-SPRING ACTUATORS.
8. MODULATING ACTUATORS SHALL BE 24VAC AND CONSUME 10VA POWER OR LESS.
9. CONDUIT CONNECTORS ARE REQUIRED WHEN SPECIFIED AND WHEN CODE REQUIRES IT.

D. DAMPER ACTUATORS:
1. OUTSIDE AIR AND EXHAUST AIR DAMPER ACTUATORS SHALL BE MECHANICAL SPRING RETURN. CAPACITORS OR OTHER NON-MECHANICAL FORMS OF FAIL-SAFE ARE NOT ACCEPTABLE. THE ACTUATOR MOUNTING ARRANGEMENT AND SPRING RETURN FEATURE SHALL PERMIT NORMALLY OPEN OR NORMALLY CLOSED POSITIONS OF THE DAMPER AS REQUIRED.
2. ECONOMIZER ACTUATORS SHALL UTILIZE ANALOG CONTROL 2–10VDC, FLOATING CONTROL IS NOT ACCEPTABLE.
3. ELECTRIC DAMPER ACTUATORS (INCLUDING VAV BOX ACTUATORS) SHALL BE DIRECT SHAFT-MOUNTED AND USE A V-BOLT AND TOOTHED V-CLAMP CAUSING A COLD WELD EFFECT FOR POSITIVE GRIPPING. SINGLE BOLT OR SET-SCREW TYPE FASTENERS ARE NOT ACCEPTABLE.
4. ONE ELECTRONIC ACTUATOR SHALL BE DIRECT SHAFT-MOUNTED PER DAMPER SECTION. NO CONNECTING RODS OR JACKSHAFTS SHALL BE NEEDED. SMALL OUTSIDE AIR AND RETURN AIR ECONOMIZER DAMPERS MAY BE MECHANICALLY LINKED TOGETHER IF ONE ACTUATOR HAS SUFFICIENT TORQUE TO DRIVE BOTH AND DAMPER DRIVE SHAFTS ARE BOTH HORIZONTAL INSTALLED.
5. MULTI-SECTION DAMPERS WITH ELECTRIC ACTUATORS SHALL BE ARRANGED SO THAT EACH DAMPER SECTION OPERATES INDIVIDUALLY. ONE ELECTRONIC ACTUATOR SHALL BE DIRECT SHAFT-MOUNTED PER DAMPER SECTION. (SEE BELOW EXECUTION SECTION FOR MORE INSTALLATION DETAILS.

E. VALVE ACTUATORS 0.5–6 INCHES:
1. MECHANICAL SPRING SHALL BE PROVIDED ON ALL ACTUATORS FOR PRE-HEAT COIL AND ACTUATORS FOR AHU HEATING OR COOLING COIL WHEN UNITS ARE MOUNTED OUTSIDE. SEE PLANS FOR FAIL-SAFE FLOW FUNCTION: NORMAL OPEN OR NORMAL CLOSED. CAPACITORS OR OTHER NON-MECHANICAL FORMS OF FAIL-SAFE ARE NOT ACCEPTABLE.
2. ALL ZONE SERVICE ACTUATORS SHALL BE NON-SPRING RETURN UNLESS OTHERWISE SPECIFIED.
3. THE VALVE ACTUATOR SHALL BE CAPABLE OF PROVIDING THE MINIMUM TORQUE REQUIRED FOR PROPER VALVE CLOSE-OFF FOR THE REQUIRED APPLICATION.

4. ALL CONTROL VALVES ACTUATORS SHALL HAVE AN ATTACHED 3-FOOT CABLE FOR EASY INSTALLATION TO A JUNCTION BOX.
5. OVERRIDE HANDLE AND GEARBOX RELEASE SHALL BE PROVIDED FOR ALL NON-SPRING RETURN VALVE ACTUATORS

F. CONTROL DAMPERS:
1. THE CONTRACTOR SHALL FURNISH AND SIZE ALL AUTOMATIC CONTROL DAMPERS UNLESS PROVIDED WITH PACKAGED EQUIPMENT. THE CONTRACTOR SHALL INSTALL ALL DAMPERS UNLESS PROVIDED WITH PACKAGED EQUIPMENT.
2. ALL DAMPERS USED FOR MODULATING SERVICE SHALL BE OPPOSED BLADE TYPE AND ARRANGED FOR NORMALLY OPEN OR NORMALLY CLOSED OPERATION AS REQUIRED. THE DAMPER IS TO BE SIZED SO THAT, WHEN WIDE OPEN, THE PRESSURE DROP IS A SUFFICIENT AMOUNT OF ITS CLOSE-OFF PRESSURE DROP FOR EFFECTIVE THROTTLING.
3. ALL DAMPERS USED FOR TWO-POSITION OR OPEN-CLOSE CONTROL SHALL BE PARALLEL BLADE TYPE ARRANGED FOR NORMALLY OPEN OR CLOSED OPERATION AS REQUIRED.
4. DAMPER LINKAGE HARDWARE SHALL BE CONSTRUCTED OF ALUMINUM OR CORROSION-RESISTANT ZINC AND NICKEL-PLATED STEEL AND FURNISHED AS FOLLOWS:
5. BEARING SUPPORT BRACKET AND DRIVE BLADE PIN EXTENSION SHALL BE PROVIDED FOR EACH DAMPER SECTION. CONTRACTOR SHALL INSTALL BEARING SUPPORT BRACKET AND DRIVE BLADE PIN EXTENSION. CONTRACTOR SHALL PROVIDE PERMANENT INDICATION OF BLADE POSITION BY SCRATCHING OR MARKING THE VISIBLE END OF THE DRIVE BLADE PIN EXTENSION.
6. DRIVE PIN MAY BE ROUND ONLY IF V-BOLT AND TOOTHED V-CLAMP IS USED TO CAUSE A COLD WELD EFFECT FOR POSITIVE GRIPPING. FOR SINGLE BOLT OR SET-SCREW TYPE ACTUATOR FASTENERS, ROUND DAMPER PIN SHAFTS MUST BE MILLED WITH AT LEAST ONE SIDE FLAT TO AVOID SLIPPAGE.
7. DAMPER MANUFACTURER SHALL SUPPLY ALIGNMENT PLATES FOR ALL MULTI-SECTION DAMPERS

G. CONTROL VALVES 0.5–6" INCHES:
1. THE CONTRACTOR SHALL FURNISH ALL SPECIFIED MOTORIZED CONTROL VALVES AND ACTUATORS. CONTRACTOR SHALL FURNISH ALL CONTROL WIRING TO ACTUATORS. THE CONTRACTOR SHALL INSTALL ALL VALVES. EQUAL PERCENTAGE CONTROL CHARACTERISTIC SHALL BE PROVIDED FOR ALL WATER COIL CONTROL VALVES. LINEAR VALVE CHARACTERISTIC IS ACCEPTABLE FOR 3-WAY VALVES THAT ARE 2.5 INCHES AND ABOVE.
2. CHARACTERIZED CONTROL VALVES SHALL BE USED FOR HYDRONIC HEATING OR COOLING APPLICATIONS AND SMALL TO MEDIUM AHU WATER-COIL APPLICATIONS TO 100GPM. ACTUATORS ARE NON-SPRING RETURN FOR TERMINAL UNIT COIL CONTROL UNLESS OTHERWISE NOTED. IF THE COIL IS EXPOSED TO THE OUTSIDE AIR STREAM, SEE PLANS FOR SPRING RETURN REQUIREMENT.
    a. LEAKAGE IS AERO PERCENT, CLOSE-OFF IS 200PSI, MAXIMUM DIFFERENTIAL IS 30PSI; RANGEABLITY IS 500:1.
    b. VALVES 0.5–2 INCHES SHALL BE NICKEL-PLATED FORGED BRASS BODY, NPT SCREW TYPE CONNECTIONS.
    c. VALVES 0.5–1.25 INCHES SHALL BE RATED FOR ANSI CLASS 600 WORKING PRESSURE. VALVES 1.5 AND 2 INCHES SHALL BE RATED FOR ANSI CLASS 400 WORKING PRESSURE.
    d. THE OPERATING TEMPERATURE RANGE SHALL BE 0–250 DEGREES F.
    e. STAINLESS STEEL BALL AND STEM SHALL BE FURNISHED ON ALL MODULATING VALVES.
    f. SEATS SHALL BE FIBERGLASS REINFORCED TEFLON.

g. TWO-WAY AND THREE-WAY VALVES SHALL HAVE AN EQUAL PERCENTAGE CONTROL PORT. FULL STEM ROTATION IS REQUIRED FOR MAXIMUM FLOW TO INSURE STABLE BTU CONTROL OF THE COIL.
h. THREE-WAY VALVE SHALL BE APPLICABLE FOR BOTH MIXING AND DIVERTING.
i. THE CHARACTERIZING DISC IS MADE OF TEFZEL AND SHALL BE KEYED AND HELD SECURE BY A RETAINING RING.
j. THE VALVES SHALL HAVE A BLOW-OUT PROOF STEM DESIGN.
k. THE STEM PACKING SHALL CONSIST OF 2 LUBRICATED O-RINGS DESIGNED FOR ON-OFF OR MODULATING SERVICE AND REQUIRE NO MAINTENANCE.
l. THE VALVES SHALL HAVE AN ISO TYPE, 4-BOLT FLANGE FOR MOUNTING ACTUATOR IN ANY ORIENTATION PARALLEL OR PERPENDICULAR TO THE PIPE.
m. A NON-METALLIC THERMAL ISOLATION ADAPTER SHALL SEPARATE VALVE FLANGE FROM ACTUATOR.
n. ONE FASTENING SCREW SHALL SECURE THE DIRECT COUPLING OF THE THERMAL ISOLATION ADAPTER BETWEEN THE ACTUATOR AND THE VALVE. THIS WILL PREVENT ALL LATERAL OR ROTATIONAL FORCES FROM AFFECTING THE STEM AND ITS PACKING O-RINGS

H. BUTTERFLY VALVES:
1. BUTTERFLY VALVES SHALL BE SIZED FOR MODULATING SERVICE AT 60–70 DEGREE STEM ROTATION. ISOLATION VALVES SHALL BE LINE-SIZE. DESIGN VELOCITY SHALL BE LESS THAN 12 FEET PER SECOND WHEN USED WITH STANDARD EPDM SEATS.
a. BODY IS CAST IRON.
b. DISC IS ALUMINUM BRONZE STANDARD.
c. SEAT IS EPDM STANDARD.
d. BODY PRESSURE IS 200 PSI, -30–275 DEGREES F.
e. FLANGE IS ANSI 125/250.
f. MEDIA TEMPERATURE RANGE IS -22–240 DEGREE F.
g. MAXIMUM DIFFERENTIAL PRESSURE IS 200 PSI FOR 2- TO 6- INCH SIZE

I. BUTTERFLY VALVE INDUSTRIAL ACTUATORS:
1. ACTUATORS SHALL BE APPROVED UNDER CANADIAN STANDARDS ASSOCIATION OR OTHER NATIONALLY RECOGNIZED TESTING LABORATORY TO UL STANDARDS. CSA CLASS 4813 02 OR EQUAL. ENCLOSURE SHALL BE NEMA 4 (WEATHERPROOF) ENCLOSURE AND WILL HAVE AN INDUSTRIAL QUALITY COATING.
a. ACTUATOR SHALL HAVE A MOTOR RATED FOR CONTINUOUS DUTY. THE MOTOR SHALL BE FRACTIONAL HORSEPOWER; PERMANENT SPLIT CAPACITOR TYPE DESIGNED TO OPERATE ON A 120VAC, 1PH, 60HZ SUPPLY. TWO ADJUSTABLE CAM-ACTUATED END TRAVEL LIMIT SWITCHES SHALL BE PROVIDED TO CONTROL DIRECTION OF TRAVEL. A SELF-RESETTING THERMAL SWITCH SHALL BE IMBEDDED IN THE MOTOR FOR OVERLOAD PROTECTION.
b. REDUCTION GEARING SHALL BE DESIGNED TO WITHSTAND THE ACTUAL MOTOR STALL TORQUE. GEARS SHALL BE HARDENED ALLOY STEEL, PERMANENTLY LUBRICATED. A SELF-LOCKING GEAR ASSEMBLY OR A BRAKE SHALL BE SUPPLIED.
c. ACTUATOR SHALL HAVE A 6 FT WIRING HARNESS PROVIDED FOR EASE IN FIELD WIRING (ABOVE 1500 IN-LBS). TWO ADJUSTABLE SPDT CAM-ACTUATED AUXILIARY SWITCHES, RATED AT 250VAC SHALL BE PROVIDED FOR INDICATION OF OPEN AND CLOSED POSITION. ACTUATOR SHALL HAVE HEATER AND THERMOSTAT TO MINIMIZE CONDENSATION WITHIN THE ACTUATOR HOUSING.
d. ACTUATOR SHALL BE EQUIPPED WITH A HAND WHEEL FOR MANUAL OVERRIDE TO PERMIT OPERATION OF THE VALVE IN THE EVENT OF ELECTRICAL POWER FAILURE OR SYSTEM MALFUNCTION. HAND WHEEL MUST BE PERMANENTLY

ATTACHED TO THE ACTUATOR AND WHEN IN MANUAL OPERATION ELECTRICAL POWER TO THE ACTUATOR WILL BE PERMANENTLY INTERRUPTED. THE HAND WHEEL WILL NOT ROTATE WHILE THE ACTUATOR IS ELECTRICALLY DRIVEN.

e. THE ACTUATOR SHALL BE ANALOG, FLOATING, OR TWO POSITION AS CALLED OUT IN THE CONTROL SEQUENCE OF OPERATION. ALL ANALOG VALVES SHALL BE POSITIVE POSITIONING, AND RESPOND TO A 2–10VDC, 4-20MA, OR ADJUSTABLE SIGNAL AS REQUIRED. ANALOG ACTUATORS SHALL HAVE A DIGITAL CONTROL CARD ALLOWING ANY VOLTAGE INPUT FOR CONTROL AND ANY DC VOLTAGE FEEDBACK SIGNAL FOR POSITION INDICATION.

2. PERFORMANCE VERIFICATION TEST:
   a. CONTROL LOOPS SHALL CAUSE PRODUCTIVE ACTUATION WITH EACH MOVEMENT OF THE ACTUATOR AND ACTUATORS SHALL MODULATE AT A RATE THAT IS STABLE AND RESPONSIVE. ACTUATOR MOVEMENT SHALL NOT OCCUR BEFORE THE EFFECTS OF PREVIOUS MOVEMENT HAVE AFFECTED THE SENSOR.
   b. ACTUATOR SHALL HAVE CAPABILITY OF SIGNALING A TROUBLE ALARM WHEN THE ACTUATOR STOP-GO RATIO EXCEEDS 30%.
3. ACTUATOR MOUNTING FOR DAMPER AND VALVE ARRANGEMENTS SHALL COMPLY TO THE FOLLOWING:
   a. DAMPER ACTUATORS: SHALL NOT BE INSTALLED IN THE AIR STREAM
   b. A WEATHER SHIELD SHALL BE USED IF ACTUATORS ARE LOCATED OUTSIDE. FOR DAMPER ACTUATORS, USE CLEAR PLASTIC ENCLOSURE.
   c. DAMPER OR VALVE ACTUATOR AMBIENT TEMPERATURE SHALL NOT EXCEED 122 DEGREES F THROUGH ANY COMBINATION OF MEDIUM TEMPERATURE OR SURROUNDING AIR. APPROPRIATE AIR GAPS, THERMAL ISOLATION WASHERS OR SPACERS, STANDOFF LEGS, OR INSULATION SHALL BE PROVIDED AS NECESSARY.
   d. ACTUATOR CORDS OR CONDUIT SHALL INCORPORATE A DRIP LEG IF CONDENSATION IS POSSIBLE. WATER SHALL NOT BE ALLOWED TO CONTACT ACTUATOR OR INTERNAL PARTS. LOCATION OF CONDUITS IN TEMPERATURES DROPPING BELOW DEW POINT SHALL BE AVOIDED TO PREVENT WATER FROM CONDENSING IN CONDUIT AND RUNNING INTO ACTUATOR.
   e. DAMPER MOUNTING ARRANGEMENTS SHALL COMPLY TO THE FOLLOWING:
      1) THE CONTRACTOR SHALL FURNISH AND INSTALL DAMPER CHANNEL SUPPORTS AND SHEET METAL COLLARS.
      2) NO JACK SHAFTING OF DAMPER SECTIONS SHALL BE ALLOWED.
      3) MULTI-SECTION DAMPERS SHALL BE ARRANGED SO THAT EACH DAMPER SECTION OPERATES INDIVIDUALLY. ONE ELECTRONIC ACTUATOR SHALL BE DIRECT SHAFT MOUNTED PER SECTION.
   f. SIZE DAMPER SECTIONS BASED ON ACTUATOR MANUFACTURER'S SPECIFIC RECOMMENDATIONS FOR FACE VELOCITY, DIFFERENTIAL PRESSURE AND DAMPER TYPE. IN GENERAL:
      1) DAMPER SECTION SHALL NOT EXCEED 24 FT-SQ. WITH FACE VELOCITY >1500 FPM.
      2) DAMPER SECTION SHALL NOT EXCEED 18 FT-SQ. WITH FACE VELOCITY > 2500 FPM.
      3) DAMPER SECTION SHALL NOT EXCEED 13 FT-SQ. WITH FACE VELOCITY > 3000 FPM.
   g. MULTIPLE SECTION DAMPERS OF TWO OR MORE SHALL BE ARRANGED TO ALLOW ACTUATORS TO BE DIRECT SHAFT MOUNTED ON THE OUTSIDE OF THE DUCT.

h. MULTIPLE SECTION DAMPERS OF THREE OR MORE SECTIONS WIDE SHALL BE ARRANGED WITH A 3-SIDED VERTICAL CHANNEL (8 INCHES WIDE BY 6 INCHES DEEP) WITHIN THE DUCT OR FAN HOUSING AND BETWEEN ADJACENT DAMPER SECTIONS. VERTICAL CHANNEL SHALL BE ANCHORED AT THE TOP AND BOTTOM TO THE FAN HOUSING OR BUILDING STRUCTURE FOR SUPPORT. THE SIDES OF EACH DAMPER FRAME SHALL BE CONNECTED TO THE CHANNELS. HOLES IN THE CHANNEL SHALL ALLOW DAMPER DRIVE BLADE SHAFTS TO PASS THROUGH CHANNEL FOR DIRECT SHAFT-MOUNTING OF ACTUATORS. OPEN SIDE OF CHANNEL SHALL BE FACED DOWNSTREAM OF THE AIRFLOW, EXCEPT FOR EXHAUST AIR DAMPERS.

i. MULTIPLE SECTION DAMPERS TO BE MOUNTED FLUSH WITHIN A WALL OR HOUSING OPENING SHALL RECEIVE EITHER VERTICAL CHANNEL SUPPORTS AS DESCRIBED ABOVE OR SHEET METAL STANDOUT COLLARS. SHEET METAL COLLARS (12-INCH MINIMUM) SHALL BRING EACH DAMPER SECTION OUT OF THE WALL TO ALLOW DIRECT SHAFT-MOUNTING OF THE ACTUATOR ON THE SIDE OF THE COLLAR.

4. VALVE SIZING FOR WATER COIL:
   a. ON/OFF CONTROL VALVES SHALL BE LINE SIZE.
   b. MODULATING CONTROL VALVE BODY SIZE MAY BE REDUCED, AT MOST, TWO PIPE SIZES FROM THE LINE SIZE OR NOT LESS THAN HALF THE PIPE SIZE. THE CONTRACTOR SHALL SIZE ALL WATER COIL CONTROL VALVES FOR THE APPLICATION AS FOLLOWS:
      1) BOOSTER-HEAT VALVES SHALL BE SIZED NOT TO EXCEED 4–9PSI DIFFERENTIAL PRESSURE. SIZE VALVE FOR 50% VALVE AUTHORITY. VALVE DESIGN PRESSURE DROP IS EQUAL TO THE SUM OF COIL DROP PLUS THE BALANCE VALVE DROP.
      2) PRIMARY VALVES SHALL BE SIZED NOT TO EXCEED 5–15PSI DIFFERENTIAL PRESSURE. SIZE VALVE FOR 50% VALVE AUTHORITY. VALVE DESIGN PRESSURE DROP IS EQUAL TO THE SUM OF COIL DROP PLUS THE BALANCE VALVE DROP.
      3) BUTTERFLY VALVES SHALL BE SIZED FOR MODULATING SERVICE AT 60–70 DEGREE ROTATION. DESIGN VELOCITY SHALL BE 12 FEET PER SECOND OR LESS WHEN USED WITH STANDARD EPDM SEATS.
   c. VALVE MOUNTING ARRANGEMENTS SHALL COMPLY TO THE FOLLOWING"
      1) UNIONS SHALL BE PROVIDED ON ALL PORTS OF TWO-WAY AND THREE-WAY VALVES.
      2) INSTALL THREE-WAY EQUAL PERCENTAGE CHARACTERIZED CONTROL VALVES IN A MIXING CONFIGURATION WITH THE "A" PORT PIPED TO THE COIL.
      3) INSTALL 2.5 INCHES AND ABOVE, THREE-WAY GLOBE VALVES, AS MANUFACTURED FOR MIXING OR DIVERTING SERVICE TO THE COIL.

2.9 ENCLOSURES

A. ALL CONTROLLERS, POWER SUPPLIES AND RELAYS SHALL BE MOUNTED IN ENCLOSURES.

B. ENCLOSURES NEMA CLASSIFICATION SHALL MEET THE INTENT OF THE ELECTRICAL NEMA CLASSIFICATION DRAWINGS FOR THE INDIVIDUAL SPACES.

C. ENCLOSURES SHALL HAVE HINGED, LOCKING DOORS.

D. PROVIDE LAMINATED PLASTIC NAMEPLATES FOR ALL ENCLOSURES IN ANY MECHANICAL ROOM OR ELECTRICAL ROOM. INCLUDE LOCATION AND UNIT SERVED ON NAMEPLATE. LAMINATED PLASTIC SHALL BE 0.125 INCHES THICK AND APPROPRIATELY SIZED TO MAKE LABEL EASY TO READ.

PART 3: EXECUTION

3.1 EXAMINATION

A. PRIOR TO STARTING WORK, CAREFULLY INSPECT INSTALLED WORK OF OTHER TRADES AND VERIFY THAT SUCH WORK IS COMPLETE TO THE POINT WHERE WORK OF THIS SECTION MAY PROPERLY COMMENCE.

B. NOTIFY THE OWNER'S REPRESENTATIVE IN WRITING OF CONDITIONS DETRIMENTAL TO THE PROPER AND TIMELY COMPLETION OF THE WORK.

C. DO NOT BEGIN WORK UNTIL ALL UNSATISFACTORY CONDITIONS ARE RESOLVED.

3.2 INSTALLATION (GENERAL)

A. INSTALL IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS.

B. PROVIDE ALL MISCELLANEOUS DEVICES, HARDWARE, SOFTWARE, INTERCONNECTIONS, INSTALLATION, AND PROGRAMMING REQUIRED TO ENSURE A COMPLETE OPERATING SYSTEM IN ACCORDANCE WITH THE SEQUENCES OF OPERATION AND POINT SCHEDULES.

3.3 LOCATION AND INSTALLATION OF COMPONENTS

A. LOCATE AND INSTALL COMPONENTS FOR EASY ACCESSIBILITY; IN GENERAL, MOUNT 54 INCHES ABOVE FLOOR WITH MINIMUM 3 FEET OF CLEAR ACCESS SPACE IN FRONT OF UNITS. OBTAIN APPROVAL ON LOCATIONS FROM OWNER'S REPRESENTATIVE PRIOR TO INSTALLATION.

B. ALL INSTRUMENTS, SWITCHES, TRANSMITTERS, ETC., SHALL BE SUITABLY WIRED AND MOUNTED TO PROTECT THEM FROM VIBRATION, MOISTURE, AND HIGH OR LOW TEMPERATURES.

C. IDENTIFY ALL EQUIPMENT AND PANELS. PROVIDE PERMANENTLY MOUNTED TAGS FOR ALL PANELS.

D. PROVIDE STAINLESS STEEL OR BRASS THERMOWELLS SUITABLE FOR RESPECTIVE APPLICATION AND FOR INSTALLATION UNDER OTHER SECTIONS, AND SIZED TO SUIT PIPE DIAMETER WITHOUT RESTRICTING FLOW.

3.4 INTERLOCKING AND CONTROL WIRING

A. PROVIDE ALL INTERLOCK AND CONTROL WIRING. ALL WIRING SHALL BE INSTALLED NEATLY AND PROFESSIONALLY, IN ACCORDANCE WITH SPECIFICATION DIVISION 16 AND ALL NATIONAL, STATE AND LOCAL ELECTRICAL CODES.

B. PROVIDE WIRING AS REQUIRED BY FUNCTIONS AS SPECIFIED AND AS RECOMMENDED BY EQUIPMENT MANUFACTURERS, TO SERVE SPECIFIED CONTROL FUNCTIONS. PROVIDE SHIELDED LOW CAPACITANCE WIRE FOR ALL COMMUNICATIONS TRUNKS.

C. CONTROL WIRING SHALL NOT BE INSTALLED IN POWER CIRCUIT RACEWAYS. MAGNETIC STARTERS AND DISCONNECT SWITCHES SHALL NOT BE USED AS JUNCTION BOXES. PROVIDE AUXILIARY JUNCTION BOXES AS REQUIRED. COORDINATE LOCATION AND ARRANGEMENT OF ALL CONTROL EQUIPMENT WITH THE OWNER'S REPRESENTATIVE PRIOR TO ROUGH-IN.

D. PROVIDE AUXILIARY PILOT DUTY RELAYS ON MOTOR STARTERS AS REQUIRED FOR CONTROL FUNCTION.

E. PROVIDE POWER FOR ALL CONTROL COMPONENTS FROM NEAREST ELECTRICAL CONTROL PANEL OR AS INDICATED ON THE ELECTRICAL DRAWINGS; COORDINATE WITH ELECTRICAL.

F. ALL CONTROL WIRING IN THE MECHANICAL, ELECTRICAL, TELEPHONE AND BOILER ROOMS TO BE INSTALLED IN RACEWAYS. ALL OTHER WIRING TO BE INSTALLED NEATLY AND INCONSPICUOUSLY PER LOCAL CODE REQUIREMENTS. IF LOCAL CODE ALLOWS AND APPROVED BY OWNER/ENGINEER, CONTROL WIRING ABOVE ACCESSIBLE CEILING SPACES MAY BE RUN WITH PLENUM-RATED CABLE (WITHOUT CONDUIT).

3.5 DDC OBJECT TYPE SUMMARY

A. PROVIDE ALL DATABASE GENERATION.

B. DISPLAYS

1. SYSTEM DISPLAYS SHALL SHOW ALL ANALOG AND BINARY OBJECT TYPES WITHIN THE SYSTEM. THEY SHALL BE LOGICALLY LAID OUT FOR EASY USE BY THE OWNER. PROVIDE OUTSIDE AIR TEMPERATURE INDICATION ON ALL SYSTEM DISPLAYS ASSOCIATED WITH ECONOMIZER CYCLES.

C. TRENDLOG

1. ALL BINARY AND ANALOG OBJECT TYPES (INCLUDING ZONES) SHALL HAVE THE CAPABILITY TO BE AUTOMATICALLY TRENDED.

D. ALARM
1. ALL ANALOG INPUTS (HIGH/LOW LIMITS) AND SELECTED BINARY INPUT ALARM POINTS SHALL BE PRIORITIZED AND ROUTED (LOCALLY OR REMOTELY) WITH ALARM MESSAGE PER OWNER'S REQUIREMENTS.

E. DATABASE SAVE
1. PROVIDE BACKUP DATABASE FOR ALL STANDALONE APPLICATION CONTROLLERS ON DISK.

3.6 FIELD SERVICES

A. PREPARE AND START LOGIC CONTROL SYSTEM UNDER PROVISIONS OF THIS SECTION.

B. START UP AND COMMISSION SYSTEMS. ALLOW SUFFICIENT TIME FOR STARTUP AND COMMISSIONING PRIOR TO PLACING CONTROL SYSTEMS IN PERMANENT OPERATION.

C. PROVIDE THE CAPABILITY FOR OFF-SITE MONITORING AT CONTRACTOR'S LOCAL OR MAIN OFFICE. AT A MINIMUM, OFF-SITE FACILITY SHALL BE CAPABLE OF SYSTEM DIAGNOSTICS AND SOFTWARE DOWNLOAD. OWNER SHALL PROVIDE PHONE LINE FOR THIS SERVICE FOR ONE YEAR OR AS SPECIFIED.

D. PROVIDE OWNER'S REPRESENTATIVE WITH SPARE PARTS LIST. IDENTIFY EQUIPMENT CRITICAL TO MAINTAINING THE INTEGRITY OF THE OPERATING SYSTEM.

3.7 AS-BUILT DOCUMENTATION REQUIRED

A. PROVIDE OWNER/ENGINEER A COPY OF FIELD INSTALLATION MARKUPS AT COMPLETION OF INSTALLATION. CONTRACTOR SHALL UPDATE INSTALLATION DOCUMENTATION FOR RECORD AND SUBMIT AS-BUILT DOCUMENTATION TO THE OWNER/ENGINEER.
1. PROVIDE (3) HARD COPIES OF AS BUILT DOCUMENTATION INCLUDING COMPONENT SUBMITTALS AND DESIGN DRAWINGS.
2. PROVIDE (3) ELECTRONIC COPIES OF AS BUILT DOCUMENTATION INCLUDING COMPONENT SUBMITTALS AND DESIGN DRAWINGS.

3.8 TRAINING

A. PROVIDE APPLICATION ENGINEER TO INSTRUCT OWNER IN OPERATION OF SYSTEMS AND EQUIPMENT.

B. PROVIDE SYSTEM OPERATOR'S TRAINING TO INCLUDE (BUT NOT BE LIMITED TO) SUCH ITEMS AS THE FOLLOWING: MODIFICATION OF DATA DISPLAYS, ALARM AND STATUS DESCRIPTORS, REQUESTING DATA, EXECUTION OF COMMANDS AND REQUEST OF LOGS. PROVIDE THIS TRAINING TO A MINIMUM OF THREE PERSONS.

C. PROVIDE ON-SITE TRAINING ABOVE AS REQUIRED, UP TO 40 HOURS AS PART OF THIS CONTRACT.

D. PROVIDE ALTERNATE FOR TUITION FOR AT LEAST ONE INDIVIDUAL TO ATTEND FOR A ONE-WEEK FACTORY TRAINING CLASS. IF APPLICABLE, COSTS FOR TRAVEL, LODGING AND MEALS WILL BE THE RESPONSIBILITY OF THE OWNER.

3.9 DEMONSTATION

A. DEMONSTRATE COMPLETE OPERATING SYSTEM TO OWNER'S REPRESENTATIVE.

B. PROVIDE CERTIFICATE STATING THAT CONTROL SYSTEM HAS BEEN TESTED AND ADJUSTED FOR PROPER OPERATION.

3.10 SEQUENCE OF OPERATION / DEMONSRATION

A. DEMONSTRATE COMPLETE OPERATING SYSTEM TO OWNER'S REPRESENTATIVE.

B. PROVIDE CERTIFICATE STATING THAT CONTROL SYSTEM HAS BEEN TESTED AND ADJUSTED FOR PROPER OPERATION

C. PROVIDE A COMPLETE AND OPERATIONAL TEMPERATURE CONTROL AND BUILDING AUTOMATION SYSTEM BASED ON THE FOLLOWING POINTS AND SEQUENCE OF OPERATION. THE SYSTEM SHALL BE COMPLETE AS TO SEQUENCES AND STANDARD CONTROL PRACTICES. THE DETERMINED POINT LIST IS THE MINIMUM AMOUNT OF POINTS THAT ARE TO BE PROVIDED. IF ADDITIONAL POINTS ARE REQUIRED TO MEET THE SEQUENCE OF OPERATION, THEY WILL BE PROVIDED.

D. BACNET OBJECT LIST:
   1. THE FOLLOWING POINTS AS DEFINED FOR EACH PIECE OF EQUIPMENT ARE DESIGNATED AS FOLLOWS:
      a. BINARY OUT (BO): DEFINED AS ANY TWO-STATE OUTPUT.
      b. BINARY IN (BI): DEFINED AS ANY TWO-STATE INPUT (ALARM, STATUS), OR OTHER.
      c. ANALOG IN (AI): DEFINED AS ANY VARIABLE INPUT (TEMPERATURE) (POSITION), OR OTHER.
      d. ANALOG OUT (AO): DEFINED AS ANY ELECTRICAL VARIABLE OUTPUT. 0-20MA, 4-20MA AND 0-10VDC ARE THE ONLY ACCEPTABLE ANALOG OUTPUTS. THE DRIVER FOR ANALOG OUTPUTS SHALL COME FROM BOTH HARDWARE AND SOFTWARE RESIDENT IN THE CONTROLLERS. TRANSDUCERS WILL NOT BE ACCEPTABLE UNDER ANY CIRCUMSTANCE.
      e. ANALOG VALUE (AV): HARDWARE POINTS, SOFTWARE POINTS, GRAPHED AND TOTALED AS STANDARD WITH MANUFACTURER.
         1) HARDWARE POINTS: AI, AO, BI, BO.
         2) SOFTWARE POINTS: AV, BV, SCHED, TREND, ALARM.
         3) SHOW ON GRAPHIC.

END OF SECTION

SECTION 23 09 93

SEQUENCE OF OPERATION

PART 1: GENERAL

1.1 THE SCOPE OF THIS SECTION SHALL INCLUDE

A. HVAC AND REFRIGERATION SYSTEMS CONTROL SEQUENCE TO BE USED AS A BASIS IN CONJUNCTION WITH THE DDC SPECIFICATION FOR OPERATION REQUIREMENTS TO BE MET BY THE CONTRACTOR.

1.2 RELATED SECTIONS AND DOCUMENTS

A. DRAWINGS AND GENERAL PROVISIONS OF THE CONTRACT, INCLUDING GENERAL AND SUPPLEMENTARY GENERAL CONDITIONS AND OTHER SPECIFICATION SECTIONS APPLY TO THE WORK OF THIS SECTION.

B. SECTION 23 09 23 – DIRECT DIGITAL CONTROLS

1.3 DEFINITIONS

A. AHU: AIR HANDLING UNIT.

B. BMS: BUILDING MANAGEMENT SYSTEM.

C. CAV: CONSTANT AIR VOLUME.

D. CU: CONDENSING UNIT

E. DDC: DIRECT DIGITAL CONTROLS.

F. EUH: ELECTRIC UNIT HEATER

G. EF: EXHAUST FAN

H. EVAP: EVAPORATOR

I. FCU: ELECTRIC FURNACE

J. GH: ROOF GRAVITY SUPPLY HOOD.

K. MAU: MAKE UP AIR UNIT

L. PAH: PROCESS AIR HANDLING UNIT

M. REF: ROOF EXHAUST FAN.

N. RSF: ROOF SUPPLY FAN.

O. RTU: ROOFTOP UNIT.

P. UH: GAS UNIT HEATER.

Q. VAV: VARIABLE AIR VOLUME

R. VFD: VARIABLE FREQUENCY DRIVE.

1.4 DESCRIPTION OF THE WORK

A. THE SEQUENCE OF OPERATIONS AND OWNERSHIP OF EQUIPMENT COMMUNICATION AND OPERATION SHALL BE THE RESPONSIBILITY OF CONTRACTOR. THIS SPECIFICATION SHALL DESCRIBE THE MINIMUM REQUIRED FUNCTIONAL OPERATION OF THE EQUIPMENT AND THE MECHANICAL CONTROLS SUBCONTRACTOR SHALL PROVIDE ALL HARDWARE, WIRING, SOFTWARE, PROGRAMMING, DISPLAYS, RELAYS, POWER SUPPLIES, TRANSFORMERS, AND ALL OTHER COMPONENTS TO MAKE THE SYSTEM FUNCTION AS DESCRIBED BELOW.

B. ALL HVAC AND REFRIGERATION SYSTEMS SHALL BE CONTROLLED THROUGH EITHER ELECTRIC/ELECTRONIC TEMPERATURE CONTROLS, OR DIRECT DIGITAL CONTROL SYSTEM AND INTEGRATED INTO LOCAL PROCESS/EQUIPMENT CONTROLLERS ACCORDING TO THE SEQUENCE OF OPERATIONS DESCRIBED IN THIS SECTION OF THE SPECIFICATIONS. EQUIPMENT, DEVICES, AND SYSTEM COMPONENTS REQUIRED FOR THE CONTROL SYSTEMS ARE SPECIFIED IN SECTION 23 09 13 HVAC INSTRUMENTATION AT A MINIMUM. DIRECT DIGITAL CONTROLS SHALL BE PROVIDED AS REQUIRED TO OPERATE SYSTEMS AS DESCRIBED IN THIS SPECIFICATION. ADDITIONAL POINTS OR SOFTWARE PROGRAMMING NOT SPECIFIED BUT WHICH ARE REQUIRED TO MEET THE SEQUENCE OF OPERATION SHALL BE PROVIDED BY THIS CONTRACTOR.

C. PROVIDE ALL LABOR, MATERIALS, EQUIPMENT, ACCESSORIES, PROGRAMMING AND SERVICES NECESSARY TO PROVIDE THE CONTROL AND SEQUENCE OF OPERATION FOR MECHANICAL SYSTEMS AND COMPONENTS, AS FOLLOW, IN ACCORDANCE WITH DRAWINGS AND SPECIFICATIONS. ELECTRICAL COMPONENTS AND INSTALLATION SHALL COMPLY WITH ELECTRICAL DRAWINGS, DETAILS AND SPECIFICATIONS.

D. UNITS SHALL OPERATE USING 460 VOLT, 3 PHASE, 60 HERTZ ELECTRICAL POWER. UNIT SHALL BE COMPLETELY FACTORY WIRED WITH TERMINAL BLOCK FOR SINGLE POINT POWER WIRING CONNECTION.
   1. SUPPLY VOLTAGE SHALL BE 480 VOLT THREE PHASE. WITH A SINGLE POINT POWER CONNECTION AND FACTOR WIRED DISCONNECT. CONFORM TO REQUIREMENTS OF NFPA 79, AND ALL LOCAL AND FEDERAL REGULATIONS.
   2. PANEL SHALL BE LABELED IN ACCORDANCE WITH NFPA 70. SCCR RATING SHALL BE 65KA AT 480 VOLTS AND 22KA FOR 208V AND BELOW.

E. THE OVERALL INTENT TO HAVE ALL HVAC AND REFRIGERATION EQUIPMENT CONTROLLED THROUGH AN OVERALL DDC CONTROL SYSTEM PROVIDED BY THIS CONTRACTOR. UNLESS SPECIFICALLY NOTED IN THIS SPECIFICATION AS "NOT ON DDC SYSTEM", THIS CONTRACTOR SHALL ASSUME CONTROL AND MONITORING OF THE SCHEDULED EQUIPMENT. LOCALLY VIA T-STATS AND MANUAL SWITCHES ARE NOTED AND SCHEDULED ACCORDINGLY.

1.5 QUALIFICATIONS

A. INSTALLER: COMPANY SPECIALIZING IN PERFORMING WORK OF THIS SECTION WITH MINIMUM THREE YEARS DOCUMENTED EXPERIENCE.

1.6 SUBMITTALS FOR REVIEW

A. SHOP DRAWINGS:
   1. SCREEN SHOTS OF SYSTEM AS PROPOSED BY MECHANICAL CONTROLS SUB-CONTRACTOR.
   2. SUBMIT DIAGRAMS INDICATING MECHANICAL SYSTEMS CONTROLLED AND CONTROL SYSTEM COMPONENTS. LABEL EQUIPMENT AND CONTROL DEVICES USING THE NOMENCLATURE ON THE DRAWINGS.
   3. CONTROL DEVICES SHALL BE LABELED WITH SETTINGS, ADJUSTABLE RANGE OF CONTROL AND LIMITS.
   4. INCLUDE WRITTEN DESCRIPTION OF CONTROL SEQUENCE, DESCRIBING OPERATION AND INTERACTION OF ALL EQUIPMENT, SENSORS, AND DEVICES.
   5. INCLUDE FLOW DIAGRAMS FOR EACH CONTROL SYSTEM, GRAPHICALLY DEPICTING CONTROL LOGIC.

1.7 CLOSEOUT SUBMITTALS

A. PROJECT RECORD DOCUMENTS:
   1. RECORD ACTUAL LOCATIONS OF COMPONENTS AND SETPOINTS OF CONTROLS, INCLUDING CHANGES TO SEQUENCES MADE AFTER SUBMISSION OF SHOP DRAWINGS.
   2. USE DESIGNATIONS WHICH MATCH IDENTIFICATION TAGS OR LABELS ON THE INSTALLED EQUIPMENT.

1.8 FIELD QUALITY CONTROL

A. MANUFACTURER'S FIELD SERVICE: ENGAGE FACTORY-AUTHORIZED SERVICE REPRESENTATIVE TO INSPECT FIELD ASSEMBLED COMPONENTS AND EQUIPMENT INSTALLATION, INCLUDING PIPING AND ELECTRICAL CONNECTIONS. REPORT RESULTS IN WRITING.
   1. OPERATIONAL TEST: AFTER ELECTRICAL CIRCUITRY HAS BEEN ENERGIZED, START UNITS TO CONFIRM PROPER UNIT OPERATION. REMOVE MALFUNCTIONING UNITS, REPLACE WITH NEW UNITS, AND RETEST.
   2. TEST AND ADJUST CONTROLS AND SAFETIES. REPLACE DAMAGED AND MALFUNCTIONING CONTROLS AND EQUIPMENT, AND RETEST.

B. ENGAGE FACTORY-AUTHORIZED SERVICE REPRESENTATIVE TO PERFORM STARTUP SERVICE.
   1. PROVIDE CALIBRATION CERTIFICATION OF COMPONENTS PROVIDED.

C. REPLACE DAMAGED OR MALFUNCTIONING CONTROLS AND EQUIPMENT.
   1. START, TEST, AND ADJUST CONTROL SYSTEMS.
   2. DEMONSTRATE COMPLIANCE WITH REQUIREMENTS, INCLUDING CALIBRATION AND TESTING, AND CONTROL SEQUENCES.

3. ADJUST, CALIBRATE, AND FINE TUNE CIRCUITS, PROGRAMMING ALGORITHMS AND EQUIPMENT TO ACHIEVE SEQUENCE OF OPERATION SPECIFIED.

1.9 FIELD SERVICES

A. ENGAGE FACTORY-AUTHORIZED SERVICE REPRESENTATIVE FOR TRAINING OF OWNER'S MAINTENANCE PERSONNEL IN CONTROL SYSTEMS AND COMPONENTS. SCHEDULE TRAINING WITH OWNER WITH AT LEAST SEVEN DAYS' ADVANCE NOTICE.

1. TRAIN OWNER'S MAINTENANCE PERSONNEL ON PROCEDURES AND SCHEDULES FOR STARTING AND STOPPING, TROUBLESHOOTING, SERVICING, AND MAINTAINING EQUIPMENT AND SCHEDULES.
2. PROVIDE OPERATOR TRAINING ON DATA DISPLAY, ALARM AND STATUS DESCRIPTORS, REQUESTING DATA, EXECUTING COMMANDS, CALIBRATING AND ADJUSTING DEVICES, RESETTING DEFAULT VALUES, AND REQUESTING LOGS. INCLUDE MINIMUM OF 40 HOURS OF DEDICATED INSTRUCTOR TIME ON-SITE.
3. REVIEW DATA IN OPERATION'S AND MAINTENANCE MANUALS WITH OWNERS DESIGNATED PERSONNEL.
4. THE GRAPHICS DESIGNER AND PROGRAMMER SHALL INCLUDE UP TO 5 WORKING DAYS (40 HOURS) OF ON-SITE TIME FOR OWNER REQUESTED CHANGES/MODIFICATIONS TO BUILDING MANAGEMENT SYSTEM (DDC) AND CUSTOM SCREENS.

B. OCCUPANCY ADJUSTMENTS:

1. WITHIN ONE YEAR OF DATE OF SUBSTANTIAL COMPLETION, PROVIDE UP TO THREE (3) PROJECT SITE VISITS, WHEN REQUESTED BY OWNER, TO ADJUST AND CALIBRATE COMPONENTS AND TO ASSIST OWNER'S PERSONNEL IN MAKING PROGRAM CHANGES AND IN ADJUSTING SENSORS AND CONTROLS TO SUIT ACTUAL CONDITIONS.

PART 2: PRODUCTS - NOT USED

PART 3: EXECUTION

3.1 GENERAL:

A. DATA LOGGING OF ALL SET POINT AND MONITORED POINT VALUES FOR A MINIMUM OF THIRTY (30) DAYS.

B. DDC SYSTEM SHALL MONITOR THE STATUS OF ALL FANS UNLESS SPECIFICALLY NOTED. ALARMS SHALL BE RECORDED FOR UNSCHEDULED LOSS OF AIR FLOW.

C. SEE DRAWING M9.001 MECHANICAL QUALITY PLAN FOR OCCUPIED TEMPERATURE SETPOINT INFORMATION. CONSULT WITH OWNER/ENGINEER DURING COMISSIONING FOR UNOCCUPIED SETBACK SETPOINT. ALL SETPOINTS SHALL BE OWNER ADJUSTABLE.

3.2 REFRIGERATION SPLIT SYSTEMS

A. GENERAL:

1. EACH UNIT SHALL BE FULLY INTEGRATED INTO THE CENTRAL DDC SYSTEM. CONTRACTOR OR VENDOR SHALL PROVIDE ALL EQUIPMENT, MATERIAL, AND LABOR REQUIRED TO MEET THIS SPECIFICATION.
2. EACH UNIT SHALL BE CAPABLE OF STAND ALONE OPERATION.
3. CONTRACTOR SHALL BE RESPONSIBLE FOR SIZING, INSTALLING AND WIRING ALL CONTROL POWER TRANSFORMERS REQUIRED.

B. CONTROL PANEL:

1. SYSTEM CONTROL PANEL ENCLOSURE SHALL BE INTEGRAL TO THE UNIT HOUSING OR SHALL BE WITHIN AN EXTERNAL WEATHERPROOF HOUSING ATTACHED TO UNIT WITH SEPARATE ACCESS DOOR PROVIDED WITH AN APPROVED LOCKING DEVICE.
2. ALL ELECTRICAL COMPONENTS CONTAINED IN THE PANEL SHALL BE UL/CSA CERTIFIED AND LABELED. THE PANELASSEMBLEY SHALL BE UL LISTED
3. CONTRACTOR SHALL BE RESPONSIBLE FOR 120 VOLT WIRING TO PANEL.
4. PANEL SHALL HAVE A FUSED 4 AMP OUTLET FOR LAPTOP USE, WIRED AHEAD OF THE CONTROL TRANSFORMER.
5. PANEL SHALL HAVE A MAIN DISCONNECT SWITCH.

C. THE DDC SYSTEM SHALL INTERFACE WITH UNIT MOUNTED CONTROLS TO PROVIDE THE FOLLOWING FUNCTIONS AS A MINIMUM.
   1. DDC SYSTEM SHALL HAVE A MINIMUM OF THE FOLLOWING INPUTS
      a. SPACE AIR TEMPERATURE
      b. COMPRESSOR RUN STATUS
      c. CONDENSER FAN RUN STATUS
      d. EVAPORATOR REFRIGERANT SUPPLY VALVE STATUS (OPEN/CLOSED)
      e. EVAPORATOR FAN STATUS
      f. DEFROST SYSTEM STATUS
   2. DDC SYSTEM SHALL HAVE A MINUMUM OF THE FOLLOWING OUTPUTS
      a. COMPRESSOR/CONDENSER UNIT START/STOP
      b. EVAPORATOR REFRIGERANT SUPPLY VALVE OPEN/CLOSE
      c. EVAPORATOR FAN START/STOP
      d. DEFROST SYSTEM START/STOP ON SCHEDULE
   3. ALARMS SHALL BE RECORDED AND REPORTED AT THE OPERATOR TERMINAL. ALL ALARMS SHALL BE RECORDED WITH TIME AND DATE. ALARMS SHALL BE LOGGED FOR A MINIMUM OF 30 DAYS. ALARMS SHALL BE RECORDED FOR THE FOLLOWING:
      a. SPACE TEMPERATURE +/- 5ºF OUTSIDE OF SETPOINT FOR 5 CONTINUOUS MINUTES.
      b. UNSCHEDULED FAN SHUTDOWN.
      c. UNSCHEDULED SHUTDOWN OF COMPRESSORS.

D. CURING COOLER (P106) – CU-01
   1. DDC SYSTEM SHALL MONITOR SPACE TEMPERATURE. ON A RISE IN SPACE TEMPERATURE ABOVE 36°F (ADJUSTABLE), CU-01 SHALL START, AND REFRIGERANT SUPPLY VALVES TO EVAP-01 SHALL OPEN
   2. IF SPACE TEMPERATURE DROPS BELOW 32°F, CU-01 SHALL STOP AND REFRIGERANT SUPPLY VALVES TO EVAP-01 SHALL CLOSE.
   3. PROVIDE FAN STATUS OUTPUTS.
   4. PROVIDE COMPRESSOR STATUS OUTPUTS

E. HOT PRODUCT ROOM (P108) – CU-02
   1. DDC SYSTEM SHALL MONITOR SPACE TEMPERATURE. ON A RISE IN SPACE TEMPERATURE ABOVE 34°F (ADJUSTABLE), CU-01 SHALL START, AND REFRIGERANT SUPPLY VALVES TO EVAP-02 SHALL OPEN
   2. IF SPACE TEMPERATURE DROPS BELOW 32°F, CU-01 SHALL STOP AND REFRIGERANT SUPPLY VALVES TO EVAP-02 SHALL CLOSE.
   3. PROVIDE FAN STATUS OUTPUTS.
   4. PROVIDE COMPRESSOR STATUS OUTPUTS

F. PACKAGING ROOM (P109) – CU-03
   1. DDC SYSTEM SHALL MONITOR SPACE TEMPERATURE. ON A RISE IN SPACE TEMPERATURE ABOVE 45°F (ADJUSTABLE), CU-03 SHALL START, AND REFRIGERANT SUPPLY VALVES TO EVAP-09 SHALL OPEN
   2. IF SPACE TEMPERATURE DROPS BELOW 40°F, CU-03 SHALL STOP AND REFRIGERANT SUPPLY VALVES TO EVAP-09 SHALL CLOSE.
   3. PROVIDE FAN STATUS OUTPUTS.
   4. PROVIDE COMPRESSOR STATUS OUTPUTS

G. INEDIBLES/HIDES DOCK (S100) – CU-04
   1. DDC SYSTEM SHALL MONITOR SPACE TEMPERATURE. ON A RISE IN SPACE TEMPERATURE ABOVE 45°F (ADJUSTABLE), CU-04 SHALL START, AND REFRIGERANT SUPPLY VALVES TO EVAP-05 AND EVAP-06 SHALL OPEN
   2. IF SPACE TEMPERATURE DROPS BELOW 40°F, CU-04 SHALL STOP AND REFRIGERANT SUPPLY VALVES TO EVAP-05 AND EVAP-06 SHALL CLOSE.

3. PROVIDE FAN STATUS OUTPUTS.
4. PROVIDE COMPRESSOR STATUS OUTPUTS

H. CHILL COOLER (S102) – CU-05
1. DDC SYSTEM SHALL MONITOR SPACE TEMPERATURE. ON A RISE IN SPACE TEMPERATURE ABOVE 34°F (ADJUSTABLE), CU-05 SHALL START, AND REFRIGERANT SUPPLY VALVES TO EVAP-07 AND EVAP-08 SHALL OPEN
2. IF SPACE TEMPERATURE DROPS BELOW 32°F, CU-05 SHALL STOP AND REFRIGERANT SUPPLY VALVES TO EVAP-07 AND EVAP-08 SHALL CLOSE.
3. PROVIDE FAN STATUS OUTPUTS.
4. PROVIDE COMPRESSOR STATUS OUTPUTS

I. SALES COOLER (S103) – CU-06
1. DDC SYSTEM SHALL MONITOR SPACE TEMPERATURE. ON A RISE IN SPACE TEMPERATURE ABOVE 34°F (ADJUSTABLE), CU-06 SHALL START, AND REFRIGERANT SUPPLY VALVES TO EVAP-09, EVAP-10, AND EVAP-11 SHALL OPEN
2. IF SPACE TEMPERATURE DROPS BELOW 32°F, CU-06 SHALL STOP AND REFRIGERANT SUPPLY VALVES TO EVAP-09, EVAP-10, AND EVAP-11 SHALL CLOSE.
3. PROVIDE FAN STATUS OUTPUTS.
4. PROVIDE COMPRESSOR STATUS OUTPUTS

J. CHILLED BOXED COOLER (S105) – CU-07
1. DDC SYSTEM SHALL MONITOR SPACE TEMPERATURE. ON A RISE IN SPACE TEMPERATURE ABOVE 28°F (ADJUSTABLE), CU-07 SHALL START, AND REFRIGERANT SUPPLY VALVES TO EVAP-12 AND EVAP-13 SHALL OPEN
2. IF SPACE TEMPERATURE DROPS BELOW 24°F, CU-07 SHALL STOP AND REFRIGERANT SUPPLY VALVES TO EVAP-12 AND EVAP-13 SHALL CLOSE.
3. PROVIDE FAN STATUS OUTPUTS.
4. PROVIDE COMPRESSOR STATUS OUTPUTS

K. CURING COOLER (S107) – CU-08
1. DDC SYSTEM SHALL MONITOR SPACE TEMPERATURE. ON A RISE IN SPACE TEMPERATURE ABOVE -20°F (ADJUSTABLE), CU-08 SHALL START, AND REFRIGERANT SUPPLY VALVES TO EVAP-14, EVAP-15, AND EVAP-16 SHALL OPEN
2. IF SPACE TEMPERATURE DROPS BELOW -24°F, CU-08 SHALL STOP AND REFRIGERANT SUPPLY VALVES TO EVAP-14, EVAP-15, AND EVAP-16 SHALL CLOSE.
3. PROVIDE FAN STATUS OUTPUTS.
4. PROVIDE COMPRESSOR STATUS OUTPUTS

3.3 CONSTANT VOLUME PACKAGED DX/GAS/ELECTRIC ROOFTOP UNITS: RTU-02, RTU-03, RTU-05

A. GENERAL:
1. PROVIDE FACTORY FURNISHED, WIRED, AND PROGRAMMED PLC SYSTEM TO CONTROL ALL FUNCTIONS OF THE RTU AND SPECIFIED SENSORS/DEVICES.
2. THE PLC SYSTEM FOR EACH UNIT SHALL BE CAPABLE OF STAND ALONE OPERATION.
3. PROVIDE WITH BACNET DDC INTEGRATION CONTROLLER. CONTROLS MANUFACTURER AND DESIGN TO BE DETERMINED DURING SUBMITTAL PHASE WITH CONTRACTOR.
4. CONTRACTOR SHALL BE RESPONSIBLE FOR SIZING, INSTALLING AND WIRING ALL CONTROL POWER TRANSFORMERS REQUIRED.
5. PROVIDE AND INSTALL WITH SPACE TEMPERATURE SENSOR WITH ADJUSTABLE THERMOSTAT FOR EACH RTU. SEE DRAWINGS FOR INSTALLATION LOCATION.

B. CONTROL PANEL:
1. UNIT CONTROL PANEL ENCLOSURE SHALL BE INTEGRAL TO THE UNIT HOUSING OR SHALL BE WITHIN AN EXTERNAL WEATHERPROOF HOUSING ATTACHED TO UNIT WITH SEPARATE ACCESS DOOR PROVIDED WITH AN APPROVED LOCKING DEVICE.

2. ALL ELECTRICAL COMPONENTS CONTAINED IN THE PANEL SHALL BE UL/CSA CERTIFIED AND LABELED. THE PANEL ASSEMBLY SHALL BE UL LISTED.
3. CONTRACTOR SHALL BE RESPONSIBLE FOR 120 VOLT WIRING TO PANEL.
4. PANEL SHALL HAVE A FUSED 4 AMP OUTLET FOR LAP TOP USE WIRED A HEAD OF THE CONTROL TRANSFORMER. PANEL SHALL HAVE A MAIN DISCONNECT SWITCH.

C. THE DDC SYSTEM SHALL INTERFACE WITH UNIT MOUNTED CONTROLS TO PROVIDE THE FOLLOWING FUNCTIONS AS A MINIMUM:
   1. OCCUPIED / UNOCCUPIED MODE:
      a. OCCUPIED MODE
         1) SUPPLY AIR FAN SHALL OPERATE CONTINUOUSLY WITH OUTDOOR AIR DAMPER AT MINIMUM POSITION AND RETURN AIR DAMPER AT MAXIMUM. AIR DAMPERS SHALL BE POSITIONED TO DELIVER OUTDOOR AIR AS SCHEDULED.
         2) SPACE TEMPERATURE SHALL BE MAINTAINED AT TEMPERATURE SETPOINT (ADJUSTABLE). CONTROL SYSTEM SHALL STAGE COMPRESSORS AND/OR ADJUST COMPRESSOR VFDS TO MAINTAIN SPACE TEMPERATURE.
         3) GAS HEATED UNITS (RTU-02, RTU-03): IF SPACE TEMPERATURE DROPS BELOW 5°F BELOW SETPOINT (ADJUSTABLE) THE GAS BURNER SHALL BE ENABLED AND THE GAS VALVE SHALL BE MODULATED TO MAINTAIN SPACE TEMPERATURE SET POINT. WHERE UNITS DO NOT HAVE GAS HEAT, SUPPLY FAN SHALL BE OFF WHEN SPACE TEMPERATURE IS MORE THAN 5°F BELOW SETPOINT (ADJUSTABLE).
         4) ELECTRIC HEATED UNITS (RTU-05): IF SPACE TEMPERATURE DROPS BELOW 5°F BELOW SETPOINT (ADJUSTABLE) THE ELECTRIC HEATER SHALL BE ENABLED TO MAINTAIN SPACE TEMPERATURE SET POINT.
         5) A COMPARATIVE ENTHALPY ECONOMIZER SHALL BE USED FOR FREE COOLING. UNIT EXHAUST FAN SHALL BE ENERGIZED TO RELIEVE SPACE PRESSURE DURING ECONOMIZER OPERATIONS. EXHAUST FAN SHALL BE CONTROLLED BY SPACE PRESSURE.
      b. UNOCCUPIED MODE
         1) SUPPLY AIR FAN SHALL BE CYCLED WITH OUTDOOR AIR DAMPER CLOSED AND RETURN AIR DAMPER AT FULL OPEN POSITION. CONTROL SYSTEM SHALL STAGE COMPRESSORS TO MAINTAIN SETBACK SPACE TEMPERATURE SETPOINT (ADJUSTABLE).
         2) SPACE TEMPERATURE SHALL BE MAINTAINED AT TEMPERATURE SETBACK SETPOINT (ADJUSTABLE).
         3) GAS HEATED UNITS (RTU-02, RTU-03): IF SPACE TEMPERATURE DROPS BELOW 5°F BELOW SETPOINT (ADJUSTABLE) THE GAS BURNER SHALL BE ENABLED AND THE GAS VALVE SHALL BE MODULATED TO MAINTAIN SPACE TEMPERATURE SET POINT. WHERE UNITS DO NOT HAVE GAS HEAT, SUPPLY FAN SHALL BE OFF WHEN SPACE TEMPERATURE IS MORE THAN 5°F BELOW SETPOINT (ADJUSTABLE).
         4) ELECTRIC HEATED UNITS (RTU-05): IF SPACE TEMPERATURE DROPS BELOW 5°F BELOW SETPOINT (ADJUSTABLE) THE ELECTRIC HEATER SHALL BE ENABLED TO MAINTAIN SPACE TEMPERATURE SET POINT.
         5) A COMPARATIVE ENTHALPY ECONOMIZER SHALL BE USED FOR FREE COOLING. UNIT EXHAUST FAN SHALL BE ENERGIZED TO RELIEVE SPACE PRESSURE DURING ECONOMIZER OPERATIONS. EXHAUST FAN SHALL BE CONTROLLED BY SPACE PRESSURE.

c. OCCUPANCY SHALL BE SET TO 24 HOUR 7 DAYS PER WEEK AT PROJECT START UP WITH THE CAPABILITY OF BEING ADJUSTED.

2. (WHERE APPLICABLE) AUXILIARY CONTACTS ON DUCT MOUNTED SUPPLY AND RETURN SMOKE DETECTORS SHALL BE HARD WIRED TO SHUT SUPPLY AND EXHAUST FANS. SHUT DOWN SHALL NOT BE VIA SOFTWARE.
3. DDC SYSTEM SHALL HAVE A MINIMUM OF THE FOLLOWING INPUTS:
    a. OUTDOOR AIR TEMPERATURE
    b. OUTDOOR AIR ENTHALPY
    c. OUTDOOR AIR FLOW
    d. RETURN AIR TEMPERATURE
    e. RETURN AIR ENTHALPY
    f. MIXED AIR TEMPERATURE
    g. SPACE TEMPERATURE
    h. SUPPLY AIR TEMPERATURE
    i. RETURN AIR DAMPER POSITION
    j. EXHAUST AIR DAMPER POSITION
    k. OUTSIDE AIR DAMPER POSITION
    l. STAGES OF COOLING
    m. PRE-FILTER PRESSURE DROP
    n. FINAL FILTER PRESSURE DROP
    o. SUPPLY FAN STATUS
    p. EXHAUST FAN STATUS (WHERE APPLICABLE)
    q. GAS BURNER ALARM (WHERE APPLICABLE)
    r. ELECTRIC HEATER STATUS (WHERE APPLICABLE)
    s. SUPPLY DUCT SMOKE DETECTOR STATUS (WHERE APPLICABLE)
    t. RETURN DUCT SMOKE DETECTOR STATUS (WHERE APPLICABLE)
4. DDC SYSTEM SHALL HAVE A MINIMUM OF THE FOLLOWING OUTPUTS:
    a. SPACE TEMPERATURE SETPOINT (ADJUSTABLE)
    b. SUPPLY AIR TEMPERATURE SETPOINT (ADJUSTBALE)
    c. SUPPLY FAN START/STOP
    d. EXHAUST FAN START/STOP (WHERE APPLICABLE)
    e. EXHAUST FAN SPEED (WHERE APPLICABLE)
    f. OUTSIDE AIR DAMPER MODULATION
    g. RETURN AIR DAMPER MODULATION
    h. GAS VALVE MODULATION (WHERE APPLICABLE)
    i. SHUTDOWN VIA SMOKE DETECTION (WHERE ACCPLICABLE)
5. ALARMS SHALL BE RECORDED AND REPORTED AT THE OPERATOR TERMINAL. ALL ALARMS SHALL BE RECORDED WITH TIME AND DATE. ALARMS SHALL BE LOGGED FOR A MINIMUM OF 30 DAYS. ALARMS SHALL BE RECORDED FOR THE FOLLOWING:
    a. SPACE TEMPERATURE +/- 5ºF OUTSIDE OF SETPOINT FOR 5 CONTINUOUS MINUTES.
    b. UNSCHEDULED FAN SHUTDOWN. LOSS OF SUPPLY OR EXHAUST FAN STATUS.
    c. LOW DISCHARGE AIR TEMPERATURE.
    d. COMPRESSOR STATUS ALARM.
    e. GAS BURNER ALARM (WHERE APPLICABLE).
    f. PRE-FILTER ELEVATED PRESSURE DROP.
    g. FINAL FILTER ELEVATED PRESSURE DROP.
    h. LOW OUTDOOR AIR FLOW.
    i. SHUT DOWN VIA SMOKE DETECTOR. (WHERE APPLICABLE)

D. DATA LOGGING OF ALL SET POINT AND MONITORED POINT VALUES FOR A MINIMUM OF THIRTY (30) DAYS.

3.4 CONSTANT VOLUME PACKAGED DX/GAS/ELECTRIC ROOFTOP UNITS: RTU-06

A. GENERAL:
1. PROVIDE FACTORY FURNISHED, WIRED, AND PROGRAMMED PLC SYSTEM TO CONTROL ALL FUNCTIONS OF THE RTU AND SPECIFIED SENSORS/DEVICES.
2. THE PLC SYSTEM FOR EACH UNIT SHALL BE CAPABLE OF STAND ALONE OPERATION.
3. PROVIDE WITH BACNET DDC INTEGRATION CONTROLLER. CONTROLS MANUFACTURER AND DESIGN TO BE DETERMINED DURING SUBMITTAL PHASE WITH CONTRACTOR.
4. CONTRACTOR SHALL BE RESPONSIBLE FOR SIZING, INSTALLING AND WIRING ALL CONTROL POWER TRANSFORMERS REQUIRED.
5. PROVIDE AND INSTALL WITH SPACE TEMPERATURE SENSOR WITH ADJUSTABLE THERMOSTAT FOR EACH RTU. SEE DRAWINGS FOR INSTALLATION LOCATION.

B. CONTROL PANEL:
1. UNIT CONTROL PANEL ENCLOSURE SHALL BE INTEGRAL TO THE UNIT HOUSING OR SHALL BE WITHIN AN EXTERNAL WEATHERPROOF HOUSING ATTACHED TO UNIT WITH SEPARATE ACCESS DOOR PROVIDED WITH AN APPROVED LOCKING DEVICE.
2. ALL ELECTRICAL COMPONENTS CONTAINED IN THE PANEL SHALL BE UL/CSA CERTIFIED AND LABELED. THE PANEL ASSEMBLY SHALL BE UL LISTED.
3. CONTRACTOR SHALL BE RESPONSIBLE FOR 120 VOLT WIRING TO PANEL.
4. PANEL SHALL HAVE A FUSED 4 AMP OUTLET FOR LAP TOP USE WIRED A HEAD OF THE CONTROL TRANSFORMER. PANEL SHALL HAVE A MAIN DISCONNECT SWITCH.

C. THE DDC SYSTEM SHALL INTERFACE WITH UNIT MOUNTED CONTROLS TO PROVIDE THE FOLLOWING FUNCTIONS AS A MINIMUM:
1. OCCUPIED / UNOCCUPIED MODE:
a. OCCUPIED MODE
1) SUPPLY AIR FAN SHALL OPERATE CONTINUOUSLY WITH 100% OUTDOOR AIR.
2) SUPPLY AIR TEMPERATURE SHALL BE MAINTAINED AT TEMPERATURE SETPOINT (ADJUSTABLE). CONTROL SYSTEM SHALL STAGE COMPRESSORS AND/OR ADJUST COMPRESSOR VFDS TO MAINTAIN SUPPLY AIR TEMPERATURE.
3) ELECTRIC: IF SPACE TEMPERATURE DROPS BELOW 5°F BELOW SETPOINT (ADJUSTABLE) THE ELECTRIC HEATER SHALL BE ENABLED TO MAINTAIN SPACE TEMPERATURE SET POINT.
b. UNOCCUPIED MODE
1) SUPPLY FAN SHALL SHUTDOWN.
2) ALL COOLING SHALL SHUTDOWN.
c. OCCUPANCY SHALL BE SET TO 24 HOUR 7 DAYS PER WEEK AT PROJECT START UP WITH THE CAPABILITY OF BEING ADJUSTED.
2. DDC SYSTEM SHALL HAVE A MINIMUM OF THE FOLLOWING INPUTS:
a. OUTDOOR AIR TEMPERATURE
b. OUTDOOR AIR ENTHALPY
c. OUTDOOR AIR FLOW
d. MIXED AIR TEMPERATURE
e. SUPPLY AIR TEMPERATURE
f. OUTSIDE AIR DAMPER POSITION
g. STAGES OF COOLING
h. PRE-FILTER PRESSURE DROP
i. FINAL FILTER PRESSURE DROP
j. SUPPLY FAN STATUS
k. ELECTRIC HEATER STATUS (WHERE APPLICABLE)
3. DDC SYSTEM SHALL HAVE A MINIMUM OF THE FOLLOWING OUTPUTS:

a. SPACE TEMPERATURE SETPOINT (ADJUSTABLE)
b. SUPPLY AIR TEMPERATURE SETPOINT (ADJUSTABLE)
c. SUPPLY FAN START/STOP
d. OUTSIDE AIR DAMPER MODULATION

4. ALARMS SHALL BE RECORDED AND REPORTED AT THE OPERATOR TERMINAL. ALL ALARMS SHALL BE RECORDED WITH TIME AND DATE. ALARMS SHALL BE LOGGED FOR A MINIMUM OF 30 DAYS. ALARMS SHALL BE RECORDED FOR THE FOLLOWING:
   a. SPACE TEMPERATURE +/- 5ºF OUTSIDE OF SETPOINT FOR 5 CONTINUOUS MINUTES.
   b. UNSCHEDULED FAN SHUTDOWN. LOSS OF SUPPLY OR EXHAUST FAN STATUS.
   c. LOW DISCHARGE AIR TEMPERATURE.
   d. COMPRESSOR STATUS ALARM.
   e. PRE-FILTER ELEVATED PRESSURE DROP.
   f. FINAL FILTER ELEVATED PRESSURE DROP.
   g. LOW OUTDOOR AIR FLOW.

D. DATA LOGGING OF ALL SET POINT AND MONITORED POINT VALUES FOR A MINIMUM OF THIRTY (30) DAYS.

3.5 CONSTANT VOLUME PACKAGED DX/GAS ROOFTOP UNIT (WASHDOWN): RTU-04

A. GENERAL:
1. EACH UNIT SHALL HAVE A PLC MICROPROCESSOR SYSTEM ENGINEERED, MOUNTED, WIRED, PROGRAMMED AND TESTED BY THE EQUIPMENT VENDOR OR THE CONTRACTOR.
2. THE PLC SYSTEM FOR EACH UNIT SHALL BE CAPABLE OF STAND ALONE OPERATION
3. PROVIDE WITH BACNET DDC INTEGRATION CONTROLLER. CONTROLS MANUFACTURER AND DESIGN TO BE DETERMINED DURING SUBMITTAL PHASE WITH CONTRACTOR.
4. CONTRACTOR SHALL BE RESPONSIBLE FOR SIZING, INSTALLING AND WIRING ALL CONTROL POWER TRANSFORMERS REQUIRED.
5. PROVIDE AND INSTALL NEMA 4X RATED REMOTE CONTROL PANEL FOR WALL MOUNTING IN KILL FLOOR CLEANING (P101). THE REMOTE PANEL SHALL INCLUDE SPACE TEMP SENSOR, ADJUSTABLE THERMOSTAT, ON/OFF SWITCH WITH LIGHT, WASHDOWN ON/OFF SWITCH WITH LIGHT, BURNER LIGHTS, AND DIRTY FILTER LIGHT FOR PRE AND FINAL FILTERS.

B. CONTROL PANEL:
1. UNIT CONTROL PANEL ENCLOSURE SHALL BE INTEGRAL TO THE UNIT HOUSING OR SHALL BE WITHIN AN EXTERNAL WEATHERPROOF HOUSING ATTACHED TO UNIT WITH SEPARATE ACCESS DOOR PROVIDED WITH AN APPROVED LOCKING DEVICE.
2. ALL ELECTRICAL COMPONENTS CONTAINED IN THE PANEL SHALL BE UL/CSA CERTIFIED AND LABELED. THE PANEL ASSEMBLY SHALL BE UL LISTED.
3. CONTRACTOR SHALL BE RESPONSIBLE FOR 120 VOLT WIRING TO PANEL.
4. PANEL SHALL HAVE A FUSED 4 AMP OUTLET FOR LAP TOP USE WIRED A HEAD OF THE CONTROL TRANSFORMER. PANEL SHALL HAVE A MAIN DISCONNECT SWITCH.

C. THE DDC SYSTEM SHALL INTERFACE WITH UNIT MOUNTED CONTROLS TO PROVIDE THE FOLLOWING FUNCTIONS AS A MINIMUM:
1. OCCUPIED / WASHDOWN/ UNOCCUPIED MODE:
   a. OCCUPIED MODE
      1) SUPPLY AIR FAN SHALL OPERATE CONTINUOUSLY WITH OUTDOOR AIR DAMPER AT MINIMUM POSITION AND RETURN AIR DAMPER AT MAXIMUM.
      2) SPACE TEMPERATURE SHALL BE MAINTAINED AT TEMPERATURE SETPOINT (ADJUSTABLE). CONTROL SYSTEM SHALL STAGE COMPRESSORS AND/OR MODULATE COMPRESSOR VFDS TO MAINTAIN SPACE TEMPERATURE.

3) IF SPACE TEMPERATURE DROPS BELOW 5°F BELOW SETPOINT (ADJUSTABLE) THE GAS BURNER SHALL BE ENABLED AND THE GAS VALVE SHALL BE MODULATED TO MAINTAIN SPACE TEMPERATURE SET POINT. WHERE UNITS DO NOT HAVE GAS HEAT, SUPPLY FAN SHALL BE OFF WHEN SPACE TEMPERATURE IS MORE THAN 5°F BELOW SETPOINT (ADJUSTABLE).
4) A COMPARATIVE ENTHALPY ECONOMIZER SHALL BE USED FOR FREE COOLING. UNIT EXHAUST FAN SHALL BE ENERGIZED TO RELIEVE SPACE PRESSURE DURING ECONOMIZER OPERATIONS. EXHAUST FAN SHALL BE CONTROLLED BY SPACE PRESSURE.

b. UNOCCUPIED MODE
1) SUPPLY AIR FAN SHALL BE CYCLED WITH OUTDOOR AIR DAMPER CLOSED AND RETURN AIR DAMPER FULL OPEN POSITION. CONTROL SYSTEM SHALL STAGE COMPRESSORS TO MAINTAIN SETBACK SPACE TEMPERATURE SETPOINT (ADJUSTABLE).
2) SPACE TEMPERATURE SHALL BE MAINTAINED AT TEMPERATURE SETBACK SETPOINT (ADJUSTABLE).
3) GAS HEATED: IF SPACE TEMPERATURE DROPS BELOW 5°F BELOW SETPOINT (ADJUSTABLE) THE GAS BURNER SHALL BE ENABLED AND THE GAS VALVE SHALL BE MODULATED TO MAINTAIN SPACE TEMPERATURE SET POINT.
4) A COMPARATIVE ENTHALPY ECONOMIZER SHALL BE USED FOR FREE COOLING. UNIT EXHAUST FAN SHALL BE ENERGIZED TO RELIEVE SPACE PRESSURE DURING ECONOMIZER OPERATIONS. EXHAUST FAN SHALL BE CONTROLLED BY SPACE PRESSURE.

c. WASHDOWN MODE (HEATING ONLY)
1) WASHDOWN MODE SHALL BE ACTIVATED BY WALL MOUNTED REMOTE CONTROL PANEL SWITCH. WASHDOWN SHALL OVERRIDE CURRENT OCCUPANCY MODE. FOLLOWING WASHDOWN, UNIT SHALL RETURN TO PREVIOUSLY SCHEDULED OCCUPANCY SETTINGS.
2) SUPPLY AIR FAN SHALL OPERATE CONTINUOUSLY WITH OUTDOOR AIR DAMPER FULLY OPENED AND RETURN AIR DAMPER FULLY CLOSED. EXHAUST AIR FAN SHALL SHUTDOWN. UNIT SHALL SUPPLY 100% OA.
3) SPACE TEMPERATURE SHALL BE MAINTAINED AT TEMPERATURE SETPOINT (ADJUSTABLE).
4) IF SPACE TEMPERATURE DROPS BELOW 5°F BELOW SETPOINT (ADJUSTABLE) THE GAS BURNER SHALL BE ENABLED AND THE GAS VALVE SHALL BE MODULATED TO MAINTAIN SPACE TEMPERATURE SET POINT.
5) COOLING SHALL BE DISABLED.
6) WASHDOWN MODE SHALL HAVE A TIMER THAT WILL RETURN THE UNIT BACK TO THE SCHEDULE OCCUPANY MODE. AT START OF PROJECT, THE WASHDOWN MODE TIMER SHALL BE SET TO 1 HOUR (OWNER ADJUSTABLE).

d. OCCUPANCY SHALL BE SET TO 24 HOUR 7 DAYS PER WEEK AT PROJECT START UP WITH THE CAPABILITY OF BEING ADJUSTED.

2. (WHERE APPLICABLE) AUXILIARY CONTACTS ON DUCT MOUNTED SUPPLY AND RETURN SMOKE DETECTORS SHALL BE HARD WIRED TO SHUT SUPPLY AND EXHAUST FANS. SHUT DOWN SHALL NOT BE VIA SOFTWARE.
3. DDC SYSTEM SHALL HAVE A MINIMUM OF THE FOLLOWING INPUTS:
a. OUTDOOR AIR TEMPERATURE
b. OUTDOOR AIR ENTHALPY

c. OUTDOOR AIR FLOW
d. RETURN AIR TEMPERATURE
e. RETURN AIR ENTHALPY
f. MIXED AIR TEMPERATURE
g. SPACE TEMPERATURE
h. SUPPLY AIR TEMPERATURE
i. RETURN AIR DAMPER POSITION
j. EXHAUST AIR DAMPER POSITION
k. OUTSIDE AIR DAMPER POSITION
l. STAGES OF COOLING
m. PRE-FILTER PRESSURE DROP
n. FINAL FILTER PRESSURE DROP
o. SUPPLY FAN STATUS
p. EXHAUST FAN STATUS (WHERE APPLICABLE)
q. GAS BURNER ALARM (WHERE APPLICABLE)
r. ELECTRIC HEATER STATUS (WHERE APPLICABLE)
s. SUPPLY DUCT SMOKE DETECTOR STATUS (WHERE APPLICABLE)
t. RETURN DUCT SMOKE DETECTOR STATUS (WHERE APPLICABLE)

4. DDC SYSTEM SHALL HAVE A MINIMUM OF THE FOLLOWING OUTPUTS:
   a. SPACE TEMPERATURE SETPOINT (ADJUSTABLE)
   b. SUPPLY AIR TEMPERATURE SETPOINT (ADJUSTABLE)
   c. SUPPLY FAN START/STOP
   d. EXHAUST FAN START/STOP (WHERE APPLICABLE)
   e. EXHAUST FAN SPEED (WHERE APPLICABLE)
   f. OUTSIDE AIR DAMPER MODULATION
   g. RETURN AIR DAMPER MODULATION
   h. GAS VALVE MODULATION (WHERE APPLICABLE)
   i. SHUTDOWN VIA SMOKE DETECTOR.
5. ALARMS SHALL BE RECORDED AND REPORTED AT THE OPERATOR TERMINAL. ALL ALARMS SHALL BE RECORDED WITH TIME AND DATE. ALARMS SHALL BE LOGGED FOR A MINIMUM OF 30 DAYS. ALARMS SHALL BE RECORDED FOR THE FOLLOWING:
   a. SPACE TEMPERATURE +/- 5ºF OUTSIDE OF SETPOINT FOR 5 CONTINUOUS MINUTES. THIS ALARM SHALL BE DISABLED DURING WASHDOWN MODE.
   b. UNSCHEDULED FAN SHUTDOWN. LOSS OF SUPPLY OR EXHAUST FAN STATUS.
   c. LOW DISCHARGE AIR TEMPERATURE.
   d. COMPRESSOR STATUS ALARM.
   e. GAS BURNER ALARM (WHERE APPLICABLE).
   f. PRE-FILTER ELEVATED PRESSURE DROP.
   g. FINAL FILTER ELEVATED PRESSURE DROP.
   h. LOW OUTDOOR AIR FLOW.
   i. SHUT DOWN VIA SMOKE DETECTOR.

D. DATA LOGGING OF ALL SET POINT AND MONITORED POINT VALUES FOR A MINIMUM OF THIRTY (30) DAYS.

3.6 VARIABLE VOLUME PACKAGED DX/GAS ROOFTOP UNITS: RTU-01

A. GENERAL:
1. PROVIDE FACTORY FURNISHED, WIRED, AND PROGRAMMED PLC SYSTEM TO CONTROL ALL FUNCTIONS OF THE RTU AND SPECIFIED SENSORS/DEVICES.
2. THE PLC SYSTEM FOR EACH UNIT SHALL BE CAPABLE OF STAND ALONE OPERATION.
3. PROVIDE WITH BACNET DDC INTEGRATION CONTROLLER. CONTROLS MANUFACTURER AND DESIGN TO BE DETERMINED DURING SUBMITTAL PHASE WITH CONTRACTOR.

4. CONTRACTOR SHALL BE RESPONSIBLE FOR SIZING, INSTALLING AND WIRING ALL CONTROL POWER TRANSFORMERS REQUIRED.
5. SYSTEM SHALL INTERFACE WITH ASSOCIATED VAVs FOR MOST EFFICIENT OPERATION.

B. CONTROL PANEL:
   1. UNIT CONTROL PANEL ENCLOSURE SHALL BE INTEGRAL TO THE UNIT HOUSING OR SHALL BE WITHIN AN EXTERNAL WEATHERPROOF HOUSING ATTACHED TO UNIT WITH SEPARATE ACCESS DOOR PROVIDED WITH AN APPROVED LOCKING DEVICE.
   2. ALL ELECTRICAL COMPONENTS CONTAINED IN THE PANEL SHALL BE UL/CSA CERTIFIED AND LABELED. THE PANEL ASSEMBLY SHALL BE UL LISTED.
   3. CONTRACTOR SHALL BE RESPONSIBLE FOR 120 VOLT WIRING TO PANEL.
   4. PANEL SHALL HAVE A FUSED 4 AMP OUTLET FOR LAP TOP USE WIRED A HEAD OF THE CONTROL TRANSFORMER. PANEL SHALL HAVE A MAIN DISCONNECT SWITCH.

C. THE DDC SYSTEM SHALL INTERFACE WITH UNIT MOUNTED CONTROLS TO PROVIDE THE FOLLOWING FUNCTIONS AS A MINIMUM:
   1. OCCUPIED / UNOCCUPIED MODE:
      a. OCCUPIED MODE
         1) SUPPLY AIR FAN SHALL OPERATE CONTINUOUSLY WITH OUTDOOR AIR DAMPER AT MINIMUM POSITION AND RETURN AIR DAMPER AT MAXIMUM.
         2) SUPPLY AIR FAN SPEED SHALL BE MODULATED BY THE VFD TO MAINTAIN A CONSTANT SUPPLY DUCT STATIC PRESSURE (ADJUSTABLE).
         3) SUPPLY AIR TEMPERATURE SHALL BE MAINTAINED AT A CONSTANT 55°F (ADJUSTABLE). CONTROL SYSTEM SHALL STAGE COMPRESSORS AND/OR MODULATE COMPRESSOR VFDS TO MAINTAIN SUPPLY AIR TEMPERATURE.
         4) IF SPACE TEMPERATURE DROPS BELOW 55°F (ADJUSTABLE) THE GAS BURNER SHALL BE ENABLED AND THE GAS VALVE SHALL BE MODULATED TO MAINTAIN SUPPLY AIR TEMPERATURE SET POINT. IF ANY ZONE IS BELOW ZONE SETPOINT WITH REHEAT ENABLED, SUPPLY AIR TEMPERATURE SHALL BE RESET.
         5) A COMPARATIVE ENTHALPY ECONOMIZER SHALL BE USED FOR FREE COOLING. UNIT EXHAUST FAN SHALL BE ENERGIZED TO RELIEVE SPACE PRESSURE DURING ECONOMIZER OPERATIONS. EXHAUST FAN SHALL BE CONTROLLED BY SPACE PRESSURE.
      b. UNOCCUPIED MODE
         1) CONTROL SYSTEM SHALL POLL ALL ZONES. SUPPLY AIR FAN SHALL BE CYCLED WITH OUTDOOR AIR DAMPER CLOSED AND RETURN AIR DAMPER FULL OPEN POSITION. CONTROL SYSTEM SHALL STAGE COMPRESSORS TO MAINTAIN SETBACK SPACE TEMPERATURE SETPOINT (ADJUSTABLE). VAV BOXES SHALL BE OPENED.
         2) ZONE SPACE TEMPERATURE SHALL BE MAINTAINED AT TEMPERATURE SETBACK SETPOINT (ADJUSTABLE).
         3) IF SPACE TEMPERATURE DROPS BELOW 5°F BELOW HEATING SETBACK SETPOINT (ADJUSTABLE) THE GAS BURNER SHALL BE ENABLED AND THE GAS VALVE SHALL BE MODULATED TO MAINTAIN ZONE SPACE TEMPERATURE SET POINT.
         4) UNIT SHALL OPERATE IN A MORNING WARM UP / COOL DOWN MODE TWO HOURS PRIOR TO SCHEDULED OCCUPANCY. CONTROL SYSTEM SHALL POLE EACH ZONE AND RESET DISCHARGE AIR TEMPERATURE TO SATISFY ZONE MOST OUT OF SET POINT. ZONES AT OCCUPIED SETPOINT SHALL HAVE VAV BOXES CLOSED TO PREVENT OVER HEATING OR COOLING.

5) A COMPARATIVE ENTHALPY ECONOMIZER SHALL BE USED FOR FREE COOLING. UNIT EXHAUST FAN SHALL BE ENERGIZED TO RELIEVE SPACE PRESSURE DURING ECONOMIZER OPERATIONS. EXHAUST FAN SHALL BE CONTROLLED BY SPACE PRESSURE.

c. OCCUPANCY SHALL BE SET TO 24 HOUR 7 DAYS PER WEEK AT PROJECT START UP WITH THE CAPABILITY OF BEING ADJUSTED.

2. AUXILIARY CONTACTS ON DUCT MOUNTED SUPPLY AND RETURN SMOKE DETECTORS SHALL BE HARD WIRED TO SHUT SUPPLY AND EXHAUST FANS. SHUT DOWN SHALL NOT BE VIA SOFTWARE.
3. DDC SYSTEM SHALL HAVE A MINIMUM OF THE FOLLOWING INPUTS:
    a. OUTDOOR AIR TEMPERATURE
    b. OUTDOOR AIR ENTHALPY
    c. OUTDOOR AIR FLOW
    d. RETURN AIR TEMPERATURE
    e. RETURN AIR ENTHALPY
    f. MIXED AIR TEMPERATURE
    g. SPACE TEMPERATURE
    h. SPACE PRESSURE
    i. SUPPLY AIR TEMPERATURE
    j. SUPPLY DUCT PRESSURE
    k. RETURN AIR DAMPER POSITION
    l. OUTSIDE AIR DAMPER POSITION
    m. STAGES OF COOLING
    n. PRE-FILTER PRESSURE DROP
    o. FINAL FILTER PRESSURE DROP
    p. SUPPLY FAN STATUS
    q. SUPPLY FAN SPEED (HZ)
    r. EXHAUST FAN STATUS
    s. EXHAUST FAN SPEED (HZ)
    t. GAS BURNER ALARM
    u. SUPPLY DUCT SMOKE DETECTOR STATUS
    v. RETURN DUCT SMOKE DETECTOR STATUS
4. DDC SYSTEM SHALL HAVE A MINIMUM OF THE FOLLOWING OUTPUTS:
    a. SUPPLY AIR TEMPERATURE SETPOINT (ADJUSTABLE)
    b. SUPPLY FAN START/STOP
    c. SUPPLY FAN SPEED
    d. EXHAUST FAN START/STOP
    e. EXHAUST FAN SPEED
    f. OUTSIDE AIR DAMPER MODULATION
    g. EXHAUST AIR DAMPER MODULATION
    h. RETURN AIR DAMPER MODULATION
    i. GAS VALVE MODULATION.
    j. SHUTDOWN VIA SMOKE DETECTION.
5. ALARMS SHALL BE RECORDED AND REPORTED AT THE OPERATOR TERMINAL. ALL ALARMS SHALL BE RECORDED WITH TIME AND DATE. ALARMS SHALL BE LOGGED FOR A MINIMUM OF 30 DAYS. ALARMS SHALL BE RECORDED FOR THE FOLLOWING:
    a. SPACE TEMPERATURE +/- 5ºF OUTSIDE OF SETPOINT FOR 5 CONTINUOUS MINUTES.
    b. UNSCHEDULED FAN SHUTDOWN. LOSS OF SUPPLY OR EXHAUST FAN STATUS.
    c. LOW/HIGH DISCHARGE AIR TEMPERATURE.
    d. COMPRESSOR STATUS ALARM.

e. GAS BURNER ALARM.
f. PRE-FILTER ELEVATED PRESSURE DROP.
g. FINAL FILTER ELEVATED PRESSURE DROP.
h. LOW OUTDOOR AIR FLOW.
i. SHUT DOWN VIA SMOKE DETECTOR.

D. DATA LOGGING OF ALL SET POINT AND MONITORED POINT VALUES FOR A MINIMUM OF THIRTY (30) DAYS.

3.7 CONSTANT VOLUME PROCESS AIR HANDLING UNIT: AHU-01

A. GENERAL:
1. PROVIDE FACTORY FURNISHED, WIRED, AND PROGRAMMED PLC SYSTEM TO CONTROL ALL FUNCTIONS OF THE RTU AND SPECIFIED SENSORS/DEVICES.
2. THE PLC SYSTEM FOR EACH UNIT SHALL BE CAPABLE OF STAND ALONE OPERATION.
3. PROVIDE WITH BACNET DDC INTEGRATION CONTROLLER. CONTROLS MANUFACTURER AND DESIGN TO BE DETERMINED DURING SUBMITTAL PHASE WITH CONTRACTOR.
4. CONTRACTOR SHALL BE RESPONSIBLE FOR SIZING, INSTALLING AND WIRING ALL CONTROL POWER TRANSFORMERS REQUIRED.
5. PROVIDE AND INSTALL NEMA 4X RATED REMOTE CONTROL PANEL FOR WALL MOUNTING IN BREAKING AND FABRICATION (P105). THE REMOTE PANEL SHALL INCLUDE SPACE TEMP SENSOR, ON/OFF SWITCH WITH LIGHT, WASHDOWN ON/OFF SWITCH WITH LIGHT, BURNER LIGHTS, AND DIRTY FILTER LIGHT FOR PRE AND FINAL FILTERS.

B. CONTROL PANEL:
1. UNIT CONTROL PANEL ENCLOSURE SHALL BE INTEGRAL TO THE UNIT HOUSING OR SHALL BE WITHIN AN EXTERNAL WEATHERPROOF HOUSING ATTACHED TO UNIT WITH SEPARATE ACCESS DOOR PROVIDED WITH AN APPROVED LOCKING DEVICE.
2. ALL ELECTRICAL COMPONENTS CONTAINED IN THE PANEL SHALL BE UL/CSA CERTIFIED AND LABELED. THE PANEL ASSEMBLY SHALL BE UL LISTED.
3. CONTRACTOR SHALL BE RESPONSIBLE FOR 120 VOLT WIRING TO PANEL.
4. PANEL SHALL HAVE A FUSED 4 AMP OUTLET FOR LAP TOP USE WIRED A HEAD OF THE CONTROL TRANSFORMER. PANEL SHALL HAVE A MAIN DISCONNECT SWITCH.

C. THE DDC SYSTEM SHALL INTERFACE WITH UNIT MOUNTED CONTROLS TO PROVIDE THE FOLLOWING FUNCTIONS AS A MINIMUM:
1. OCCUPIED / UNOCCUPIED MODE:
a. OCCUPIED MODE
1) SUPPLY AIR FAN SHALL OPERATE CONTINUOUSLY WITH OUTDOOR AIR DAMPER AT MINIMUM POSITION AND RETURN AIR DAMPER AT MAXIMUM.
2) CONTROLLER SHALL MEASURE AIRFLOW AND MODULATE SUPPLY FAN SPEED TO ENSURE CONSTANT SUPPLY AIR FLOW.
3) SPACE TEMPERATURE SHALL BE MAINTAINED AT TEMPERATURE SETPOINT (ADJUSTABLE). CONTROL SYSTEM SHALL MODULATE REFRIGERANT COOLING COIL CONTROL VALVE TO MAINTAIN SPACE TEMPERATURE.
4) IF SPACE TEMPERATURE DROPS 5 °BELOW SETPOINT (ADJUSTABLE) THE GAS BURNER SHALL BE ENABLED AND THE GAS VALVE SHALL BE MODULATED TO MAINTAIN SUPPLY AIR TEMPERATURE SET POINT.
5) A COMPARATIVE ENTHALPY ECONOMIZER SHALL BE USED FOR FREE COOLING. UNIT EXHAUST FAN SHALL BE ENERGIZED TO RELIEVE SPACE PRESSURE DURING ECONOMIZER OPERATIONS. EXHAUST FAN SHALL BE CONTROLLED BY SPACE PRESSURE.
b. UNOCCUPIED MODE
1) SUPPLY AIR FAN SHALL BE CYCLED WITH OUTDOOR AIR DAMPER CLOSED AND RETURN AIR DAMPER FULL OPEN POSITION. CONTROL SYSTEM

SHALL MODULATE REFRIGERANT CONTROL VALVE TO MAINTAIN SETBACK SPACE TEMPERATURE SETPOINT (ADJUSTABLE).

2) SPACE TEMPERATURE SHALL BE MAINTAINED AT TEMPERATURE SETBACK SETPOINT (ADJUSTABLE).
3) IF SPACE TEMPERATURE DROPS BELOW 5°F BELOW HEATING SETBACK SETPOINT (ADJUSTABLE) THE GAS BURNER SHALL BE ENABLED AND THE GAS VALVE SHALL BE MODULATED TO MAINTAIN ZONE SPACE TEMPERATURE SET POINT.
4) A COMPARATIVE ENTHALPY ECONOMIZER SHALL BE USED FOR FREE COOLING. UNIT EXHAUST FAN SHALL BE ENERGIZED TO RELIEVE SPACE PRESSURE DURING ECONOMIZER OPERATIONS. EXHAUST FAN SHALL BE CONTROLLED BY SPACE PRESSURE.

c. WASHDOWN MODE (HEATING ONLY)
   1) WASHDOWN MODE SHALL BE ACTIVATED BY WALL MOUNTED REMOTE CONTROL PANEL SWITCH. WASHDOWN SHALL OVERRIDE CURRENT OCCUPANCY MODE. FOLLOWING WASHDOWN, UNIT SHALL RETURN TO PREVIOUSLY SCHEDULED OCCUPANCY SETTINGS.
   2) SUPPLY AIR FAN SHALL OPERATE CONTINUOUSLY WITH OUTDOOR AIR DAMPER FULLY OPENED AND RETURN AIR DAMPER FULLY CLOSED. EXHAUST AIR FAN SHALL OPERATE CONTINUOUSLY.
   3) SPACE TEMPERATURE SHALL BE MAINTAINED AT TEMPERATURE SETPOINT (ADJUSTABLE).
   4) IF SPACE TEMPERATURE DROPS BELOW 5°F BELOW SETPOINT (ADJUSTABLE) THE GAS BURNER SHALL BE ENABLED AND THE GAS VALVE SHALL BE MODULATED TO MAINTAIN SPACE TEMPERATURE SET POINT.
   5) COOLING SHALL BE DISABLED.
   6) WASHDOWN MODE SHALL HAVE A TIMER THAT WILL RETURN THE UNIT BACK TO THE SCHEDULED OCCUPANY MODE. AT START OF PROJECT, THE WASHDOWN MODE TIMER SHALL BE SET TO 1 HOUR (ADJUSTABLE).

d. OCCUPANCY SHALL BE SET TO 24 HOUR 7 DAYS PER WEEK AT PROJECT START UP WITH THE CAPABILITY OF BEING ADJUSTED.

2. AUXILIARY CONTACTS ON DUCT MOUNTED SUPPLY AND RETURN SMOKE DETECTORS SHALL BE HARD WIRED TO SHUT SUPPLY AND EXHAUST FANS. SHUT DOWN SHALL NOT BE VIA SOFTWARE.
3. DDC SYSTEM SHALL HAVE A MINIMUM OF THE FOLLOWING INPUTS:
   a. OUTDOOR AIR TEMPERATURE
   b. OUTDOOR AIR ENTHALPY
   c. OUTDOOR AIR FLOW
   d. RETURN AIR TEMPERATURE
   e. RETURN AIR ENTHALPY
   f. MIXED AIR TEMPERATURE
   g. SPACE TEMPERATURE
   h. SPACE PRESSURE
   i. SUPPLY AIR TEMPERATURE
   j. RETURN AIR DAMPER POSITION
   k. OUTSIDE AIR DAMPER POSITION
   l. PRE-FILTER PRESSURE DROP
   m. FINAL FILTER PRESSURE DROP
   n. SUPPLY FAN STATUS
   o. SUPPLY FAN (HZ)
   p. EXHAUST FAN STATUS

q. EXHAUST FAN SPEED (HZ)
r. GAS BURNER ALARM
s. SUPPLY DUCT SMOKE DETECTOR STATUS
t. RETURN DUCT SMOKE DETECTOR STATUS

4. DDC SYSTEM SHALL HAVE A MINIMUM OF THE FOLLOWING OUTPUTS:
   a. SPACE TEMPERATURE SETPOINT (ADJUSTABLE)
   b. SUPPLY AIR TEMPERATURE SETPOINT (ADJUSTABLE)
   c. SUPPLY FAN START/STOP
   d. SUPPLY FAN SPEED
   e. EXHAUST FAN START/STOP
   f. EXHAUST FAN SPEED
   g. OUTSIDE AIR DAMPER MODULATION
   h. RETURN AIR DAMPER MODULATION
   i. GAS VALVE MODULATION
   j. REFRIGERANT CONTROL VALVE MODULATION
5. ALARMS SHALL BE RECORDED AND REPORTED AT THE OPERATOR TERMINAL. ALL ALARMS SHALL BE RECORDED WITH TIME AND DATE. ALARMS SHALL BE LOGGED FOR A MINIMUM OF 30 DAYS. ALARMS SHALL BE RECORDED FOR THE FOLLOWING:
   a. SPACE TEMPERATURE +/- 5ºF OUTSIDE OF SETPOINT FOR 5 CONTINUOUS MINUTES.
   b. UNSCHEDULED FAN SHUTDOWN. LOSS OF SUPPLY OR EXHAUST FAN STATUS.
   c. LOW DISCHARGE AIR TEMPERATURE.
   d. PRE-FILTER ELEVATED PRESSURE DROP.
   e. FINAL FILTER ELEVATED PRESSURE DROP.
   f. GAS BURNER ALARM.
   g. LOW OUTDOOR AIR FLOW.
   h. SHUT DOWN VIA SMOKE DETECTOR.
6. DATA LOGGING OF ALL SET POINT AND MONITORED POINT VALUES FOR A MINIMUM OF THIRTY (30) DAYS.

3.8 VAV ZONE CONTROL: VAV-01 THRU VAV-06

A. VAV BOXES SHALL BE PROVIDED WITH APPLICATION SPECIFIC CONTROLLERS TO PROVIDE PRESSURE INDEPENDENT CONTROL. EACH CONTROLLER SHALL BE PROVIDED WITH A ZONE TEMPERATURE SENSOR.

B. VAV CONTROLLER SHALL MONITOR SPACE TEMPERATURE AND SUPPLY AIR TEMPERATURE. DISCHARGE AIR TEMPERATURE SENSOR SHALL BE PROVIDED.

C. VAV CONTROLLER SHALL RECEIVE SET POINT ADJUSTMENT AND OCCUPANCY OVERRIDE FOR ZONE TEMPERATURE SENSOR.

D. SINGLE DUCT VAV BOXES SHALL MODULATE AIR DAMPER TO MAINTAIN SPACE SET POINT (ADJUSTABLE). ON A CALL FOR HEAT, AIR DAMPER SHALL BE A MINIMUM POSITION AND THE FIRST STAGE OF HEAT SHALL ENERGIZE. THE SECOND STAGE OF HEAT SHALL ENERGIZE THE ELECTRIC REHEAT COIL AS NEEDED. ELECTRIC REHEAT SHALL BE CONTROLLED IN STAGES.

E. VAV ZONES SHALL BE IN OCCUPIED AND UNOCCUPIED MODE ON THE SAME SCHEDULE AS RTU-01.

F. IN UNOCCUPIED MODE, THE ELECTRIC REHEAT COILS SHALL BE ENERGIZED IN STAGES TO MAINTAIN UNOCCUPIED SETPOINT.

G. IN THE UNOCCUPIED MODE, IF SPACE TEMPERATE RISES ABOVE UNOCCUPIED SET POINT (ADJUSTABLE), VAV BOX SHALL MODULATE OPEN AND RTU SHALL BE STARTED.

H. IN MORNING WARM UP / COOL DOWN MODE, VAV BOXES SHALL BE OPEN. VAV SHALL MODULATE AS OCCUPIED TEMPERATURE SET POINT IS REACHED FOR ITS ZONE.

I. DDC SYSTEM SHALL HAVE A MINIMUM OF THE FOLLOWING INPUTS:
   1. SPACE AIR TEMPERATURE

2. LOCAL SPACE TEMPERATURE ADJUSTMENT
3. DISCHARGE AIR TEMPERATURE

J. DDC SYSTEM SHALL HAVE A MINIMUM OF THE FOLLOWING OUTPUTS:
1. DAMPER MODULATION
2. STAGES OF REHEAT
3. FAN START / STOP

3.9 EXHAUST AND SUPPLY FANS

A. GENERAL
1. DDC SYSTEM SHALL MONITOR THE STATUS OF ALL FANS UNLESS SPECIFICALLY NOTED. ALARMS SHALL BE REORDERED FOR UNSCHEDULED LOSS OF AIR FLOW.
2. ALL FANS WITH THREE PHASE MOTORS WILL HAVE STARTERS INSTALLED IN HVAC MOTOR STARTER PANELS. CONTRACTOR SHALL BE RESPONSIBLE FOR WIRING TO ALL PANELS, MOTOR CONTROL PANELS, AND STARTERS TO COMPLETE THIS SPECIFICATION.

B. BATHROOM EXHAUST FANS (EF-01, EF-02)
1. EXHAUST FAN CONTROLLED ON OCCUPANCY SCHEDULE. EACH FAN SHALL BE CAPABLE OF SCHEDULING INDEPENDENTLY. SCHEDULE SHALL BE SET FOR 24/7 OCCUPANCY (ADJUSTABLE).
2. OCCUPIED MODE
    a. START FAN
3. UNOCCUPIED MODE
    a. SHUTDOWN FAN
4. PROVIDE FAN STATUS OUTPUT.
5. PROVIDE ALARM FOR UNSCHEDULED SHUT DOWN.

C. CHEMICAL STORAGE EXHAUST FAN (EF-03)
1. EXHAUST FAN CONTROLLED ON OCCUPANCY SCHEDULE. SCHEDULE SHALL BE SET FOR 24/7 OCCUPANCY (ADJUSTABLE).
2. OCCUPIED MODE
    a. START FAN
3. UNOCCUPIED MODE
    a. SHUTDOWN FAN
4. PROVIDE FAN STATUS OUTPUT.
5. PROVIDE ALARM FOR UNSCHEDULED SHUT DOWN.

D. KILL FLOOR CLEANING WASHDOWN EXHAUST FAN (EF-04)
1. EXHAUST FAN SHALL BE INTERLOCKED TO START DURING WASHDOWN MODE OF RTU-01. WASHDOWN MODE SHALL BE ACTIVATED BY REMOTE CONTROL PANEL LOCATED IN KILL ROOM CLEANING (P101). FAN SHALL BE CAPABLE OF SCHEDULING INDEPENDENTLY.
2. FAN SHALL BE SUPPLIED WITH A MOTORIZED DAMPER. PRIOR TO START-UP OF FAN, MOTORIZED DAMPER SHALL FULLY OPEN UPON ACTIVATION OF WASHDOWN MODE FOR RTU-01. FAN SHALL NOT START UNLESS DAMPER IS FULLY OPEN.
3. WHEN RTU-01 IS NOT IN WASHDOWN, FAN SHALL SHUTDOWN AND DAMPER SHALL CLOSE. DAMPER SHALL NOT CLOSE UNLESS FAN IS SHUTDOWN.
4. PROVIDE MOTORIZED DAMPER STATUS OUTPUT.
5. PROVIDE FAN STATUS OUTPUT.
6. PROVIDE ALARM FOR UNSCHEDULED SHUT DOWN.

E. KILL FLOOR HIDE ON EXHAUST FAN (EF-05)
1. EXHAUST FAN SHALL BE SCHEDULED TO START DURING OCCUPIED AND WASHDOWN MODE OF RTU-01. FAN SHALL BE CAPABLE OF SCHEDULING INDEPENDENTLY.
2. FAN SHALL BE SUPPLIED WITH A MOTORIZED DAMPER. PRIOR TO START-UP OF FAN, MOTORIZED DAMPER SHALL FULLY OPEN. FAN SHALL NOT START UNLESS DAMPER IS FULLY OPEN.

3. WHEN RTU-01 IS IN UNOCCUPIED MODE, FAN SHALL SHUTDOWN AND DAMPER SHALL CLOSE. DAMPER SHALL NOT CLOSE UNLESS FAN IS SHUTDOWN.
4. PROVIDE MOTORIZED DAMPER STATUS OUTPUT.
5. PROVIDE FAN STATUS OUTPUT.
6. PROVIDE ALARM FOR UNSCHEDULED SHUT DOWN.

F. INTERSTITIAL SPACE FANS (EF-06 & SF-01, EF-07 & SF-02)
1. DDC SYSTEM SHALL MONITOR SPACE TEMPERATURE. ON A RISE IN SPACE TEMPERATURE AT ASSOCIATED SPACE TEMPERATURE SENSORS ABOVE 85°F (ADJUSTABLE), FANS SHALL START.
2. IF SPACE TEMPERATURE AT ASSOCIATED SPACE TEMPERATURE SENSORS DROPS BELOW 70°F, RESPECTIVE FANS SHALL STOP.
3. PROVIDE FAN STATUS OUTPUTS.
4. PROVIDE ALARM FOR UNSCHEDULED SHUT DOWN OF FANS.

G. UTILITY ROOM (EF-08 AND L-01)
1. DDC SYSTEM SHALL MONITOR SPACE TEMPERATURE. ON A RISE IN SPACE TEMPERATURE ABOVE 75 DEG. F (ADJUSTABLE), EXHAUST FAN SHALL START AND OPERATE AT THE MINIMUM BALANCED VFD SPEED (APPROX 4,000 CFM). IF THE SPACE TEMPERATURE RISES ABOVE 85F THE SUPPLY AND EXHAUST FAN SHALL INCREASE SPEED TO THE MAXIMUM BALANCED VFD SPEED (APPROX. 12,000 CFM). IF THE SPACE DROPS BELOW 72 F THE FAN SHALL RETURN TO THE LOWER SPEED.
2. IF SPACE TEMPERATURE DROPS BELOW 65 DEG F, FAN SHALL SHUTDOWN.
3. PRIOR TO FAN START, MOTORIZED DAMPER SHALL FULLY OPEN. FOLLOWING FAN SHUTDOWN, MOTORIZED DAMPER SHALL COMPLETELY CLOSE. FAN SHALL NOT OPERATE UNLESS MOTORIZED DAMPER IS FULLY OPEN.
4. PROVIDE DAMPER STATUS OUTPUT.
5. PROVIDE FAN STATUS OUTPUT.
6. PROVIDE ALARM FOR UNSCHEDULED SHUT DOWN.

H. PACKAGING ROOM VENT GV-01 (MOTORIZED DAMPER)
1. PRIOR TO START-UP OF RTU-06, MOTORIZED DAMPER SHALL BE FULLY OPEN. FOLLOWING SHUTDOWN OF RTU-06, MOTORIZED DAMPER SHALL COMPLETELY CLOSE.
2. PROVIDE DAMPER STATUS OUTPUT.

3.10 ELECTRIC UNIT HEATERS: EUH-1 THRU EUH-05

A. GENERAL:
1. CONTRACTOR SHALL PROVIDE ALL SPACE TEMPERATURE SENSORS AS INDICATED ON DRAWINGS FOR SPACE TEMPERATURE MONITORING.

B. THE DDC SYSTEM SHALL INTERFACE WITH UNIT CONTROLS TO PROVIDE THE FOLLOWING FUNCTIONS AS A MINIMUM:
1. TEMPERATURE CONTROL:
a. SPACE TEMPERATURE SHALL BE MAINTAINED AT TEMPERATURE SETPOINT (ADJUSTABLE). WHEN SPACE TEMPERATURE FALLS BELOW SETPOINT UNIT FAN SHALL BE ENERGIZED AND HEATER STAGES SHALL BE ENERGIZED AS REQUIRED TO MAINTAIN SPACE TEMPERATURE.
2. DDC SYSTEM SHALL HAVE A MINIMUM OF THE FOLLOWING INPUTS:
a. SPACE AIR TEMPERATURE
3. DDC SYSTEM SHALL HAVE A MINIMUM OF THE FOLLOWING OUTPUTS:
a. FAN START / STOP
b. STAGES OF HEAT
4. ALARMS SHALL BE RECORDED AND REPORTED AT THE OPERATOR TERMINAL. ALL ALARMS SHALL BE RECORDED WITH TIME AND DATE. ALARMS SHALL BE LOGGED FOR A MINIMUM OF 30 DAYS. ALARMS SHALL BE RECORDED FOR THE FOLLOWING:

a. SPACE TEMPERATURE +/- 5ºF OUTSIDE OF SETPOINT FOR 5 CONTINUOUS MINUTES (ADJUSTABLE).

3.11 SPLIT SYSTEMS: HP-01 (ELECTRICAL ROOM)

A. DDC SYSTEM SHALL MONITOR SPACE TEMPERATURE OF ELECTRICAL ROOM (U100).

B. THE SPLIT SYSTEM SHALL BE CONTROLLED THROUGH SYSTEM COMPATABLE PROGRAMMABLE THERMOSTAT.

C. THE SPLIT SYSTEM WILL NOT BE INTEGRATED INTO THE DDC SYSTEM.

D. DDC SYSTEM SHALL HAVE A MINIMUM OF THE FOLLOWING INPOUTS:

1. SPACE AIR TEMPERATURE

E. ALARMS SHALL BE RECORDED AND REPORTED AT THE OPERATOR TERMINAL. ALL ALARMS SHALL BE RECORDED WITH TIME AND DATE. ALARMS SHALL BE LOGGED FOR A MINIMUM OF 30 DAYS. ALARMS SHALL BE RECORDED FOR THE FOLLOWING:

1. SPACE TEMPERATURE +/- 5ºF OUTSIDE OF SETPOINT FOR 5 CONTINUOUS MINUTES (ADJUSTABLE).

3.12 MOTOR CONTROL CENTER INTERFACE

A. SEE ELECTRICAL DRAWINGS FOR MCC / STARTER PANEL (MECP) DETAILS AND LOCATION.

B. CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING ALL ELECTRICAL EQUIPMENT AND WIRING REQUIRED FOR CONTROL OF EQUIPMENT LISTED IN THIS SPECIFICATION. CONTRACTOR SHALL SUPPLY AND INSTALL CONTROL CIRCUIT ON THREE PHASE STARTERS.

END OF SECTION

SECTION 23 20 01

MECHANICAL DRAIN PIPING

PART 1: GENERAL

1.1 THE WORK OF THIS SECTION SHALL INCLUDE SCOPE OF WORK

A. THE WORK UNDER THIS CONTRACT SHALL ALSO INCLUDE ALL LABOR, MATERIALS, TOOLS, EQUIPMENT, TRANSPORTATION, INSURANCE, TEMPORARY PROTECTION, SUPERVISION AND INCIDENTAL ITEMS ESSENTIAL FOR PROPER INSTALLATION AND OPERATION, EVEN THOUGH NOT SPECIFICALLY MENTIONED OR INDICATED ON THE DRAWINGS BUT WHICH ARE USUALLY PROVIDED OR ARE ESSENTIAL FOR PROPER INSTALLATION AND OPERATION OF ALL SYSTEMS AS INDICATED ON THE DRAWINGS AND SPECIFIED HEREIN.

B. THE SPECIFICATIONS AND DRAWINGS DESCRIBE THE MINIMUM REQUIREMENTS THAT MUST BE MET BY CONTRACTOR FOR THE INSTALLATION OF ALL WORK AS SHOWN ON THE DRAWINGS AND AS SPECIFIED HEREIN UNDER.

C. THE WORK OF THIS SECTION SHALL INCLUDE PROVISION OF THE FOLLOWING:

1. PROVISION OF ALL CONDENSATE DRAIN AND EQUIPMENT DRAIN PIPING FOR ALL HVAC UNITS WITH COOLING COILS AND DRAIN PANS.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. THE FOLLOWING REFERENCED SECTIONS ARE LISTED AS A MINIMUM OF ADDITIONAL REQUIREMENTS AND/OR WORK NOT INCLUDED IN THIS SECTION WHICH MAY BE REQUIRED TO BE PERFORMED UNDER OTHER DESIGNATED SECTIONS:

1. SECTION 23 05 53 - MECHANICAL IDENTIFICATION.
2. SECTION 23 07 00 - MECHANICAL INSULATION.

1.3 REFERENCE STANDARDS

A. PIPE AND FITTING STANDARDS: REFER TO PIPE CLASSIFICATIONS SCHEDULE ON DRAWINGS.

1.4 SUBMITTALS

A. SUBMITTALS SHALL BE SUBMITTED IN CONFORMANCE WITH THE REQUIREMENTS OF SECTION 23 00 01 MECHANICAL GENERAL PROVISIONS.

B. SUBMITTALS ARE REQUIRED FOR:

1. CONDENSATE DRAIN PIPING AND FITTINGS.

1.5 QUALITY ASSURANCE

A. PIPING MATERIALS SHALL BEAR LABEL, STAMP, OR OTHER MARKINGS OF SPECIFIED TESTING AGENCY.

B. COMPLY WITH NSF 14, "PLASTICS PIPING SYSTEMS COMPONENTS AND RELATED MATERIALS," FOR PLASTIC PIPING COMPONENTS. INCLUDE MARKING WITH "NSF-DWV" FOR PLASTIC DRAIN, WASTE, AND VENT PIPING; "NSF-DRAIN" FOR PLASTIC DRAIN PIPING; "NSF-TUBULAR" FOR PLASTIC CONTINUOUS WASTE PIPING; AND "NSF-SEWER" FOR PLASTIC SEWER PIPING.

C. WELDING MATERIALS AND PROCEDURES: CONFORM TO ASME CODE AND APPLICABLE STATE LABOR REGULATIONS.

D. WELDERS CERTIFICATION: IN ACCORDANCE WITH ANSI/ASME SECTION 9.

1.6 DRAWINGS

A. THE DRAWINGS SHOW THE EXTENT AND GENERAL ARRANGEMENT OF PIPING, AND LOCATIONS OF THE EQUIPMENT. PIPING, FIXTURES, AND EQUIPMENT ARE SHOWN DIAGRAMMATICALLY. THE CONTRACTOR SHALL BE RESPONSIBLE FOR FINAL LOCATIONS IN THE MOST PRACTICAL MANNER, FREE FROM INTERFERENCE WITH OTHER PIPING OR STRUCTURAL FEATURES.

1.7 ACCESSIBILITY

A. ALL WORK SHALL BE INSTALLED SO THAT ALL PARTS REQUIRED ARE READILY ACCESSIBLE FOR INSPECTION, OPERATION, MAINTENANCE AND REPAIR. MINOR DEVIATIONS FROM THE DRAWINGS MAY BE MADE TO ACCOMPLISH THIS END, BUT CHANGES OF MAGNITUDE SHALL NOT BE MADE WITHOUT PRIOR WRITTEN APPROVAL FROM THE ENGINEER.

1.8 PROTECTION

A. THE CONTRACTOR SHALL BE RESPONSIBLE FOR WORK AND EQUIPMENT UNTIL FINAL INSPECTION, AND ACCEPTANCE. CAREFULLY STORE MATERIALS AND EQUIPMENT WHICH ARE

NOT IMMEDIATELY INSTALLED AFTER DELIVERY TO THE SITE. CLOSE OPEN ENDS OF WORK WITH TEMPORARY COVERS OR PLUGS DURING CONSTRUCTION TO PREVENT ENTRY OF OBSTRUCTING MATERIAL.

1.9 EXAMINATION OF SITE

A. BEFORE SUBMITTING PROPOSAL, VISIT THE SITE, EXAMINE ITS CONDITION, AND BECOME ACQUAINTED WITH THE OBSTACLES AND ADVANTAGES FOR PERFORMING THE WORK. STUDY THE DRAWINGS AND SPECIFICATIONS EXPLANATORY OF THE WORK TO BE PERFORMED AND COMPARE THEM WITH THE INFORMATION GATHERED BY THE EXAMINATION OF THE SITE.

B. NO CLAIM FOR EXTRA COMPENSATION WILL BE RECOGNIZED IF DIFFICULTIES ARE ENCOUNTERED WHICH AN EXAMINATION OF THE SITE CONDITIONS AND CONTRACT DOCUMENTS PRIOR TO EXECUTING THE CONTRACT WOULD HAVE REVEALED.

1.10 TESTS

A. FURNISH ALL LABOR, MATERIAL, INSTRUMENTS, SUPPLIES AND SERVICES, AND BEAR ALL COSTS FOR THE ACCOMPLISHMENT OF THE TESTS SPECIFIED IN PART 3.0. CORRECT ALL DEFECTS APPEARING UNDER TEST, AND REPEAT THE TESTS UNTIL NO DEFECTS ARE DISCLOSED. LEAVE THE EQUIPMENT CLEAN AND READY FOR USE.

B. PERFORM ALL TESTS, OTHER THAN SPECIFIED HEREIN, WHICH MAY BE REQUIRED BY LEGAL AUTHORITIES OR BY AGENCIES TO WHOSE REQUIREMENTS THIS WORK IS TO CONFORM.

PART 2: PRODUCTS

A. PIPING CLASSES

1. SEE PIPE CLASSIFICATIONS SCHEDULE ON DRAWINGS.

2.2 MISCELLANEOUS PIPING MATERIALS

A. NIPPLES: NIPPLES SHALL CONFORM TO WW N 351 AND SHALL BE THE SAME MATERIAL AS THE PIPING IN WHICH INSTALLED.

B. UNIONS: UNIONS SHALL BE BRASS OR BRONZE, 125 LB., EITHER THREADED OR WITH SOLDER JOINT ENDS, CONFORMING TO WW U 516 FOR USE IN COPPER TUBING.

C. DIELECTRIC CONNECTIONS: UNION WITH GALVANIZED OR PLATED STEEL THREADED END, WATER IMPERVIOUS ISOLATION BARRIER.

D. INSULATING BUSHINGS AND UNIONS: HARD RUBBER THREADED BUSHING INSERTED BETWEEN TWO DISSIMILAR METALS.

E. FLANGES ON COPPER TUBE OR PIPE: CAST BRONZE, 150 LB., SOLDER JOINT CONNECTION.

F. FLOOR AND CEILING ESCUTCHEON PLATES: FLOOR AND CEILING ESCUTCHEON PLATES SHALL BE SPLIT HINGED, LOCKED TYPE. PLATES SHALL BE OF PRESSED STEEL WITH A HEAVY COATING OF COPPER, NICKEL AND CHROMIUM.

PART 3: EXECUTION

3.1 GENERAL

A. THE MECHANICAL DRAWINGS INTEND TO SHOW ONLY THE SCOPE OF THE DESIGN, AND THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE INSTALLATION OF HIS WORK IN A MANNER SATISFACTORY TO THE BEST PRACTICES OF HIS TRADE AND TO COMPLETE THE SCOPE OF THIS WORK IN ALL RESPECTS.

B. THE LOCATION OF PIPING AS INDICATED ON THE DRAWINGS IS DIAGRAMMATICALLY ONLY, AND THE EXACT LOCATION SHALL BE DETERMINED IN THE FIELD. THE RUN AND ARRANGEMENT OF ALL PIPES SHALL BE APPROXIMATELY AS SHOWN ON THE DRAWINGS, AS DIRECTED DURING INSTALLATION, AS STRAIGHT AND DIRECT AS POSSIBLE, FORMING RIGHT ANGLES OR PARALLEL LINES WITH BUILDING WALL AND OTHER PIPES, AND NEATLY SPACED. ALL RISERS SHALL BE ERECTED TRUE AND PLUMB, PARALLEL WITH WALLS AND OTHER PIPES, AND NEATLY SPACED. ALL HORIZONTAL RUNS OF PIPING EXCEPT WHERE CONCEALED IN PARTITIONS, SHALL BE KEPT AS HIGH AS POSSIBLE AND CLOSE TO WALLS. WHEREVER POSSIBLE, ADJACENT PIPE LINES, BOTH HEATING AND MECHANICAL, SHALL BE GROUPED IN THE SAME VERTICAL OR HORIZONTAL PLANES. ALL PIPING SHALL BE CONCEALED AND SHALL HAVE A MINIMUM NUMBER OF FITTINGS. PIPING SHALL NOT INTERFERE WITH THE OPERATION OR ACCESSIBILITY OF DOORS, WINDOWS,

ACCESS PANELS, OR EQUIPMENT AND SHALL NOT ENCROACH ON AISLES OR PASSAGEWAYS. ALL PIPING SHALL BE INSTALLED TO PRESERVE ACCESS TO ALL VALVES, TRAPS AND EQUIPMENT.

C. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE CORRECTNESS OF FIELD DIMENSIONS AND SHALL CHECK FOR HIMSELF ALL GRADES, LINES, MEASUREMENTS, AND OTHER DATA IN ANY WAY AFFECTING HIS WORK. WORK INSTALLED BY THE CONTRACTOR WHICH IS IMPROPERLY LOCATED AND/OR INTERFERES WITH OR MODIFIES EITHER THE PHASING SCHEDULE OR THE ARCHITECTURAL OR STRUCTURAL DESIGN, SHALL BE CORRECTED AS DIRECTED BY THE ENGINEER, AND ALL COSTS INCIDENTAL TO SUCH CHANGES SHALL BE PAID BY THE CONTRACTOR.

D. THE CONTRACTOR SHALL ALSO PROVIDE THE NECESSARY DATA AND SUPERVISION FOR THE PROVISION OF ALL OPENINGS IN THE STRUCTURE, INCLUDING BOLT HOLE TEMPLATES, WEIGHTS OF EQUIPMENT AND MANUFACTURER'S RECOMMENDATIONS FOR PROPER EMPLACEMENT DESIGN. THIS SHALL BE FURNISHED TO THE GENERAL CONTRACTOR AND OTHER RELATED TRADES.

E. THE CONTRACTOR SHALL NOT WELD TO OR BORE THROUGH ANY STRUCTURAL STEEL MEMBER. PENETRATIONS OF PRECAST CONCRETE WALL PANELS SHALL BE LOCATED BY THE ENGINEER.

3.2 INSTALLATION

A. ALL EXPOSED RUNOUTS TO EQUIPMENT, MATERIALS AND FIXTURES HAVING CHROME PLATED TRIM AND/OR FITTINGS SHALL BE CHROME PLATED BRASS WITH CHROME PLATED BRASS FITTINGS, UNLESS OTHERWISE NOTED.

B. VENTS SHALL EXTEND SUFFICIENTLY ABOVE ROOF SO THAT OUTLET WILL BE MINIMUM OF 24 INCHES ABOVE ROOF AND A MAXIMUM OF 36” ABOVE ROOF.

C. REMOVE SCALE AND DIRT, ON INSIDE AND OUTSIDE, BEFORE ASSEMBLY.

D. PREPARE PIPING CONNECTIONS TO EQUIPMENT WITH FLANGES OR UNIONS.

E. ROUTE PIPING IN ORDERLY MANNER.

F. INSTALL PIPING TO CONSERVE BUILDING SPACE AND NOT INTERFERE WITH USE OF SPACE.

G. GROUP PIPING WHENEVER PRACTICAL AT COMMON ELEVATIONS.

H. INSTALL PIPING TO ALLOW FOR EXPANSION AND CONTRACTION WITHOUT STRESSING PIPE, JOINTS, OR CONNECTED EQUIPMENT.

I. PROVIDE CLEARANCE FOR INSTALLATION OF ACCESS TO VALVES AND FITTINGS.

J. PROVIDE ACCESS WHERE VALVES AND FITTINGS ARE NOT EXPOSED. COORDINATE SIZE AND LOCATION OF ACCESS DOORS.

3.3 CONDENSATE DRAIN SYSTEMS

A. INTERIOR PIPING SHALL PITCH IN ACCORDANCE WITH CODE REQUIREMENTS, UNLESS OTHERWISE NOTED.

B. ALL CHANGES IN PIPE SIZE AND DIRECTION SHALL BE MADE WITH Y'S AND CLEANOUTS, REDUCING FITTINGS, RECESSED REDUCERS. Y'S AND 45 DEGREE FITTINGS OR 45 DEGREE COMBINATION FITTINGS SHALL BE USED WHEREVER CONDITIONS PERMIT.

C. SANITARY LONG SWEEP BENDS AND Y'S SHALL BE USED FOR CONNECTIONS TO BRANCH LINES FOR FIXTURES AND TY'S ON VERTICAL RUNS OF PIPE. LONG TURN FITTINGS SHALL BE USED WHEREVER CONDITIONS PERMIT.

D. ALL FITTINGS, REGARDLESS OF TYPE, SHALL BE FURNISHED COMPLETE WITH THE NECESSARY BOLTS, NUTS AND WASHERS, AS WELL AS BRASS OR CHROME PLATED NIPPLES OF THE PROPER LENGTH.

E. CLEANOUTS SHALL BE INSTALLED WHERE INDICATED ON THE DRAWINGS, OR APPROXIMATELY EVERY 100 FT. ALONG HORIZONTAL RUNS, AT ALL CHANGES IN DIRECTION, AND AT THE BASE OF ALL SANITARY, PROCESS OR STORM STACKS. TEST TEES WITH BRASS CLEAN OUT PLUGS SHALL BE INSTALLED AT THE BASE OF ALL VERTICAL PIPING. NO PROJECTION ABOVE THE FLOOR LINE WILL BE PERMITTED. CLEANOUTS OCCURRING IN OR BACK OF WALLS SHALL BE EXTENDED OUT TO FINISHED WALL AND FINISHED WITH FLUSH METAL ACCESS PANEL. CLEANOUTS LOCATED IN FLOOR SHALL BE EXTENDED TO GRADE AND FINISHED WITH AN ACCESS PANEL. RUNNING

CLEANOUTS MAY BE USED WHERE IT IS IMPRACTICAL TO USE END CLEANOUTS AT BASE OF RISERS.

F. EACH DRAIN AND PIECE OF EQUIPMENT MUST BE SEPARATELY TRAPPED UNLESS OTHERWISE NOTED.

3.4 PIPE JOINTS

A. GENERAL: EXERCISE CARE WHEN MAKING PIPE JOINTS AND MAKE JOINTS IN ACCORDANCE WITH THE PIPE MATERIAL MANUFACTURER'S RECOMMENDATIONS AND THE FOLLOWING REQUIREMENTS. IN EACH INSTANCE OF PIPE JOINING, THOSE PORTIONS OF PIPES INVOLVED MUST BE ABSOLUTELY CLEAN JUST PRIOR TO ASSEMBLY. IF A JOINT IS EXTREMELY DIFFICULT TO ASSEMBLE OR SEALING IS NOT EFFECTED, DISASSEMBLE THE JOINT AND CORRECT THE DIFFICULTY IF POSSIBLE. REMAKE THE JOINT USING NEW MATERIALS WHEN NECESSARY.

B. SWEAT JOINTS: CUT TUBING AND PIPING ENDS SQUARE, DEBURR AND REAM TO SIZE OF ORIGINAL BORE. PRIOR TO APPLYING FLUX AND SWEATING, CLEAN PIPE ENDS AND FITTING SURFACES INVOLVED IN THE JOINT, TO BRIGHT METAL WITHOUT MARRING SURFACES. FINISHED JOINTS SHALL HAVE JOINT SHALL BE FILLED THE FULL LENGTH OF THE SOCKET , SHOW NO EVIDENCE OF HARD-TEMPER DUE TO OVERHEATING, NO EVIDENCE OF IMPROPER SOLDER DRAW, AND EXCESS SOLDER MUST BE REMOVED.

C. WELDED JOINTS: CUT TUBING AND PIPING ENDS SQUARE, DEBURR AND REAM TO SIZE OF ORIGINAL BORE. CLEAN PIPE ENDS AND FITTING SURFACES INVOLVED IN THE JOINT, TO BRIGHT METAL WITHOUT MARRING SURFACES. FINISHED JOINTS SHALL HAVE JOINT FILLED THE FULL LENGTH AND DEPTH OF THE MATING JOINT PIECES, SHOW NO EVIDENCE OF HARD-TEMPER DUE TO OVERHEATING AND EXCESS WELDING SLAG MUST BE REMOVED AND THE JOINT CLEANED.

D. THREADED JOINTS: CUT PIPE ENDS SQUARE, DEBURR AND REAM TO SIZE OF ORIGINAL BORE. CUT THREADS TO STANDARD GAGE DEPTH AND LENGTH AND CLEAN THREADS FREE OF OIL AND CUTTINGS. USE "TEFLON" FORMULATION JOINT TAPE OR "TEFLON" JOINT PASTE TO AID IN JOINT LUBRICATION AND SEALING IN JOINING OPERATION.

E. FLANGED JOINTS: FACE ACCURATELY, INSTALL GASKETS AND DRAW UP SQUARE AND TIGHT TO INSURE FULL GASKET FLOW SEAL.

F. NO-HUB JOINTS: CAST IRON NO-HUB JOINT ENDS MUST BE PROPERLY ENTERED IN THE GASKET SHIELD/CLAMP ASSEMBLY PRIOR TO TIGHTENING. MAKE NO-HUB JOINTS IN ACCORDANCE WITH PROCEDURES OUTLINED IN PAMPHLET NO. 100 OF CISPI 301.

G. PLASTIC PIPE

1. GENERAL: PIPE SHALL BE CUT SQUARELY WITH A FINE-TOOTHED SAW OR KNIFE. REMOVE ALL BURRS WITH KNIFE OR FILE.
2. JOINTS TO BE MADE IN STRICT ACCORDANCE TO THE PIPE MANUFACTURERS' REQUIREMENTS AND SPECIFICATIONS. JOINTS SHALL NOT BE MADE IF THE MATERIALS OR AIR TEMPERATURE IS NOT WITHIN THE SPECIFIED LIMITS.

3.5 PIPE PENETRATIONS

A. ALL NON-INSULATED PIPE THAT PENETRATE INSULATED PANEL WALLS SHALL BE INSULATED WITH A MINIMUM OF 2" THICK PIPE INSULATION. INSULATION SHALL IDEALLY PROJECT A MINIMUM OR 30" ON THE WARM SIDE AND 6" ON THE COLD SIDE OR THE WALL. TOTAL LENGTH OF PIPE COVERING SHALL BE 36". INSULATION SHALL BE CAPPED AND VAPOR SEALED ON BOTH ENDS TO THE PIPE. REFER TO THE DETAIL DRAWINGS FOR ADDITIONAL INFORMATION.

B. ALL UNINSULATED PIPE THAT PENETRATE UNINSULATED WALLS SHALL BE ISOLATED AND SEALED WITH A WALL SLEEVE AND CASING SEAL. SLEEVES AND SEALS SHALL BE SIZED TO PREVENT PROJECTION BEYOND THE WALL PLANES AND PIPE COLLAR MUST BE PROVIDED TO COVER THE WALL OPENING ON BOTH SIDES OF THE WALL.

1. SLEEVE AND SEAL MATERIAL MUST BE CHEMICALLY AND MECHANICALLY COMPATIBLE WITH THE PIPE AND SERVICE TO WHICH IT IS SUBJECTED.

C. FOR INSULATED PIPE PENETRATIONS THAT PENETRATE INSULATED PANEL WALLS, REFER TO THE DETAILS PROVIDED ON THE DRAWINGS.

D. ON ALL INSULATED LINES THAT PENETRATE UNINSULATED WALLS, THE PIPE INSULATION SHALL BE CARRIED THROUGH THE WALL WITH NO DECREASE IN PIPE INSULATION THICKNESS. UNLESS THE WALL IS FIRE-RATED IN WHICH CASE THE INSULATION SHALL TERMINATE AT THE WALL AND THE PENETRATIONS SHALL BE FITTED WITH DOW CORNING RTV.
   1. IN ALL UNINSULATED WALL PENETRATIONS, THE PIPE INSULATION SHALL BE WRAPPED WITH AT LEAST TWO LAYERS OF 15# ROOFING PAPER TO PROTECT THE INSULATION.
   2. IN ALL UNINSULATED WALL PENETRATIONS, WALL SLEEVES AND WHERE NECESSARY, SEALS SHALL BE PROVIDED. SLEEVES AND SEALS SHALL BE SIZED TO PREVENT PROJECTION BEYOND THE WALL PLANES AND PIPE COLLARS SHALL BE PROVIDED TO COVER THE WALL OPENINGS ON BOTH SIDES OF THE WALL. SEAL MATERIALS MUST BE CHEMICALLY AND MECHANICALLY COMPATIBLE WITH THE PIPE INSULATION AND WALL SLEEVE AND FOR THE SERVICE TO WHICH IT IS SUBJECTED.

E. CUT OPENINGS IN INSULATED PANELS FOR PIPE PENETRATIONS AND INSTALL THE PIPE. RESEAL ALL OPENINGS IN THE INSULATED PANELS TO ASSURE VAPOR BARRIER CONTINUITY IS MAINTAINED.

F. PENETRATIONS OF EXISTING WALLS AND FLOORS: MAKE PENETRATIONS FOR PIPES BY THE "CORE-DRILLING" METHOD. SUCH PENETRATIONS SHALL BE CLEAN AND FREE FROM EXCESSIVE SPALLING.
   1. MAKE WALL PENETRATION SIZED TO ACCOMMODATE THE PIPE PLUS ¼".
   2. PACK MASONRY WALL PENETRATION VOID TIGHT AROUND PIPE WITH GROUT TO WITHIN ½" OF THE EXTERIOR WALL FACE. PLUG REMAINING ½" SPACE WATERTIGHT USING AN ELECTRICIAN'S SEALING MASTIC SUCH AS "SEALFLEX" BY M & W ELECTRIC OR EQUAL.

3.6 CONNECTIONS:

A. DRAWINGS INDICATE GENERAL ARRANGEMENT OF PIPING, FITTINGS, AND SPECIALTIES.

B. CONNECTIONS TO EQUIPMENT, ETC., SHALL BE MADE IN ACCORDANCE WITH THE SHOP DRAWINGS AND ROUGH-IN MEASUREMENTS FURNISHED BY THE MANUFACTURER OF THE PARTICULAR EQUIPMENT FURNISHED. ANY AND ALL ADDITIONAL CONNECTIONS NOT SHOWN ON THE DRAWINGS, BUT CALLED FOR BY THE EQUIPMENT MANUFACTURER'S SHOP DRAWINGS OR REQUIRED FOR THE SUCCESSFUL OPERATION OF THE PARTICULAR EQUIPMENT FURNISHED, SHALL BE INSTALLED WITH NO ADDITIONAL CHARGE.

C. CONDENSATE DRAIN:
   1. CONNECT CONDENSATE DRAIN PIPING TO EQUIPMENT WITH COOLING COIL CONDENSATE DRAIN OR GENERAL DRAIN CONNECTION.
   2. PROVIDE TRAP AT DRAIN CONNECTION SIZED APPROPRIATELY TO EQUIPMENT STATIC PRESSURE AT POINT OF CONNECTION.
   3. USE TRANSITION FITTING TO JOIN DISSIMILAR PIPING MATERIALS.

3.7 TESTING

A. THE CONTRACTOR SHALL NOTIFY THE ENGINEER THREE WORKING DAYS PRIOR TO DAY TESTS ARE TO BE MADE. TEST ALL PIPING AND MAKE IT GAS AND WATER TIGHT, IN ACCORDANCE WITH THE AUTHORITY HAVING JURISDICTION AND ORDINANCES, AND IN THE PRESENCE AND TO THE SATISFACTION OF THE APPLICABLE INSPECTOR ALONG WITH THE ENGINEER AND HIS REPRESENTATIVE.

B. NO PIPING SHALL BE BURIED, CONCEALED OR INSULATED BEFORE TESTED AND APPROVED. PARTIAL TESTS SHALL BE MADE AS REQUIRED, BY THE PROGRESS OF THE WORK, AND THE CONTRACTOR SHALL ACCOMMODATE THE TESTING OPERATIONS TO THE PROGRESS OF THE PROJECT. FURNISH ALL EQUIPMENT, LABOR, SERVICES AND APPARATUS; ALSO PAY FOR ALL COSTS FOR PERTINENT TESTS. ALL APPROVALS SHALL BE RENDERED IN WRITING AND SUBMITTED TO THE ENGINEER. REMEDY ALL DEFECTIVE WORK AND REPLACE ALL DEFECTIVE MATERIALS, EQUIPMENT OR FIXTURES WITH NEW ONES OF THE SPECIFIED GRADE. NO CAULKING, PEENING, OR WICKING OF SCREWED JOINTS OR HOLES WILL BE ACCEPTABLE. THIS CONTRACTOR SHALL MAKE AND REMOVE ALL TEMPORARY PIPING AND LINE CONNECTIONS REQUIRED FOR THE

TESTS AND SHALL DISPOSE OF TEST WATER AND ALL WASTES AFTER TESTS IN A SATISFACTORY AND NON-DAMAGING MANNER.

C. PIPING SYSTEMS

1. CONDENSATE DRAIN:

a. TEST PIPING ACCORDING TO PROCEDURES OF AUTHORITIES HAVING JURISDICTION OR, IN ABSENCE OF PUBLISHED PROCEDURES, AS FOLLOWS:

1) TEST FOR LEAKS AND DEFECTS IN NEW PIPING AND PARTS OF EXISTING PIPING THAT HAVE BEEN ALTERED, EXTENDED, OR REPAIRED. IF TESTING IS PERFORMED IN SEGMENTS, SUBMIT SEPARATE REPORT FOR EACH TEST, COMPLETE WITH DIAGRAM OF PORTION OF PIPING TESTED.

2) LEAVE UNCOVERED AND UNCONCEALED NEW, ALTERED, EXTENDED, OR REPLACED DRAINAGE AND VENT PIPING UNTIL IT HAS BEEN TESTED AND APPROVED. EXPOSE WORK THAT WAS COVERED OR CONCEALED BEFORE IT WAS TESTED.

3) TEST PROCEDURE: TEST DRAINAGE AND VENT PIPING, ON COMPLETION OF PIPING AND BEFORE ANY PIPING IS CONCEALED. CLOSE OPENINGS IN PIPING SYSTEM AND FILL WITH WATER TO POINT OF OVERFLOW, BUT NOT LESS THAN 10-FOOT HEAD OF WATER OR EQUIVALENT HYDROSTATIC PRESSURE TEST. FROM 15 MINUTES BEFORE INSPECTION STARTS TO COMPLETION OF INSPECTION, WATER LEVEL OR TEST PRESSURE MUST NOT DROP. TEST SHALL BE HELD FOR A MINIMUM PERIOD OF 8 HOURS. INSPECT EACH AND EVERY JOINT AND FITTING FOR LEAKS DURING TEST PERIOD.

4) REPAIR LEAKS AND DEFECTS WITH NEW MATERIALS AND RETEST PIPING, OR PORTION THEREOF, UNTIL SATISFACTORY RESULTS ARE OBTAINED.

5) PREPARE REPORTS FOR TESTS AND REQUIRED CORRECTIVE ACTION.

3.8 CLEANING OF SYSTEMS

A. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE CLEANING AND PURGING OF ALL PERTINENT SYSTEMS AFTER INSTALLATION AND BEFORE SYSTEM OPERATION. ANY DAMAGE TO PART OF THE BUILDING, ITS FINISH OR FURNISHINGS, DUE TO THIS CONTRACTOR'S FAILURE TO PROPERLY CLEAN THE SYSTEM, SHALL BE REPAIRED OR REPLACED, AT HIS EXPENSE.

B. ALL FINISHED METAL WORK SHALL BE CLEANED, POLISHED AND LEFT BRIGHT. ALL EQUIPMENT, PIPE, VALVES, DRAINS AND FITTINGS SHALL BE CLEANED OF GREASE, METAL CUTTING AND SLUDGE, WHICH MAY HAVE ACCUMULATED DURING CONSTRUCTION AND/OR TESTING.

C. THE CONTRACTOR SHALL REFINISH AND RESTORE TO ITS ORIGINAL CONDITION ALL MECHANICAL EQUIPMENT WHICH HAS SUSTAINED DAMAGE TO THE MANUFACTURER'S PRIME AND FINISH COATS OF PAINT AND/OR ENAMEL.

END OF SECTION

SECTION 23 31 00

DUCTWORK

PART 1: GENERAL

A. THE SCOPE OF THIS SECTION SHALL INCLUDE:
   1. ALL SUPPLY AIR, RETURN AIR AND EXHAUST AIR DUCTWORK AND FITTINGS.
   2. SEALANTS.
   3. FIRESTOPPING.

B. THE SPECIFICATIONS AND DRAWINGS DESCRIBE THE MINIMUM REQUIREMENTS THAT MUST BE MET BY CONTRACTOR FOR THE INSTALLATION OF ALL WORK AS SHOWN ON THE DRAWINGS, SCHEDULES AND AS SPECIFIED HEREIN.

1.2 RELATED WORK

A. SECTION 23 05 29 - HANGERS AND SUPPORTS
B. SECTION 23 37 13 - AIR OUTLETS AND INLETS
C. SECTION 23 33 00 - DUCTWORK ACCESSORIES
D. SECTION 23 05 93 - TESTING, ADJUSTING AND BALANCING

1.3 REFERENCES

A. ASHRAE HANDBOOK FUNDAMENTALS; DUCT DESIGN CHAPTER
B. ASHRAE HANDBOOK EQUIPMENT; DUCT CONSTRUCTION CHAPTER
C. ASTM A 90 WEIGHT OF COATING ON ZINC COATED (GALVANIZED) IRON OR STEEL ARTICLES
D. ASTM A 167 STAINLESS AND HEAT RESISTING CHROMIUM NICKEL STEEL PLATE, SHEET, AND STRIP
E. ASTM A653/A653M – STANDARD SPECIFICATION FOR STEEL SHEET, ZINC COATED (GALVANIZED) OR ZINC-IRON ALLOY COATED (GALVANNEALED) BY THE HOT DIP PROCESS
F. ASTM A 527 STEEL SHEET, ZINC COATED (GALVANIZED) BY HOT DIP PROCESS, LOCK FORMING QUALITY
G. ASTM B209 ALUMINUM AND ALUMINUM ALLOY SHEET AND PLATE
H. NFPA 90A INSTALLATION OF AIR CONDITIONING AND VENTILATING SYSTEMS
I. SMACNA HVAC DUCT CONSTRUCTION STANDARDS
J. SMACNA – ROUND INDUSTRIAL DUCT CONSTRUCTION STANDARDS
K. SMACNA – RECTANGULAR INDUSTRIAL DUCT CONSTRUCTION STANDARDS
L. UL 181 FACTORY MADE AIR DUCTS AND CONNECTORS
M. AMCA STANDARDS 210 AND 300, CAPACITY RATINGS
N. AMCA STANDARDS 300 AND 301, SOUND RATINGS

1.4 DEFINITIONS

A. DUCT SIZES: SIZES SHOWN ON DRAWINGS ARE INSIDE CLEAR DIMENSIONS.
B. LOW PRESSURE: PRESSURE CLASSIFICATIONS
   1. UP TO 2" WG POSITIVE OR NEGATIVE STATIC PRESSURE AND VELOCITIES LESS THAN 2,500 FPM, SEAL CLASS B IN ACCORDANCE WITH SMACNA
C. MEDIUM PRESSURE: PRESSURE CLASSIFICATIONS
   1. 3"-10" WG POSITIVE OR NEGATIVE STATIC VELOCITIES LESS THAN 4,000 FPM, SEAL CLASS A IN ACCORDANCE WITH SMACNA

1.5 REGULATORY REQUIREMENTS

A. CONSTRUCT DUCTWORK TO NFPA 90A AND NFPA 90B STANDARDS.
B. GAUGE SHALL BE STAMPED ON ALL METAL.

1.6 DELIVERY, STORAGE AND HANDLING:

A. WHERE POSSIBLE, STORE PRODUCTS INSIDE AND PROTECT FROM WEATHER. WHERE NECESSARY TO STORE OUTSIDE, STORE ABOVE GRADE AND ENCLOSE WITH A VENTED WATERPROOF WRAPPING.

1.7 SUBMITTALS

A. SHOP DRAWINGS AND PRODUCT DATA: SUBMIT COPIES OF SHOP DRAWINGS FOR REVIEW BEFORE INSTALLATION FOR THE ITEMS LISTED BELOW. SUBMITTALS SHALL BE CHECKED AND APPROVED BEFORE SUBMITTING. ITEMS SHALL NOT BE INSTALLED BEFORE REVIEW OF SUBMITTALS.
   1. COMPLETE MATERIAL LIST OF ALL ITEMS PROPOSED TO BE FURNISHED AND INSTALLED UNDER THIS SECTION.
   2. SHOP DRAWINGS SHOWING COMPLETE DUCTWORK LAYOUT, ALL DETAILS OF THE PROPOSED INSTALLATION, AND THE INTERFACE OF DUCTS AND EQUIPMENT WITH ALL OTHER ITEMS. DRAWINGS SHALL SHOW ALL DUCT SEGMENTS WITH ELEVATIONS CLEARLY INDICATED. DUCT MATERIALS AND INSULATION TYPE SHALL BE INDICATED.
      a. DUCTWORK SHALL NOT BE FABRICATED OR DELIVERED TO SITE PRIOR TO APPROVED SHOP DRAWINGS.

b. ALL DUCTWORK SHALL BE FIELD MEASURED.
c. SHOP DRAWINGS SHALL BE PRODUCED USING AUTOCAD. MINIMUM DRAWING SCALE SHALL BE ¼"=1'-0".

3. MANUFACTURER'S RECOMMENDED INSTALLATION PROCEDURES WHICH, WHEN APPROVED WILL BECOME THE BASIS FOR INSPECTING AND ACCEPTING OR REJECTING ACTUAL INSTALLATION PROCEDURES USED ON THE WORK.
4. INDICATE DUCTWORK AND FITTINGS ALONG WITH GAUGES, SIZES AND CONFIGURATION PRIOR TO START OF WORK FOR ALL DUCT SYSTEMS.

B. STAINLESS STEEL WELDED DUCTWORK
1. WELDING PROCEDURE SPECIFICATION.
2. WELDING PROCEDURE QUALIFICATION.
3. WELDER PROCEDURE VERIFICATION.
4. WELDER 6 MONTHS ACTIVE CERTIFICATION.
5. ONE SAMPLE PER WELDER.
a. TWO PIECES OF SAMPLE DUCT MATERIAL WELDED TOGETHER ACCORDING TO WELDING PROCEDURE SPECIFICATION.
b. EACH OF THE TWO PIECES SHALL BE A MINIMUM OF 6 INCHES LONG BY MINIMUM OF 3 INCHES WIDE.
c. A SAMPLE SHALL BE SUBMITTED FOR THE THINNEST MATERIAL (GAGE) USED.
d. WHERE RECTANGULAR DUCTWORK IS USED A WELDED CORNER SHALL BE INCORPORATED AS PART OF THE SAMPLE.
6. A SAMPLE SHALL BE SUBMITTED FOR EACH TYPE OF STAINLESS USED.
7. OWNER WILL REVIEW AND MAY REQUIRE ADJUSTMENTS AND RESUBMITTAL.
8. FIELD WELDING INSPECTION PROCEDURE.

C. MANUAL: UPON COMPLETION OF THIS PORTION OF THE WORK, AND AS A CONDITION OF ITS ACCEPTANCE, DELIVER TO THE CONTRACTOR COPIES OF AN OPERATION AND MAINTENANCE MANUAL COMPILED PER THE GENERAL AND SPECIAL CONDITIONS OF THE CONTRACT.

D. PRODUCT DATA: SUBMIT MANUFACTURER'S SPECIFICATIONS ON MATERIALS AND MANUFACTURED PRODUCTS USED FOR WORK OF THIS SECTION.

1.8 QUALITY ASSURANCE

A. LEAKAGE TEST - PERFORM LEAKAGE TEST AS SET FORTH BY THE SMACNA MANUALS FOR THE APPLICABLE PRESSURE CLASS.

B. BALANCING AND ADJUSTING - PERFORM BALANCING AND ADJUSTING OF HVAC DUCTWORK SYSTEMS.

PART 2: PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. DUCTMATE INDUSTRIES, INC.
B. FROMMELT
C. KB DUCT
D. LEWIS & LAMBERT COMPANY
E. LOCKFORMER COMPANY, TRANSVERSE DUCT CONNECTOR (TDC) SYSTEM
F. MCGILL AIRFLOW
G. LINDAB, INC.
H. MKT MANUFACTURING
I. NORDFAB
J. WARD

2.2 MATERIALS

A. GENERAL:
1. NON COMBUSTIBLE OR CONFORMING TO REQUIREMENTS FOR CLASS 1 AIR DUCT MATERIALS, OR UL 181.
2. DUCTWORK SYSTEM SHALL BE CONSTRUCTED IN ACCORDANCE WITH SMACNA STANDARDS.
3. WELD SAMPLES SHALL BE PROVIDED TO CM FOR REVIEW PRIOR TO FABRICATION.

B. DUCTWORK APPLICATION SCHEDULE
1. DUCTWORK MATERIAL AND PRESSURE CLASS SHALL BE AS INDICATED ON DUCTWORK SCHEDULE IN THE MECHANICAL DRAWINGS DUCTWORK APPLICATION SCHEDULE

C. GALVANIZED STEEL DUCTS:

1. ASTM A653/A653M GALVANIZED STEEL SHEET, LOCK FORMING QUALITY, HAVING G90 ZINC COATING.
2. WHERE REQUIRED PRIME COAT WELDED JOINTS OF GALVANIZED DUCT WITH "ZRC ZINCPLATE", "GALVAX" OR APPROVED EQUAL. REVIEW USE WITH OWNER PRIOR TO WELDING.
3. SPIRAL DUCT IS ACCEPTABLE ONLY WHERE INDICATED ON THE DUCTWORK SCHEULDE. SPIRAL DUCT MAY BE INCLUDED AS AN ALTERNATE TO THE BASE FOR OWNER EVALUATION ON AREAS NOT SPECIFED AS SPIRAL.

D. FLEXIBLE DUCTS:
1. INTERLOCKING SPIRAL OF GALVANIZED STEEL OR ALUMINUM CONSTRUCTION OR FABRIC SUPPORTED BY HELICALLY-WOUND SPRING STEEL WIRE OR FLAT STEEL BANDS; RATED TO 2" WG POSITIVE AND 1.5" WG NEGATIVE FOR LOW-PRESSURE DUCTS.

E. INSULATED FLEXIBLE DUCTS:
1. FLEXIBLE DUCT AS SPECIFIED ABOVE, WRAPPED WITH MINIMUM 1" THICK FLEXIBLE GLASS FIBER INSULATION, ENCLOSED BY SEAMLESS ALUMINUM PIGMENTED PLASTIC VAPOR BARRIER JACKET; MAXIMUM 'K' VALUE = 0.23 AT 75ºF.

F. STAINLESS STEEL DUCTS:
1. ASTM A167, TYPE 304 WITH MIL FINISH FOR CONCEALED SPACES, AND TYPE 304 WITH #2B FINISH FOR EXPOSED SPACES.
2. WELDED JOINTS SHALL BE GROUND SMOOTH.

G. ALUMINUM DUCTS:
1. ASTM B209; ALUMINUM SHEET, ALLOY 3003 H14. MINIMUM TENSIL STRENGTH SHALL BE 19,000 PSI. ALUMINUM CONNECTORS AND BAR STOCK: ALLOY 6061 T6 OR OF EQUIVALENT STRENGTH.

H. GREASE DUCTS:
1. FURNISH SINGLE-WALL, FACTORY BUILT, GREASE DUCT FOR USE WITH TYPE I KITCHEN HOODS, WHICH CONFORMS TO THE REQUIREMENTS OF NFPA-96. PRODUCTS SHALL BE ETL LISTED TO UL-1978 AND CAN/ULC-S662 FOR VENTING AIR AND GREASE VAPORS FROM COMMERCIAL COOKING OPERATIONS AS DESCRIBED IN NFPA-96.
2. THE DUCT WALL SHALL BE CONSTRUCTED OF .036 AND .047 THICK STAINLESS STEEL AND BE AVAILABLE IN DIAMETERS 8" THROUGH 24".
3. ALL SUPPORTS, FAN ADAPTERS, HOOD CONNECTIONS, FITTINGS AND EXPANSION JOINTS REQUIRED TO INSTALL GREASE DUCT SHALL BE INCLUDED.
4. ROOF PENETRATIONS SHALL COMPLY WITH LISTED CLEARANCE TO COMBUSTIBLES, SEE "CLEARANCE TO COMBUSTIBLES" GUIDE FOR DETAILS. THE GREASE DUCT WILL TERMINATE AT THE FAN ADAPTER PLATE, WILL BE FULLY WELDED TO THE FAN ADAPTER PLATE AND THE FAN ADAPTER PLATE WILL BE FASTENED TO THE CURB USING A SUITABLY SIZED FASTENER PROVIDED BY OTHERS; SEE PAGE 12 OF THE "INSTALLATION, OPERATION AND MAINTENANCE MANUAL" FOR DETAILS.
5. GREASE DUCT JOINTS SHALL BE HELD TOGETHER BY MEANS OF FORMED VEE CLAMPS AND SEALED WITH 3M FIRE BARRIER 2000+. SCREWS USED TO SECURE THE VEE CLAMPS SHALL BE OF THE HEX-HEAD TYPE WITH FLANGED STOPS AND TAPERED "LEAD IN" THREADS FOR EASY STARTING. NUTS SHALL BE RETAINED BY MEANS OF A FREE-FLOATING CAGE TO ALLOW EASY ALIGNMENT.
6. SINGLE-WALL GREASE DUCT SHALL BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURER'S "INSTALLATION, OPERATION AND MAINTENANCE MANUAL", ETL LISTING AND STATE AND LOCAL CODES.
7. GREASE DUCT INSTALLED OUTSIDE OF THE BUILDING SHALL BE PROTECTED AGAINST ACCIDENTAL DAMAGE OR VANDALISM.
8. SUPPORT VERTICALLY INSTALLED GREASE DUCT FROM THE BUILDING STRUCTURE USING RIGID STRUCTURAL SUPPORTS. ANCHOR SUPPORTS TO THE STRUCTURE BY WELDING OR BOLTING STEEL EXPANSION ANCHORS OR CONCRETE INSERTS. SUPPORT HORIZONTALLY INSTALLED GREASE DUCT FROM THE BUILDING STRUCTURE USING ABOVE METHOD. 1/2" THREADED ROD AND SADDLES MAY ALSO BE USED FOR THE SUPPORT OF HORIZONTAL GREASE DUCT.
9. FANS SHALL BE SUPPORTED INDEPENDENTLY FROM THE GREASE DUCT SECTIONS. PROTECT GREASE DUCT FROM TWISTING OR MOVEMENT CAUSED BY FAN TORQUE OR VIBRATION.

I. FASTENERS:
1. RIVETS, BOLTS, OR SHEET METAL SCREWS FOR STEEL DUCTS.
2. WELD ALL JOINTS IN DUST COLLECTION SYSTEM, CLEAN ROOM EXHAUST SYSTEM, AND PROCESS STACKS.

3. PROCESS DUCTWORK SHALL BE FASTENED USING COMPANION ANGLES, OR GASKETED FLANGE. THIS INSTALLATION SHALL FACILITATE INTERIOR CLEANING.
4. NON-PROCESS DUCTWORK BE FASTENED USING COMPANION ANGLES, OR GASKETED FLANGE OR TRANSVERSE DUCT CONNECTOR (TDC) SYSTEM USING POP-RIVETS INSTALLED FROM THE INTERIOR FOR A SMOOTH SURFACE. THIS INSTALLATION SHALL FACILITATE INTERIOR CLEANING.

J. HANGERS AND SUPPORT RODS:
1. REFER TO SECTION 23 05 29. STEEL, STAINLESS OR GALVANIZED. RODS THREADED BOTH ENDS, THREADED ONE END, OR CONTINUOUSLY THREADED AS NOTED ELSEWHERE IN OTHER SPECIFICATIONS OR ON THE DRAWINGS. USE DOUBLE NUTS AND LOCK WASHERS ON THREADED ROD SUPPORTS.

2.3 DUCTS SERVING AND EXPOSED IN PROCESS AREAS

A. PROVIDE DUCTS AND FITTINGS WITH WELDED LONGITUDINAL. WELD JOINTS WITH SAME MATERIAL AS DUCTWORK.
1. WHERE INSULATION IS USED, TRANSVERSE DUCT CONNECTOR FLANFES (TDC), GASKETED COMPANION ANGLES OR GASKETED FLANGES FOR JOINTS BETWEEN DUCT SECTIONS IS ALLOWABLE. INSULATION SHALL BE THICK ENOUGH TO COVER FLANGE JOINTS TO ACHIEVE A SMOOTH FINISH.

B. USE ROUND DUCTS WHEREVER POSSIBLE. RECTANGULAR DUCTS SHALL HAVE A PEAK ALONG THE TOP SURFACE CENTERLINE SO THAT IT IS SLOPED (1" PER FT.) TO PREVENT ACCUMULATION OF MOISTURE AND DEBRIS.

C. PROVIDE ACCESS DOORS ADJACENT TO ALL DAMPERS, CONTROL SENSORS/DEVICES, FILTER HOUSINGS, ROOF FAN CONNECTIONS, ELBOWS WITH TURNING VANES, TAKEOFF FITTINGS, AND/OR EVERY 20 FEET OF STRAIGHT HORIZONTAL RUN AND EVERY 20 FEET OF VERTICAL RUN.

D. FASTENERS USED TO CONSTRUCT ALL DUCTWORK, FITTINGS, AND ACCESSORIES SERVING PROCESS AREAS SHALL BE POP RIVETS, ORIENTED "HEADS IN" TO FACILITATE CLEANING. SCREWS WITH EXPOSED THREADS SHALL NOT BE PERMITTED.

E. DUCTWORK FROM CLEAN ROOMS, WASH ROOMS, AND WET ENVIRONMENTS SHALL BE INSTALLED WITH A MINIMUM SLOPE OF 1/8" PER 12" BACK TOWARDS THE EXHAUST GRILLE.

2.4 DUCTWORK FABRICATION

A. FABRICATE AND SUPPORT IN ACCORDANCE WITH SMACNA HVAC DUCT CONSTRUCTION STANDARDS AND ASHRAE HANDBOOKS, EXCEPT AS INDICATED. PROVIDE DUCT MATERIAL, GAUGES, REINFORCING, AND SEALING FOR OPERATING PRESSURES INDICATED.

B. FASTENERS USED TO CONSTRUCT ALL DUCTWORK, FITTINGS, AND ACCESSORIES SERVING PROCESS AREAS SHALL BE POP RIVETS, ORIENTED "HEADS IN" TO FACILITATE CLEANING. SCREWS WITH EXPOSED THREADS SHALL NOT BE PERMITTED.

C. ROUND DUCTS IN LIEU OF SPECIFIC INDIVIDUAL RECTANGULAR DUCTWORK SIZES SHOWN ON THE DRAWINGS WILL BE ALLOWED ONLY IF THE FOLLOWING CONDITIONS ARE MET:
1. THE DUCTWORK SYSTEM DESIGN AND/OR CONFIGURATION IS NOT REVISED.
2. ASHRAE TABLE FOR EQUIVALENT RECTANGULAR AND ROUND DUCTWORK IS USED TO CONVERT INDIVIDUAL DUCTWORK SIZES.
3. PER APPROVAL OF ENGINEER.

D. FABRICATED GALVANIZED CONTINUOUSLY WELDED MEDIUM PRESSURE ROUND DUCT FITTINGS SHALL BE TWO GAGES HEAVIER THAN DUCT GAGES INDICATED IN SMACNA STANDARD. JOINTS SHALL BE MINIMUM 4 INCH CEMENTED SLIP JOINT, BRAZED OR ELECTRIC WELDED.

2.5 JOINT AND SEAM SEALANTS

A. GENERAL: THE TERM SEALANT USED HERE IS NOT LIMITED TO MATERIALS OF ADHESIVE OR MASTIC NATURE, BUT ALSO INCLUDES TAPES AND COMBINATIONS OF OPEN WEAVE FABRIC STRIPS AND MASTICS.

B. ALL SEALANTS SHALL BE FDA APPROVED.

C. ALL SEALANTS USED ON AHU, DEH, FAN, EF, FC EQUIPMENT SHALL HAVE TEMPERATURE RATING MEETING OR EXCEEDING 0-120 DEGREES F, UNLESS OTHERWISE NOTED.
1. ABOVE TEMPERATURE RATINGS DO NOT APPLY TO HOT WATER HEATERS, BOILERS, OR ANY DIRECT PROCESS RELATED EXHAUST SYSTEMS.

D. SEAL ALL DUCTWORK SEAMS, JOINTS, FASTENER PENETRATIONS AND FITTING CONNECTIONS WITH SEALANTS IN ACCORDANCE WITH SMACNA SEAL CLASSIFICATION AS REQUIRED BY SMACNA DUCT PRESSURE CLASSIFICATION. WHERE DUCTS ARE NOT CONTINUOUSLY WELDED, PROVIDE LIQUID SEALANTS AND GASKETS AS REQUIRED TO MEET THE SPECIFIED DUCT LEAKAGE ALLOWANCE.

E. SEALANTS - SEAL ALL JOINTS AND SEAMS WITH FDA APPROVED FIBER-FREE SEALANT. DUCT SEAL SHALL BE APPLIED PER MANUFACTURER'S INSTRUCTIONS.
   1. SEAL ALL PITTSBURGH SEAMS WITH SEALANT INJECTED INTO THE JOINT BEFORE FINAL FABRICATION.
   2. SYSTEMS SUCH AS DUCTMATE OR TRANSVERSE DUCT CONNECTOR (TDC) MAY BE USED. SEAL ALL DUCTMATE AND TRANSVERSE DUCT CONNECTOR (TDC) TYPE FLANGES TOGETHER WITH DUCTMATE SPECIFIED FDA APPROVED SEALANT.
   3. APPROVED SEALANTS
      a. 601 DUCT-SEAL
      b. DESIGN POLYMERICS
      c. APPROVED EQUAL

F. FLANGE JOINT SEAL: WHERE APPROVED GASKET TAPE SHALL BE APPLIED TO DUCT FLANGES AS RECOMMENDED BY THE MANUFACTURER FOR LIGHT GAUGE FLANGE INSTALLATIONS. FLANGES SHALL BE TIGHTENED TO THE MANUFACTURERS RECOMMENDED TORQUE RATINGS. GASKET TAPE SHALL BE A MINIMUM OF 5/8" THICK.
   1. STAINLESS STEEL DUCT SYSTEMS SHALL BE GASKETED WITH A FULL FACE GASKET MATCHED TO THE BOLT PATTERN OF THE FLANGE. THE FULL FACE GASKET SHALL BE APPLIED TO FLANGE AS RECOMMENDED BY THE MANUFACTURE. FLANGES SHALL BE TIGHTEDED TO THE MANUFACTURERS RECOMMENDED TORQUE RATINGS.

G. SEALANT COMPOSITE FIRE AND SMOKE RATINGS, WHEN TESTED IN ACCORDANCE WITH ASTM E 84, NFPA 255 OR UL 723, SHALL NOT EXCEED FLAME SPREAD OF 25 AND SMOKE DEVELOPED OF 50.

H. ALL STAINLESS STEEL JOINTS ARE TO BE WELDED OR FLANGED UNLESS NOTED OTHERWISE.

I. ALL PROCESS DUCT COMPANION ANGLES OR FLANGES SHALL BE GASKETED TO PREVENT AIR LEAKAGE.
   1. GASKETS SHALL BE PTFE AS MANUFACTURED BY GORE OR APPROVED EQUAL. GASKETS SHALL BE INSTALLED IN STRICT ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS.

2.6 FIRE STOPPING

A. FIRE-RESISTANT SEALANT: PROVIDE TWO-PART, FOAMED-IN-PLACE, FIRE-STOPPING SILICONE SEALANT OR ONE PART ELASTOMETRIC SEALANT FORMULATED FOR USE IN A THROUGH-PENETRATION FIRE-STOP SYSTEM FOR FILLING OPENINGS AROUND DUCT PENETRATIONS THROUGH WALLS AND FLOORS. FIRE STOPPING SHALL HAVE FIRE-RESISTANCE RATINGS INDICATED AS ESTABLISHED BY TESTING IDENTICAL ASSEMBLIES PER ASTM E 814 BY UNDERWRITERS LABORATORY, INC. OR OTHER TESTING AND INSPECTING AGENCY ACCEPTABLE TO AUTHORITIES HAVING JURISDICTION.

B. FIRE STOPPING DETAILS SHALL BE AS PUBLISHED BY THE PRODUCT MANUFACTURER.

C. PRODUCTS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE ONE OF THE FOLLOWING:
   1. "DOW CORNING FIRE STOP FOAM"; DOW CORNING CORP.
   2. "PENSIL 851"; GENERAL ELECTRIC CO.
   3. "DOW CORNING FIRE STOP SEALANT"; DOW CORNING CORP.
   4. "3M FIRE BARRIER CAULK CP-25"; ELECTRICAL PRODUCTS DIV./3M.
   5. "RTV 7403"; GENERAL ELECTRIC CO.
   6. "FYRE PUTTY"; STANDARD OIL ENGINEERED MATERIALS CO.

PART 3: EXECUTION

3.1 GENERAL

A. PROVIDE BALANCING DAMPERS AT POINTS OF LOW-PRESSURE SUPPLY, RETURN AND EXHAUST WHERE BRANCHES ARE TAKEN FROM LARGER DUCTS AS REQUIRED FOR AIR BALANCING. USE SPLITTER DAMPERS ONLY WHERE INDICATED.

B. PROVIDE OPENINGS IN DUCTWORK WHERE REQUIRED TO ACCOMMODATE THERMOMETERS AND CONTROLLERS. PROVIDE PITOT TUBE OPENINGS WHERE REQUIRED FOR TESTING OF SYSTEMS, COMPLETE WITH METAL CAN WITH SPRING DEVICE OR SCREW CAP TO ENSURE AGAINST AIR LEAKAGE. EXTEND TUBE TO CLEAR INSULATION.

C. DURING CONSTRUCTION PROVIDE TEMPORARY CLOSURES OF METAL OR TAPED POLYETHYLENE ON OPEN DUCTWORK TO PREVENT CONSTRUCTION DUST FROM ENTERING DUCTWORK SYSTEM.

D. SUPPORT ALL DUCTWORK WITH HANGER RODS ATTACHED TO THE STRUCTURE PER SMACNA GUIDELINES AND AS SPECIFIED IN SECTION 23 05 29.

E. ADHERE TO DRAWINGS AS CLOSELY AS POSSIBLE. IF APPROVED BY THE ENGINEER, THE RUN AND SHAPE OF DUCTS MAY VARY AND OFFSETS MAY BE MADE DURING PROGRESS OF WORK, IF REQUIRED TO MEET STRUCTURAL OR OTHER INTERFERENCE.

F. SIZES SHOWN ON THE DRAWINGS ARE INSIDE CLEAR DIMENSIONS.

G. PRIOR TO BALANCING, BLOW OUT ALL DUCTWORK WITH ALL DAMPER GRILLES, REGISTERS AND OUTLETS WIDE OPEN.
H. REFER TO SECTION 23 05 93, "TESTING, ADJUSTING AND BALANCING."
I. DO NOT OPERATE AIR SYSTEMS WITHOUT TEMPORARY (CONSTRUCTION) AIR FILTERS IN PLACE. DO NOT INSTALL PERMANENT (SPECIFIED) AIR FILTERS UNTIL SYSTEMS HAVE BEEN GIVEN FINAL ACCEPTANCE. PERMANENT FILTERS MUST BE INSTALLED FOR AIR BALANCING.

3.2 INSTALLATION LAYOUT

A. COORDINATE ALL DUCTS AND ACCESSORIES TO CLEAR ALL BEAMS, PIPES, AND CONDUIT IN ACCORDANCE WITH THE FOLLOWING:
   1. DUCT PARALLEL OR PERPENDICULAR TO BUILDING WALLS.
   2. DUCT GENERALLY PLUMB AND LEVEL AND IN A SPACE CONSERVING MANNER.
B. LOCATE DUCTS WITH SUFFICIENT SPACE AROUND EQUIPMENT TO ALLOW INSTALLATION OF INSULATION AND NORMAL OPERATING AND MAINTENANCE ACTIVITIES.
C. PROVIDE EASEMENTS WHERE DUCTWORK CONFLICTS WITH PIPING AND STRUCTURE. WHERE EASEMENTS EXCEED 10% DUCT CROSS-SECTION AREA, SPLIT INTO TWO DUCTS MAINTAINING ORIGINAL CROSS-SECTION AREA.
D. REFER TO ARCHITECTURAL DRAWINGS FOR LOCATIONS OF FULL HEIGHT PARTITIONS. MINIMUM REQUIRED OPENING IN FULL HEIGHT PARTITIONS SHALL BE CUT IN FULL HEIGHT PARTITIONS TO ALLOW DUCT TO PASS THROUGH. PENETRATIONS SHALL BE TREATED AS SHOWN ON DRAWING DETAIL.

3.3 FABRICATION

A. DUCTS SHALL BE STRAIGHT AND SMOOTH ON THE INSIDE WITH NEATLY FINISHED JOINTS, AIRTIGHT, AND SHALL BE FREE FROM VIBRATION UNDER ALL CONDITIONS OF OPERATION.
B. FABRICATE AND INSTALL DUCTS AS TO PREVENT SEAMS OR JOINTS BEING CUT FOR THE INSTALLATION OF FITTINGS, GRILLES, REGISTERS OR OUTLETS.
C. DUST SERVING PROCESS AREAS DUCT SYSTEM SHALL BE GUARANTEED TO BE COMPLETELY LEAK PROOF.
D. FLANGES, JOINTS, CRIMPS, AND HARDWARE SHALL NOT BE LOCATED IN THE AIR STREAM OF PROCESS AREA DUCTWORK.
E. AIR TURNS SHALL BE INSTALLED IN ALL ABRUPT ELBOWS AND SHALL CONSIST OF CURVED METAL BLADES OR VANES, ARRANGED TO PERMIT THE AIR TO MAKE THE TURNS WITHOUT APPRECIABLE TURBULENCE. THEY SHALL BE THE MANUFACTURER'S STANDARD PRODUCT AND SHALL BE QUIET WHEN THE SYSTEM IS IN OPERATION
F. REINFORCE ALL DUCTS TO PREVENT BUCKLING, BREATHING, VIBRATIONS OR UNNECESSARY NOISES, AS DURING START-UP, SHUTDOWN AND/OR CONTINUOUS OPERATION OF AIR HANDLING SYSTEM. REINFORCING TO BE AS RECOMMENDED IN THE LATEST ASHRAE GUIDE AND DATA BOOK AND SMACNA "DUCT MANUALS." ALL DUCTWORK SHALL BE REINFORCED USING STEEL ANGLES ATTACHED TO THE DUCTWORK BETWEEN DUCTMATE OR TRANSVERSE DUCT CONNECTOR (TDC) FLANGES. THESE ANGLES SHALL BE ATTACHED USING STAINLESS STEEL POP RIVETS BEING APPLIED FROM THE INTERIOR SO THAT A SMOOTH INTERIOR SURFACE RESULTS (HEADS IN). EVERY ANGLE SUPPORT MAY BE USED AS A DUCTWORK SUPPORT.
G. CONSTRUCT TEES, BENDS, AND ELBOWS WITH RADIUS OF NOT LESS THAN 1 ½ TIMES WIDTH OF DUCT ON CENTERLINE. WHERE RADIUS TURNS ARE NOT POSSIBLE AND WHERE RECTANGULAR ELBOWS ARE USED, PROVIDE TURNING VANES WELDED IN PLACE. (SUBMIT WELD SAMPLE, MUST BE SMOOTH, NO CRACKS OR CREVICES.)
H. INCREASE DUCT SIZES GRADUALLY, NOT EXCEEDING 15º DIVERGENCE WHEREVER POSSIBLE. CONSTRUCT WITH DIVERGENCE UPSTREAM OF EQUIPMENT NOT EXCEEDING 30º; CONVERGENCE DOWNSTREAM OF EQUIPMENT SHALL NOT EXCEED 45º.
I. PROVIDE STANDARD LO-LOSS TAKEOFFS OR STANDARD 45° LATERAL WYE TAKEOFFS UNLESS OTHERWISE INDICATED WHERE 90º CONICAL TEE CONNECTIONS MAY BE USED.
J. RECTANGULAR DUCTS:
   1. MECHANICAL (NOT WELDED) SEAMS AND JOINTS SHALL BE EXTERNAL, INTERNALLY SEALED WITH APPROVED SEALER. LONGITUDINAL SEAMS SHALL LOCATE AT THE TOP OF THE DUCT. THEY MAY BE LOCATED ON THE SIDES WITH APPROVAL FROM THE OWNER. THEY SHALL NEVER BE LOCATED ON THE BOTTOM OF THE DUCT.
   2. ELBOWS: ALL ELBOWS WITH A THROAT RADIUS LESS THAN 3/4 X WIDTH OF DUCT SHALL BE VANED. ALL VANED ELBOWS SHALL HAVE A MINIMUM THROAT RADIUS OF 6".
   3. ALL VANED ELBOWS SHALL HAVE FULL RADIUS VANES AND FULL HEEL RADIUS. LEADING EDGES SHALL BE BRACED AND STAYS SHALL BE PROVIDED AS REQUIRED BY GOOD PRACTICE (24" MAXIMUM SPACING). SQUARE ELBOWS MUST BE USED WHERE SHOWN ON DRAWINGS).

4. THE ADJUSTABLE TYPE OF TURNING VANE MUST BE INSTALLED WHENEVER INSTALLATION AT 45O ANGLE TO THE AIRSTREAM IS NOT POSSIBLE.
5. CHANGE IN SHAPE OR DIMENSION OF DUCT: IN ALL TRANSFORMATIONS, THE SLOPE OF ANY SIDE SHALL NOT EXCEED 1" TO 7" EXCEPT THAT A SLOPE OF 1" TO 4" IS ACCEPTABLE WHERE THE TRANSFORMATION RESULTS IN A DECREASE IN DUCT AREA.
6. THE ANGLE OF TRANSFORMATION AT CONNECTIONS TO COILS AND OTHER EQUIPMENT SHALL NOT EXCEED 200 ON ANY SIDE OF THE APPROACH AND 30O ON THE LEAVING SIDE. VANES MUST BE PROVIDED IF THESE REQUIREMENTS CANNOT BE MET.
7. THE DIMENSIONS OF THE DUCTS INDICATED ON THE DRAWINGS SHALL NOT BE CONSIDERED AS ABSOLUTE; HOWEVER, ANY CHANGES FROM DIMENSIONS INDICATED ARE SUBJECT TO THE OWNER'S APPROVAL. WHERE, FOR STRUCTURAL REASON, IT IS NECESSARY TO CHANGE THE SHAPE OF DUCTS, EQUIVALENT AREAS MUST BE MAINTAINED.
8. PROVIDE RESIDUE TRAPS IN EXHAUST DUCTS AT BASE OF VERTICAL RISERS WITH CLEAN OUTS.

K. ROUND DUCTS:
1. PROCESS FLANGED JOINTS SHALL BE FULLY WELDED TO DUCT.
2. NON PROCESS FLANGED JOINTS SHALL BE SEALED AND WIPED INTERNALLY WITH AN APPROVED SEALANT.
3. WELDED JOINTS SHALL BE ACCORDING TO THE SUBMITTED WELDING PROCEDURE.

L. CONNECT OFFICE AREA FLEXIBLE DUCTS TO METAL DUCTS WITH DRAW BANDS.

M. CONNECT DIFFUSERS TO LOW-PRESSURE DUCTS WITH 8' MAXIMUM LENGTH OF FLEXIBLE DUCT. HOLD IN PLACE WITH STRAP OR CLAMP. FASTEN INSULATION SEPARATELY.

3.4 ADJUSTING AND CLEANING

A. CLEAN DUCT SYSTEM AND FORCE AIR AT THROUGH DUCT TO REMOVE ACCUMULATED DUST. CLEAN HALF THE SYSTEM AT A TIME IF NECESSARY TO OBTAIN SUFFICIENT AIR VELOCITY. PROTECT EQUIPMENT THAT MAY BE HARMED BY EXCESSIVE DIRT WITH TEMPORARY FILTERS, OR BYPASS DURING CLEANING.

B. AIR OUTLETS SHALL BE COVERED WITH CLOTH FILTER MEDIA AT INITIAL START UP TO PREVENT CEILING SMUDGING. CONTRACTOR SHALL REPLACE CEILING TILES WHERE SMUDGING HAS OCCURRED.

C. DUCTWORK SHALL BE INSPECTED DURING CONSTRUCTION AND AT TIME OF TURNOVER TO OWNER. DUCTWORK SHALL BE CLEAN, FREE OF OIL, DIRT, AND METAL SHAVINGS. OPEN ENDED DUCTS SHALL BE TEMPORARILY COVERED DURING CONSTRUCTION TO PREVENT CONSTRUCTION DEBRIS FROM ENTERING THE DUCT SYSTEMS.

D. DUCTWORK SYSTEMS SHALL BE TURNED OVER TO OWNER CLEAN AND FREE OF DUCT FABRICATION LABELING, STICKERS AND MARKINGS.

3.5 PROTECTION

A. COVER OPEN ENDS OF ALL DUCT SYSTEMS DURING CONSTRUCTION WITH PLASTIC WRAP AND TAPE TO PREVENT CONSTRUCTION DUST FROM ENTERING DUCTWORK.

END OF SECTION

SECTION 23 33 00

DUCT ACCESSORIES

PART 1: GENERAL

1.1 THE WORK OF THIS SECTION SHALL INCLUDE

- A. DUCT ACCESS DOORS
- B. DUCT TEST HOLES
- C. FLEXIBLE DUCT CONNECTIONS
- D. AIR TURNING DEVICES
- E. FILTER HOUSINGS
- F. SPLITTER DAMPERS
- G. FIRE DAMPERS
- H. SMOKE DAMPERS
- I. COMBINATION DAMPERS
- J. VOLUME CONTROL DAMPERS
- K. MOTOR OPERATED DAMPERS
- L. BACKDRAFT DAMPERS
- M. LOUVERS

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. THE FOLLOWING REFERENCED SECTIONS ARE LISTED AS A MINIMUM OF ADDITIONAL REQUIREMENTS AND/OR WORK NOT INCLUDED IN THIS SECTION WHICH MAY BE REQUIRED TO BE PERFORMED UNDER OTHER DESIGNATED SECTIONS:
  1. SECTION 23 05 29 - SUPPORTS AND ANCHORS
  2. SECTION 23 07 00 - DUCTWORK INSULATION
  3. SECTION 23 31 00 - DUCTWORK
  4. SECTION 23 37 00 - AIR OUTLETS AND INLETS
  5. SECTION 23 08 93 - TESTING, ADJUSTING AND BALANCING

1.3 REFERENCES

- A. NFPA 90A INSTALLATION OF AIR CONDITIONING AND VENTILATING SYSTEMS.
- B. NFPA 92A SMOKE CONTROL SYSTEMS.
- C. NFPA 70 NATIONAL ELECTRICAL CODE.
- D. SMACNA HVAC DUCT CONSTRUCTION STANDARDS METAL AND FLEXIBLE.
- E. UL 33 HEAT RESPONSIVE LINKS FOR FIRE PROTECTION SERVICE.
- F. UL 555 FIRE DAMPERS AND CEILING DAMPERS.
- G. UL 555S LEAKAGE RATED DAMPERS FOR USE IN SMOKE CONTROL SYSTEMS.

1.4 SUBMITTALS

- A. SUBMITTALS SHALL BE PROVIDED IN CONFORMANCE WITH SECTION 23 00 01 MECHANICAL GENERAL PROVISIONS.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. PROTECT DAMPERS FROM DAMAGE TO OPERATING LINKAGES AND BLADES.

PART 2: PRODUCTS

2.1 DUCT ACCESS DOORS

- A. FABRICATED IN ACCORDANCE WITH SMACNA HVAC DUCT CONSTRUCTION STANDARDS METAL AND FLEXIBLE, AND AS INDICATED.
- B. DOORS SHALL BE RATED FOR PRESSURE APPLICATION AS DESCRIBED ON DUCTWORK SCHEDULE.
- C. ACCESS DOOR MATERIAL SHALL MATCH DUCT MATERIAL OF SYSTEM BEING INSTALLED.
  1. ACCESS DOORS INSTALLED ON INSULATED DUCT SYSTEM SHALL BE INSULATED TO SAME THICKNESS AS DUCT INSULATION.
  2. INSULATION STOP FLANGE DEPTH SHALL MATCH THE INSULATION DEPTH ON THE SYSTEM THAT THE DOOR IS INSTALLED.
- D. FABRICATION:

1. RIGID AND CLOSE-FITTING OF GALVANIZED STEEL WITH SEALING GASKETS AND QUICK FASTENING LOCKING DEVICES. FOR INSULATED DUCTWORK, INSTALL MINIMUM 1 INCH THICK INSULATION WITH SHEET METAL COVER.
2. DOOR GASKET SHALL BE PROVIDED TO PREVENT AIR LEAKAGE. NEOPRENE GASKET SHALL BE A MINIMUM OF 1/2 INCH WIDE.
3. SEAL AROUND FRAME ATTACHMENT TO DUCT AND DOOR TO FRAME WITH NEOPRENE.
4. PROVIDE A MINIMUM OF TWO PINNED HINGES, OR CONTINUOUS PIANO HINGE.
5. 8"X8" ACCESS DOORS: SECURE WITH CAM LOCKS.
6. 12"X12" ACCESS DOORS: PROVIDE HINGE AND ONE CAM LOCK FOR STANDARD PRESSURE, AND THREE CAM LOCKS FOR HIGH PRESSURE.
7. 16"X16" AND 24"X24"ACCESS DOORS: PROVIDE HINGE AND TWO CAM LOCKS FOR STANDARD PRESSURE, AND SIX CAM LOCKS FOR HIGH PRESSURE.
8. LARGER SIZES: PROVIDE AN ADDITIONAL HINGE AND LOCKS AS RECOMMENDED BY MANUFACTURER.
9. ACCESS DOORS WITH SHEET METAL SCREW OR DOVE TAIL FASTENERS ARE NOT ACCEPTABLE.
10. ACCESS DOORS SHALL BE AS FABRICATED BY KEES INCORPORATED.
    a. ACCEPTABLE MODELS – FH-IS AND FH-IS-HP OR APPROVED EQUAL

E. SIZES:
1. FOR DUCTS 26" AND LARGER ACCESS DOOR SHALL BE 24"X24"
2. FOR DUCTS 18-24" ACCESS DOOR SHALL BE 16"X16"
3. FOR DUCTS 14-16" ACCESS DOOR SHALL BE 12"X12"
4. FOR DUCTS 12" AND SMALLER – 8"X8" OR THROUGH FLANGED JOINT. FLANGED DUCTWORK SECTION TO BE 36" LONG.

2.2 DUCT TEST HOLES

A. TEMPORARY TEST HOLES: CUT OR DRILL IN DUCTS AS REQUIRED. CAP WITH NEAT PATCHES, NEOPRENE PLUGS, DRILL TEMPORARY TEST HOLES IN DUCTS AS REQUIRED. PLUG HOLES WITH RED PLASTIC, PRESS FIT PLUGS. TEST HOLES SHALL NOT EXCEED 3/8" DIA.

B. PERMANENT TEST HOLES SHALL BE FACTORY FABRICATED, AIR TIGHT FLANGED FITTINGS WITH SCREW CAP. PROVIDE EXTENDED NECK FITTINGS TO CLEAR INSULATION.
1. MANUFACTURER: VENTLOK MODEL 699

2.3 FLEXIBLE DUCT CONNECTIONS

A. FLEXIBLE DUCT CONNECTORS ARE NOT PERMITTED IN PROCESS AREAS (BELOW IMP CEILINGS).
1. FLEXIBLE CONNECTIONS ARE ACCEPTABLE ABOVE THE IMP CEILING AT UNIT AND DIFFUSER / DIFFUSER BOX CONNECTIONS.

B. FABRICATE IN ACCORDANCE WITH SMACNA HVAC DUCT CONSTRUCTION STANDARDS METAL AND FLEXIBLE, AND AS INDICATED.

C. CONNECTOR: FABRIC CRIMPED INTO METAL EDGING STRIP.
1. FABRIC: UL LISTED FIRE RETARDANT NEOPRENE COATED WOVEN GLASS FIBER FABRIC TO NFPA 90A, MINIMUM DENSITY 30 OZ PER SQ YD.
2. NET FABRIC WIDTH: APPROXIMATELY 3 INCHES WIDE COMPRESSED TO 2" UPON INSTALLATION.
3. METAL: 3 INCH WIDE, 24 GAGE GALVANIZED STEEL

2.4 AIR TURNING DEVICES:

A. MULTI BLADE DEVICE WITH BLADES ALIGNED IN SHORT DIMENSION OR WITH RADIUSED BLADES, ATTACHED TO A PIVOTING FRAME AND BRACKET OR INDIVIDUALLY ADJUSTABLE.

B. STAINLESS STEEL, GALVANIZED STEEL, OR ALUMINUM CONSTRUCTION (MATERIAL SAME AS DUCT) WITH MOUNTING STRAPS PUSH PULL OPERATOR STRAP, ROTARY OPERATOR KNOB, WORM DRIVE MECHANISM WITH 18 INCH LONG REMOVABLE KEY OPERATOR

C. SINGLE WALL VANE AS MANUFACTURED BY AERO/DYNE CO., OR APPROVED EQUAL.

2.5 FILTERS AND FILTER HOUSINGS

SECTION 23 33 00

DUCT ACCESSORIES

A. FILTERS:
   1. FILTERS SHALL BE PROVIDED ON ALL BUILDING SUPPLY AIR EQUIPMENT AND INTAKES, WHERE DESCRIBED, AND SHOWN ON DRAWINGS. FILTERS SHALL BE PROVIDED ON BUILDING HVAC EQUIPMENT RA SYSTEMS AS INDICATED ON DRAWINGS.
   2. TYPES:
      a. MERV-8 FILTERS SHALL BE 2-INCH THICK DESIGN, PLEATED, DISPOSABLE TYPE. FILTER EFFICIENCY SHALL BE NO LESS THAN MERV-8 IN ACCORDANCE WITH ASHRAE TEST METHODS. MAXIMUM VELOCITIES THROUGH THE FILTER SHALL NOT EXCEED 500 FEET PER MINUTE. THE FILTER SHALL BE CAPABLE OF WITHSTANDING UP TO 2"W.G. WITHOUT FAILURE TO MEDIA PACK. FILTER SHALL BE EQUAL TO CAMFIL FARR 30/30.
      b. MERV-14 TO 16 FILTERS SHALL BE OF 12-INCH HIGH CAPACITY V-STYLE. THE AVERAGE EFFICIENCY OF THE FILTER BANK SHALL NOT BE LESS THAN MERV-14 PER ASHRAE TEST METHODS. MAXIMUM VELOCITIES THROUGH THE FILTER SHALL NOT EXCEED 500 FEET PER MINUTE. THE FILTER SHALL BE CAPABLE OF WITHSTANDING UP TO 10"W.G. WITHOUT FAILURE TO MEDIA PACK. FILTER SHALL BE EQUAL TO CAMFIL FARR DURAFIL.
      c. ROLL MEDIA FILTER SHALL BE 1" THICK CONSTRUCTED OF 100% HIGH BULK POLYESTER SYNTHETIC FIBERS THAT ARE THERMOBONDED WITH FIRE-RETARDANT RESIN. FILTERS SHALL BE CAPABLE OF FILTERING AIR AT A MAXIMUM VELOCITY OF 500 FPM. FILTERS SHALL BE COMPATIBLE WITH VELCRO ATTACHMENT SYSTEM FILTERS SHALL BE AS MANUFACTURED BY AMERICAN AIR FILTER OR EQUAL.

B. FILTER HOUSING:
   1. 2-STAGE FILTER RACK:
      a. FILTER HOUSING USED IN SUPPLY AIR FOR HIGH CARE AREAS. THE FILTER HOUSING SHALL BE TWO-STAGE SYSTEM CONSISTING OF A MINIMUM OF 16 GAUGE STEEL (STAINLESS OR GALVANIZED) ENCLOSURE. THE HOUSING MATERIAL SHALL MATCH THE DUCT SYSTEM.
      b. FILTER HOUSING SHALL HAVE DUAL ACCESS DOORS FOR FILTER SERVICE FROM EITHER SIDE OF THE UNIT. THE DOOR GASKETS SHALL BE CLOSED CALL MATERIAL AND ENSURE THE DOORS MEET THE SYSTEMS STATIC PRESSURE REQUIREMENTS.
      c. THE FILTER RACK SEALS SHALL BE DESIGNED TO MINIMIZE LEAKAGE TO LESS THAN 0.5% OF 1% LEAKAGE.
      d. THE TRACKS SHALL BE CAPABLE OF ACCEPTING 2" DEEP MERV-8 PREFILTERS AND 12" DEEP FINAL FILTERS.
   2. V-BANK FILTER RACK:
      a. FILTER HOUSING FOR GENERAL BUILDING SUPPLY AND RETURN AIR SHALL BE SINGLE STAGE FILTER SYSTEM CONSISTING OF 16 GAUGE (STAINLESS OR GALVANIZED) ENCLOSURES. THE HOUSING MATERIAL SHALL MATCH THE DUCT SYSTEM. FILTER TRACKS SHALL BE "V-BANK" ORIENTATION.
      b. FILTER HOUSING SHALL HAVE FULL FILTER SIZE, DUAL ACCESS DOORS, FILTER SEALING GASKET, AND DOOR SEALS.
      c. FILTER TRACK SHALL HAVE 1"X1" GALVANIZED MESH SCREEN SECURED TO TRACK TO PREVENT THE FILTER MEDIA FROM DROPPING OUT OF, OR BEING DRAWN THRU FILTER HOUSING.
         1) MESH SCREEN SHALL BE PROVIDED AND INSTALLED BY CONTRACTOR IF NOT STANDARD TO FILTER HOUSING.
      d. VELOCITY WITHIN FILTER HOUSING SHALL NOT EXCEED 500 FPM.
      e. FILTER HOUSING SHALL BE LESS THAN 1% AT 3"W.G.

f. FILTER HOUSING SHALL BE AS MANUFACTURED BY CAMFIL FARR OR EQUAL.

2.6 DAMPERS

A. DAMPER ACCESS HOLES:
1. SUITABLE OPENINGS WITH TIGHTLY FITTED COVERS SHALL BE PROVIDED TO MAKE DAMPERS ACCESSIBLE FOR INSPECTION AND MAINTENANCE
2. SHALL BE IN ACCORDANCE WITH “DUCT ACCESS DOORS” HEREIN.

B. FIRE DAMPERS:
1. DAMPERS SHALL BE SIZED SO THAT THE FREE AIR SPACE IS NOT LESS THAN THE CONNECTED DUCT FREE AIR SPACE.
2. LOCATION SHALL BE AS REQUIRED BY GOVERNING CODE.
3. CONSTRUCTION:
a. FABRICATE IN ACCORDANCE WITH NFPA 90A,UL, AND UL 5531, AND AS INDICATED.
b. THEY SHALL POSSES A MINIMUM OF 1-1/2 HOUR STANDARD FIRE PROTECTION RATING OR AS NOTED ON DRAWINGS FOR 3-HOUR RATED DAMPERS.
1) REFER TO ARCHITECTURAL DRAWINGS FOR WALL RATINGS.
c. ALL DAMPERS SHALL CARRY NBFU SEAL.
d. DAMPERS MADE UP BY THE CONTRACTOR WILL NOT BE ACCEPTED.
4. HORIZONTAL DAMPERS: GALVANIZED STEEL, 22 GAGE FRAME, STAINLESS STEEL CLOSURE SPRING, AND LIGHTWEIGHT, HEAT RETARDANT NON ASBESTOS FABRIC BLANKET.
5. CURTAIN TYPE DAMPERS: GALVANIZED STEEL WITH INTERLOCKING BLADES. PROVIDE STAINLESS STEEL CLOSURE SPRINGS AND LATCHES FOR CLOSURE UNDER AIR FLOW CONDITIONS. CONFIGURE WITH BLADES OUT OF AIR STREAM EXCEPT FOR 1.0 INCH PRESSURE CLASS DUCTS UP TO 12 INCHES IN HEIGHT.
6. MULTIPLE BLADE DAMPERS: 16 GAGE GALVANIZED STEEL FRAME AND BLADES, OIL IMPREGNATED BRONZE OR STAINLESS STEEL SLEEVE BEARINGS AND PLATED STEEL AXLES, 1/8 X 1/2 INCH PLATED STEEL CONCEALED LINKAGE, STAINLESS STEEL CLOSURE SPRING, BLADE STOPS, AND LOCK.
7. FUSIBLE LINKS:
a. FIRE DAMPERS SHALL BE ARRANGED TO CLOSE AUTOMATICALLY AND REMAIN TIGHTLY CLOSED UPON THE OPERATION OF AN APPROVED FUSIBLE LINK OR OTHER APPROVED HEAT ACTUATED DEVICE, LOCATED WHERE READILY AFFECTED BY AN ABNORMAL RISE OF TEMPERATURE IN THE DUCT.
b. FUSIBLE LINKS SHALL HAVE A TEMPERATURE RATING OF AT LEAST 212 OF OR APPROXIMATELY 50OF ABOVE THE MAXIMUM TEMPERATURE THAT WOULD NORMALLY BE ENCOUNTERED WHEN THE SYSTEM IS IN OPERATION OR SHUT DOWN.
c. PROVIDE ADJUSTABLE LINK STRAPS FOR COMBINATION FIRE/BALANCING DAMPERS.
8. MANUFACTURERS:
a. DUCT MOUNTED FIRE DAMPERS SHALL UL LISTED RUSKIN MODEL IBD2 OR IB23 OR APPROVED EQUAL

C. SMOKE DAMPERS:
1. NORMALLY CLOSED SMOKE VENT DAMPERS:
a. CURTAIN TYPE, OPENING BY GRAVITY UPON ACTUATION OF ELECTRO THERMAL LINK, FLEXIBLE STAINLESS STEEL BLADE EDGE SEALS TO PROVIDE CONSTANT SEALING PRESSURE.
2. NORMALLY OPEN SMOKE DAMPER:
a. CURTAIN TYPE, CLOSING UPON ACTUATION OF ELECTRO THERMAL LINK, FLEXIBLE STAINLESS STEEL BLADE EDGE SEALS TO PROVIDE CONSTANT

SEALING PRESSURE, STAINLESS STEEL SPRINGS WITH LOCKING DEVICES ENSURE POSITIVE CLOSURE FOR UNITS MOUNTED HORIZONTALLY.

3. MOTORIZED SMOKE DAMPERS:
    a. CURTAIN TYPE, NORMALLY OPEN WITH POWER ON, CLOSE AUTOMATICALLY WHEN POWER IS INTERRUPTED, UL LISTED AND LABELED DAMPER AND DAMPER OPERATOR.
    b. ELECTRO THERMAL LINK: A FUSIBLE LINK WHICH OPERATES SIMILAR TO A FUSE LINK (ABOVE} AND FROM AN EXTERNAL IMPULSE ELECTRICAL IMPULSE, UL LISTED AND LABELED.
    c. OPERATORS SHALL BE SPRING RETURN ELECTRIC TYPE SUITABLE TO OPERATE ON 120 V AC, 60 CYCLE. OPERATORS SHALL BE UL LISTED AND LABELED. PROVIDE END SWITCHES TO INDICATE DAMPER POSITION.

D. COMBINATION FIRE AND SMOKE DAMPERS:
    1. PROVIDE FACTORY SLEEVE FOR EACH DAMPER. INSTALL DAMPER OPERATOR ON EXTERIOR OF SLEEVE AND LINK TO DAMPER OPERATING SHAFT.
    2. PROVIDE WITH MULTIPLE BLADES WITH 16 GAGE MINIMUM GALVANIZED STEEL FRAME AND BLADES, OIL IMPREGNATED BRONZE OR STAINLESS STEEL SLEEVE BEARINGS AND PLATED STEEL AXLES, STAINLESS STEEL JAMB SEALS, 1/8 X 1/2 INCH PLATED STEEL CONCEALED LINKAGE, STAINLESS STEEL CLOSURE SPRING, BLADE STOPS, AND LOCK, AND 1/2 INCH ACTUATOR SHAFT.
    3. OPERATORS SHALL BE SPRING RETURN ELECTRIC TYPE SUITABLE TO OPERATE ON 120 V AC, 60 CYCLE. OPERATORS SHALL BE UL LISTED AND LABELED. PROVIDE END SWITCHES TO INDICATE DAMPER POSITION.

E. BACKDRAFT DAMPERS.
    1. MULTI BLADE, PARALLEL ACTION GRAVITY BALANCED BACKDRAFT DAMPERS: 16 GAGE THICK GALVANIZED STEEL, WITH BLADES OF MAXIMUM 6 INCH WIDTH, WITH FLEXIBLE VINYL SEALED EDGES, LINKED TOGETHER IN RATTLE FREE MANNER WITH 90 DEGREE STOP, STEEL BALL BEARINGS, AND PLATED STEEL PIVOT PIN; ADJUSTMENT DEVICE TO PERMIT SETTING FOR VARYING DIFFERENTIAL STATIC PRESSURE.

F. MOTOR OPERATED DAMPERS:
    1. TYPE: THE AUTOMATIC DAMPERS SHALL BE OF THE OPPOSED BLADE, 100 PERCENT SHUTOFF TYPE, SUITABLE FOR THE STATIC PRESSURES SHOWN ON THE DRAWINGS. SPLITTER DAMPERS SHALL BE OF A STREAMLINED SHAPE.
    2. FRAME: FRAME SHALL BE A MINIMUM OF 14 GAUGE, MATCHING THE DUCT MATERIAL, AND SHALL BE PROVIDED WITH MOUNTING HOLES. THE FRAME SHALL BE ROLL FORMED, INTERLOCKED, AND WELDED AT CORNERS. THE FRAME SHALL BE A MINIMUM OF 4 INCHES IN WIDTH.
    3. BLADES: BLADES SHALL BE CONSTRUCTED OF 16 GAUGE ROLL FORMED, MATCHING DUCT MATERIAL, NOT TO EXCEED 6 INCHES IN DEPTH AND SHALL BE FORMED WITH DOUBLE 90 DEGREES BENDS TO INSURE POSITIVE AIR LOCK AND MAXIMUM STRENGTH. BLADES SHALL BE VINYL TIPPED TO INSURE TIGHT CLOSURE AND NOISELESS OPERATION.
    4. SECTIONS: DAMPER AND DAMPER FRAME MAY BE MADE IN ONE SECTION UP TO 48 INCHES IN WIDTH AND 96 INCHES IN HEIGHT. LARGER SIZES SHALL BE MADE IN SECTIONS.
    5. LINKAGE: THE DAMPER SHALL HAVE DUAL BLADE LINKAGE CONCEALED IN THE JAMBS AND CONNECTED WITH STEEL RODS. THE BLADES SHALL ROTATE ON 7/16 DIAMETER PIVOT ASSEMBLY IN PERMANENTLY LUBRICATED OILLITE BEARINGS. BLADES SHALL BE CAPABLE OF OPENING TO A FULL 90 DEGREES AND LINKAGE SHALL INCORPORATE POSITIVE 90 DEGREE OPENING STOP. OPERATION SHAFT SHALL BE SUITABLE FOR

MOTOR OPERATION. ON INSULATED DUCTS MOUNT QUADRANT REGULATORS ON STANDOFF MOUNTING BRACKETS, BASES, OR ADAPTERS.

6. PRESSURE DROP: PRESSURE DROP THROUGH THE DAMPER SHALL NOT EXCEED 0.02 INCHES WG AT 500 FEET PER MINUTE VELOCITY BASED ON THE FACE AREA.
7. FINAL ADJUSTMENT: AFTER INSTALLATION, THE LINKAGE OF THE AUTOMATIC DAMPER SHALL BE ADJUSTED TO THE AIR FLOW QUANTITIES SHOWN ON THE DRAWINGS.
8. CLEANING: THE DAMPERS AND LINKAGE SHALL BE CLEANED OF ALL CONSTRUCTION DIRT. ANY DEBRIS OR DIRT THAT COULD CAUSE BINDING SHALL BE THOROUGHLY REMOVED.
9. MANUFACTURER:
    a. THE DAMPER, DAMPER FRAME AND LINKAGE SHALL BE A SINGLE COMPLETE PRODUCT OF A MANUFACTURER REGULARLY ENGAGED IN THE PRODUCTION OF HIGH QUALITY DAMPERS.
    b. MOTOR OPERATED DAMPERS SHALL BE AS MANUFACTURED BY RUSKIN MODEL CD80, OR APPROVED EQUAL.

G. MANUAL VOLUME CONTROL DAMPERS:
1. FABRICATE IN ACCORDANCE WITH SMACNA HVAC DUCT CONSTRUCTION STANDARDS METAL AND FLEXIBLE, AND AS INDICATED.
2. MULTI BLADE DAMPER: FABRICATE OF OPPOSED BLADE PATTERN WITH MAXIMUM BLADE SIZES 8 X 72 INCH. ASSEMBLE CENTER AND EDGE CRIMPED BLADES IN PRIME COATED OR GALVANIZED CHANNEL FRAME WITH SUITABLE HARDWARE.
3. END BEARINGS: EXCEPT IN ROUND DUCTWORK 12 INCHES AND SMALLER, PROVIDE END BEARINGS. ON MULTIPLE BLADE DAMPERS, PROVIDE OIL IMPREGNATED NYLON OR SINTERED BRONZE BEARINGS.
4. QUADRANTS:
    a. PROVIDE LOCKING, INDICATING QUADRANT REGULATORS ON SINGLE AND MULTI BLADE DAMPERS.
    b. ON INSULATED DUCTS MOUNT QUADRANT REGULATORS ON STAND OFF MOUNTING BRACKETS, BASES, OR ADAPTERS.
    c. WHERE ROD LENGTHS EXCEED 30 INCHES PROVIDE REGULATOR AT BOTH ENDS.

2.7 LOUVERS

A. LOUVERS SHALL BE DRAINABLE STATIONARY TYPE CONTAINED WITH IN A SINGLE FRAME.
B. LOUVER FRAME AND BLADES SHALL BE CONSTRUCTED OF 6063-T5 EXTRUDED ALUMINUM ALLOY.
C. LOUVER FRAMES SHALL HAVE FRONT FLANGE TO COMPLETELY COVER MASONRY OPENING.
D. BLADES SHALL BE SUPPORTED WITH HIDDEN MULLIONS FOR A CONTINUOUS EXTERIOR APPEARANCE. BLADE ANGLE SHALL BE 37.5º. BLADES SHALL HAVE INTEGRAL DRAIN TO DIRECT WATER TO DOWN DRAIN AT FRAME.
E. LOUVER SHALL BE DESIGNED FOR A 20 POUND PER SQUARE FOOT WIND LOAD.
F. LOUVER SHALL NOT HAVE WATER PENETRATION WITH A FREE AREA AIR VELOCITY OF 870 FEET PER MINUTE.
G. LOUVER PERFORMANCE SHALL BE TESTED PER AMCA STANDARD 500-L.
H. LOUVER FREE AREA SHALL NOT BE LESS THAT 54%.
I. LOUVER SHALL BE PROVIDED WITH AN INTERIOR INSECT SCREEN, 18 MESH.
J. LOUVER SHALL HAVE A CLEAR ANODIZED FINISH.
K. LOUVER SHALL BE AS MANUFACTURED BY RUSKIN MODEL ELF375DX OR EQUAL.

2.8 LOUVERS (WIND DRIVEN)

A. LOUVERS SHALL BE WIND DRIVEN RAIN, DRAINABLE STATIONARY TYPE CONTAINED WITH IN A SINGLE FRAME.
B. LOUVER FRAME AND BLADES SHALL BE CONSTRUCTED OF 0.81” THICK 6063-T5 EXTRUDED ALUMINUM ALLOY.

C. LOUVER FRAMES SHALL HAVE FRONT FLANGE TO COMPLETELY COVER MASONRY OR IMP OPENING.
D. BLADES SHALL BE SUPPORTED WITH HIDDEN MULLIONS FOR A CONTINUOUS EXTERIOR APPEARANCE. BLADE SHALL BE OF THE VERTICAL BLADE DESIGN. BLADES SHALL HAVE INTEGRAL DRAIN TO DIRECT WATER TO DOWN DRAIN AT FRAME.
E. LOUVER SHALL BE DESIGNED FOR A 50 MPH WIND LOAD VELOCITY AND UP TO 8"/HR OF RAIN FALL.
F. LOUVER SHALL NOT HAVE WATER PENETRATION WITH A FREE AREA AIR VELOCITY OF 870 FEET PER MINUTE.
G. LOUVER PERFORMANCE SHALL BE TESTED PER MIAMI-DADE COUNTY PA-100(A).
H. LOUVER FREE AREA SHALL NOT BE LESS THAT 47%.
I. LOUVER SHALL BE PROVIDED WITH AN EXTERIOR INSECT SCREEN, 18 MESH.
    1. MESH SHALL BE REMOVABLE FOR PERIODIC CLEANING. REMOVABLE MESH SCREEN SHALL BE DESIGNED AND PROVIDED BY CONTRACTOR WHEN NOT AVAILABLE THROUGH LOUVER MANUFACTURER.
J. LOUVER SHALL HAVE A CLEAR ANODIZED FINISH.
K. LOUVER SHALL BE AS MANUFACTURED BY SAFE-AIR DOWCO MODEL WDL-04 OR EQUAL

2.9 LOUVERS (STAINLESS STEEL)

A. LOUVERS SHALL BE DRAINABLE STATIONARY TYPE CONTAINED WITHIN A SINGLE FRAME.
B. LOUVER FRAME AND BLADES SHALL BE CONSTRUCTED OF FORMED STAINLESS STEEL WITH 16 GAUGE FRAME AND BLADES.
C. LOUVER FRAMES SHALL HAVE FRONT FLANGE TO COMPLETELY COVER MASONRY, PRECAST OR IMP OPENING.
D. BLADES SHALL BE SUPPORTED WITH HIDDEN MULLIONS FOR A CONTINUOUS EXTERIOR APPEARANCE. BLADE ANGLE SHALL BE 37.5º. BLADES SHALL HAVE INTEGRAL DRAIN TO DIRECT WATER TO DOWN DRAIN AT FRAME.
E. LOUVER SHALL BE DESIGNED FOR A 20 POUND PER SQUARE FOOT WIND LOAD.
F. LOUVER SHALL NOT HAVE WATER PENETRATION WITH A FREE AREA AIR VELOCITY OF 800 FEET PER MINUTE.
G. LOUVER PERFORMANCE SHALL BE TESTED PER AMCA STANDARD 511.
H. LOUVER FREE AREA SHALL NOT BE LESS THAT 54%.
I. LOUVER SHALL BE AS MANUFACTURED BY RUSKIN MODEL L6375D-SS OR EQUAL.

PART 3: EXECUTION

3.1 PREPARATION

A. VERIFY THAT ELECTRIC POWER IS AVAILABLE AND OF THE CORRECT CHARACTERISTICS.
B. CONTRACTOR SHALL PROVIDE REQUIRED TRANSFORMER FOR PROPER OPERATING ELECTRICAL POWER.

3.2 GENERAL

A. INSTALL ACCESSORIES IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS, NFPA 90A, AND FOLLOW SMACNA HVAC DUCT CONSTRUCTION STANDARDS METAL AND FLEXIBLE. REFER TO SECTION 15810 FOR DUCT CONSTRUCTION AND PRESSURE CLASS.
B. SET PLENUM DOORS 12 INCHES MINIMUM ABOVE FLOOR. ARRANGE DOOR SWINGS SO THAT FAN STATIC PRESSURE HOLDS DOOR IN CLOSED POSITION.
C. VERTICAL RISER DUCTS SHALL BE SUPPORTED AT THE FLOOR LINE WITH STEEL ANGLES TO THE FLOOR CONSTRUCTION. HANGING DUCTS FROM OTHER PIPES OR DUCTS WILL NOT BE PERMITTED. DUCT SUPPORTS SHALL BE IN ACCORDANCE WITH THE SMACNA MANUALS.
D. ACCESS DOOR SHALL BE INSTALLED WITHIN 12" OF IMP CEILING CONNECTION FOR INSPECTION, CLEANING AND ADJUSTMENT OF SURFACE MOUNTED CEILING DIFFUSERS AND GRILLES.

3.3 ACCESS DOORS

A. PROVIDE DUCT ACCESS DOORS FOR INSPECTION AND CLEANING BEFORE AND AFTER FILTERS, COILS, FANS, AUTOMATIC DAMPERS, AT FIRE DAMPERS, COMBINATION FIRE AND SMOKE

DAMPERS, AND ELSEWHERE AS INDICATED. PROVIDE MINIMUM 8 X 8 INCH SIZE FOR HAND ACCESS, AND AS INDICATED FOR LARGER DUCT INSPECTION.

B. WHERE OPENINGS ARE PROVIDED IN INSULATED DUCTWORK, INSTALL INSULATION MATERIAL INSIDE A METAL RING.

C. ACCESS DOORS SHALL BE INSTALLED AT MINIMUM OF 20' INTERVALS, MINIMUM OF (1) ACCESS DOOR PER PIECE OF EQUIPMENT, AT ALL SMOKE DETECTOR LOCATIONS, AND AS INDICATED ON DRAWINGS.

3.4 DUCT TEST AND ACCESS HOLES

A. PROVIDE OPENINGS IN DUCTWORK WHERE REQUIRED TO ACCOMMODATE THERMOMETERS AND CONTROLLERS. PROVIDE PITOT TUBE OPENINGS WHERE REQUIRED FOR TESTING OF SYSTEMS, COMPLETE WITH METAL COVER PLATE WITH SPRING DEVICE OR SCREW TO ENSURE AGAINST AIR LEAKAGE.

B. PROVIDE DUCT TEST HOLES WHERE INDICATED AND REQUIRED FOR TESTING AND BALANCING PURPOSES.

3.5 FLEXIBLE CONNECTORS

A. FLEXIBLE DUCT CONNECTORS ARE NOT PERMITTED IN PROCESS AREAS BELOW IMP CEILINGS.

B. PROVIDE FLEXIBLE CONNECTIONS IMMEDIATELY ADJACENT TO EQUIPMENT IN DUCTS ASSOCIATED WITH FANS AND MOTORIZED EQUIPMENT

C. PROVIDE FLEXIBLE CONNECTION AT AIR INLET AND OUTLET MOUNTED ON INSULATED PANEL CEILING.

3.6 FIRE, SMOKE AND COMBINATION DAMPERS

A. PROVIDE FIRE DAMPERS, COMBINATION FIRE AND SMOKE DAMPERS, AND SMOKE DAMPERS AT LOCATIONS INDICATED, WHERE DUCTS AND OUTLETS PASS THROUGH FIRE RATED COMPONENTS AND WHERE REQUIRED BY AUTHORITIES HAVING JURISDICTION. INSTALL WITH REQUIRED PERIMETER MOUNTING ANGLES, SLEEVES, BREAKAWAY DUCT CONNECTIONS, CORROSION RESISTANT SPRINGS, BEARINGS, BUSHINGS AND HINGES. PROVIDE AN ACCESS DOOR OR PANEL COMPLETE WITH EASY ACCESS TO THE FUSIBLE LINK.

B. DEMONSTRATE RESETTING OF FIRE DAMPERS TO AUTHORITIES HAVING JURISDICTION AND OWNER'S REPRESENTATIVE.

3.7 VOLUME CONTROL AND OTHER DAMPERS

A. PROVIDE BALANCING DAMPERS AT POINTS ON SUPPLY, RETURN, AND EXHAUST SYSTEMS WHERE BRANCHES ARE TAKEN FROM LARGER DUCTS AS REQUIRED FOR AIR BALANCING. USE SPLITTER DAMPERS ONLY WHERE INDICATED.

B. PROVIDE BALANCING DAMPERS ON DUCT TAKE OFF TO DIFFUSERS, GRILLES, AND REGISTERS, REGARDLESS OF WHETHER DAMPERS ARE SPECIFIED AS PART OF THE DIFFUSER, GRILLE, OR REGISTER ASSEMBLY. DAMPERS SHALL BE PROVIDED AS NECESSARY FOR BALANCING EVEN WHEN NOT SPECIFICALLY SHOWN ON THE DRAWINGS.

1. INSTALL BALANCING DAMPERS SO THE DAMPER POSITION HANDLE IS ACCESSIBLE FOR TAB. PROVIDE DAMPER AT LOCATION CLOSEST TO DIFFUSER OR AS SHOWN ON DRAWING.

C. PROVIDE BACKDRAFT DAMPERS ON EXHAUST FANS OR EXHAUST DUCTS NEAREST TO OUTSIDE AND WHERE INDICATED.

3.8 MOTOR OPERATED DAMPERS

A. PROVIDE MOTOR OPERATED DAMPERS ON INTERIOR SIDE OF LOUVERS.

B. WHERE REQUIRED DAMPER AREAS MAY BE CONSTRUCTED OF MULTIPLE DAMPERS. PROVIDE JACK SHAFT AND/OR LINKAGES TO OPERATE SPECIFIED AREA IN UNISON. MULTIPLE SECTIONS SHALL BE ASSEMBLED PER MANUFACTURER'S INSTRUCTIONS.

C. DAMPER WEIGHT SHALL BE SUPPORTED FROM POST AT FLOOR.

3.9 LOUVERS

A. LOUVER SHALL BE INSTALLED PER MANUFACTURER'S INSTALLATION INSTRUCTIONS. MOUNTING HARDWARE SHALL BE RECOMMENDED BY MANUFACTURER.

B. FRAME SHALL BE CAULKED WATER TIGHT.

C. CONTRACTOR SHALL FIELD VERIFY MASONRY OPENING DIMENSIONS TO ENSURE PROPER LOUVER SIZING.

END OF SECTION

SECTION 23 34 00

FANS

PART 1: GENERAL

1.1 THE WORK OF THIS SECTION SHALL INCLUDE PROVISIONS FOR THE FOLLOWING

A. ROOF MOUNTED CENTRIFUGAL EXHAUST FANS
B. KITCHEN EXHAUST FANS
C. ROOF MOUNTED HOODED SUPPLY FANS
D. ROOF MOUNTED TUBULAR SUPPLY FANS
E. CIRCULATION FANS
F. ROOF GRAVITY VENTILATORS.
G. ROOF CURBS FOR FANS AND HOOD
H. IN-LINE FANS.
I. INTEGRAL DISCONNECTS; FACTORY WIRED, EXTERNALLY MOUNTED AND LOCKABLE

1.2 RELATED WORK

A. SECTION 23 00 01 – MECHANICAL GENERAL PROVISIONS.
B. SECTION 23 05 48 – VIBRATION, SEISMIC AND SOUND CONTROL.
C. SECTION 23 31 00 – DUCTWORK.
D. SECTION 23 33 00 - DUCTWORK ACCESSORIES.

1.3 REFERENCES

A. ABMA STD 9 (AMERICAN BOILER MANUFACTURERS ASSOCIATION) - LOAD RATINGS AND FATIGUE LIFE FOR BALL BEARINGS.
B. ABMA STD 11 (AMERICAN BOILER MANUFACTURERS ASSOCIATION) - LOAD RATINGS AND FATIGUE LIFE FOR ROLLER BEARINGS.
C. AMCA 99 (AIR MOVEMENT AND CONTROL ASSOCIATION) - STANDARDS HANDBOOK.
D. AMCA 210 (AIR MOVEMENT AND CONTROL ASSOCIATION) - LABORATORY METHODS OF TESTING FANS FOR RATING.
E. AMCA 300 (AIR MOVEMENT AND CONTROL ASSOCIATION) - REVERBERANT ROOM METHOD FOR SOUND TESTING OF FANS.
F. AMCA 301 (AIR MOVEMENT AND CONTROL ASSOCIATION) - METHODS FOR CALCULATING FAN SOUND RATINGS FROM LABORATORY TEST DATA.
G. NEMA MG1 (NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION) - MOTORS AND GENERATORS.
H. NFPA 70 - NATIONAL ELECTRICAL CODE.
I. SMACNA - HVAC DUCT CONSTRUCTION STANDARDS - METAL AND FLEXIBLE.
J. UL 705 (UNDERWRITERS LABORATORIES, INC.) - POWER VENTILATORS.

1.4 SUBMITTALS

A. SUBMITTALS SHALL BE PROVIDED IN CONFORMANCE WITH SECTION 23 00 01 MECHANICAL GENERAL PROVISIONS.
B. SUBMIT ROOF CURB SHOP DRAWINGS TWO WEEKS AFTER RECEIPT OF PURCHASE ORDER FROM CONTRACTOR.
C. SHOP DRAWINGS: INDICATE ASSEMBLY OF CENTRIFUGAL FANS AND ACCESSORIES INCLUDING FAN CURVES WITH SPECIFIED OPERATING POINT CLEARLY PLOTTED, SOUND POWER LEVELS FOR BOTH FAN INLET AND OUTLET AT RATED CAPACITY, AND ELECTRICAL CHARACTERISTICS AND CONNECTION REQUIREMENTS.
D. PRODUCT DATA: PROVIDE DATA ON CENTRIFUGAL FANS AND ACCESSORIES INCLUDING FAN CURVES WITH SPECIFIED OPERATING POINT CLEARLY PLOTTED, SOUND POWER LEVELS FOR BOTH FAN INLET AND OUTLET AT RATED CAPACITY, AND ELECTRICAL CHARACTERISTICS AND CONNECTION REQUIREMENTS.
E. MANUFACTURER'S INSTALLATION INSTRUCTIONS.

1.5 OPERATION AND MAINTENANCE DATA

A. SUBMIT UNDER PROVISIONS OF SECTION 01700.
B. MAINTENANCE DATA: INCLUDE INSTRUCTIONS FOR LUBRICATION, MOTOR AND DRIVE REPLACEMENT, SPARE PARTS LIST, AND WIRING DIAGRAMS.

1.6 DELIVERY, STORAGE, AND HANDLING

A. DELIVER, STORE, PROTECT AND HANDLE PRODUCTS TO SITE UNDER PROVISIONS OF SECTION 01600.

B. PROTECT MOTORS, SHAFTS, AND BEARINGS FROM WEATHER AND CONSTRUCTION DUST.

1.7 ENVIRONMENTAL REQUIREMENTS

A. DO NOT OPERATE FANS FOR ANY PURPOSE UNTIL DUCTWORK IS CLEAN, FILTERS IN PLACE, BEARINGS LUBRICATED, AND FAN HAS BEEN TEST RUN UNDER OBSERVATION.

1.8 EXTRA MATERIALS

A. SUBMIT UNDER PROVISIONS OF SECTION 01700.

B. PROVIDE ONE SET OF BELTS FOR EACH FAN.

1.9 WARRANTY

A. FURNISH PER SECTION 01700 - CONTRACT CLOSEOUT AND SECTION 01740 - WARRANTIES AND BONDS.

B. PROVIDE A ONE-YEAR FULL PARTS REPLACEMENT WARRANTY TO INCLUDE COVERAGE FROM TIME OF OWNER'S ACCEPTANCE (NOT SHIPMENT DATE).

PART 2: PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. LOREN COOK COMPANY

B. GREENHECK

C. ENGINEER APPROVED EQUAL

2.2 ROOF EXHAUST FANS (UP-BLAST AND DOWN-BLAST)

A. DESCRIPTION: FAN SHALL BE A SPUN ALUMINUM, ROOF MOUNTED, BELT DRIVEN, DOWN-BLAST OR UP-BLAST (AS SCHEDULED) CENTRIFUGAL EXHAUST VENTILATOR.

B. PRODUCT REQUIREMENTS:

1. PERFORMANCE RATINGS: CONFORM TO AMCA 210 AND BEAR THE AMCA CERTIFIED RATING SEAL.
2. SOUND RATINGS: AMCA 301, TESTED TO AMCA 300, AND BEAR AMCA CERTIFIED SOUND RATING SEAL.
3. FABRICATION: CONFORM TO AMCA 99.
4. UL COMPLIANCE: UL LISTED AND LABELED, DESIGNED, MANUFACTURED, AND TESTED IN ACCORDANCE WITH UL 705.

C. CONSTRUCTION:

1. THE FAN SHALL BE OF BOLTED AND WELDED CONSTRUCTION UTILIZING CORROSION RESISTANT FASTENERS. THE SPUN ALUMINUM STRUCTURAL COMPONENTS SHALL BE CONSTRUCTED OF MINIMUM 16 GAUGE MARINE ALLOY ALUMINUM, BOLTED TO A RIGID ALUMINUM SUPPORT STRUCTURE. THE ALUMINUM BASE SHALL HAVE CONTINUOUSLY WELDED CURB CAP CORNERS FOR MAXIMUM LEAK PROTECTION. THE DISCHARGE BAFFLE SHALL HAVE A ROLLED BEAD FOR ADDED STRENGTH. A TWO PIECE TOP CAP SHALL HAVE STAINLESS STEEL QUICK RELEASE LATCHES TO PROVIDE ACCESS INTO THE MOTOR COMPARTMENT WITHOUT THE USE OF TOOLS. AN INTEGRAL CONDUIT CHASE SHALL BE PROVIDED THROUGH THE CURB CAP AND INTO THE MOTOR COMPARTMENT TO FACILITATE WIRING CONNECTIONS. THE MOTOR, BEARINGS AND DRIVES SHALL BE MOUNTED ON A MINIMUM 14 GAUGE STEEL POWER ASSEMBLY, ISOLATED FROM THE UNIT STRUCTURE WITH RUBBER VIBRATION ISOLATORS. THESE COMPONENTS SHALL BE ENCLOSED IN A WEATHER-TIGHT COMPARTMENT, SEPARATED FROM THE EXHAUST AIRSTREAM. PROVIDE WITH INTEGRAL BIRD SCREEN. LIFTING LUGS SHALL BE PROVIDED TO HELP PREVENT DAMAGE FROM IMPROPER LIFTING. UNIT SHALL BEAR AN ENGRAVED ALUMINUM NAMEPLATE AND SHALL BE SHIPPED IN ISTA CERTIFIED TRANSIT TESTED PACKAGING.
2. FANS SHALL BE SPARK RESISTANT CONSTRUCTION WHERE SCHEDULED ON THE DRAWINGS.

3. FANS SHALL BE EPOXY COATED WHERE SCHEDULED ON THE DRAWINGS.

D. WHEEL:
   1. WHEEL SHALL BE CENTRIFUGAL BACKWARD INCLINED, CONSTRUCTED OF 100 PERCENT ALUMINUM, INCLUDING A PRECISION MACHINED CAST ALUMINUM HUB. WHEEL INLET SHALL OVERLAP AN AERODYNAMIC ALUMINUM INLET CONE TO PROVIDE MAXIMUM PERFORMANCE AND EFFICIENCY. WHEEL SHALL BE BALANCED IN ACCORDANCE WITH AMCA STANDARD 204-96, BALANCE QUALITY AND VIBRATION LEVELS FOR FANS.

E. MOTOR:
   1. MOTOR SHALL BE HEAVY DUTY TYPE WITH PERMANENTLY LUBRICATED SEALED BALL BEARINGS. TOTALLY ENCLOSED FAN COOLED (TEFC) WHERE IN AIR STREAM, OPEN DRIP PROOF (ODP) WHERE IN SEPARATE HOUSING.
   2. FANS SHALL HAVE EXPLOSION PROOF MOTORS WHERE SCHEDULED ON THE DRAWINGS.
   3. FANS SHALL HAVE INVERTER DUTY MOTORS FOR USE WITH VFD'S WHERE SCHEDULED ON THE DRAWINGS.
   4. MOTOR SHALL BE CAPABLE OF OPERATING IN TEMPERATURES OF UP TO 180ºF.

F. BEARINGS:
   1. BEARINGS SHALL BE DESIGNED AND INDIVIDUALLY TESTED SPECIFICALLY FOR USE IN AIR HANDLING APPLICATIONS. CONSTRUCTION SHALL BE HEAVY DUTY REGREASABLE BALL TYPE IN A CAST IRON PILLOW BLOCK HOUSING SELECTED FOR A MINIMUM L50 LIFE IN EXCESS OF 200,000 HOURS AT MAXIMUM CATALOGED OPERATING SPEED.

G. BELTS AND DRIVES:
   1. BELTS SHALL BE OIL AND HEAT RESISTANT, NON-STATIC TYPE. DRIVES SHALL BE PRECISION MACHINED CAST IRON TYPE, KEYED AND SECURELY ATTACHED TO THE WHEEL AND MOTOR SHAFTS. DRIVES SHALL BE SIZED FOR 150 PERCENT OF THE INSTALLED MOTOR HORSEPOWER. THE VARIABLE PITCH MOTOR DRIVE MUST BE FACTORY SET TO THE SPECIFIED FAN RPM.

H. ACCESSORIES
   1. ROOF CURB: 24 INCH HIGH. GALVANIZED STEEL WITH CONTINUOUSLY WELDED SEAMS, BUILT-IN CANT STRIPS, 1-1/2 INCH CLOSED CELL INSULATION AND CURB BOTTOM, AND FACTORY INSTALLED PLASTIC WOOD NAILER STRIP. CURB SHALL BE INTERNALLY LINED WITH GALVANIZED SHEET METAL. ROOF CURBS WITH ANY SIDE GREATER THAN 24" LONG SHALL BE SLOPED TO MATCH THE ROOF SLOPE. ROOF CURB SHALL BE DOUBLE WALL TO CONCEAL INSULATION FROM THE AIR STREAM (CONTRACTOR SHALL PROVIDE LINER WHEN NOT SUPPLIED BY THE MFG). CONTRACTOR SHALL BE RESPONSIBLE FOR COORDINATING EXACT LOCATION.
   2. VENTILATED ROOF CURB EXTENSION (WHERE SCHEDULED): VENTILATED ROOF CURB, WITH HINGED BASE AND GREASE TRAP. CURB SHALL BE PROVIDED WITH FANS SCHEDULED TO COMPLY WITH NFPA 96.
   3. DISCONNECT SWITCH: FACTORY MOUNTED AND WIRED, NEMA 3R FOR EXTERIOR MOUNTING, NON-FUSIBLE, IN HOUSING FOR THERMAL OVERLOAD PROTECTED MOTOR. DISCONNECT SHALL BE EXPLOSION PROOF WHERE EXPLOSION PROOF MOTORS ARE SPECIFIED.
   4. BACK-DRAFT DAMPER (WHERE SCHEDULED): GRAVITY ACTUATED, ALUMINUM MULTIPLE BLADE CONSTRUCTION, FELT EDGED WITH OFFSET HINGE PIN, NYLON BEARINGS, BLADES LINKED.
   5. MOTORIZED DAMPERS (WHERE SCHEDULED): OPPOSED BLADE, GALVANIZED STEEL FRAME WITH ALUMINUM BLADES. LEAKAGE IS LIMITED TO 7 CFM/ SQUARE FOOT AT 5" WG. DAMPERS SHALL BE SHIPPED LOOSE FOR MOUNTING IN THE DUCTWORK BY THE CONTRACTOR. ACTUATOR SHALL BE LOCATED OUTSIDE OF AIR STREAM (EXTERIOR OF DUCT) AND HAVE END (LIMIT) SWITCHES FOR POSITION CONTACTS.

6. HINGED BASE (WHERE SCHEDULED): HEAVY GAUGE HINGE SUITABLE FOR SUPPORTING ASSOCIATED FAN AND RESTRAINT CABLE FOR INTERIOR DUCTWORK INSPECTION AND CLEANING FROM ROOF.
7. EPOXY COATED (WHERE SCHEDULED).
8. AMCA SPARK RESISTANT CONSTRUCTION (WHERE SCHEDULED).
9. AUTOMATIC BELT TENSIONER: ALL FANS SHALL BE FURNISHED WITH FACTORY INSTALLED AUTOMATIC BELT TENSIONER TO MAINTAIN PROPER BELT TENSION. (WHERE SCHEDULED).
10. FAN SPEED CONTROLLER: PROVIDE FACTORY FAN SPEED CONTROLLER (WHERE SCHEDULED)
11. REFER TO FAN SCHEDULE FOR ADDITIONAL ACCESSORIES REQUIRED.

I. ELECTRICAL CHARACTERISTICS AND COMPONENTS:
1. AS SCHEDULED ON THE DRAWINGS.
2. WIRING TERMINATIONS: PROVIDE TERMINAL LUGS TO MATCH BRANCH CIRCUIT CONDUCTOR QUANTITIES, SIZES, AND MATERIALS INDICATED. ENCLOSE TERMINAL LUGS IN TERMINAL BOX SIZED TO NFPA 70. PROVIDE CONDUIT CHASE FOR INSTALLING WIRING THROUGH THE ROOF CURB, AND CONDUIT CHASE FOR ROOFTOP FIELD WIRING.

J. PERFORMANCE: AS SCHEDULED ON THE DRAWINGS.

2.3 KITCHEN EXHAUST FANS

A. DESCRIPTION: FAN SHALL BE A SPUN ALUMINUM, ROOF MOUNTED, BELT DRIVEN, DOWN-BLAST OR UP-BLAST (AS SCHEDULED) CENTRIFUGAL EXHAUST VENTILATOR.

B. PRODUCT REQUIREMENTS:
1. PERFORMANCE RATINGS: CONFORM TO AMCA 211 AND BEAR THE AMCA CERTIFIED RATING SEAL.
2. SOUND RATINGS: AMCA 311, TESTED TO AMCA 301, AND BEAR AMCA CERTIFIED SOUND RATING SEAL.
3. FABRICATION: CONFORM TO AMCA 99.
4. UL COMPLIANCE: UL LISTED AND LABELED, DESIGNED, MANUFACTURED, AND TESTED IN ACCORDANCE WITH UL 762.
5. NFPA COMPLIANCE: CONFORM TO NFPA 96

C. CONSTRUCTION:
1. THE FAN SHALL BE OF BOLTED AND WELDED CONSTRUCTION UTILIZING CORROSION RESISTANT FASTENERS. THE SPUN ALUMINUM STRUCTURAL COMPONENTS SHALL BE CONSTRUCTED OF MINIMUM 16 GAUGE MARINE ALLOY ALUMINUM, BOLTED TO A RIGID ALUMINUM SUPPORT STRUCTURE. THE ALUMINUM BASE SHALL HAVE A ONE PIECE INLET SPINNING AND CONTINUOUSLY WELDED CURB CAP CORNERS FOR MAXIMUM LEAK PROTECTION. THE WINDBAND SHALL HAVE A ROLLED BEAD FOR ADDED STRENGTH. A TWO PIECE TOP CAP SHALL HAVE STAINLESS STEEL QUICK RELEASE LATCHES TO PROVIDE ACCESS INTO THE MOTOR COMPARTMENT WITHOUT THE USE OF TOOLS. AN EXTERNAL WIRING COMPARTMENT WITH INTEGRAL CONDUIT CHASE SHALL BE PROVIDED INTO THE MOTOR COMPARTMENT TO FACILITATE WIRING CONNECTIONS. THE MOTOR, BEARINGS AND DRIVES SHALL BE MOUNTED ON A MINIMUM 14 GAUGE STEEL POWER ASSEMBLY. THESE COMPONENTS SHALL BE ENCLOSED IN A WEATHER-TIGHT COMPARTMENT, SEPARATED FROM THE EXHAUST AIRSTREAM. A ONE INCH THICK, THREE POUND DENSITY FOIL BACKED HEAT SHIELD SHALL BE UTILIZED TO PROTECT THE MOTOR AND DRIVE COMPONENTS FROM EXCESSIVE HEAT. LIFTING LUGS SHALL BE PROVIDED TO HELP PREVENT DAMAGE FROM IMPROPER LIFTING. UNIT SHALL BEAR AN ENGRAVED ALUMINUM NAMEPLATE AND SHALL BE SHIPPED IN ISTA CERTIFIED TRANSIT TESTED PACKAGING.
2. FANS SHALL BE SPARK RESISTANT CONSTRUCTION WHERE SCHEDULED ON THE DRAWINGS

3. FANS SHALL BE EPOXY COATED WHERE SCHEDULED ON THE DRAWINGS.

D. WHEEL:
   1. WHEEL SHALL BE CENTRIFUGAL BACKWARD INCLINED, CONSTRUCTED OF 100 PERCENT ALUMINUM, INCLUDING A PRECISION MACHINED CAST ALUMINUM HUB. WHEEL INLET SHALL OVERLAP AN AERODYNAMIC ALUMINUM INLET CONE TO PROVIDE MAXIMUM PERFORMANCE AND EFFICIENCY. WHEEL SHALL BE BALANCED IN ACCORDANCE WITH AMCA STANDARD 204-96, BALANCE QUALITY AND VIBRATION LEVELS FOR FANS.

E. MOTOR:
   1. MOTOR SHALL BE HEAVY DUTY TYPE WITH PERMANENTLY LUBRICATED SEALED BALL BEARINGS. TOTALLY ENCLOSED FAN COOLED (TEFC) WHERE IN AIR STREAM, OPEN DRIP PROOF (ODP) WHERE IN SEPARATE HOUSING.
   2. FANS SHALL HAVE INVERTER DUTY MOTORS FOR USE WITH VFD'S WHERE SCHEDULED ON THE DRAWINGS.
   3. FANS SHALL HAVE EXPLOSION PROOF MOTORS WHERE SCHEDULED ON THE DRAWINGS.
   4. MOTOR SHALL BE CAPABLE OF OPERATING IN TEMPERATURES OF UP TO 300ºF.

F. BEARINGS:
   1. BEARINGS SHALL BE DESIGNED AND INDIVIDUALLY TESTED SPECIFICALLY FOR USE IN AIR HANDLING APPLICATIONS. CONSTRUCTION SHALL BE HEAVY DUTY REGREASABLE BALL TYPE IN A CAST IRON PILLOW BLOCK HOUSING SELECTED FOR A MINIMUM L50 LIFE IN EXCESS OF 200,000 HOURS AT MAXIMUM CATALOGED OPERATING SPEED.

G. BELTS AND DRIVES:
   1. BELTS SHALL BE OIL AND HEAT RESISTANT, NON-STATIC TYPE. DRIVES SHALL BE PRECISION MACHINED CAST IRON TYPE, KEYED AND SECURELY ATTACHED TO THE WHEEL AND MOTOR SHAFTS. DRIVES SHALL BE SIZED FOR 150 PERCENT OF THE INSTALLED MOTOR HORSEPOWER. THE VARIABLE PITCH MOTOR DRIVE MUST BE FACTORY SET TO THE SPECIFIED FAN RPM.

H. ACCESSORIES
   1. ROOF CURB: 24 INCH HIGH. GALVANIZED STEEL WITH CONTINUOUSLY WELDED SEAMS, BUILT-IN CANT STRIPS, 1-1/2 INCH CLOSED CELL INSULATION AND CURB BOTTOM, AND FACTORY INSTALLED PLASTIC WOOD NAILER STRIP. CURB SHALL BE INTERNALLY LINED WITH GALVANIZED SHEET METAL. ROOF CURBS WITH ANY SIDE GREATER THAN 24" LONG SHALL BE SLOPED TO MATCH THE ROOF SLOPE. ROOF CURB SHALL BE DOUBLE WALL TO CONCEAL INSULATION FROM THE AIR STREAM (CONTRACTOR SHALL PROVIDE LINER WHEN NOT SUPPLIED BY THE MFG). CONTRACTOR SHALL BE RESPONSIBLE FOR COORDINATING EXACT LOCATION.
   2. VENTILATED ROOF CURB EXTENSION (WHERE SCHEDULED): VENTILATED ROOF CURB, WITH HINGED BASE AND GREASE TRAP. CURB SHALL BE PROVIDED WITH FANS SCHEDULED TO COMPLY WITH NFPA 96.
   3. DISCONNECT SWITCH: FACTORY MOUNTED AND WIRED, NEMA 3R FOR EXTERIOR MOUNTING, NON-FUSIBLE, IN HOUSING FOR THERMAL OVERLOAD PROTECTED MOTOR. DISCONNECT SHALL BE EXPLOSION PROOF WHERE EXPLOSION PROOF MOTORS ARE SPECIFIED.
   4. BACK-DRAFT DAMPER (WHERE SCHEDULED): GRAVITY ACTUATED, ALUMINUM MULTIPLE BLADE CONSTRUCTION, FELT EDGED WITH OFFSET HINGE PIN, NYLON BEARINGS, BLADES LINKED.
   5. HINGED BASE (WHERE SCHEDULED): HEAVY GAUGE HINGE SUITABLE FOR SUPPORTING ASSOCIATED FAN AND RESTRAINT CABLE FOR INTERIOR DUCTWORK INSPECTION AND CLEANING FROM ROOF.
   6. EPOXY COATED (WHERE SCHEDULED).
   7. AMCA SPARK RESISTANT CONSTRUCTION (WHERE SCHEDULED).
   8. REFER TO FAN SCHEDULE FOR ADDITIONAL ACCESSORIES REQUIRED.

I. ELECTRICAL CHARACTERISTICS AND COMPONENTS:
   1. AS SCHEDULED ON THE DRAWINGS.
   2. WIRING TERMINATIONS: PROVIDE TERMINAL LUGS TO MATCH BRANCH CIRCUIT CONDUCTOR QUANTITIES, SIZES, AND MATERIALS INDICATED. ENCLOSE TERMINAL LUGS IN TERMINAL BOX SIZED TO NFPA 70. PROVIDE CONDUIT CHASE FOR INSTALLING WIRING THROUGH THE ROOF CURB.

J. PERFORMANCE: AS SCHEDULED ON THE DRAWINGS.

2.4 HOODED PROPELLER ROOF FANS

A. FAN SHALL BE A HOODED, LOW PROFILE, FILTERED, ROOF MOUNTED, BELT DRIVEN, PROPELLER SUPPLY FAN.

B. CERTIFICATIONS: FAN SHALL BE MANUFACTURED AT AN ISO 9001 CERTIFIED FACILITY. FAN SHALL BE LISTED BY UNDERWRITERS LABORATORIES (UL 705. FAN SHALL BEAR THE AMCA CERTIFIED RATINGS SEAL FOR AIR PERFORMANCE.

C. CONSTRUCTION: THE FAN SHALL BE OF BOLTED AND WELDED CONSTRUCTION UTILIZING CORROSION RESISTANT FASTENERS. THE MOTOR, BEARINGS AND DRIVES SHALL BE MOUNTED ON A WELDED TUBULAR STEEL POWER ASSEMBLY. THE POWER ASSEMBLY SHALL BE RIGIDLY SECURED TO THE FAN HOUSING. THE POWDER COATED STEEL FAN HOUSING SHALL INCLUDE A MINIMUM 14 GAUGE BASE WITH INTEGRAL SPUN VENTURI AND CONTINUOUSLY WELDED CURB CAP CORNERS. THE FAN SHALL BE ENCLOSED WITH A MINIMUM 18 GAUGE GALVANIZED STEEL HOOD BOLTED TO THE FAN HOUSING. THE HOOD SHALL HAVE A REMOVABLE TOP CAP TO ALLOW UNOBSTRUCTED ACCESS TO THE MOTOR AND POWER ASSEMBLY WITHOUT REMOVING ENTIRE HOOD.

D. UNIT SHALL BEAR AN ENGRAVED ALUMINUM NAMEPLATE.

E. COATING: ALL STEEL FAN COMPONENTS SHALL BE COATED WITH AN ELECTROSTATICALLY APPLIED, BAKED POLYESTER POWDER COATING. EACH COMPONENT SHALL BE SUBJECT TO A FIVE STAGE ENVIRONMENTALLY FRIENDLY WASH SYSTEM, FOLLOWED BY A MINIMUM 2 MIL THICK BAKED POWDER FINISH. PAINT MUST EXCEED 1,000 HOUR SALT SPRAY UNDER ASTM B117 TEST METHOD.

F. PROPELLER: PROPELLER SHALL BE EXTRUDED ALUMINUM AIRFOIL DESIGN WITH CAST ALUMINUM HUB. THE BLADE PITCH SHALL BE FACTORY SET AND LOCKED USING SET SCREWS AND ROLL PIN. THE HUB SHALL BE KEYED AND LOCKED TO THE SHAFT UTILIZING TWO SET SCREWS OR A TAPER LOCK BUSHING. PROPELLER SHALL BE BALANCED IN ACCORDANCE WITH AMCA STANDARD 204-96, BALANCE QUALITY AND VIBRATION LEVELS FOR FANS.

G. MOTOR:
   1. MOTOR SHALL BE HEAVY DUTY TYPE WITH PERMANENTLY LUBRICATED SEALED BALL BEARINGS. TOTALLY ENCLOSED FAN COOLED (TEFC) WHERE IN AIR STREAM, OPEN DRIP PROOF (ODP) WHERE IN SEPARATE HOUSING.
   2. FANS SHALL HAVE INVERTER DUTY MOTORS FOR USE WITH VFD'S WHERE SCHEDULED ON THE DRAWINGS.

H. BEARINGS: BEARINGS SHALL BE DESIGNED AND TESTED SPECIFICALLY FOR USE IN AIR HANDLING APPLICATIONS. CONSTRUCTION SHALL BE HEAVY DUTY REGREASABLE BALL TYPE IN A CAST IRON HOUSING SELECTED FOR A MINIMUM L50 LIFE IN EXCESS OF 200,000 HOURS AT MAXIMUM CATALOGED OPERATING SPEED.

I. BELTS AND DRIVES: BELTS SHALL BE OIL AND HEAT RESISTANT, NON-STATIC TYPE. DRIVES SHALL BE PRECISION MACHINED CAST IRON TYPE, KEYED AND SECURELY ATTACHED TO THE WHEEL AND MOTOR SHAFTS. DRIVES SHALL BE SIZED FOR 150% OF THE INSTALLED MOTOR HORSEPOWER. THE VARIABLE PITCH MOTOR DRIVE MUST BE FACTORY SET TO THE SPECIFIED FAN RPM.

J. ACCESSORIES
   1. ROOF CURB: 24 INCH HIGH. GALVANIZED STEEL WITH CONTINUOUSLY WELDED SEAMS, BUILT-IN CANT STRIPS, 1-1/2 INCH CLOSED CELL INSULATION AND CURB BOTTOM, AND

FACTORY INSTALLED PLASTIC WOOD NAILER STRIP. CURB SHALL BE INTERNALLY LINED WITH GALVANIZED SHEET METAL. ROOF CURBS WITH ANY SIDE GREATER THAN 24" LONG SHALL BE SLOPED TO MATCH THE ROOF SLOPE. ROOF CURB SHALL BE DOUBLE WALL TO CONCEAL INSULATION FROM THE AIR STREAM (CONTRACTOR SHALL PROVIDE LINER WHEN NOT SUPPLIED BY THE MFG). CONTRACTOR SHALL BE RESPONSIBLE FOR COORDINATING EXACT LOCATION.

2. DISCONNECT SWITCH: FACTORY WIRED AND MOUNTED, NEMA 3R FOR EXTERIOR MOUNTING, NON-FUSIBLE, IN HOUSING FOR THERMAL OVERLOAD PROTECTED MOTOR.
3. BACK-DRAFT DAMPER (WHERE SCHEDULED): GRAVITY ACTUATED, ALUMINUM MULTIPLE BLADE CONSTRUCTION, FELT EDGED WITH OFFSET HINGE PIN, NYLON BEARINGS, BLADES LINKED.
4. MOTORIZED DAMPERS (WHERE SCHEDULED): OPPOSED BLADE, GALVANIZED STEEL FRAME WITH ALUMINUM BLADES. LEAKAGE IS LIMITED TO 7 CFM/ SQUARE FOOT AT 5" WG. DAMPERS SHALL BE SHIPPED LOOSE FOR MOUNTING IN THE DUCTWORK BY THE CONTRACTOR. ACTUATOR SHALL BE LOCATED OUTSIDE OF AIR STREAM (EXTERIOR OF DUCT) AND HAVE END (LIMIT) SWITCHES FOR POSITION CONTACTS.
5. HINGED BASE (WHERE SCHEDULED): HEAVY GAUGE HINGE SUITABLE FOR SUPPORTING ASSOCIATED FAN AND RESTRAINT CABLE FOR INTERIOR DUCTWORK INSPECTION AND CLEANING FROM ROOF.
6. PROVIDE WITH FILTERS: FILTERS SHALL BE WASHABLE EXPANDED ALUMINUM MEDIA WITH 2" FORMED ALUMINUM FRAME. ALUMINUM INSECT SCREEN SHALL BE MOUNTED ACROSS THE INLET OPENING. FILTER FRAMES SHALL BE ARRANGED TO PREVENT SCREENS FROM ENTERING THE PROPELLER DEPARTMENT.
    a. WHERE SCHEDULED PROVIDE MERV-8 PLEATED PANEL FILTERS AND RETENTION HOUSING IN LIEU OF ALUMINUM FILTERS.
7. SAFETY SCREENS: EXPANDED GALVANIZED METAL OVER INLET, MOTOR, AND DRIVE AND OUTLET; TO COMPLY WITH OSHA REGULATIONS.
8. HOOD: WEATHER SHIELD, TO EXCLUDE RAIN AND SNOW.
9. REFER TO FAN SCHEDULE FOR ADDITIONAL ACCESSORIES REQUIRED.

K. ELECTRICAL CHARACTERISTICS AND COMPONENTS:
1. AS SCHEDULED ON THE DRAWINGS.
2. WIRING TERMINATIONS: PROVIDE TERMINAL LUGS TO MATCH BRANCH CIRCUIT CONDUCTOR QUANTITIES, SIZES, AND MATERIALS INDICATED. ENCLOSE TERMINAL LUGS IN TERMINAL BOX SIZED TO NFPA 70. PROVIDE CONDUIT CHASE FOR INSTALLING WIRING THROUGH THE ROOF CURB. PROVIDE FACTORY WIRED DISCONNECT.

L. PERFORMANCE: AS SCHEDULED ON THE DRAWINGS.

2.5 ROOF HOODED GRAVITY VENTILATOR

A. DESCRIPTION:
1. UNIT SHALL BE A HOODED ALUMINUM, ROOF MOUNTED GRAVITY FILTERED INTAKE VENTILATOR.

B. CONSTRUCTION:
1. THE UNIT SHALL BE OF BOLTED AND WELDED CONSTRUCTION UTILIZING CORROSION RESISTANT FASTENERS. THE ALUMINUM HOOD SHALL BE CONSTRUCTED OF MINIMUM 14 GAUGE MARINE ALLOY ALUMINUM, BOLTED TO A MINIMUM 8 GAUGE ALUMINUM SUPPORT STRUCTURE. THE ALUMINUM BASE SHALL HAVE CONTINUOUSLY WELDED CURB CAP CORNERS FOR MAXIMUM LEAK PROTECTION.
2. ALUMINUM INSECT SCREEN SHALL BE MOUNTED ACROSS THE INLET OPENING.
3. FILTERS SHALL BE WASHABLE EXPANDED ALUMINUM MEDIA WITH 2" FORMED ALUMINUM FRAME. ENTIRE INLET AREA SHALL BE FILTERS
4. UNIT SHALL BEAR AN ENGRAVED ALUMINUM NAMEPLATE.

5. ROOF CURB: 24 INCH HIGH. GALVANIZED STEEL WITH CONTINUOUSLY WELDED SEAMS, BUILT-IN CANT STRIPS, 1-1/2 INCH CLOSED CELL INSULATION AND CURB BOTTOM, AND FACTORY INSTALLED PLASTIC WOOD NAILER STRIP. CURB SHALL BE INTERNALLY LINED WITH GALVANIZED SHEET METAL. ROOF CURBS WITH ANY SIDE GREATER THAN 24" LONG SHALL BE SLOPED TO MATCH THE ROOF SLOPE. ROOF CURB SHALL BE DOUBLE WALL TO CONCEAL INSULATION FROM THE AIR STREAM (CONTRACTOR SHALL PROVIDE LINER WHEN NOT SUPPLIED BY THE MFG). CONTRACTOR SHALL BE RESPONSIBLE FOR COORDINATING EXACT LOCATION.

2.6 ROOF MOUNTED TUBULAR SUPPLY FAN

A. DESCRIPTION:

1. FANS SHALL BE BELT DRIVEN, TUBULAR MIXED-FLOW SUPPLY FAN.

B. CONSTRUCTION:

1. THE FAN SHALL BE OF WELDED AND BOLTED CONSTRUCTION UTILIZING CORROSION RESISTANT FASTENERS. HOUSING SHALL BE MINIMUM OF 14 GAUGE LOERNIZED STEEL WITH INTEGRAL INLET COMPANION FLANGE FOR DUCT CONNECTIONS. STRAIGHTENING VANES SHALL BE INCLUDED TO ASSURE MAXIMUM EFFICIENCY AND LOW NOISE LEVELS. ADJUSTABLE MOTOR PLATE SHALL UTILIZE THREADED STUDS FOR POSITIVE BELT TENSIONING. COPPER EXTENDED LUBE LINES SHALL BE FURNISHED FOR LUBRICATION OF FAN BEARINGS. LIFTING LUGS SHALL BE PROVIDED FOR EASE OF INSTALLATION. FAN SHALL HAVE SPUN ALUMINUM TOP CAPS CONSTRUCTED OF MINIUM 0.063 TICK MARINE ALLOY ALUMINUM TO PREVENT RAIN INFILTRATION. UNIT SHALL BEAR AN ENGRAVED ALUMINUM NAMEPLATE. NAMEPLATE SHALL INDICATED FAN TAG DESIGNATION, DESIGN CFM, STATIC PRESSURE, AND MAXIMUM FAN RPM. UNIT SHALL BE SHIPPED IN ISTA CERTIFIED TRANSIT TESTED PACKAGING.

C. COATING:

1. STEEL FAN COMPONENTS SHALL BE LORENIZED WITH AN ELECTROSTATICALLY APPLIED, BAKED POLYESTER POWDER COATING. EACH COMPONENT SHALL BE SUBJECT TO A FIVE STAGE ENVIRONMENTALLY FRIENDLY WASH SYSTEM, FOLLOWED BY A MINIMUM 2 MIL THICK BAKED POWDER FINISH. PAINT MUST EXCEED 1,000 HOUR SALT SPRAY UNDER ASTM B117 TEST METHOD.

D. WHEEL:

1. WHEEL SHALL BE STEEL, NON-OVERLOADING, HIGH EFFICIENCY MIXED-FLOW TYPE. CONTOURED SINGLE THICKNESS BLADES SHALL INCORPORATE 3-D CURVATURE FOR A MAXIMUM EFFICIENCY ACROSS THE ENTIRE SURFACE OF THE BLADE. BLADES SHALL BE CONTINUOUSLY WELDED TO THE BACKPLATE AND INLET SHROUD. HUBS SHALL BE KEYED AND SECURELY ATTACHED TO THE FAN SHAFT. WHEEL SHALL OVERLAP AN AERODYNAMIC ALUMINUM INLET CONE TO PROVIDE MAXIMUM PERFORMANCE AND EFFICIENCY. WHEEL SHALL BE BALANCED IN ACCORDANCE WITH AMCA STANDARD 204-05.

E. MOTOR:

1. MOTOR SHALL BE MINIMUM NEMA DESIGN B WITH CLASS B INSULATION RATED FOR CONTINUOUS DUTY AND FURNISHED AT THE SPECIFIED VOLTAGE, PHASE, AND ENCLOSURE.
2. MOTOR SHALL BE HEAVY DUTY TYPE WITH PERMANENTLY LUBRICATED SEALED BALL BEARINGS. TOTALLY ENCLOSED FAN COOLED (TEFC) SCHEDULED.
3. MOTOR SHALL BE PREMIUM EFFICIENCY SUITABLE FOR VFD OPERATION.

F. BLOWER SHAFT:

1. BLOWER SHAFT SHALL BE AISI C-1045 HOT ROLLED AND ACCURATELY TURNED, GROUND AND POLISHED. SHAFTING SHALL BE SIZED FOR A CRITICAL SPEED OF AT LEAST 125% OF MAXIMUM RPM.

G. BEARINGS:

1. BEARINGS SHALL BE DESIGNED AND TESTED SPECIFICALLY FOR USE IN AIR HANDLING APPLICATIONS. CONSTRUCTION SHALL BE HEAVY DUTY REGREASABLE BALL OR ROLLER TYPE IN A CAST IRON PILLOW BLOCK HOUSING SELECTED FOR A MINIMUM L50 LIFE IN EXCESS OF 200,000 HOURS AT MAXIMUM CATALOGED OPERATING SPEED.

H. BELTS AND DRIVES:
1. BELTS SHALL BE OIL AND HEAT RESISTANT, NON-STATIC TYPE. DRIVES SHALL BE PRECISION MACHINED CAST IRON TYPE, KEYED AND SECURELY ATTACHED TO THE WHEEL AND MOTOR SHAFTS. DRIVES SHALL BE SIZED FOR 150% OF THE INSTALLED MOTOR HORSEPOWER.

I. ELECTRICAL CHARACTERISTICS AND COMPONENTS:
1. AS SCHEDULED ON THE DRAWINGS.
2. WIRING TERMINATIONS: PROVIDE TERMINAL LUGS TO MATCH BRANCH CIRCUIT CONDUCTOR QUANTITIES, SIZES, AND MATERIALS INDICATED. ENCLOSE TERMINAL LUGS IN TERMINAL BOX SIZED TO NFPA 70.

J. ACCESSORIES:
1. ROOF CURB: 24 INCH HIGH. GALVANIZED STEEL WITH CONTINUOUSLY WELDED SEAMS, BUILT-IN CANT STRIPS, 1-1/2 INCH CLOSED CELL INSULATION AND CURB BOTTOM, AND FACTORY INSTALLED CCA PRESSURE TREATED WOOD NAILER STRIP. CURB SHALL BE INTERNALLY LINED WITH GALVANIZED SHEET METAL. ROOF CURBS WITH ANY SIDE GREATER THAN 24" LONG SHALL BE SLOPED TO MATCH THE ROOF SLOPE. ROOF CURB SHALL BE DOUBLE WALL TO CONCEAL INSULATION FROM THE AIR STREAM (CONTRACTOR SHALL PROVIDE LINER WHEN NOT SUPPLIED BY THE MFG). CONTRACTOR SHALL BE RESPONSIBLE FOR COORDINATING EXACT LOCATION.
2. PROVIDE TEMPLATES, ANCHOR BOLTS, AND ACCESSORIES FOR MOUNTING AND ANCHORING EQUIPMENT.
3. FINISHED ROOF CURB HEIGHT SHALL BE A MINIMUM 24 INCHES ABOVE ROOF DECK.
    a. WHERE CURB ACCESS PANELS ARE REQUIRED THE CURB HEIGHT SHALL BE EXTENDED BY 18 INCHES.
4. PROVIDE GALVANIZED OR CADMIUM-PLATED WEDGE ANCHORS FOR ALL EQUIPMENT PLACED ON CONCRETE PADS OR CONCRETE SLABS, OF THE SIZE AND NUMBER RECOMMENDED BY THE EQUIPMENT MANUFACTURER.
5. DISCONNECT SWITCH: FACTORY WIRED AND MOUNTED, NEMA 3R FOR EXTERIOR MOUNTING, NON-FUSIBLE, IN HOUSING FOR THERMAL OVERLOAD PROTECTED MOTOR.
6. MOTORIZED DAMPERS (WHERE SCHEDULED): OPPOSED BLADE, GALVANIZED STEEL FRAME WITH ALUMINUM BLADES. LEAKAGE IS LIMITED TO 7 CFM/ SQUARE FOOT AT 5" WG. DAMPERS SHALL BE SHIPPED LOOSE FOR MOUNTING IN THE DUCTWORK BY THE CONTRACTOR. ACTUATOR SHALL BE LOCATED OUTSIDE OF AIR STREAM (EXTERIOR OF DUCT) AND HAVE END (LIMIT) SWITCHES FOR POSITION CONTACTS.

K. PERFORMANCE: AS SCHEDULED ON THE DRAWINGS.

2.7 CIRCULATION FANS

A. DESCRIPTION:
1. FAN SHALL BE A WALL, COLUMN MOUNTED FROM STRUCTURE ABOVE, DIRECT DRIVEN, HIGH VOLUME, HIGH VELOCITY, AND INDUSTRIAL AIR CIRCULATOR.

B. CONSTRUCTION:
1. THE FAN SHALL BE OF BOLTED AND WELDED CONSTRUCTION UTILIZING CORROSION RESISTANT FASTENERS. THE FAN SHALL BE MOUNTED ON AN ADJUSTABLE AND PIVOTING BRACKET TO DIRECT AIRFLOW. ZINC PLATED STEEL WIRE GUARD THAT COMPLIES WITH OSHA STANDARDS, ½" MAXIMUM OPENING REQUIREMENTS SHALL BE ATTACHED TO THE INLET OF THE FAN HOUSING. UNIT SHALL BEAR AN ENGRAVED ALUMINUM NAMEPLATE AND SHALL BE SHIPPED IN ISTA TRANSIT TESTED PACKAGING.

C. PROPELLER:

1. PROPELLER SHALL BE A CAST ALUMINUM PROPELLER. THE PROPELLER SHALL BE SECURELY FASTENED TO THE MOTOR SHAFT UTILIZING SETSCREWS. PROPELLER SHALL BE BALANCED IN ACCORDANCE WITH AMCA STANDARD 204-05.

D. MOTOR:

1. MOTOR SHALL BE TOTALLY ENCLOSED WITH PERMANENTLY LUBRICATED SEALED BALL BEARINGS AND FURNISHED AT THE SPECIFIED VOLTAGE AND PHASE. PIGTAIL SHALL BE PROVIDED FOR HARD WIRING IN FIELD.

E. ACCESSORIES: AS SCHEDULED ON DRAWINGS.

F. PERFORMANCE: AS SCHEDULES ON DRAWINGS.

2.8 CIRCULATION FANS (HIGH VOLUME, LOW SPEED - HVLS)

A. COMPLETE UNIT:

1. THE FAN SHALL BE ETL CERTIFIED AND BUILT PURSUANT TO CONSTRUCTION GUIDELINES SET FORTH BY UL STANDARD 507 AND CSA STANDARD 22.2. THE FAN SHALL BE DESIGNED TO MOVE AN EFFECTIVE AMOUNT OF AIR FOR COOLING AND DESTRATIFICATION IN LARGE INDUSTRIAL APPLICATIONS WITH DENSE FLOOR OBSTRUCTIONS, OVER AN EXTENDED LIFE. THE FAN AND COMPONENTS SHALL BE DESIGNED SPECIFICALLY FOR HIGH VOLUME, LOW SPEED FANS TO ENSURE LOWER NOISE OPERATION. THE SOUND LEVELS FROM THE FAN OPERATING AT MAXIMUM SPEED SHALL NOT EXCEED 55 DBA (MEASURED 20’ OR 6.1 M BELOW THE BLADES AND 20’ OR 6.1 M HORIZONTALLY FROM THE CENTER OF THE FAN).

B. AIRFOILS:

1. THE FAN SHALL BE EQUIPPED WITH TEN (10) HIGH VOLUME, LOW SPEED AIRFOILS OF PRECISION EXTRUDED ALUMINUM ALLOY. EACH AIRFOIL SHALL BE OF THE HIGH PERFORMANCE POWERFOIL DESIGN. THE AIRFOILS SHALL BE CONNECTED BY MEANS OF TWO (2) LOCKING BOLTS PER AIRFOIL. THE AIRFOILS SHALL BE CONNECTED TO THE HUB AND INTERLOCKED WITH ZINC PLATED STEEL RETAINERS. AS AN OPTION, AIRFOILS MAY BE POWDER COATED AS SPECIFIED BY THE ARCHITECT OR OWNER.

C. WINGLETS:

1. THE FAN SHALL BE EQUIPPED WITH TEN (10) POWERFOIL PLUS WINGLETS DESIGNED TO MOVE AIR AWAY FROM THE FAN AT AN ANGLE, THEREBY INCREASING THE AMOUNT OF AREA AFFECTED BY THE FAN. THE WINGLETS SHALL BE MOLDED OF HIGH DENSITY POLYETHYLENE. A WINGLET SHALL BE ATTACHED AT THE TIP OF EACH AIRFOIL. THE STANDARD COLOR OF THE WINGLETS SHALL BE “SAFETY YELLOW,” BUT MAY BE COLORED AS SPECIFIED BY THE ARCHITECT OR OWNER.

D. MOTOR:

1. THE FAN MOTOR SHALL BE AN AC INDUCTION TYPE INVERTER RATED AT 1725 RPM, 230/460 VAC, AND 60 HZ FOR 3 Φ AND 1725 RPM, 208 VAC, AND 60 HZ FOR 1 Φ. THE MOTOR SHALL BE TOTALLY ENCLOSED, FAN COOLED (TEFC) WITH AN IP55 NEMA CLASSIFICATION. NEMA STANDARD FRAMES 56C/143TC/145TC SHALL BE PROVIDED FOR EASE OF SERVICE. THE MOTOR SHALL BE MANUFACTURED WITH A DOUBLE BAKED CLASS F INSULATION AND BE CAPABLE OF CONTINUOUS OPERATION IN -30OF TO 122OF (-34OC TO 50OC) AMBIENT CONDITIONS.

E. GEARBOX:

1. THE FAN GEARBOX SHALL BE A NITROSEAL DRIVE DESIGNED SPECIFICALLY FOR THE POWERFOIL X. THE GEARBOX SHALL INCLUDE A HIGH EFFICIENCY, HERMETICALLY SEALED, NITROGEN FILLED, OFFSET HELICAL GEAR REDUCER WITH TWO STAGE GEARING, A 2-1/2” (6.4 CM) HOLLOW OUTPUT SHAFT, CAST IRON HOUSING, DOUBLE LIP SEALS, HIGH QUALITY SKF EXPLORERSERIES BEARINGS WITH CROWNED CAGES FOR OPTIMAL LUBRICATION FLOW, AND PRECISION MACHINED GEARING TO MAINTAIN BACKLASH LESS THAN 11 ARC-MINUTES OVER THE LIFE OF THE UNIT. LUBRICATION

SHALL BE A HIGH GRADE, LOW FOAMING SYNTHETIC OIL WITH EXTREME PRESSURE ADDITIVES AND A WIDE TEMPERATURE RANGE.

2. THE FAN GEARBOX SHALL BE EQUIPPED WITH A PASSAGEWAY IN WHICH WIRING, PIPING, ETC CAN BE ROUTED BELOW THE FAN. A NON-ROTATING, STANDARD JUNCTION BOX SHALL BE PROVIDED AT THE BASE OF THE FAN FOR INSTALLING OPTIONAL FEATURES SUCH AS LIGHTS, CAMERAS, AND VESDA. AN ALUMINUM COVER PLATE SHALL BE PROVIDED FOR ATTACHMENT TO THE JUNCTION BOX WHEN THESE FEATURES ARE NOT INSTALLED.

F. MOUNTING POST:

1. THE FAN SHALL BE EQUIPPED WITH A MOUNTING POST THAT PROVIDES A STRUCTURAL CONNECTION BETWEEN THE FAN ASSEMBLY AND UPPER MOUNTING SYSTEM. THE MOUNTING POST SHALL BE 3" X 3" (7.6 CM X 7.6 CM) SQUARE TUBING AND POWDER COATED FOR CORROSION RESISTANCE AND APPEARANCE. AS AN OPTION, MOUNTING POST MAY BE COLORED AS SPECIFIED BY THE ARCHITECT OR OWNER.

G. HUB:

1. THE FAN HUB SHALL BE PRECISION CAST ALUMINUM ALLOY FOR HIGH STRENGTH AND LIGHT WEIGHT. THE HUB SHALL BE SECURED TO THE OUTPUT SHAFT OF THE GEARBOX BY MEANS OF A STEEL FLANGE INTERFACE. BOTH HUB AND FLANGE SHALL BE PRECISION MACHINED TO ACHIEVE A WELL BALANCED AND SOLID ROTATING ASSEMBLY. THE HUB SHALL INCORPORATE FIVE (5) SAFETY RETAINING CLIPS MADE OF 1/4" (0.6 CM) THICK STEEL THAT SHALL RESTRAIN THE HUB/AIRFOIL ASSEMBLY IN CASE OF GEARBOX OUTPUT SHAFT FAILURE.

H. MOUNTING SYSTEM:

1. THE FAN MOUNTING SYSTEM SHALL BE DESIGNED FOR QUICK AND SECURE INSTALLATION FROM A STRUCTURAL SUPPORT BEAM. ALL COMPONENTS IN THE MOUNTING SYSTEM SHALL BE OF WELDED CONSTRUCTION USING LOW CARBON STEEL NO LESS THAN 3/16" (0.5 CM) THICK AND BE POWDER COATED FOR APPEARANCE AND RESISTANCE TO CORROSION. ALL MOUNTING BOLTS SHALL BE SAE GRADE 8 OR EQUIVALENT. AS AN OPTION, MOUNTING COMPONENTS MAY BE COLORED AS SPECIFIED BY THE ARCHITECT OR OWNER.

I. SAFETY CABLE:

1. THE FAN SHALL BE EQUIPPED WITH A SAFETY CABLE THAT PROVIDES AN ADDITIONAL MEANS OF SECURING THE FAN ASSEMBLY TO THE BUILDING STRUCTURE. THE SAFETY CABLE SHALL BE 3/8" (1 CM) DIAMETER AND FABRICATED OUT OF 7 X 19 STRANDED GALVANIZED STEEL. THE LOOPS SHALL BE SECURED WITH SWAGED NICOPRESS FITTINGS, PRE-LOADED AND TESTED TO 3,000 LB·F (13,345 N).
2. FIELD CONSTRUCTION OF SAFETY CABLES IS NOT PERMITTED.

J. CONTROLLER:

1. THE FAN CONTROLLER SHALL BE CONSTRUCTED USING A VARIABLE SPEED DRIVE (VSD) THAT IS PRE-WIRED TO THE MOTOR AND FACTORY PROGRAMMED TO MINIMIZE THE STARTING AND BRAKING TORQUES, FOR SMOOTH AND EFFICIENT OPERATION. THE CONTROLLER SHALL BE PREWIRED TO THE MOTOR USING A SHORT FUN OF FLEXIBLE CONDUIT THHM WITH A DEDICATED GROUND CONDUCTOR TO MINIMIZE ELECTROMAGNETIC INTERFERENCE (EMI) AND RADIO FREQUENCY INTERFERENCE (RFI). AN INCOMING POWER CORD SHALL ALSO BE PRE-WIRED TO THE CONTROLLER FOR EASE OF INSTALLATION. THE CONTROLLER SHALL BE CONTAINED WITHIN A COMPLETELY SEALED ALUMINUM ENCLOSURE WITH AN IP45 NEMA CLASSIFICATION FOR 3 Φ AND A NEMA 4/12 RATING FOR 1 Φ. THE CONTROLLER WILL BE SECURED TO THE MOUNTING POST 'ONBOARD' THE FAN ASSEMBLY.

K. WALL CONTROL:

1. THE FAN SHALL BE EQUIPPED WITH A REMOTE WALL CONTROL. THE WALL CONTROL SHALL BE A DIGITAL KEYPAD DEVICE MOUNTED INSIDE AN ALUMINUM BEZEL. THE BEZEL SHALL BE CAPABLE OF MOUNTING TO A STANDARD WALL BOX. THE WALL CONTROL SHALL BE EQUIPPED WITH TOUCHPAD CONTROLS AND AN LED DISPLAY FOR CONTROLLING THE FAN'S DIRECTION, OPERATION AND SPEED. COMMUNICATION WITH THE FAN DRIVE AND CONTROLLER SHALL BE BY A STANDARD COMMERCIALLY AVAILABLE CAT-5 (OR HIGHER) ETHERNET CABLE THAT IS FIELD INSTALLED AND PROVIDED BY THE INSTALLER.
2. A 5' (1.5 M) 'PATCH CABLE' SHALL BE PROVIDED TO TEST AND VERIFY COMMUNICATION SIGNALS LOCALLY PRIOR TO CONNECTING THE REMOTE CONNECTION CABLE.
3. THE WALL CONTROL SHALL BE EQUIPPED WITH A SIMPLE DIAGNOSTIC PROGRAM TO IDENTIFY FAULTS IN THE SYSTEM. PROVISIONS MUST BE MADE FOR RETRIEVING FAN OPERATION AND DIAGNOSTIC DATA (FAULT MESSAGES) THROUGH THE REMOTE WALL DEVICE.

L. WARRANTY:

1. THE MANUFACTURER SHALL REPLACE ANY PRODUCTS OR COMPONENTS DEFECTIVE IN MATERIAL OR WORKMANSHIP, FREE OF CHARGE TO THE CUSTOMER (INCLUDING TRANSPORTATION CHARGES WITHIN THE USA, F.O.B. LEXINGTON, KY), PURSUANT TO THE COMPLETE TERMS AND CONDITIONS OF THE BIG ASS FANS NON-PRORATED WARRANTY IN ACCORDANCE TO THE FOLLOWING SCHEDULE:
   -AIRFOILS LIFETIME (PARTS)
   -HUB LIFETIME (PARTS)
   -MOTOR 10 YEARS (PARTS)
   -GEARBOX 10 YEARS (PARTS)
   -CONTROLLER 10 YEARS (PARTS)
   -LABOR 1 YEAR
   -10 YEAR PARTS WARRANTY ONLY VALID WITH FACTORY INSTALLATION, 5 YEAR PARTS WITHOUT FACTORY INSTALLATION.
   -ALL REASONABLE COSTS OF REPAIR OR REPLACEMENT WILL BE PAID OR REIMBURSED PROVIDED CUSTOMER OBTAINS PRE-APPROVAL; SEE FULL WARRANTY FOR DETAILS.
   FURTHER INFORMATION ON THE TERMS AND CONDITIONS OF THE WARRANTIES CAN BE FOUND IN THE INSTALLATION GUIDE

2.9 SQUARE INLINE FAN

A. FAN SHALL BE DUCT MOUNTED, BELT DRIVEN CENTRIFUGAL SQUARE INLINE.

B. CERTIFICATIONS: FAN SHALL BE MANUFACTURED AT AN ISO 9001 CERTIFIED FACILITY. FAN SHALL BE LISTED BY UNDERWRITERS LABORATORIES (UL 705). FAN SHALL BEAR THE AMCA CERTIFIED RATINGS SEAL FOR SOUND AND AIR PERFORMANCE.

C. CONSTRUCTION: THE FAN SHALL BE OF BOLTED CONSTRUCTION UTILIZING CORROSION RESISTANT FASTENERS. HOUSING SHALL BE MINIMUM 18 GAUGE GALVANIZED STEEL WITH INTEGRAL DUCT COLLARS. BOLTED ACCESS DOORS SHALL BE PROVIDED ON THREE SIDES, SEALED WITH CLOSED CELL NEOPRENE GASKETING. PIVOTING MOTOR PLATE SHALL UTILIZE THREADED L-BOLT DESIGN FOR POSITIVE BELT TENSIONING. HOUSING SHALL BE PRE-DRILLED TO ACCOMMODATE UNIVERSAL MOUNTING FEET FOR VERTICAL OR HORIZONTAL INSTALLATION. UNIT SHALL BEAR AN ENGRAVED ALUMINUM NAMEPLATE AND SHALL BE SHIPPED IN ISTA CERTIFIED TRANSIT TESTED PACKAGING.

D. WHEEL: WHEEL SHALL BE CENTRIFUGAL BACKWARD INCLINED, CONSTRUCTED OF 100% ALUMINUM, INCLUDING A PRECISION MACHINED CAST ALUMINUM HUB. WHEEL INLET SHALL OVERLAP AN AERODYNAMIC ALUMINUM INLET CONE TO PROVIDE MAXIMUM PERFORMANCE AND EFFICIENCY. WHEEL SHALL BE BALANCED IN ACCORDANCE WITH AMCA STANDARD 204-96, BALANCE QUALITY AND VIBRATION LEVELS FOR FANS.

E. MOTOR: MOTOR SHALL BE HEAVY DUTY EXPLOSION PROOF TYPE WITH PERMANENTLY LUBRICATED SEALED BALL BEARINGS AND FURNISHED AT THE SPECIFIED VOLTAGE, PHASE AND ENCLOSURE.

F. BEARINGS: BEARINGS SHALL BE DESIGNED AND INDIVIDUALLY TESTED SPECIFICALLY FOR USE IN AIR HANDLING APPLICATIONS. CONSTRUCTION SHALL BE HEAVY DUTY REGREASABLE BALL TYPE IN A PILLOW BLOCK CAST IRON HOUSING SELECTED FOR A MINIMUML50 LIFE IN EXCESS OF 200,000 HOURS AT MAXIMUM CATALOGED OPERATING SPEED.

G. BELTS AND DRIVES: BELTS SHALL BE OIL AND HEAT RESISTANT, NON-STATIC TYPE. DRIVES SHALL BE PRECISION MACHINED CAST IRON TYPE, KEYED AND SECURELY ATTACHED TO THE WHEEL AND MOTOR SHAFTS. DRIVES SHALL BE SIZED FOR 150% OF THE INSTALLED MOTOR HORSEPOWER. THE VARIABLE PITCH MOTOR DRIVE MUST BE FACTORY SET TO THE SPECIFIED FAN RPM.

H. ACCESSORIES:

1. PROVIDE SPRING ISOLATION HANGING KIT.
2. FANS SHALL BE PROVIDED WITH FACTORY WIRED DISCONNECT SWITCH (WHERE SCHEDULED): FACTORY-WIRED AND MOUNTED, LOCKABLE NEMA 3R, NON-FUSIBLE DISCONNECT. THE DISCONNECT SHALL BE FACTORY MOUNTED TO THE EXTERIOR OF THE FAN HOUSING (NOT INSIDE OF THE MOTOR/BELT COMPARTMENT. DISCONNECT SHALL BE EXPLOSION PROOF WHERE EXPLOSION PROOF MOTORS ARE SPECIFIED.

PART 3: EXECUTION

3.1 INSTALLATION

A. GENERAL:

1. INSTALL IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS.
2. INSTALL UNITS WITH CLEARANCES FOR SERVICE AND MAINTENANCE.
3. INSURE THAT ROOF MOUNTED FAN CURBS ARE INSTALLED LEVEL ON ROOF.
4. COORDINATE INSTALLATION OF ROOF CURB AND FLASHING OF ROOFING MEMBRANE WITH THE ROOFING CONTRACTOR.
5. SUPPORT FLOOR-MOUNTING UNITS USING SPRING ISOLATORS HAVING A STATIC DEFLECTION OF MININUM 1 INCH. VIBRATION- AND SEISMIC-CONTROL DEVICES ARE SPECIFIED IN DIVISION 23 SECTION "MECHANICAL SOUND AND VIBRATION CONTROL."
6. SECURE VIBRATION AND SEISMIC CONTROLS TO CONCRETE BASES USING ANCHOR BOLTS CAST IN CONCRETE BASE.
7. SUPPORT SUSPENDED UNITS FROM STRUCTURE USING THREADED STEEL RODS AND SPRING HANGERS. VIBRATION-CONTROL DEVICES ARE SPECIFIED IN DIVISION 23 SECTION "MECHANICAL SOUND AND VIBRATION CONTROL."
8. PROVIDE SAFETY INSECT SCREEN WHERE INLET IS EXPOSED.

B. CONNECTIONS

1. DUCT INSTALLATION AND CONNECTION REQUIREMENTS ARE SPECIFIED IN OTHER DIVISION 23 SECTIONS. DRAWINGS INDICATE GENERAL ARRANGEMENT OF DUCTS AND DUCT ACCESSORIES.
2. INSTALL DUCTS ADJACENT TO FANS TO ALLOW SERVICE AND MAINTENANCE.
3. TIGHTEN ELECTRICAL CONNECTORS AND TERMINALS ACCORDING TO MANUFACTURER'S PUBLISHED TORQUE-TIGHTENING VALUES. IF MANUFACTURER'S TORQUE VALUES ARE NOT INDICATED, USE THOSE SPECIFIED IN UL 486A AND UL 486B.

C. EQUIPMENT STARTUP CHECKS:

1. VERIFY THAT SHIPPING, BLOCKING, AND BRACING ARE REMOVED.
2. VERIFY THAT UNIT IS SECURE ON MOUNTINGS AND SUPPORTING DEVICES AND THAT CONNECTIONS TO DUCTS AND ELECTRICAL COMPONENTS ARE COMPLETE. VERIFY THAT PROPER THERMAL-OVERLOAD PROTECTION IS INSTALLED IN MOTORS, STARTERS, AND DISCONNECT SWITCHES.
3. VERIFY THAT CLEANING AND ADJUSTING ARE COMPLETE.

4. DISCONNECT FAN DRIVE FROM MOTOR, VERIFY PROPER MOTOR ROTATION DIRECTION, AND VERIFY FAN WHEEL FREE ROTATION AND SMOOTH BEARING OPERATION. RECONNECT FAN DRIVE SYSTEM, ALIGN AND ADJUST BELTS, AND INSTALL BELT GUARDS.
5. VERIFY LUBRICATION FOR BEARINGS AND OTHER MOVING PARTS.
6. VERIFY THAT MANUAL AND AUTOMATIC VOLUME CONTROL AND FIRE AND SMOKE DAMPERS IN CONNECTED DUCTWORK SYSTEMS ARE IN FULLY OPEN POSITION.

D. STARTUP PROCEDURES:
1. ENERGIZE MOTOR AND ADJUST FAN TO INDICATED RPM.
2. MEASURE AND RECORD MOTOR VOLTAGE AND AMPERAGE.
3. OPERATIONAL TEST: AFTER ELECTRICAL CIRCUITRY HAS BEEN ENERGIZED, START UNITS TO CONFIRM PROPER MOTOR ROTATION AND UNIT OPERATION. REMOVE MALFUNCTIONING UNITS, REPLACE WITH NEW UNITS, AND RETEST.
4. TEST AND ADJUST CONTROLS AND SAFETIES. REPLACE DAMAGED AND MALFUNCTIONING CONTROLS AND EQUIPMENT.
5. SHUT UNIT DOWN AND RECONNECT AUTOMATIC TEMPERATURE-CONTROL OPERATORS.

E. ADJUSTMENT:
1. ADJUST DAMPER LINKAGES FOR PROPER DAMPER OPERATION.
2. ADJUST BELT TENSION.
    a. EXCEPTION: FANS SUPPLIED WITH AUTO-TENSIONER.
3. PROVIDE AND REPLACE FAN AND MOTOR PULLEYS AS REQUIRED TO ACHIEVE DESIGN AIRFLOW.
4. LUBRICATE BEARINGS.

F. REFER TO DIVISION 15 SECTION "TESTING, ADJUSTING, AND BALANCING" FOR TESTING, ADJUSTING, AND BALANCING PROCEDURES.

G. REPAIR OR REPLACE MALFUNCTIONING UNITS AT NO COST TO THE OWNER. RETEST AS SPECIFIED ABOVE AFTER REPAIRS OR REPLACEMENTS ARE MADE.

END OF SECTION

SECTION 23 36 00

AIR TERMINAL UNITS

PART 1: GENERAL

1.1 THE WORK OF THIS SECTION SHALL INCLUDE:

A. THIS SECTION PROVIDES FOR THE FURNISHING AND INSTALLING OF ALL EQUIPMENT, ACCESSORIES AND SERVICES NECESSARY TO PROVIDE AND INSTALL ALL VARIABLE VOLUME TERMINAL UNITS, INTEGRAL HEATING COILS, AND INTEGRAL CONTROLS IN ACCORDANCE WITH DRAWINGS AND SPECIFICATIONS.

1.2 RELATED WORK

A. SECTION 23 31 00 – DUCTWORK
B. SECTION 23 37 00 - AIR OUTLETS & INLETS
C. SECTION 23 09 13 – HVAC INSTRUMENTATION
D. SECTION 23 05 93 - TESTING, ADJUSTING AND BALANCING

1.3 REFERENCES

A. ADC 1062 AIR DISTRIBUTION AND CONTROL DEVICE TEST CODE.
B. NFPA 70 NATIONAL ELECTRICAL CODE.
C. NFPA 90A INSTALLATION OF AIR CONDITIONING AND VENTILATION SYSTEMS.
D. UL 181 FACTORY MADE AIR DUCTS AND CONNECTORS.

1.4 PERFORMANCE TOLERANCES

A. BASE PERFORMANCE ON TESTS CONDUCTED IN ACCORDANCE WITH ADC 1062.

1.5 SUBMITTALS

A. SHOP DRAWINGS: INDICATE CONFIGURATION, GENERAL ASSEMBLY, AND MATERIALS USED IN FABRICATION, AND ELECTRICAL CHARACTERISTICS AND CONNECTION REQUIREMENTS.
B. PRODUCT DATA: PROVIDE DATA INDICATING CONFIGURATION, GENERAL ASSEMBLY, AND MATERIALS USED IN FABRICATION. INCLUDE CATALOG PERFORMANCE RATINGS WHICH INDICATE AIR FLOW, STATIC PRESSURE, AND NC DESIGNATION. INCLUDE ELECTRICAL CHARACTERISTICS AND CONNECTION REQUIREMENTS.
C. INCLUDE SCHEDULES LISTING DISCHARGE AND RADIATED SOUND POWER LEVEL FOR EACH OF SECOND THROUGH SIXTH OCTAVE BANDS AT INLET STATIC PRESSURES OF 1 TO 4 INCH WG.

1.6 OPERATION AND MAINTENANCE DATA

A. OPERATION AND MAINTENANCE DATA: INCLUDE MANUFACTURER'S DESCRIPTIVE LITERATURE, OPERATING INSTRUCTIONS, MAINTENANCE AND REPAIR DATA, AND PARTS LISTS. INCLUDE DIRECTIONS FOR RESETTING CONSTANT VOLUME REGULATORS.

1.7 REGULATORY REQUIREMENTS

A. PRODUCTS REQUIRING ELECTRICAL CONNECTION: LISTED AND CLASSIFIED BY UNDERWRITERS' LABORATORIES INC., AS SUITABLE FOR THE PURPOSE SPECIFIED AND INDICATED.

PART 2: PRODUCTS

2.1 MANUFACTURERS

A. FURNISH AND INSTALL AIR TERMINAL UNITS AS SCHEDULED ON THE DRAWINGS. MANUFACTURERS AND MODEL NUMBERS ARE USED FOR SETTING A STANDARD OF TYPE AND QUALITY FOR THE UNITS. THE ENGINEER SHALL ALLOW ALTERNATE MANUFACTURERS BASED UPON DETERMINATION OF EQUALITY WITH SCHEDULED UNITS.
B. APPROVED MANUFACTURERS:
    1. TRANE
    2. PRICE
    3. TITUS
    4. METAL-AIRE

2.2 MANUFACTURED UNITS

A. CEILING MOUNTED VARIABLE AIR VOLUME SUPPLY AIR CONTROL TERMINALS FOR CONNECTION TO SINGLE DUCT, CENTRAL AIR SYSTEMS, WITH DDC VARIABLE VOLUME CONTROLS.
B. IDENTIFY EACH TERMINAL UNIT WITH CLEARLY MARKED IDENTIFICATION LABEL AND AIR FLOW INDICATOR. INCLUDE UNIT NOMINAL AIR FLOW, MAXIMUM FACTORY SET AIRFLOW, MINIMUM FACTORY SET AIR FLOW, AND COIL TYPE.

2.3 SINGLE DUCT VARIABLE VOLUME UNITS

A. GENERAL: UNITS SHALL BE VARIABLE AIR VOLUME SUPPLY AIR CONTROL TERMINALS FOR CONNECTION TO SINGLE DUCT, CENTRAL AIR SYSTEMS, WITH ELECTRONIC VARIABLE VOLUME CONTROLS. IDENTIFY EACH TERMINAL UNIT WITH CLEARLY MARKED IDENTIFICATION LABEL AND AIR FLOW INDICATOR. INCLUDE UNIT NOMINAL AIR FLOW, MAXIMUM FACTORY SET AIRFLOW, MINIMUM FACTORY SET AIR FLOW, AND COIL TYPE.

B. TERMINAL ASSEMBLIES SHALL BE PRESSURE INDEPENDENT AND SHALL RESET TO ANY AIR FLOW BETWEEN ZERO AND THE MAXIMUM CATALOGED AIR VOLUME.

C. BASIC ASSEMBLY:

1. CASINGS: MINIMUM 22 GAGE GALVANIZED STEEL.
2. LINING: INTERNALLY LINED WITH 3/8" INCH THICK, NON-POROUS, ENGINEERED POLYMER FOAM LINER WITH SELF SEALING EDGES OR 1" DOUBLE WALL WITH FIBERGLASS INSULATION (FIBERGLASS INSULATION SHALL NOT BE IN THE AIR STREAM). LINER SHALL COMPLY WITH UL 181 (AIR EROSION) UL 181 (MOLD GROWTH & HUMIDITY) UL 723 (25/50) (FLAME & SMOKE) ASTM E 84 (25/50) (FLAME & SMOKE) ASTM C 665 (FUNGI RESISTANCE).
3. AIR INLET: ROUND STUB FOR DUCT ATTACHMENT.
4. AIR OUTLET: RECTANGULAR WITH S SLIP AND DRIVE CONNECTIONS.
5. LEAKAGE: AIR LEAKAGE SHALL NOT EXCEED 2 CFM AT ½" W.G. PRESSURE.

D. DAMPER:

1. THE PRIMARY AIR VALVE DAMPER SHALL BE HEAVY GAUGE METAL, WITH PERIPHERAL GASKET AND SOLID STEEL SHAFT, PIVOTED IN SELF-LUBRICATING BEARINGS. IN THE FULL CLOSED POSITION, AIR LEAKAGE PAST THE CLOSED DAMPER SHALL NOT EXCEED 2% OF THE NOMINAL CATALOG RATING AT 3"W.G. INLET STATIC PRESSURE, WHEN TESTED IN ACCORDANCE WITH ASHRAE 130.

E. ELECTRIC HEATING COIL:

1. CONSTRUCTION: UL LISTED, SCR TYPE, OPEN COIL DESIGN, INTEGRAL CONTROL BOX FACTORY WIRED AND INSTALLED, WITH:
    a. PRIMARY AND SECONDARY OVER TEMPERATURE PROTECTION.
    b. MINIMUM AIRFLOW SWITCH.
    c. SCR CONTROL
2. HEATER SHALL BE CAPABLE OF PROVIDING PROPORTIONAL CONTROL USING AND ANALOG SIGNAL FROM THE SPACE TEMPERATURE CONTROL DEVICE. THE SCR CONTROLLER SHALL EMPLOY SOLID STATE SWITCHING WITH ZERO CROSSOVER FOR SILENT OPERATION. CONTACTORS ARE NOT ACCEPTABLE.

F. ACTUATORS:

1. ACTUATORS SHALL BE FIELD MOUNTED BY CONTROL CONTRACTOR.

G. FLOW SENSOR:

1. THE AIR FLOW SENSOR SHALL BE OF A CROSS CONFIGURATION LOCATED AT THE INLET OF THE ASSEMBLY. THE SENSOR SHALL HAVE TWELVE TOTAL PRESSURE SENSING PORTS AND A CENTER AVERAGING CHAMBER DESIGNED TO ACCURATELY AVERAGE THE FLOW ACROSS THE INLET OF THE ASSEMBLY. SENSOR SHALL PROVIDE ACCURACY WITHIN 5% WITH A 90° SHEET METAL ELBOW DIRECTLY AT THE INLET OF THE ASSEMBLY. THE AIR FLOW SENSOR SHALL AMPLIFY THE SENSED AIR FLOW SIGNAL.
2. PRESSURE PICK-UP TUBING SHALL BE PROVIDED TO THE CONTROL ENCLOSURE.

H. CONTROL:

1. EQUIPMENT MANUFACTURER SHALL COORDINATE WITH CONTRACTOR TO ENSURE COMPATIBILITY WITH DDC SYSTEM. IF REQUESTED, PROVIDE NECESSARY DDC VAV CONTROLLER. IF CONTRACTOR IS PROVIDING AND INSTALLING DDC CONTROLLER, UNIT SHALL BE PROVIDED WITH AN ENCLOSURE TO HOUSE THE CONTROLLER.
2. DISCONNECT SWITCH: FACTORY MOUNT AND WIRED FUSED DISCONNECT SWITCH.

2.4 PARALLEL FAN POWERED VARIABLE VOLUME UNITS

SECTION 23 36 00

AIR TERMINAL UNITS

A. GENERAL: UNITS SHALL BE VARIABLE AIR VOLUME SUPPLY AIR CONTROL TERMINALS WITH PARALLEL FAN FOR CONNECTION TO SINGLE DUCT, CENTRAL AIR SYSTEMS, WITH ELECTRONIC VARIABLE VOLUME CONTROLS. IDENTIFY EACH TERMINAL UNIT WITH CLEARLY MARKED IDENTIFICATION LABEL AND AIR FLOW INDICATOR. INCLUDE UNIT NOMINAL AIR FLOW, MAXIMUM FACTORY SET AIRFLOW, MINIMUM FACTORY SET AIR FLOW, AND COIL TYPE.

B. TERMINAL ASSEMBLIES SHALL BE PRESSURE INDEPENDENT AND SHALL RESET TO ANY AIR FLOW BETWEEN ZERO AND THE MAXIMUM CATALOGED AIR VOLUME.

C. BASIC ASSEMBLY
   1. CASINGS GAUGE OF THE ASSEMBLY CASING SHALL BE AS FOLLOWS:
      a. CASING WIDTH LESS THAN 36" - MINIMUM 22 GAUGE.
      b. CASING WIDTH 36" OR GREATER - MINIMUM 20 GAUGE.
   2. CASING SHALL HAVE BOTTOM ACCESS DOOR FOR REMOVAL OF FAN AND SERVICE.
   3. LINING: INTERNALLY LINED WITH3/8” INCH THICK, NON-POROUS, ENGINEERED POLYMER FOAM LINER WITH SELF SEALING EDGES, OR 1” DOUBLE WALL WITH FIBERGLASS INSULATION (FIBERGLASS INSULATION SHALL NOT BE IN THE AIR STREAM). LINER SHALL COMPLY WITH UL 181 (AIR EROSION) UL 181 (MOLD GROWTH & HUMIDITY) UL 723 (25/50) (FLAME & SMOKE) ASTM E 84 (25/50) (FLAME & SMOKE) ASTM C 665 (FUNGI RESISTANCE).
   4. PLENUM AIR INLETS: PROVIDE FILTER ON INLET.
   5. PRIMARY: ROUND STUB FOR DUCT ATTACHMENT.
   6. AIR OUTLETS: S SLIP AND DRIVE CONNECTIONS.
   7. PROVIDE BACKDRAFT DAMPER TO PREVENT PRIMARY AIR FROM FLOWING INTO PLENUM.
   8. LEAKAGE: AIR LEAKAGE SHALL NOT EXCEED 2 CFM AT ½” W.G. PRESSURE.

D. DAMPER:
   1. THE PRIMARY AIR VALVE DAMPER SHALL BE HEAVY GAUGE METAL, WITH PERIPHERAL GASKET AND SOLID STEEL SHAFT, PIVOTED IN SELF-LUBRICATING BEARINGS. IN THE FULL CLOSED POSITION, AIR LEAKAGE PAST THE CLOSED DAMPER SHALL NOT EXCEED 2% OF THE NOMINAL CATALOG RATING AT 3"W.G. INLET STATIC PRESSURE, WHEN TESTED IN ACCORDANCE WITH ASHRAE 130.

E. FAN ASSEMBLY
   1. FAN BLOWER SHALL BE CONSTRUCTED OF STEEL WITH FORWARD CURVED BLADES, DYNAMICALLY BALANCED WHEELS AND DIRECT DRIVE MOTOR. MOTORS SHALL BE PERMANENT SPLIT CAPACITOR TYPE, WITH LUBRICATED BEARINGS AND THERMAL OVERLOAD PROTECTION. MOTOR SHALL BE DESIGNED FOR USE WITH ELECTRONIC FAN SPEED CONTROLLER. PROVIDE ISOLATION BETWEEN MOTOR AND BLOWER ASSEMBLY.
   2. PROVIDE AN ELECTRONIC SPEED CONTROLLER WHICH ALLOWS CONTINUOUSLY ADJUSTABLE FAN SPEED FROM MAXIMUM TO MINIMUM. SPEED CONTROL SHALL BE ELECTRONIC AND SHALL BE EQUIPPED WITH A MINIMUM VOLTAGE STOP TO ENSURE MOTOR WILL NOT OPERATE IN THE STALL MODE. VOLTAGE STOP SHALL BE FACTORY ADJUSTED
   3. ISOLATION: FAN/MOTOR ASSEMBLY ON RUBBER ISOLATORS.

F. ELECTRIC HEATING COIL:
   1. CONSTRUCTION: UL LISTED, SCR TYPE, OPEN COIL DESIGN, INTEGRAL CONTROL BOX FACTORY WIRED AND INSTALLED, WITH:
      a. PRIMARY AND SECONDARY OVER TEMPERATURE PROTECTION.
      b. MINIMUM AIRFLOW SWITCH.
      c. SCR CONTROL
   2. HEATER SHALL BE CAPABLE OF PROVIDING PROPORTIONAL CONTROL USING AND ANALOG SIGNAL FROM THE SPACE TEMPERATURE CONTROL DEVICE. THE SCR CONTROLLER SHALL EMPLOY SOLID STATE SWITCHING WITH ZERO CROSSOVER FOR SILENT OPERATION. CONTACTORS ARE NOT ACCEPTABLE.

G. ELECTRICAL AND CONTROL

1. ELECTRICAL AND CONTROL ENCLOSURES SHALL BE PROVIDED WITH UNIT.
2. UNIT SHALL HAVE A SINGLE POINT POWER CONNECTION. FAN MOTOR AND ELECTRIC COIL SHALL BE PROTECTED FROM OVER VOLTAGE OR CURRENT.
3. CONTRACTOR SHALL PROVIDE AND INSTALL DDC CONTROLLER
4. FACTORY OR FIELD MOUNT TRANSFORMER FOR CONTROL VOLTAGE. CONTROLS TRANSFORMERS SHALL BE SIZED BY CONTRACTOR. CONTROL POWER FOR NON-FAN POWERED VAV BOXES SHALL DERIVED FROM CONTROL TRANSFORMERS IN ADJACENT FAN POWERED BOXES.
5. DISCONNECT SWITCH: FACTORY MOUNT AND WIRED FUSED DISCONNECT SWITCH.

2.5 SERIES FAN POWERED VARIABLE VOLUME UNITS

A. GENERAL: UNITS SHALL BE VARIABLE AIR VOLUME SUPPLY AIR CONTROL TERMINALS WITH SERIES FAN FOR CONNECTION TO SINGLE DUCT, CENTRAL AIR SYSTEMS, WITH ELECTRONIC VARIABLE VOLUME CONTROLS. IDENTIFY EACH TERMINAL UNIT WITH CLEARLY MARKED IDENTIFICATION LABEL AND AIR FLOW INDICATOR. INCLUDE UNIT NOMINAL AIR FLOW, MAXIMUM FACTORY SET AIRFLOW, MINIMUM FACTORY SET AIR FLOW, AND COIL TYPE.

B. TERMINAL ASSEMBLIES SHALL BE PRESSURE INDEPENDENT AND SHALL RESET TO ANY AIR FLOW BETWEEN ZERO AND THE MAXIMUM CATALOGED AIR VOLUME.

C. BASIC ASSEMBLY

1. CASINGS GAUGE OF THE ASSEMBLY CASING SHALL BE AS FOLLOWS:
    a. CASING WIDTH LESS THAN 36" - MINIMUM 22 GAUGE.
    b. CASING WIDTH 36" OR GREATER - MINIMUM 20 GAUGE.
2. CASING SHALL HAVE BOTTOM ACCESS DOOR FOR REMOVAL OF FAN AND SERVICE.
3. LINING: INTERNALLY LINED WITH 3/8” INCH THICK, NON-POROUS, ENGINEERED POLYMER FOAM LINER WITH SELF SEALING EDGES, OR 1” DOUBLE WALL WITH FIBERGLASS INSULATION (FIBERGLASS INSULATION SHALL NOT BE IN THE AIR STREAM). LINER SHALL COMPLY WITH UL 181 (AIR EROSION) UL 181 (MOLD GROWTH & HUMIDITY) UL 723 (25/50) (FLAME & SMOKE) ASTM E 84 (25/50) (FLAME & SMOKE) ASTM C 665 (FUNGI RESISTANCE).
4. PROVIDE BACKDRAFT DAMPER TO PREVENT PRIMARY AIR FROM FLOWING INTO PLENUM.
5. PLENUM AIR INLETS: PROVIDE FILTER ON INLET.
6. PRIMARY: ROUND STUB FOR DUCT ATTACHMENT.
7. AIR OUTLETS: S SLIP AND DRIVE CONNECTIONS.
8. LEAKAGE: AIR LEAKAGE SHALL NOT EXCEED 2 CFM AT ½” W.G. PRESSURE.

D. DAMPER:

1. THE PRIMARY AIR VALVE DAMPER SHALL BE HEAVY GAUGE METAL, WITH PERIPHERAL GASKET AND SOLID STEEL SHAFT, PIVOTED IN SELF-LUBRICATING BEARINGS. IN THE FULL CLOSED POSITION, AIR LEAKAGE PAST THE CLOSED DAMPER SHALL NOT EXCEED 2% OF THE NOMINAL CATALOG RATING AT 3"W.G. INLET STATIC PRESSURE, WHEN TESTED IN ACCORDANCE WITH ASHRAE 130.

E. FAN ASSEMBLY

1. FAN BLOWER SHALL BE CONSTRUCTED OF STEEL WITH FORWARD CURVED BLADES, DYNAMICALLY BALANCED WHEELS AND DIRECT DRIVE MOTOR. MOTORS SHALL BE PERMANENT SPLIT CAPACITOR TYPE, WITH LUBRICATED BEARINGS AND THERMAL OVERLOAD PROTECTION. MOTOR SHALL BE DESIGNED FOR USE WITH ELECTRONIC FAN SPEED CONTROLLER. PROVIDE ISOLATION BETWEEN MOTOR AND BLOWER ASSEMBLY.
2. PROVIDE AN ELECTRONIC SPEED CONTROLLER WHICH ALLOWS CONTINUOUSLY ADJUSTABLE FAN SPEED FROM MAXIMUM TO MINIMUM. SPEED CONTROL SHALL BE ELECTRONIC AND SHALL BE EQUIPPED WITH A MINIMUM VOLTAGE STOP TO ENSURE MOTOR WILL NOT OPERATE IN THE STALL MODE. VOLTAGE STOP SHALL BE FACTORY ADJUSTED
3. ISOLATION: FAN/MOTOR ASSEMBLY ON RUBBER ISOLATORS.

F. ELECTRIC HEATING COIL:

1. CONSTRUCTION: UL LISTED, SCR TYPE, OPEN COIL DESIGN, INTEGRAL CONTROL BOX FACTORY WIRED AND INSTALLED, WITH:
    a. PRIMARY AND SECONDARY OVER TEMPERATURE PROTECTION.
    b. MINIMUM AIRFLOW SWITCH.
    c. SCR CONTROL
2. HEATER SHALL BE CAPABLE OF PROVIDING PROPORTIONAL CONTROL USING AND ANALOG SIGNAL FROM THE SPACE TEMPERATURE CONTROL DEVICE. THE SCR CONTROLLER SHALL EMPLOY SOLID STATE SWITCHING WITH ZERO CROSSOVER FOR SILENT OPERATION. CONTACTORS ARE NOT ACCEPTABLE.

G. ELECTRICAL AND CONTROL
1. ELECTRICAL AND CONTROL ENCLOSURES SHALL BE PROVIDED WITH UNIT.
2. UNIT SHALL HAVE A SINGLE POINT POWER CONNECTION. FAN MOTOR AND ELECTRIC COIL SHALL BE PROTECTED FROM OVER VOLTAGE OR CURRENT.
3. CONTRACTOR SHALL PROVIDE AND INSTALL DDC CONTROLLER
4. FACTORY OR FIELD MOUNT TRANSFORMER FOR CONTROL VOLTAGE. CONTROLS TRANSFORMERS SHALL BE SIZED BY CONTRACTOR. CONTROL POWER FOR NON-FAN POWERED VAV BOXES SHALL DERIVED FROM CONTROL TRANSFORMERS IN ADJACENT FAN POWERED BOXES.
5. DISCONNECT SWITCH: FACTORY MOUNT AND WIRED FUSED DISCONNECT SWITCH.

PART 3: EXECUTION

3.1 INSTALLATION

A. INSTALL IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS.
B. IF REQUESTED, PROVIDE NECESSARY DDC VAV CONTROLLER.
C. PROVIDE CEILING ACCESS DOORS OR LOCATE UNITS ABOVE EASILY REMOVABLE CEILING COMPONENTS.
D. SUPPORT UNITS INDIVIDUALLY FROM STRUCTURE. DO NOT SUPPORT FROM ADJACENT DUCTWORK.
E. CONNECT TO DUCTWORK IN ACCORDANCE WITH FLEXIBLE INLET CONNECTION DETAIL.
F. VERIFY THAT ELECTRIC POWER IS AVAILABLE AND OF THE CORRECT CHARACTERISTICS (4 WIRE VS 3 WIRE POWER).
G. LABEL EACH VAV WITH 3” HIGH LABELS ON THE BOTTOM OF THE VAV BOX.

END OF SECTION

SECTION 23 37 13

AIR OUTLETS AND INLETS

PART 1: GENERAL

1.1 THE WORK OF THIS SECTION SHALL INCLUDE:

A. PROVISION OF THE FOLLOWING:

1. CEILING AND SIDEWALL DIFFUSERS, REGISTERS, GRILLES.

1.2 RELATED WORK

A. SECTION 23 31 00 – DUCTS

B. SECTION 23 05 93 - TESTING, ADJUSTING AND BALANCING

1.3 REFERENCES

A. ADC 1062 CERTIFICATION, RATING AND TEST MANUAL

B. AMCA 500 TEST METHOD FOR LOUVERS, DAMPERS AND SHUTTERS

C. ANSI/NFPA 90A INSTALLATION OF AIR CONDITIONING AND VENTILATING SYSTEMS

D. ARI 650 AIR OUTLETS AND INLETS

E. ASHRAE 70 METHOD OF TESTING FOR RATING THE AIR FLOW PERFORMANCE OF OUTLETS AND INLETS

F. SMACNA LOW PRESSURE DUCT CONSTRUCTION STANDARD

G. INTERNATIONAL MECHANICAL CODE 2009.

1.4 QUALITY ASSURANCE

A. TEST AND RATE PERFORMANCE OF AIR OUTLETS AND INLETS IN ACCORDANCE WITH ADC EQUIPMENT TEST CODE 1062 AND ASHRAE 70.

B. TEST AND RATE PERFORMANCE OF LOUVERS IN ACCORDANCE WITH AMCA 500.

1.5 SUBMITTALS

A. GENERAL: COMPLY WITH THE PROVISIONS OF SECTION 15050.

B. INCLUDE PRODUCT DATA FOR OUTLETS AND INLETS INDICATING TYPE, SIZE, LOCATION, APPLICATION, AND NOISE LEVEL.

C. REVIEW REQUIREMENTS OF OUTLETS AND INLETS AS TO SIZE, FINISH, AND TYPE OF MOUNTING PRIOR TO SUBMITTING PRODUCT DATA AND SCHEDULES OF OUTLETS AND INLETS.

D. INCLUDE MANUFACTURER'S INSTALLATION INSTRUCTIONS.

1.6 REGULATORY REQUIREMENTS

A. CONFORM TO ANSI/NFPA 90A.

PART 2: PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. METAL*AIRE

B. PRICE INDUSTRIES

C. TITUS

2.2 REGISTERS, GRILLES, DIFFUSERS, AND LOUVERS

A. PROVIDE SIZES MODELS AND SIZES, WITH FINISHES AND ACCESSORIES, AS SHOWN ON THE DRAWINGS AND SCHEDULES. CONTRACTOR TO ADVISE CONSTRUCTION MANAGER WHERE MODEL NUMBERS DO NOT AGREE WITH DESCRIPTION OR APPLICATION.

B. CONTRACTOR IS RESPONSIBLE FOR QUANTITIES.

2.3 LOUVERED CEILING SUPPLY (TYPE A,C)

A. FURNISH AND INSTALL DIRECTIONAL LOUVERED FACE DIFFUSERS OF THE SIZES AND MOUNTING TYPES SHOWN ON THE PLANS AND AIR DISTRIBUTION SCHEDULE. DIFFUSERS SHALL CONSIST OF AN OUTER FRAME ASSEMBLY WHICH FACILITATES MOUNTING IN THE APPLICATION SHOWN. A COLLAR THAT ALLOWS CONNECTION TO THE SQUARE DUCT SIZE INDICATED SHALL BE AN INTEGRAL PART OF THE FRAME ASSEMBLY. PROVIDE ROUND COLLAR WHERE FLEXIBLE DUCT IS USED. AN INNER CORE ASSEMBLY CONSISTING OF FIXED LOUVERS CAPABLE OF PRODUCING THE AIRFLOW DISCHARGE PATTERN INDICATED ON THE PLANS SHALL BE FULLY REMOVABLE FROM THE INSTALLED DIFFUSER FRAME FOR ACCESS TO ANY DAMPERS OR OTHER DUCTWORK COMPONENTS LOCATED IN OR NEAR THE DIFFUSER NECK. A SET OF ADJUSTMENT VANES SHALL BE PROVIDED ON EACH SIDE OF THE DIFFUSER WHICH ALLOWS FIELD ADJUSTMENT FROM HORIZONTAL TO VERTICAL AIRFLOW DISCHARGE. FINISH SHALL BE WHITE POWDER COAT.

2.4 SQUARE PLAQUE CEILING RETURN/EXHAUST (OFFICE) (TYPE B,D)

A. FURNISH AND INSTALL DIFFUSERS OF THE SIZES AND MOUNTING TYPES SHOWN ON THE PLANS AND AIR DISTRIBUTION SCHEDULE. DIFFUSERS SHALL CONSIST OF PRECISION FORMED BACK CONE OF ONE PIECE SEAMLESS CONSTRUCTION WHICH INCORPORATES A ROUND INLET COLLAR OF SUFFICIENT LENGTH FOR CONNECTING RIGID OR FLEXIBLE DUCT. AN INNER PLAQUE ASSEMBLY SHALL BE INCORPORATED THAT DROPS NO MORE THAN ¼" BELOW THE CEILING PLANE TO ASSURE PROPER PERFORMANCE. THE INNER PLAQUE ASSEMBLY SHALL BE COMPLETELY REMOVABLE FROM THE DIFFUSER FACE TO ALLOW FULL ACCESS TO ANY DAMPERS OR DUCTWORK COMPONENTS NEAR THE NECK. FINISH SHALL BE WHITE POWDER COAT.

2.5 LINEAR SLOT WITH PLENUM (TYPE E)

A. FURNISH AND INSTALL SUPPLY DIFFUSERS OF THE SIZES, CONFIGURATIONS AND MOUNTING TYPES INDICATED ON THE PLANS AND OUTLET SCHEDULE. DIFFUSERS SHALL HAVE DISCHARGE SLOTS 1" WIDE (UNLESS OTHERWISE SCHEDULED) EACH WITH EXTRUDED ALUMINUM AERODYNAMICALLY CURVED "ICE-TONG" SHAPED PATTERN CONTROLLERS FOR 180 DEGREE AIR PATTERN CONTROL AND AIRFLOW DAMPERING IF REQUIRED. NUMBER OF SLOTS IS INDICATED ON THE DRAWINGS. THE DIFFUSER BORDER SHALL BE HEAVY EXTRUDED ALUMINUM CONSTRUCTION WITH EXTRUDED ALUMINUM SPACERS. CONTINUOUS LENGTH UNITS SHALL BE PROVIDED WITH FACTORY ASSEMBLED CORNER MODULES TO SUIT DRAWINGS AND ON SITE CONDITIONS. JOINER STRIPS SHALL BE PROVIDED TO ALIGN CONTINUOUS SLOT ASSEMBLIES. THE DIFFUSER BORDER SHALL BE FINISHED IN WHITE.

B. LINEAR SLOT DIFFUSER SHALL BE PROVIDED WITH MODEL PLENUM ASSEMBLY OF THE SIZES, CONFIGURATIONS AND MOUNTING TYPES INDICATED ON THE PLANS AND OUTLET SCHEDULE. PLENUMS SHALL BE CONSTRUCTED OF ZINC COATED STEEL. PLENUM ASSEMBLIES SHALL BE OF A ROUND SIDE INLET CONFIGURATION. PLENUMS SHALL FIT SLOT DIFFUSER PROVIDED.

2.6 DOUBLE DEFLECTION SUPPLY (TYPE F,Fa)

A. FURNISH AND INSTALL SUPPLY REGISTERS OF THE SIZES AND MOUNTING TYPES INDICATED ON THE PLANS AND OUTLET SCHEDULE. REGISTERS SHALL BE DOUBLE DEFLECTION TYPE WITH TWO SETS OF FULLY ADJUSTABLE DEFLECTION BLADES SPACED 3/4" ON CENTER. THE FRONT BLADES SHALL RUN PARALLEL TO THE SHORT DIMENSION OF THE REGISTER. BOTH BLADES AND BORDER SHALL BE OF HEAVY EXTRUDED ALUMINUM CONSTRUCTION. THE INTEGRAL VOLUME CONTROL DAMPER SHALL BE OF THE OPPOSED BLADE TYPE AND SHALL BE CONSTRUCTED OF OPTIONAL ALUMINUM. THE DAMPER SHALL BE OPERABLE FROM THE REGISTER FACE. THE DAMPER SHALL BE MILL FINISH ALUMINUM. THE GRILLE SHALL BE FINISHED IN WHITE POWDER COAT. THE Fa MODEL SHALL HAVE AN ALUMINUM COLOR FINISH.

2.7 LOUVERED RETURN (TYPE G,Ga)

A. FURNISH AND INSTALL REGISTERS OF THE SIZES AND MOUNTING TYPES INDICATED ON THE PLANS AND OUTLET SCHEDULE. REGISTERS SHALL BE 45 DEGREE DEFLECTION FIXED LOUVER TYPE WITH BLADES SPACED 1/2" ON CENTER. THE BLADES SHALL RUN PARALLEL TO THE LONG DIMENSION OF THE REGISTER AS INDICATED IN THE OUTLET SCHEDULE. BOTH BLADES AND BORDER SHALL BE OF HEAVY EXTRUDED ALUMINUM CONSTRUCTION. THE INTEGRAL VOLUME CONTROL DAMPER SHALL BE OF THE OPPOSED BLADE TYPE AND SHALL BE CONSTRUCTED OF COLD ROLLED STEEL. THE DAMPER SHALL BE OPERABLE FROM THE REGISTER FACE. THE DAMPER SHALL BE COATED STEEL. THE GRILLE SHALL BE FINISHED IN WHITE POWDER COAT. THE Ga MODEL SHALL HAVE AN ALUMINUM COLOR FINISH.

2.8 DRUM LOUVER (TYPE H, Ha, Hs)

A. FURNISH AND INSTALL SUPPLY OUTLETS OF THE SIZES AND MODELS INDICATED ON THE PLANS AND OUTLET SCHEDULE. THE OUTLETS SHALL CONSIST OF INDIVIDUALLY ADJUSTABLE SPREAD CONTROL VANES HOUSED WITHIN A ROTATABLE DRUM. CURVED OUTER DRUM, VANES AND ALL OTHER COMPONENTS CONSTRUCTED OF STAINLESS STEEL. THE DRUM PIVOT MECHANISM SHALL INCORPORATE A POSITIVE POSITIONING DETENT DEVICE TO HOLD FIELD ADJUSTED DRUM ANGLES OF UP TO 30° OFF CENTER. ADJUSTABLE VANES ARE TO PIVOT AND MAINTAIN BLADE

SETTING. THE BORDER SHALL BE CONSTRUCTED OF FORMED STAINLESS STEEL WITH WELDED, REINFORCED CORNERS FOR EXTRA STRENGTH. SCREW HOLES SHALL BE COUNTERSUNK FOR AESTHETIC APPEAL. THE INTEGRAL VOLUME CONTROL DAMPER SHALL BE OF THE OPPOSED BLADE TYPE AND SHALL BE CONSTRUCTED OF STAINLESS STEEL. THE DAMPER SHALL BE OPERABLE FROM THE REGISTER FACE. THE UNIT FINISH SHALL BE MILL FINISH. (MODEL DLSS) WHERE SPECIFIED AS HCD COMPONENTS SHALL BE ALUMINUM WITH A WHITE FINISH. THE Ha MODEL SHALL HAVE AN ALUMINUM COLOR FINISH.

2.9 EGGCRATE RETURN (TYPE I)

A. FURNISH AND INSTALL RETURN/EXHAUST REGISTERS OF THE SIZES AND MOUNTING TYPES INDICATED ON THE PLANS AND OUTLET SCHEDULE. REGISTERS SHALL BE OF ALUMINUM CONSTRUCTION, CONSISTING OF 1" X 1" X 1" GRIDS (EGG CRATE CORE) AND AN EXTRUDED ALUMINUM BORDER. THE INTEGRAL VOLUME CONTROL DAMPER SHALL BE PROVIDED FOR EXHAUST APPLICATIONS. THE DAMPER SHALL BE OPERABLE FROM THE REGISTER FACE. THE DAMPER SHALL BE COATED STEEL. THE GRILLE SHALL BE FINISHED IN WHITE POWDER COAT.

2.10 DOUBLE DEFLECTION SUPPLY (TYPE J, Ja, Js)

A. FURNISH AND INSTALL SUPPLY GRILLE OF THE SIZES AND MOUNTING TYPES INDICATED ON THE PLANS AND OUTLET SCHEDULE. REGISTERS SHALL BE DOUBLE DEFLECTION TYPE WITH TWO SETS OF FULLY ADJUSTABLE DEFLECTION BLADES SPACED 3/4" ON CENTER. THE FRONT BLADES SHALL RUN PARALLEL TO THE SHORT DIMENSION OF THE REGISTER. BOTH BLADES AND BORDER SHALL BE OF STAINLESS STEEL OR ALUMINUM CONSTRUCTION. THE INTEGRAL VOLUME CONTROL DAMPER SHALL BE OF THE OPPOSED BLADE TYPE AND SHALL BE CONSTRUCTED OF SAME MATERIAL AS BLADES. THE DAMPER SHALL BE OPERABLE FROM THE REGISTER FACE. THE GRILLE SHALL BE #4 FINISH FOR STAINLESS STEEL. THE DAMPER SHALL BE 2B FINISH FOR STAINLESS. THE Ja MODEL SHALL HAVE AN ALUMINUM COLOR FINISH. THE Js MODEL SHALL BE ALL STAINLESS STEEL.

2.11 LOUVERED RETURN (TYPE K)

A. FURNISH AND INSTALL STAINLESS STEEL RETURN GRILLES OF THE SIZES AND MOUNTING TYPES INDICATED ON THE PLANS AND OUTLET SCHEDULE. GRILLES SHALL BE 45 DEGREE DEFLECTION FIXED LOUVER TYPE WITH BLADES SPACED 3/4" ON CENTER. THE BLADES SHALL RUN PARALLEL TO THE LONG/ DIMENSION OF THE GRILLE. THE GRILLE BORDER SHALL HAVE A #4 FINISH WITH THE BLADES BEING A 2B FINISH.

2.12 DOUBLE DEFLECTION AIRFOIL (TYPE L).

A. FURNISH AND INSTALL SUPPLY GRILLES OF THE SIZES AND MOUNTING TYPES INDICATED ON THE PLANS AND OUTLET SCHEDULE. GRILLES SHALL BE DOUBLE DEFLECTION TYPE WITH TWO SETS OF FULLY ADJUSTABLE, 3 IN. DEEP, AIRFOIL SHAPED DEFLECTION BLADES SPACED 3 IN. ON CENTER. THE FRONT SET OF BLADES SHALL RUN PARALLEL TO THE (LONG / SHORT) DIMENSION OF THE GRILLE. THE BLADES SHALL BE OF HEAVY EXTRUDED ALUMINUM CONSTRUCTION WITH A 11/4 IN. FLAT BORDER OF HEAVY GAUGE STEEL. THE GRILLE SHALL BE FINISHED IN (WHITE POWDER COAT OR ALUMINUM POWDER COAT AS SCHEDULED). PAINT FINISH SHALL PASS 500 HOURS OF SALT SPRAY EXPOSURE WITH NO MEASURABLE CREEP IN ACCORDANCE WITH ASTM D1654 AND 1000 HOURS WITH NO RUSTING OR BLISTERING AS PER ASTM D610 AND ASTM D714.

2.13 FILTERED GRILLE (TYPE M)

A. FURNISH AND INSTALL ALUMINUM FILTER RETURN GRILLES OF THE SIZES AND MOUNTING TYPES INDICATED ON THE PLANS AND OUTLET SCHEDULE. GRILLES SHALL BE 45 DEGREE DEFLECTION FIXED LOUVER TYPE WITH BLADES SPACED 3/4" ON CENTER. THE BLADES SHALL RUN PARALLEL TO THE LONG DIMENSION OF THE GRILLE. THE BORDER SHALL BE MOUNTED TO THE FILTER FRAME WITH 1/4 TURN QUICK RELEASE FASTENERS. THE MOUNTING FRAME SHALL ACCEPT A STANDARD 1" FILTER MEDIA. THE GRILLE SHALL BE FINISHED IN WHITE POWDER COAT.

2.14 HEPA - FILTERED CEILING SUPPLY (TYPE N)

A. FURNISH AND INSTALL LAMINAR FLOW DIFFUSERS WITH REPLACEABLE HIGH EFFICIENCY FILTERS AS INDICATED ON THE PLANS AND OUTLET SCHEDULE. THE DIFFUSER SHALL BE A

DUCTED SUPPLY DIFFUSER WITH AN EASILY REPLACEABLE HIGH EFFICIENCY FILTER. THE ASSEMBLY SHALL HAVE A GEL SEAL DESIGN, WHICH ALLOWS REMOVAL AND REPLACEMENT OF THE FILTER WITHOUT MOVING OR DISCONNECTING THE DIFFUSER HOUSING FROM THE CEILING SYSTEM.

B. THE HEPA DIFFUSER SHALL INCORPORATE THE FOLLOWING FEATURES:
   1. AIRTIGHT CONSTRUCTION OF FILTER HOUSING.
   2. AN EASILY REMOVED PERFORATED FACE.
   3. STATIC PRESSURE TEST PORT.
      a. THE STATIC PRESSURE PORT IS USED DURING FACTORY TESTING FOR LEAKS, AS WELL AS IN THE FIELD TO MEASURE THE PRESSURE DROP ACROSS THE FILTER.
   4. EACH STANDARD LFDC HOUSING ASSEMBLY IS FACTORY SCAN TESTED FOR LEAKS. THE TEST ENSURES THAT PINHOLES OR EDGE LEAKS ARE DETECTED AT THE FACTORY AND CORRECTED BEFORE SHIPMENT.

C. THE DIFFUSER SHALL HAVE A WHITE POWDER COAT FINISH ON THE BORDER AND PERFORATED FACE.

2.15 SPOT DIFFUSER (TYPE O)

A. FURNISH AND INSTALL ALUMINUM SPOT DIFFUSERS AS INDICATED ON THE PLANS AND OUTLET SCHEDULE. THE SPOT DIFFUSERS SHALL BE MANUFACTURED FROM HEAVY-GAGE ALUMINUM. PROVIDE WITH A MULTI-DIRECTIONAL LOUVER BODY AND ALL OTHER COMPONENTS ARE MACHINED TO CLOSE TOLERANCES FROM SOLID ALUMINUM ALLOYS, AND THEN BRIGHT POLISH. PROVIDE WITH A FLANGE-TO-BODY GASKET CONSISTING OF TWO TANDEM FELT STRIPS FOR A LEAK-PROOF SEAL. THESE COMPONENTS SHALL COMPRISE A UNIT WHICH PROVIDES SMOOTH MOVEMENT OF THE LOUVER BODY WHEN ADJUSTING ITS DIRECTION. THE FLANGE MOUNTING GASKET SHALL BE CLOSED-CELL NEOPRENE OR FELT, DEPENDING ON UNIT SIZE

2.16 SINGLE DEFLECTION SUPPLY (TYPE P)

A. FURNISH AND INSTALL RETURN GRILLE OF THE SIZES AND MOUNTING TYPES INDICATED ON THE PLANS AND OUTLET SCHEDULE. REGISTERS SHALL BE SINGLE DEFLECTION TYPE WITH FULLY ADJUSTABLE DEFLECTION BLADES SPACED 3/4" ON CENTER. THE FRONT BLADES SHALL RUN PARALLEL TO THE SHORT DIMENSION OF THE REGISTER. BOTH BLADES AND BORDER SHALL BE OF STAINLESS STEEL OR ALUMINUM CONSTRUCTION. THE INTEGRAL VOLUME CONTROL DAMPER SHALL BE OF THE OPPOSED BLADE TYPE AND SHALL BE CONSTRUCTED OF SAME MATERIAL AS BLADES. THE DAMPER SHALL BE OPERABLE FROM THE REGISTER FACE. THE GRILLE SHALL BE #4 FINISH FOR STAINLESS STEEL. THE DAMPER SHALL BE 2B FINISH FOR STAINLESS.

PART 3: EXECUTION

3.1 INSTALLATION

A. INSTALL ITEMS IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS.

B. CHECK LOCATION OF OUTLETS AND INLETS AND MAKE NECESSARY ADJUSTMENTS IN POSITION TO CONFORM TO ARCHITECTURAL FEATURES, SYMMETRY, AND LIGHTING ARRANGEMENT.

C. INSTALL DIFFUSERS TO DUCTWORK WITH AIRTIGHT CONNECTION, AND CONTINUE INSULATION ONTO BACK OF DIFFUSER.

D. IN PRODUCTION AREAS, COMPLETELY SEAL PERIMETER OF REGISTER/GRILLE/DIFFUSER FRAME AND SCREW HOLES WITH EVENLY-APPLIED BEAD OF CLEAR-DRYING RTV SILICONE CAULK.

E. PROVIDE ALL SPECIALTIES AND FRAMES FOR AIR DEVICES REQUIRED FOR INSTALLATION IN CEILING TYPE INDICATED IN ARCHITECTURAL DOCUMENTS. PROVIDE ALL CUTTING AND PATCHING OF TILES, T-BARS, GYPSUM BOARD AND OTHER CEILING SYSTEMS AS REQUIRED FOR INSTALLATION OF AIR DEVICES.

F. PROVIDE AND INSTALL FILTERS AT ALL FILTER GRILLES INSTALLED.

G. CUSTOM FLOW BARS (WHERE SPECIFIED OR SHOWN ON DRAWINGS) SHALL BE FIELD MEASURED AND VERIFIED WITH ARCHITECT PRIOR TO ORDERING.

3.2 ADJUSTING

A. AFTER INSTALLATION, ADJUST DIFFUSERS, REGISTERS, AND GRILLES TO AIR PATTERNS INDICATED, OR AS DIRECTED, BEFORE STARTING AIR BALANCING.

END OF SECTION

SECTION 23 71 13

PACKAGED OUTDOOR HVAC EQUIPMENT (RTU)

PART 1: GENERAL

1.1 SUMMARY

A. REFER TO THESE SPECIFICATIONS TO ASCERTAIN THE FULL EXTENT OF WORK REQUIRED FOR THE UNITARY AIR CONDITIONING UNITS, WITH PACKAGED DX COOLING, INDIRECT GAS HEAT (OR ELECTRIC HEAT), FACTORY PROVIDED AND INSTALLED CONTROLS WITH ACCESSORIES AND OPTIONS AS REFERENCED HEREIN.

B. THE EQUIPMENT SHALL BE RECEIVED AND INSTALLED AT THE SITE BY THE CONTRACTOR.

C. THE EQUIPMENT MANUFACTURER, COORDINATED THROUGH THE CONTRACTOR, SHALL PROVIDE STARTUP SERVICES AND VERIFICATION OF CONTROL SYSTEM OPERATION AFTER INSTALLATION.

D. THE EQUIPMENT MANUFACTURER, COORDINATED THOUGHT THE CONTRACTOR, SHALL PROVIDE ON SITE OWNER TRAINING.

1.2 SCOPE

A. THE SCOPE OF WORK OF THIS SECTION SHALL INCLUDE BUT NOT NECESSARILY BE LIMITED TO THE FOLLOWING:

1. PROVIDE THE SCHEDULED CAPACITY UNITARY AIR CONDITIONING UNITS RTU-01 THRU RTU-06 AS SPECIFIED HEREIN. THE EQUIPMENT SHALL BE PROVIDED TO MEET THE INTENT OF THIS SPECIFICATION, THE EQUIPMENT SCHEDULES AND THE SEQUENCE OF OPERATION.
2. PROVIDE ROOFTOP UNITARY AIR CONDITIONING UNIT CONTROLS COMPATIBLE TO BUILDING HVAC CONTROLS REQUIREMENTS.
3. PROVIDE INSUALTED AND LINED SLOPED ROOF MOUNTING BASE CURBS SUITABLE FOR PROJECT SEISMIC ZONE FOR EACH UNIT.
4. PROVIDE SHOP DRAWINGS FOR EQUIPMENT.
5. PROVIDE FACTORY RUN TESTING OF EQUIPMENT AND CONTROLS.
6. PROVIDE SHIPPING, HANDLING AND DELIVERY OF EQUIPMENT TO THE PROJECT SITE.

1.3 REGULATORY REQUIREMENTS

A. ALL MATERIALS AND WORKMANSHIP SHALL COMPLY WITH ALL APPLICABLE CODES, SPECIFICATIONS, LOCAL AND STATE ORDINANCES, LATEST EDITIONS.

B. IN CASE OF DIFFERENCE BETWEEN BUILDING CODES, STATE LAWS, LOCAL ORDINANCES AND INDUSTRY STANDARD THE MANUFACTURE SHALL PROMPTLY NOTIFY THE OWNER IN WIRING OF ANY SUCH DIFFERENCE.

C. IN CASE OF CONFLICT BETWEEN THESE SPECIFICATIONS AND THE REQUIREMENTS OF ANY CODE OR AUTHORITIES HAVING JURISDICTION, THE MOST STRINGENT REQUIREMENTS OF THE AFOREMENTIONED SHALL GOVERN.

D. SHOULD THE MANUFACTURER PERFORM ANY WORK THAT DOES NOT COMPLY WITH THE REQUIREMENTS OF THE APPLICABLE BUILDING CODES, STATE LAWS, LOCAL ORDINANCES AND INDUSTRY STANDARDS, HE SHALL BEAR ALL COSTS ARISING IN CORRECTING THE DEFICIENCIES, AS APPROVED BY THE OWNER.

E. APPLICABLE CODES AND STANDARDS SHALL INCLUDE ALL STATE LAWS, LOCAL ORDINANCES AND THE APPLICABLE REQUIREMENTS OF THE FOLLOWING ACCEPTED CODES AND STANDARDS, WITHOUT LIMITING THE NUMBER, AS FOLLOWS:

1. INTERNATIONAL MECHANICAL CODE
2. OSHA
3. DEPARTMENT OF ENVIRONMENTAL PROTECTION
4. NFPA

F. IN THESE SPECIFICATIONS, REFERENCES MADE TO THE FOLLOWING INDUSTRY STANDARDS AND CODE BODIES ARE INTENDED TO INDICATE THE LATEST VOLUME OR PUBLICATION OF THE STANDARD. ALL EQUIPMENT, MATERIALS AND DETAILS OF INSTALLATION SHALL COMPLY WITH THE REQUIREMENTS AND LATEST REVISIONS OF THE FOLLOWING BODIES, AS APPLICABLE:

1. AGA AMERICAN GAS ASSOCIATION
2. AMCA AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL, INC.

3. ANSI AMERICAN NATIONAL STANDARDS INSTITUTE
4. ARI AMERICAN REFRIGERATION INSTITUTE
5. ASHRAE AMERICAN SOCIETY OF HEATING, REFRIGERATION, AIR CONDITIONING ENGINEERS
6. ASTM AMERICAN SOCIETY OF TESTING MATERIALS
7. FM FACTORY MUTUAL
8. NEMA NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION
9. NFPA NATIONAL FIRE PROTECTION ASSOCIATION
10. UL UNDERWRITERS LABORATORIES
11. AMCA 99 STANDARDS HANDBOOK.
12. AMCA 210 LABORATORY METHODS OF TESTING FANS FOR RATING.
13. AMCA 500 TEST METHODS FOR LOUVERS, DAMPERS AND SHUTTERS.
14. ARI 410 STANDARD FOR FORCED-CIRCULATION AIR-COOLING AND AIR HEATING COILS.
15. ARI 430 STANDARD FOR CENTRAL-STATION AIR-HANDLING UNITS.
16. ARI GUIDELINE D - APPLICATION AND INSTALLATION OF CENTRAL STATION AIR-HANDLING UNITS.
17. NEMA MG1 MOTORS AND GENERATORS.
18. SMACNA HVAC DUCT CONSTRUCTION STANDARDS - METAL AND FLEXIBLE.
19. UL 900 STANDARD FOR AIR FILTER UNITS.

1.4 DEFINITIONS

A. “EQUIPMENT MANUFACTURER"(EM), SHALL REFER TO THE MANUFACTURER RESPONSIBLE FOR FURNISHING AND INSTALLATION OF ALL WORK INDICATED ON THE DRAWINGS AND SPECIFICATIONS, AS APPLICABLE AND/OR REFERENCED IN THE CONTRACT DOCUMENTS OR INSTRUCTED BY THE “CONSTRUCTION MANAGER” (CM).

1.5 SUBMITTALS

A. SUBMITTALS SHALL BE PROVIDED IN CONFORMANCE WITH SECTION 23 00 01 MECHANICAL GENERAL PROVISIONS.

B. SHOP DRAWINGS: FOR EACH UNITARY AIR CONDITIONING UNIT SPECIFIED, MANUFACTURERS LITERATURE INCLUDING THE FOLLOWING INFORMATION:
   1. ASSEMBLY AND CONSTRUCTION DETAILS
   2. SHIPPING SPLITS AND DETAILED INSTRUCTION FOR FIELD LABOR REQUIRED TO ASSEMBLE UNITS
   3. UNIT DIMENSIONS
   4. WEIGHT LOADING AND DISTRIBUTION
   5. REQUIRED CLEARANCES
   6. FIELD CONNECTION DETAILS
   7. ELECTRICAL CHARACTERISTICS AND CONNECTION REQUIREMENTS
   8. COMPLETE WIRING DIAGRAMS

C. PRODUCT DATA: FOR EACH UNITARY AIR CONDITIONING UNIT SPECIFIED, MANUFACTURERS LITERATURE INCLUDING THE FOLLOWING INFORMATION:
   1. COOLING CAPACITIES AND RATINGS
   2. MATERIAL GAGES AND FINISHES.
   3. DATA FOR FILTER MEDIA, MANUFACTURER, FILTER PERFORMANCE DATA, FILTER ASSEMBLY, AND FILTER FRAMES
   4. CERTIFIED COIL-PERFORMANCE RATINGS WITH SYSTEM OPERATING CONDITIONS INDICATED. INCLUDE DATA FOR COIL TYPE, CONFIGURATION, MATERIALS, FIN SPACING AND HEADER CONNECTIONS.
   5. CERTIFIED FAN-PERFORMANCE AND FAN CURVES WITH SPECIFIED OPERATING POINT CLEARLY PLOTTED, POWER, RPM.
   6. SOUND POWER LEVEL DATA, FAN OUTLET AND CASING RADIATION AT RATED CAPACITY.

7. CONTROL SYSTEM DEVICES AND OPERATIONS.
8. MOTOR RATINGS AND ELECTRICAL CHARACTERISTICS PLUS MOTOR AND FAN ACCESSORIES.
9. ELECTRICAL REQUIREMENTS: POWER SUPPLY WIRING INCLUDING WIRING DIAGRAMS FOR INTERLOCK AND CONTROL WIRING, CLEARLY INDICATING FACTORY-INSTALLED AND FIELD-INSTALLED WIRING.

1.6 CLOSEOUT SUBMITTALS

A. THE FOLLOWING INFORMATION SHALL BE SUBMITTED FOR EACH PIECE OF VARIED EQUIPMENT FOR RECORD PURPOSES UPON DELIVERY OF EQUIPMENT. PROVIDE THREE (3) COPIES AND (3) ELECTRONIC.
   1. INSTALLATION INSTRUCTIONS AND PROCEDURES.
   2. SYSTEM OPERATION AND MAINTENANCE MANUAL.
   3. EQUIPMENT WIRING DIAGRAMS.
   4. RECOMMENDED SPARE PARTS AND MAINTENANCE MATERIALS LIST
   5. DETAILED PREVENTIVE MAINTENANCE PROGRAM AND GENERAL PLANT MAINTENANCE PROGRAM, FOR ALL EQUIPMENT FURNISHED UNDER THIS SECTION INCLUDING BUT NOT LIMITED TO: LUBRICATION, FILTER REPLACEMENT, MOTOR AND DRIVE REPLACEMENT.

1.7 QUALITY ASSURANCE

A. PROVIDE CAPACITY RATINGS WITH ARI CERTIFICATION.
B. PROVIDE EFFICIENCY RATINGS THAT MEET OR EXCEED ASHRAE 90.1.
C. UNIT SHALL BE ETL LABELED PER UL-1995 AND CSA C22.2 NO. 236 LATEST EDITION.
D. ELECTRICAL COMPONENTS SHALL BE UL LISTED;
   1. SUPPLY VOLTAGE SHALL BE 480 VOLT THREE PHASE. WITH A SINGLE POINT POWER CONNECTION AND FACTOR WIRED DISCONNECT. CONFORM TO REQUIREMENTS OF NFPA 79, AND ALL LOCAL AND FEDERAL REGULATIONS.
   2. PANEL SHALL BE LABELED IN ACCORDANCE WITH NFPA 70. SCCR RATING SHALL BE 65KA AT 480 VOLTS AND 22KA FOR 208V AND BELOW.
E. FANS SHALL BE TESTED IN AN AMCA CERTIFIED LABORATORY.
F. INSULATION SHALL COMPLY WITH NFPA 90A.
G. COILS SHALL BE TESTED IN ACCORDANCE TO ARI 410.
H. FILTERS SHALL BE TESTED IN ACCORDANCE TO ASHRAE 52.
I. GAS FURNACE SHALL BE AGA/CGA LABELED AND ETL LISTED.
J. GAS TRAIN SHALL BE UL / FM APPROVED ARRANGEMENT
K. ALL UNITS SHALL BE FACTORY TESTED BEFORE SHIPPING. A PROOF COPY OF THE TEST SHALL BE PLACED IN THE UNIT CONTROL PANEL.
L. UNIT SHALL BE IBC 2009 SEISMICALLY CERTIFIED FOR ZONE B. UNIT SHALL BE CERTIFIED THROUGH SEISMIC ANALYSIS AND SHAKE TESTING IN ACCORDANCE WITH ASCE-7-05 AND ICC-ES AC-156. REFERENCE STRUCTURAL DESIGN CRITERIA ON 4730S1.001.

1.8 DELIVERY, STORAGE AND HANDLING

A. THE CONTRACTOR SHALL RECEIVE, UNLOAD AND STORE THE EQUIPMENT AT THE PROJECT JOB SITE OR AT LOCATION AUTHORIZED BY THE OWNER OR CM.
B. EQUIPMENT SHALL BE HANDLED AND STORED UNTIL SHIPMENT AT THE MANUFACTURER'S FACTORY IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS. ONE (1) COPY OF THESE INSTRUCTIONS SHALL BE INCLUDED WITH THE EQUIPMENT AT TIME OF SHIPMENT. CONTRACTOR SHALL HANDLE AND STORE EQUIPMENT TO THE MANUFACTURERS STANDARDS UNTIL SET IN FINAL LOCATION.

1.9 GUARANTEE

A. PROVIDE A ONE-YEAR FULL PARTS REPLACEMENT WARRANTY TO INCLUDE COVERAGE FROM TIME OF OWNER'S ACCEPTANCE (NOT SHIPMENT DATE).
   1. ALL UNITARY AIR CONDITIONING EQUIPMENT MOTORS, FANS, CASING AND DAMPERS:

2. ALL GAS HEAT EXCHANGER COMPONENTS: TEN (10) YEAR MANUFACTURER'S MATERIAL REPLACEMENT WARRANTY.
3. ALL COMPRESSORS: FIVE (5) YEAR MANUFACTURER'S MATERIAL REPLACEMENT WARRANTY.

1.10 DAMAGE CORRECTION AND EXTRA WORK

A. THE EM SHALL PROMPTLY CORRECT ALL WORK PROVIDED UNDER HIS CONTRACT REJECTED BY THE ENGINEER AS DEFECTIVE OR AS FAILING TO CONFORM TO THE CONTRACT DOCUMENTS WHETHER OBSERVED BEFORE OR AFTER COMPLETION OF WORK AND WHETHER OR NOT FABRICATED, INSTALLED OR COMPLETED. THE EM SHALL BEAR ALL COSTS OF CORRECTING SUCH REJECTED WORK.

B. NO CLAIM FOR EXTRA WORK WILL BE ALLOWED UNLESS IT IS AUTHORIZED BY THE CM OR OWNER IN WRITING BEFORE COMMENCEMENT OF THE EXTRA SAID WORK.

PART 2: PRODUCTS

2.1 GENERAL

A. THE FOLLOWING PRODUCT SPECIFICATIONS PERTAIN TO UNITS RTU-01 THRU RTU-06

B. REQUIREMENTS PARTICULAR TO SPECIFIC UNITS WILL BE NOTED AS SUCH, OTHER WISE REQUIREMENTS ARE FOR ALL UNITS LISTED ABOVE.

2.2 MANUFACTURERS

A. LAYOUT OF EQUIPMENT AS SCHEDULED AND PRESENTED ON DRAWINGS WAS BASED UPON EQUIPMENT AS MANUFACTURED BY AAON.

B. ALTERNATE MANUFACURERS:

1. OTHER ACCEPTABLE MANUFACTURES FOR EQUIPMENT THAT MAY BE PROPOSED ARE JCI, TRANE OR APPROVED EQUAL.
2. IF ALTERNATE EQUIPMENT MANUFACTURER IS PROPOSED THE CONTRACTOR SHALL BE RESPONSIBLE TO ENSURE THE SPECIFCATIONS AND SCHEDULE PERFORMANCE IS MET, AND FOR ALL COORDINATION AND DUCT/SUPPORT CHANGES RELATED TO ALTERNATE MANUFACTURERS EQUIPMENT DIMENSIONS.
    a. AAON SHALL BE INCLUDED AS THE BASE QUOTE AND ANY ALTERNATE VENDOR SHALL BE LISTED AS A DEDUCT TO THE BASE UNDER VENDOR SUGGESTED ALTERNATES.

2.3 MANUFACTURED UNITS

A. PROVIDE ROOF-MOUNTED UNITS COMPLETE WITH INDIRECT FIRED NATURAL GAS FURNACE (OR ELECTRIC HEAT), DX COOLING SYSTEM, FILTRATION AND ACCESSORIES AS SCHEDULED AND SPECIFIED HEREIN. SEE PROVIDED SCHEDULE FOR EQUIPMENT PARTICULARS FOR EACH UNIT.

B. PROVIDE UNITS WHICH ARE ROOF MOUNTED, DOWN FLOW, SELF-CONTAINED, PACKAGED, FACTORY ASSEMBLED AND PRE-WIRED CONSISTING OF INSULATED DOUBLE WALL CABINET AND FRAME, SUPPLY FAN, EXHAUST FAN, INDIRECT NATURAL GAS HEAT EXCHANGER AND BURNER, CONTROLS, AIR FILTERS, REFRIGERANT COOLING, COMPRESSOR, CONDENSER COIL AND CONDENSER FAN. UNIT SHALL BE COMPLETELY FACTORY WIRED TO CENTRAL TERMINAL BLOCKS. UNITS SHALL BE PROVIDED WITH AN EXTERNAL SERVICE DISCONNECT AND 120 VOLT SERVICE OUTLET.

2.4 PERFORMANCE

A. BASE PERFORMANCE ON ARI 210/240 AND ARI 340/360 TEST CONDITIONS UNLESS SPECIFIED OTHERWISE. SOUND RATING NUMBERS ARE IN ACCORDANCE WITH ARI 270.

B. RATED HEATING AND COOLING CAPACITIES SHALL BE AS SCHEDULED.

C. EQUIPMENT MUST MEET OR EXCEED ENERGY EFFICIENCIES SHOWN IN ASHRAE STANDARD 90.1 AND INTERNATIONAL ENERGY CONSERVATION CODE WITH NORTH CAROLINA AMMENDMENTS.

D. UNIT SHALL OPERATE AT SCHEDULED CAPACITY WITH 100ºF ENTERING CONDENSER AIR TEMPERATURE.

2.5 UNIT CASING

A. PACKAGED ROOFTOP AIR CONDITIONING UNIT SHALL BE SUPPLIED WITH A FULL LENGTH, CONTINUOUS BASE RAIL CHANNEL. THE BASE RAIL CHANNEL SHALL BE FORMED OF 14-GAUGE MINIMUM GALVANIZED STEEL.

B. PACKAGED ROOFTOP AIR CONDITIONING UNIT SHALL BE SUPPLIED WITH A FRAME CONSTRUCTION CONSISTING OF INTEGRAL GALVANIZED STEEL VERTICAL AND HORIZONTAL STRUCTURAL MEMBERS.

C. PACKAGED ROOFTOP AIR CONDITIONING UNIT SHALL BE SUPPLIED WITH DOUBLE WALL PANELS FOR WALLS, ROOF, AND FLOOR CONSTRUCTED OF G90 MILL GALVANIZED SHEET STEEL. ALL PANELS SHALL BE FORMED AND REINFORCED TO PROVIDE A RIGID ASSEMBLY. THE EXTERIOR CASING SHALL BE CONSTRUCTED OF 18-GAUGE MINIMUM GALVANIZED STEEL. EXTERIOR SHALL HAVE A BAKED ENAMEL FINISH CAPABLE OF WITHSTAND A 2,500- CONSECUTIVE-HOUR SALT SPRAY APPLICATION IN ACCORDANCE WITH STANDARD ASTM B117-95.

D. THE INTERIOR LINING OF THE WALLS AND ROOF PANELS SHALL BE A SOLID LINING OF 20-GAUGE MINIMUM GALVANIZED STEEL. THE INTERIOR LINING OF THE FLOOR PANELS SHALL BE A SOLID LINING OF 18-GAUGE MINIMUM GALVANIZED STEEL. ALL WALL, ROOF, AND FLOOR PANELS SHALL BE SUPPLIED WITH RIGID POLYURETHANE INSULATION WITH A RESULTING INSULATION VALUE OF MINIMUM R-13. INSULATION SHALL BE MINIMUM OF 2.0 POUND PER CUBIC FOOT IN DENSITY.

E. UNIT CONSTRUCTION SHALL BE DOUBLE WALL WITH G90 GALVANIZED STEEL ON BOTH SIDES AND A THERMAL BREAK. DOUBLE WALL CONSTRUCTION WITH A THERMAL BREAK PREVENTS MOISTURE ACCUMULATION ON THE INSULATION, PROVIDES A CLEANABLE INTERIOR, PREVENTS HEAT TRANSFER THROUGH THE PANEL, AND PREVENTS EXTERIOR CONDENSATION ON THE PANEL.

F. AIR CONDITIONING UNIT SHALL BE SUPPLIED WITH A SLOPED ROOF TO PROMOTE DRAINAGE OF PRECIPITATION AND PREVENT STANDING WATER.

G. ACCESS DOORS SHALL BE PROVIDED WHERE REQUIRED FOR MAINTENANCE OR WHERE REQUIRED TO FACILITATE REMOVAL OF COMPONENTS (E.G. COILS, FANS, MOTORS). ALL ACCESS DOORS SHALL HAVE HEAVY-DUTY STAINLESS STEEL HINGES OR CONTINUOUS PIANO STYLE HINGES. DOOR MATERIALS OF CONSTRUCTION SHALL MATCH WALL PANELS. DOORS SHALL BE FULLY GASKETED WITH 2 SEALS AND PROVIDED WITH NON-LOCKING LEVER TYPE HANDLES (MINIMUM OF TWO (2) AND MAXIMUM OF FOUR (4) PER DOOR), OPERABLE FROM BOTH INTERIOR AND EXTERIOR OF UNIT. ACCESS DOORS SHALL BE APPROXIMATELY 20 INCHES WIDE BY FULL HEIGHT OF CASING OR MAXIMUM OF 60 INCHES.

H. THE COOLING SEGMENT SHALL BE SUPPLIED WITH A FULL WIDTH, SLOPED DRAIN PAN THAT EXTENDS DOWNSTREAM OF THE COIL TO PROVIDE SUFFICIENT AMOUNT OF SPACE TO CONTAIN POSSIBLE MOISTURE CARRYOVER. THE DRAIN PAN SHALL BE OF DOUBLE WALL CONSTRUCTION WITH A STAINLESS STEEL LINER. THE DRAIN PAN SHALL HAVE A MINIMUM OF 2" INSULATION. INTERMEDIATE DRAIN PANS SHALL BE PROVIDED FOR ANY COOLING SEGMENT WITH A COIL HEIGHT OF MORE THAN 48" WITH DROP TUBES TO GUIDE THE CONDENSATE TO THE MAIN DRAIN PAN. COOLING SEGMENTS HAVING OVERALL COIL HEIGHT OF GREATER THAN 48" SHALL NOT BE ACCEPTABLE WITHOUT AN INTERMEDIATE DRAIN PAN. DRAIN PAN SHALL BE PROVIDED WITH A MINIMUM 1-1/4" FPT CONDENSATE CONNECTION POSITIONED BENEATH THE LOWEST POINT OF THE DRAIN PAN, OPPOSITE THE COIL HEADER.

    1. ON ALL UNITS WITH ONLY (1) DRAIN PORT, THE EQUIPMENT SHALL BE PROVIDED WITH WATER SENSOR IN THE DRAIN PAN TO SHUT DOWN THE UNIT IN THE EVENT OF A PLUGGED OR NON-DRAINING CONDENSATE.

I. UNIT SHALL BE DESIGNED TO REDUCE AIR LEAKAGE AND INFILTRATION THROUGH THE CABINET. CABINET LEAKAGE SHALL NOT EXCEED 1% OF TOTAL AIRFLOW WHEN TESTED AT 3 TIMES THE MINIMUM EXTERNAL STATIC PRESSURE PROVIDED IN AHRI STANDARD 340/360. PANEL DEFLECTION SHALL NOT EXCEED L/240 RATIO AT 125% OF DESIGN STATIC PRESSURE, AT A MAXIMUM 8 INCHES OF POSITIVE OR NEGATIVE STATIC PRESSURE, TO REDUCE AIR LEAKAGE. DEFLECTION SHALL BE MEASURED AT THE MIDPOINT OF THE PANEL HEIGHT AND WIDTH.

CONTINUOUS SEALING SHALL BE INCLUDED BETWEEN PANELS AND BETWEEN ACCESS DOORS AND OPENINGS TO REDUCE AIR LEAKAGE. REFRIGERANT PIPING AND ELECTRICAL CONDUIT THROUGH CABINET PANELS SHALL INCLUDE SEALING TO REDUCE AIR LEAKAGE.

J. UNIT SHALL BE PROVIDED WITH BASE (HORIZONTAL) DISCHARGE AND (HORIZONTAL) RETURN AIR OPENINGS. OPENINGS SHALL HAVE UPTURNED FLANGES OF AT LEAST 1/2 INCH IN HEIGHT AROUND THE OPENING.

2.6 ECONOMIZER (WHERE SCHEDULED)

A. PACKAGED ROOFTOP AIR CONDITIONING UNIT SHALL BE SUPPLIED WITH AN ECONOMIZER SECTION TO PROVIDE A MEANS OF PROVIDING OUTSIDE AIR AND EXHAUSTING AIR THROUGH THE UNIT.

B. THE ECONOMIZER SECTION SHALL CONSIST OF MULTI-LEAF, PARALLEL ACTING, ULTRA LOW-LEAK BLADES FOR OUTSIDE AIR AND RETURN AIR DAMPERS. EXHAUST AIR DAMPERS SHALL BE BAROMETRIC TYPE. THE RETURN AIR, OUTSIDE AIR, AND EXHAUST AIR DAMPERS SHALL BE SIZED FOR 100% OF UNIT AIRFLOW. THE RETURN AIR OPENING SHALL BE LOCATED IN THE BOTTOM OF THE UNIT. A RAINHOOD AND BIRD SCREEN ASSEMBLY SHALL PROTECT THE OUTSIDE AND EXHAUST AIR DAMPERS FROM THE ELEMENTS. THE OUTSIDE AIR AND EXHAUST AIR DAMPERS SHALL BE LOCATED TO PREVENT MIXING OF FRESH AIR AND EXHAUST AIR.

C. ECONOMIZER SECTION SHALL BE SUPPLIED WITH DEDICATED EXHAUST AIR FAN (AS SCHEDULED). THE EXHAUST FAN SHALL DISCHARGE THROUGH THE BAROMETRIC RELIEF TYPE DAMPERS. FAN ASSEMBLY SHALL BE COMPLETELY ISOLATED FROM UNIT BY VIBRATION ISOLATION.

D. A VARIABLE FREQUENCY DRIVE SHALL VARY EXHAUST FAN SPEED IN RESPONSE TO BUILDING PRESSURE TO ENSURE A POSITIVE PRESSURE WITHIN THE BUILDING. A DIFFERENTIAL PRESSURE CONTROL SYSTEM, SHALL USE A DIFFERENTIAL PRESSURE TRANSDUCER TO COMPARE INDOOR BUILDING PRESSURE TO OUTDOOR AMBIENT ATMOSPHERIC PRESSURE. THE RTU EXHAUST FAN SHALL BE TURNED ON WHEN REQUIRED TO LOWER BUILDING STATIC PRESSURE SETPOINT. THE CONTROL SYSTEM SHALL THEN MODULATE THE VFD TO CONTROL THE BUILDING PRESSURE TO WITHIN THE ADJUSTABLE, SPECIFIED DEAD BAND THAT SHALL BE ADJUSTABLE AT THE CONTROL PANEL. CONTROL SYSTEM SHALL NOT ALLOW THE SPACE SERVED TO HAVE A NEUTRAL OR NEGATIVE PRESSURE DURING OPERATIONAL PERIODS.

E. ECONOMIZER CONTROLS SHALL MODULATE RETURN AND OA DAMPERS SHALL MAINTAIN PROPER TEMPERATURE AND HUMIDITY IN THE CONDITIONED SPACE. ECONOMIZER SHALL BE EQUIPPED WITH AN AUTOMATIC LOCKOUT WHEN THE OUTDOOR AMBIENT TEMPERATURE OR HUMIDITY IS TOO HIGH FOR PROPER COOLING. MINIMUM POSITION CONTROL SHALL BE STANDARD AND ADJUSTABLE AT THE CONTROL PANEL.

F. A SPRING RETURN DAMPER MOTOR SHALL ENSURE CLOSURE OF OA DAMPERS DURING UNIT SHUTDOWN OR POWER INTERRUPTION. MECHANICAL COOLING SHALL BE AVAILABLE TO AID THE ECONOMIZER MODE AT ANY AMBIENT CONDITION. ULTRA LOW LEAK DAMPERS SHALL BE PROVIDED WITH GASKETING ADDED TO THE DAMPER BLADES AND ROLLED STAINLESS STEEL JAMB SEALS TO THE SIDES OF THE DAMPER ASSEMBLY. ULTRA LOW-LEAK ECONOMIZER DAMPERS SHALL HAVE A LEAKAGE RATE OF ONE PERCENT BASED ON TESTING DATA COMPLETED IN ACCORDANCE WITH AMCA STANDARD 575 AT AMCA LABORATORIES.

G. ECONOMIZER CONTROL WITH COMPARATIVE ENTHALPY: USED WITH THE FRESH AIR ECONOMIZER, TWO ENTHALPY SENSORS SHALL BE PROVIDED TO COMPARE TOTAL HEAT CONTENT OF THE INDOOR AIR AND OUTDOOR AIR TO DETERMINE THE MOST EFFICIENT AIR SOURCE WHEN ECONOMIZING.

2.7 FILTERS

A. AIR CONDITIONING UNITS SHALL BE SUPPLIED WITH A PRE-FILTER AND FINAL FILTERS AS AN INTEGRAL PART OF THE UNIT AS SCHEDULED.

B. THE FILTER FRAMES SHALL BE BUILT OF GALVANIZED STEEL.

C. THE FILTER SECTION SHALL BE SIDE SERVICE WITH A STANDARD ACCESS DOORS.

D. PRE FILTER SECTION SHALL BE INSTALLED AFTER THE ECONOMIZER/ MIXING BOX SECTION.

E. PROVIDE FINAL FILTER WHERE SPECIFIED. WHEN MANUFACTURER CAN NOT PROVIDE A UNIT MOUNTED FINAL FILTER A CURB FILTER RACK SHALL BE PROVIDED.
F. EFFICIENCY RATINGS SHALL BE ATMOSPHERIC DUST SPOT EFFICIENCIES A STANDARDIZED BY ASHRAE STANDARD 52.2-2007
G. FILTER SEGMENT SHALL BE SUPPLIED WITH A FILTER GAUGE TO MEASURE THE PRESSURE DROP ACROSS THE FILTER BANK. FILTER GAUGES SHALL BE A MAGNAHELIC, DIFFERENTIAL PRESSURE GAUGE, FACTORY INSTALLED ON THE SIDE OF THE UNIT. DIFFERENTIAL PRESSURE SWITCH SHALL ALSO BE PROVIDED ACROSS EACH FILTER SECTION TO PROVIDE ALARMS AT THE CONTROL PANEL.
H. A HINGED ACCESS DOOR SHALL BE PROVIDED AT THE FILTER SECTION.
I. PROVIDE A COMPLETE LIST OF FILTER FOR EACH UNIT PROVIDED INCLUDING SIZE, RATING AND QUANTITY.

2.8 DX COOLING SYSTEM

A. GENERAL
1. UNIT SHALL BE FACTORY CHARGED WITH R-410A REFRIGERANT.
2. EACH UNIT SHALL HAVE A MINIMUM OF TWO INDEPENDENT REFRIGERATION CIRCUITS. EACH CIRCUIT SHALL BE COMPLETE WITH A LIQUID LINE SOLENOID VALVE, LOW PRESSURE CONTROL, FILTER-DRIER, LIQUID MOISTURE INDICATOR/SIGHT GLASS, THERMAL EXPANSION VALVE, LIQUID LINE SHUTOFF VALVE WITH CHARGING PORT, DISCHARGE LINE SHUTOFF VALVE, A MANUAL RESET HIGH PRESSURE SAFETY SWITCH, HIGH PRESSURE RELIEF DEVICE AND PUMP DOWN SWITCH. THE THERMAL EXPANSION VALVE SHALL BE CAPABLE OF MODULATION FROM 100% TO 25% OF ITS RATED CAPACITY. SIGHT-GLASSES SHALL BE ACCESSIBLE FOR VIEWING WITHOUT DISRUPTING UNIT OPERATION. EACH REFRIGERANT CIRCUIT SHALL INCLUDE A SUBCOOLING CIRCUIT TO PROVIDE MINIMUM 10°F OF LIQUID SUBCOOLING.
3. EACH CIRCUIT SHALL BE DEHYDRATED AND FACTORY CHARGED WITH REFRIGERANT R-410A AND OIL. UNITS SHALL HAVE AT LEAST ONE CONDENSER FAN CONTROLLED TO MAINTAIN POSITIVE HEAD PRESSURE. THE MAIN UNIT CONTROL SYSTEM SHALL INCLUDE PROVISION FOR LOW AMBIENT COOLING FOR OPERATING AT 0°F.

B. COMPRESSORS
1. UNITS SHALL HAVE DIRECT-DRIVE SCROLL TYPE COMPRESSORS WITH CENTRIFUGAL TYPE OIL PUMPS. MOTOR SHALL BE SUCTION GAS COOLED AND SHALL HAVE A VOLTAGE UTILIZATION RANGE OF PLUS OR MINUS 10 PERCENT OF UNIT NAMEPLATE VOLTAGE. INTERNAL OVERLOADS SHALL BE PROVIDED WITH THE SCROLL COMPRESSORS. COMPRESSORS SHALL HAVE ISOLATION VALVES.
2. THE COMPRESSOR SHALL HAVE INTERNAL ISOLATION TO MINIMIZE VIBRATION TRANSMISSION AND NOISE.
3. LOW PRESSURE SWITCHES AND HIGH PRESSURE CUT-OUT SHALL BE PROVIDED.
4. UNIT SHALL INCLUDE A VARIABLE CAPACITY SCROLL COMPRESSOR ON THE LEAD REFRIGERATION CIRCUIT(S) WHICH SHALL BE CAPABLE OF MODULATION FROM 10-100% OF ITS CAPACITY.

C. REQUIRED FEATURES
1. EACH CAPACITY STAGE SHALL BE EQUIPPED WITH A 5 MINUTE OFF, DELAY TIMER TO PREVENT COMPRESSOR SHORT CYCLING.
2. EACH CAPACITY STAGE SHALL BE EQUIPPED WITH AN ADJUSTABLE, 20 SECOND DELAY TIMER TO PREVENT MULTIPLE CAPACITY STAGES FROM STARTING ALL AT ONCE.

D. REFRIGERANT CIRCUITS
1. EACH REFRIGERANT CIRCUIT SHALL HAVE A THERMAL EXPANSION VALVE. SERVICE PRESSURE PORTS, AND REFRIGERANT LINE FILTER DRIERS SHALL BE FACTORY-INSTALLED FOR EACH CIRCUIT. AN AREA SHALL BE PROVIDED FOR REPLACEMENT SUCTION LINE DRIERS.

E. EVAPORATOR COIL
   1. EVAPORATOR COIL SHALL BE CONSTRUCTED OF COPPER TUBES MECHANICALLY BONDED TO A CONFIGURED ALUMINUM PLATE FIN AND GALVANIZEDSTEEL CASING.
   2. COILS SHALL BE FURNISHED WITH A FACTORY INSTALLED EXPANSION VALVE.
   3. COILS SHALL BE LEAK TESTED AT THE FACTORY TO ENSURE PRESSURE INTEGRITY. THE EVAPORATOR COIL SHALL BE LEAK TESTED TO 200 PSIG AND PRESSURE TESTED TO 450 PSIG.
   4. A REMOVABLE, STAINLESS STEEL, DOUBLE-SLOPED CONDENSATE DRAIN PAN SHALL BE PROVIDED TO COLLECT CONDENSATE.
   5. ACCESS SHALL BE PROVIDED TO BOTH FRONT AND BACK SIDES OF COIL.

F. CONDENSER COIL
   1. CONDENSER COIL SHALL BE CONSTRUCTED OF COPPER TUBES MECHANICALLY BONDED TO A CONFIGURED ALUMINUM PLATE FIN.
   2. COILS SHALL BE LEAK TESTED AT THE FACTORY TO ENSURE PRESSURE INTEGRITY. THE CONDENSER COIL SHALL BE LEAK TESTED TO 200 PSIG AND PRESSURE TESTED TO 450 PSIG.
   3. HAIL PROTECTION QUALITY COIL GUARDS SHALL BE FACTORY INSTALLED FOR CONDENSER COIL PROTECTION.
   4. CONDENSER COILS SHALL BE RATED FOR 100°F ENTERING OUTDOOR AIR TEMPERATURE.

G. CONDENSER FANS AND MOTORS
   1. ALL CONDENSER FANS SHALL BE VERTICAL DISCHARGE, DIRECT DRIVE FANS, STATICALLY BALANCED, WITH STEEL BLADES AND ZINC PLATED STEEL HUBS. CONDENSER FAN MOTORS SHALL BE THREE-PHASE MOTORS WITH PERMANENTLY LUBRICATED BALL BEARINGS, BUILT-IN CURRENT AND THERMAL OVERLOAD PROTECTION AND WEATHER TIGHT SLINGERS OVER MOTOR BEARINGS. FAN SHALL HAVE A PROTECTIVE WIRE GUARD.

H. RTU-06 (OR AS NEEDED TO MEET EACH RTU DESIGN CONDITIONS)
   1. CONDENSER FANS SHALL BE HIGH EFFICIENCY ELECTRONICALLY COMMUTATED MOTOR DRIVEN WITH MULTIPLE SPEEDS WHICH ARE CONTROLLED WITH A FAN CYCLE SWITCH BASED ON HEAD PRESSURE AND ALLOW MATCHING CONDENSER AIRFLOW WITH COOLING CAPACITY STEPS.
   2. CONDENSER FANS SHALL BE VFD DRIVEN VARIABLE SPEED FOR CONDENSER HEAD PRESSURE CONTROL. FACTORY PROVIDED AND FACTORY PROGRAMMED VFDS SHALL CONTINUOUSLY MODULATE THE FAN AIR FLOW TO MAINTAIN HEAD PRESSURE AT ACCEPTABLE LEVELS. COOLING OPERATION SHALL BE ALLOWED DOWN TO 35°F WITH ADJUSTABLE COMPRESSOR LOCKOUTS.

2.9 NATURAL GAS FURNACE (WHERE SCHEDULED)

A. THE HEATING SECTION SHALL HAVE A TUBULAR STAINLESS STEEL HEAT EXCHANGER DESIGN USING STAINLESS STEEL BURNERS AND STAINLESS STEEL THROUGHOUT, SUITABLE FOR CONDENSING APPLICATIONS. AN INDUCED DRAFT COMBUSTION BLOWER SHALL BE USED TO PULL THE COMBUSTION PRODUCTS THROUGH THE FIRING TUBES. ON INITIAL CALL FOR HEAT, THE COMBUSTION BLOWER SHALL PURGE THE HEAT EXCHANGER FOR 20 SECONDS BEFORE IGNITION.

B. GAS SAFETY CONTROLS SHALL INCLUDE ELECTRONIC FLAME SAFETY CONTROLS TO REQUIRE PROVING OF COMBUSTION AIR PRIOR TO IGNITION SEQUENCE WHICH SHALL INCLUDE A 60 SECOND PRE-PURGE CYCLE. PILOT IGNITION SHALL BE PROVIDED ON UNITS. SIXTY SECOND DELAY SHALL BE PROVIDED BETWEEN FIRST AND SECOND STAGE GAS VALVE OPERATION ON TWO-STAGE HEATERS. CONTINUOUS ELECTRONIC FLAME SUPERVISION SHALL BE PROVIDED AS STANDARD.

C. AFTER THREE UNSUCCESSFUL IGNITION ATTEMPTS, THE ENTIRE HEATING SYSTEM SHALL BE LOCKED OUT UNTIL MANUALLY RESET AT THE THERMOSTAT/ZONE SENSOR.

D. UNITS SHALL BE SUITABLE FOR USE WITH NATURAL GAS.
E. GAS CONNECTION SHALL BE THROUGH THE SIDE WALL OF THE UNIT.
F. UNIT SHALL BE PROVIDED WITH FM GAS TRAIN.
G. UNITS SHALL HAVE MODULATING GAS CONTROL.

2.10 ELECTRIC HEATER (WHERE SCHEDULED)

A. PROPORTIONAL, MODULATING ELECTRIC COILS SHALL BE SUPPLIED AND INSTALLED. COILS SHALL BE ETL LISTED. COILS SHALL BE HOUSED IN AN ATTENUATOR SECTION INTEGRAL WITH THE TERMINAL.
B. ELECTRIC COILS SHALL CONTAIN A PRIMARY AUTOMATIC RESET THERMAL CUTOUT, A SECONDARY MANUAL RESET THERMAL CUTOUT, AND PROPORTIONAL ELECTRONIC AIRFLOW SENSOR FOR PROOF OF FLOW. THE PROPORTIONAL ELECTRONIC AIRFLOW SENSOR SHALL BE TOTALLY INDEPENDENT OF THE DUCT STATIC PRESSURE AND SHALL ADJUST THE HEATER CAPACITY ACCORDING TO THE AVAILABLE AIRFLOW. THE HEATERS SHALL DELIVER MAXIMUM HEATING WHEN NEEDED WITH NORMAL MINIMUM AIRFLOW, REDUCE HEATING WITH LOWER THAN MINIMUM AIRFLOW, AND STOP HEATING WITH NO AIRFLOW. UNIT SHALL INCLUDE INTEGRAL DOOR INTERLOCK TYPE DISCONNECT SWITCH WHICH WILL NOT ALLOW THE ACCESS DOOR TO BE OPENED WHILE POWER IS ON. ALL INDIVIDUAL COMPONENTS SHALL BE UL LISTED OR RECOGNIZED.
C. HEATERS SHALL BE EQUIPPED WITH A PROPORTIONAL SCR CONTROLLER TO MODULATE THE HEATER LOAD ACCORDING TO THE TEMPERATURE CONTROL SIGNAL. THE ELECTRONIC CONTROLLER SHALL BE COMPATIBLE WITH 0-10 VARIABLE VOLTAGE INPUT SIGNAL.

2.11 SUPPLY AIR FANS AND MOTORS

A. THE UNIT SHALL BE PROVIDED WITH INTERNALLY MOUNTED DIRECT DRIVE, UNHOUSED, BACKWARD CURVED, PLENUM SUPPLY FANS. FAN AND UNIT PERFORMANCE SHALL BE RATED AND CERTIFIED IN ACCORDANCE WITH ARI STANDARD 430. FAN SHALL BE STATICALLY AND DYNAMICALLY BALANCED AT THE FACTORY AND MOUNTED ON RUBBER ISOLATORS
B. MOTORS SHALL BE PREMIUM EFFICIENCY TEFC WITH BALL BEARINGS RATED FOR 200,000 HOURS SERVICE WITH EXTERNAL LUBRICATION POINTS.
C. SUPPLY FAN HALL BE PROVIDED WITH A VFD FOR CONTROL AND/OR BALANCING.
D. THE SUPPLY FAN SECTION SHALL BE PROVIDED WITH AN ACCESS DOOR FOR FAN/MOTOR ACCESS.
E. THE SUPPLY AIR FAN SHALL HAVE HORIZONTAL DISCHARGE INTO THE SUPPLY AIR PLENUM SECTION. THE DOUBLE WALL PLENUM SHALL HAVE A BOTTOM OUTLET TO DISCHARGE THE SUPPLY AIR DOWN THROUGH THE ROOF.
F. THE FAN SEGMENT SHALL BE SUPPLIED WITH AN INTERNALLY MOUNTED FAN MOTOR. FAN MOTORS SHALL BE NEMA DESIGN BALL-BEARING TYPE WITH ELECTRICAL CHARACTERISTICS AND HORSEPOWER AS SPECIFIED. MOTORS SHALL BE TOTALY ENCLOSED FAN COOLED TYPE.
G. ALL MOTORS SHALL BE THERMALLY PROTECTED. ALL FAN MOTORS SHALL BE PREMIUM EFFICIENCY AND SHALL MEET THE U.S. ENERGY POLICY ACT OF 2005 (EPACT).

2.12 EXHAUST AIR FANS AND MOTORS

A. EXHAUST DAMPERS SHALL BE SIZED FOR 100% RELIEF.
B. FANS AND MOTORS SHALL BE DYNAMICALLY BALANCED.
C. MOTORS SHALL BE PREMIUM EFFICIENCY TEFC WITH BALL BEARINGS RATED FOR 200,000 HOURS SERVICE WITH EXTERNAL LUBRICATION POINTS.
D. ACCESS TO EXHAUST FANS SHALL BE THROUGH DOUBLE WALL, HINGED ACCESS DOORS WITH QUARTER TURN HANDLES.
E. VENDOR SHALL SELECT MOST EFFICIENT FAN SYSTEM FROM THE LIST BELOW:
    1. UNIT SHALL INCLUDE BELT DRIVEN, UNHOUSED, BACKWARD CURVED, PLENUM EXHAUST FANS.
    2. UNIT SHALL INCLUDE BELT DRIVEN FORWARD CURVED EXHAUST FANS.

3. UNIT SHALL INCLUDE DIRECT DRIVE, AXIAL FLOW EXHAUST FANS. BLADES SHALL BE ADJUSTABLE PITCH.

F. EXHAUST FAN HALL BE PROVIDED WITH A VFD FOR CONTROL AND/OR BALANCING.

2.13 CONTROLS

A. EACH UNIT SHALL BE PROVIDED WITH A STAND ALONE MICROPROCESSOR BASED CONTROLLER. CONTROLLER SHALL BE MOUNTED WITHIN THE UNIT'S CONTROL ENCLOSURE. CONTROLLER SHALL HAVE AN LCD DISPLAY SCREEN AND INPUT KEYPAD. THE CONTROLLER PROVIDED FOR ALL CONTROL FUNCTIONS. CONTROLLER SHALL BE NETWORKABLE WITH BUILDING AUTOMATION CONTROL SYSTEM. SYSTEM SHALL BE PROVIDED WITH BACNET INTERFACE. INTERFACE SHALL BE COMPATIBLE WITH DDC CONTROLS SYSTEM.

B. THE RESIDENT CONTROL ALGORITHMS SHALL MAKE ALL HEATING, COOLING, DEHUMIDIFICATION AND/OR VENTILATING DECISIONS IN RESPONSE TO SPACE THERMOSTAT. THE CONTROL ALGORITHMS SHALL MAINTAIN ACCURATE TEMPERATURE CONTROL AND BUILDING PRESSURE AND MINIMIZES DRIFT FROM SETPOINT. A CENTRALIZED MICROPROCESSOR SHALL PROVIDE ANTI-SHORT CYCLE TIMING AND TIME DELAY BETWEEN COMPRESSORS TO PROVIDE A HIGHER LEVEL OF MACHINE PROTECTION.

C. SUPPLY AIR FANS SHALL OPERATE CONTINUOUSLY DURING OCCUPIED OPERATIONS. UNITS SCHEDULED WITH VARIABLE AIR VOLUME CONTROL SHALL BE PROVIDED WITH ALL NECESSARY CONTROLS TO OPERATE THE UNIT WITH VARIABLE SUPPLY AIR VOLUME INCLUDING DISCHARGE AIR MICROPROCESSOR CONTROLLER AND DISCHARGE AIR SENSOR. THE MICROPROCESSOR CONTROLLER SHALL COORDINATE THE ECONOMIZER CONTROL AND THE STAGES OF COOLING WITH DISCHARGE AIR TEMPERATURE RESET CAPABILITIES. UNITS SHALL INCLUDE FACTORY INSTALLED AND TESTED VARIABLE FREQUENCY DRIVES (VFD) TO PROVIDE SUPPLY FAN MOTOR SPEED MODULATION BASED UPON SUPPLY STATIC PRESSURE.

D. CONTROL SYSTEM SHALL VARY EXHAUST FAN SPEED BASED ON SPACE STATIC PRESSURE. SPACE SHALL BE POSITIVE PRESSURE TO OUTDOORS OR OTHER REFERENCE POINT.

E. A CENTRALIZED MICROPROCESSOR SHALL PROVIDE ANTI-SHORT CYCLE TIMING AND TIME DELAY BETWEEN COMPRESSORS TO PROVIDE A HIGHER LEVEL OF MACHINE PROTECTION.

F. CONTROL SYSTEM SHALL BE CAPABLE OF RECEIVING A REMOTE INPUT TO PUT THE UNIT INTO 100% OUTSIDE AIR TO PURGE THE SPACE.

G. EACH UNIT SHALL BE PROVIDED WITH SPACE TEMPERATURE SENSOR. SEE DRAWINGS FOR ANY PARTICULARS IN REGARDS TO SPACE TEMPERATURE SENSOR ENCLOSURE RATINGS.

H. CONTROLLERS WILL HAVE THE FOLLOWING SAFETIES:
   1. HIGH AND LOW PRESSURE CUT-OUTS (ONE EACH REFRIGERANT CIRCUIT)
   2. MINIMUM ON TIME FOR COMPRESSORS
   3. DELAY BETWEEN COMPRESSOR STAGES
   4. ANTI-SHORT CYCLE DELAYS (MINIMUM OFF TIME) FOR COMPRESSORS AND FANS
   5. MECHANICAL COOLING LOCKOUT BELOW 45°F FOR UNITS WITHOUT LOW AMBIENT CONTROLS
   6. AIR FLOW PROVING SWITCH FOR THE SUPPLY FAN

I. GAS HEATING MODULES SHALL HAVE THE FOLLOWING CONTROL SAFETIES:
   1. HIGH TEMPERATURE LIMIT SWITCHES
   2. AIR FLOW PROVING SWITCH FOR THE INDUCED DRAFT FAN
   3. FLAME PROVING DEVICE
   4. ROLLOUT SWITCHES TO SAFEGUARD AGAINST FLUE BLOCKAGE
   5. REDUNDANT GAS VALVES FOR ADDED SAFETY.

J. THE ECONOMIZER CONTROL SHALL BE COMPARATIVE ENTHALPY, FULL MODULATION TYPE.

K. FIELD-INSTALLED, ZONE SENSOR SHALL BE PROVIDED TO INTERFACE WITH THE UNIT CONTROLLER AND SHALL BE AVAILABLE IN EITHER MANUAL, AUTOMATIC PROGRAMMABLE WITH NIGHT SETBACK, WITH SYSTEM MALFUNCTION LIGHTS.

L. PROVIDE FACTORY INSTALLED VENDOR SPECIFIC CONTROLLER TO MEET ONE OF THE FOLLOWING OPERATION PARAMETERS TO MEET THE SEQUENCE OF OPERATIONS AND WHERE SCHEDULED:
   1. VARIABLE AIR VOLUME CONTROLLER
   2. CONSTANT VOLUME CONTROLLER
   3. D-PAC CONTROLLER
      a. UNIT SHALL BE EQUIPPED WITH VARIABLE CAPACITY COMPRESSOR, RETURN AIR BYPASS AND MODULATING HOT GAS REHEAT.
      b. UNIT SHALL MODULATE COOLING WITH CONSTANT AIRFLOW TO MEET SPACE TEMPERATURE COOLING LOADS.
      c. UNIT SHALL MODULATE COOLING, RETURN AIR BYPASS DAMPER, AND HOT GAS REHEAT AS EFFICIENTLY AS POSSIBLE, TO MEET SPACE HUMIDITY LOADS AND PREVENT SUPPLY AIR TEMPERATURE SWINGS AND OVERCOOLING OF THE SPACE.
      d. UNIT SHALL MODULATE HEATING WITH CONSTANT AIRFLOW TO MEET SPACE TEMPERATURE HEATING LOADS. WITH STAGED HEATING, CAPACITY SHALL MODULATE BASED ON SPACE TEMPERATURE. WITH MODULATING HEATING, CAPACITY SHALL MODULATE BASED ON SUPPLY AIR TEMPERATURE
   4. FIELD INSTALLED DDC CONTROLS
      a. CONTROLS SHALL BE FIELD PROVIDED AND FIELD INSTALLED.
   5. FACTORY INSTALLED DDC CONTROLS
      a. CONTROLS SHALL BE FURNISHED AND FACTORY INSTALLED.
      b. OPTIONS:
         1) ISOLATION RELAYS SHALL BE FACTORY INSTALLED.
   6. STANDARD TERMINAL BLOCK
      a. UNIT SHALL BE PROVIDED WITH A TERMINAL BLOCK FOR FIELD INSTALLATION OF CONTROLS.
      b. OPTIONS:
         1) ISOLATION RELAYS SHALL BE FACTORY INSTALLED.

2.14 ELECTRICAL

A. UNIT SHALL OPERATE USING 460 VOLT, 3 PHASE, 60 HERTZ ELECTRICAL POWER (UNLESS SCHEDULED AS 208V). UNIT SHALL BE COMPLETELY FACTORY WIRED WITH TERMINAL BLOCK FOR SINGLE POINT POWER WIRING CONNECTION.
   1. SUPPLY VOLTAGE SHALL BE 480 VOLT THREE PHASE. WITH A SINGLE POINT POWER CONNECTION AND FACTOR WIRED DISCONNECT. CONFORM TO REQUIREMENTS OF NFPA 79, AND ALL LOCAL AND FEDERAL REGULATIONS.
   2. PANEL SHALL BE LABELED IN ACCORDANCE WITH NFPA 70. SCCR RATING SHALL BE 65KA AT 480 VOLTS AND 22KA FOR 208V AND BELOW.

B. UNIT WIRING SHALL COMPLY WITH NEC REQUIREMENTS AND WITH ALL APPLICABLE UL STANDARDS. ALL ELECTRICAL COMPONENTS SHALL BE UL RECOGNIZED, WHERE APPLICABLE. TO PROVIDE FOR EASY IDENTIFICATION, ALL WIRING AND ELECTRICAL COMPONENTS PROVIDED WITH UNIT SHALL BE NUMBERED, COLOR-CODED AND LABELED ACCORDING TO THE ELECTRICAL DIAGRAM PROVIDED WITH THE UNIT. THE MAIN UNIT CONTROL PANEL SHALL BE COMPLETELY FACTORY WIRED AND CONTAINED IN A WEATHERPROOF ENCLOSURE. THE MAIN UNIT CONTROL PANEL SHALL BE PROVIDED WITH DEAD FRONT COVERS OVER ALL LINE VOLTAGE COMPONENTS. A TERMINAL BOARD SHALL BE PROVIDED FOR LOW VOLTAGE CONTROL WIRING.

C. EACH COMPRESSOR SHALL HAVE ITS OWN DEDICATED CONTACTOR AND FUSE PROTECTION. CONDENSER FAN MOTORS SHALL BE CONTROLLED BY THREE PHASE CONTACTORS AND SHALL HAVE FUSE PROTECTION. A SEPARATE KEY LOCKED CONTROL PANEL SHALL HOUSE CONDENSING SECTION CONTROLS. SUPPLY AND EXHAUST FAN MOTOR CIRCUITS SHALL INCLUDE

A DEDICATED CONTRACTOR, EXTERNAL LINE BREAK OVERLOAD PROTECTION AND DEDICATED FUSE PROTECTION.

D. UNIT SHALL HAVE A FACTORY-INSTALLED 3- POLE, MOLDED CASE CIRCUIT BREAKER DISCONNECT SWITCH. THE DISCONNECT SWITCH WILL BE INSTALLED IN THE UNIT IN A WATER TIGHT ENCLOSURE WITH ACCESS THROUGH A SWINGING DOOR. FACTORY WIRING WILL BE PROVIDED FROM THE SWITCH TO THE UNIT HIGH VOLTAGE TERMINAL BLOCK. THE SWITCH WILL BE UL/CSA AGENCY RECOGNIZED. NOTE: THE DISCONNECT SWITCH WILL BE SIZED PER NEC AND UL GUIDELINES. A FUSED DISCONNECT MAY BE PROVIDED IN PLACE OF A CIRCUIT BREAKER DISCONNECT.

E. A CONTROL TRANSFORMER SHALL BE PROVIDED AND FACTORY WIRED FOR CONTROL SYSTEM POWER. A TERMINAL BOARD SHALL BE PROVIDED FOR LOW VOLTAGE CONTROL WIRING

F. A GROUND FAULT, 120V/15AMP, 2 PLUG, CONVENIENCE OUTLET, SHALL BE FACTORY INSTALLED. OUTLET SHALL REQUIRE A SEPARATE 120V CIRCUIT. OUTLET SHALL BE IN A WEATHERPROOF ENCLOSURE.

G. POWER AND CONTROL CIRCUITS SHALL ENTER THE UNIT THROUGH THE BASE WITHIN THE ROOF CURB.

2.15 ROOF CURB

A. ROOF MOUNTING CURB: MINIMUM 24" HIGH, 18-GAUGE GALVANIZED STEEL CHANNEL FRAME WITH GASKETS AND NAILER STRIPS. TOP OF CURB SHALL HAVE A PLASTIC WOOD NAILER FOR SECURING THE UNIT TO THE CURB. CURB SHALL BE FACTORY INSULATED WITH 2" OF RIGID FIBERGLASS INSULATION FIRMLY ADHERED TO THE INSIDE FACES OF THE CURB AND LINED TO PREVENT EXPOSED INSULATION. CURB SHALL BE SLOPED TO MATCH ROOF PITCH.

B. WHERE REQUIRED BY LOCAL SEISMIC CODES THE CONTRACTOR SHALL COORDINATE THE PROCUREMENT OF SEIZMIC CURB THROUGH THE EM.

C. ROOF CURBS SHALL BE SHIPPED KNOCKED DOWN TO THE JOB SITE FOR INSTALLATION PRIOR TO THE EQUIPMENT DELIVERY DATE.

2.16 EXTRA STOCK

A. PROVIDE ONE EXTRA BELT FOR EACH DIFFERENT FAN BELT REQUIRED.

B. PROVIDE ONE COMPLTE SET OF EXTRA PRE AND FINAL FILTERS TO BE INSTALLED BY CONTRACTOR AFTER START-UP.

C. EXTRA STOCK SHALL BE TURNED OVER TO THE OWNER AT TIME OF UNIT START-UP.

PART 3: EXECUTION

3.1 INSTALLATION

A. THE CONTRACTOR SHALL INSTALL THE EQUIPMENT AS SPECIFIED HEREIN AND AS SHOWN ON THE CONTRACT DRAWINGS.

B. THE CONTRACTOR SHALL RIG AND INSTALL ALL EQUIPMENT PER THE MANUFACTURER'S RECOMMENDATIONS AND THE CONTRACT DRAWINGS.

C. MAKE WIRING DIAGRAMS AVAILABLE TO THE TRADE PERFORMING THE ELECTRICAL WORK WHEN SUCH ARE PROVIDED WITH EQUIPMENT. MAKE SUCH AVAILABLE AS SOON AS POSSIBLE AFTER DELIVERY OF EQUIPMENT. THE UNIT WIRING DIAGRAM, MADE OF WATERPROOF MATERIALS, SHALL BE MOUNTED AND CLEARLY VISIBLE ON THE INSIDE OF THE ELECTRICAL ACCESS DOOR.

D. STARTUP SERVICE: EQUIPMENT MANUFACTURES SHALL PROVIDE FACTORY-TRAINED SERVICE REPRESENTATIVE OF THE MANUFACTURER TO PERFORM THE UNIT STARTUP AND APPLICATION SPECIFIC CALIBRATION OF CONTROL COMPONENTS.

E. AFTER THE AIR CONDITIONING UNIT IS INSTALLED, VARIABLE FREQUENCY DRIVES SHALL BE FIELD COMMISSIONED BY A FACTORY TRAINED AND EMPLOYED SERVICE TECHNICIAN.

F. THE AIR CONDITIONING UNIT SHALL NOT BE OPERATED FOR ANY PURPOSE, TEMPORARY OR PERMANENT, UNTIL DUCTWORK IS CLEAN, FILTERS ARE IN PLACE, BEARINGS ARE LUBRICATED, AND FAN HAS BEEN TEST RUN UNDER OBSERVATION.

3.2 TRAINING

A. EQUIPMENT MANUFACTURER TO PROVIDE A TRAINING SESSION FOR UP TO 6 OWNER'S REPRESENTATIVE FOR 2 NORMAL WORKDAYS AT A JOBSITE LOCATION DETERMINED BY THE OWNER.
B. THE TRAINING SESSION SHALL BE CONDUCTED BY A MANUFACTURER'S QUALIFIED REPRESENTATIVE. THE TRAINING PROGRAM SHALL CONSIST OF INSTRUCTION ON OPERATION OF THE EQUIPMENT, CONTROLS, AND ALL MAJOR COMPONENTS WITHIN THE ASSEMBLY.
C. EM SHALL PROVIDE A MINIMUM OF THREE (3) BOUND COPIES OF MANUFACTURERS OPERATION AND MAINTENANCE MANUALS FOR EACH SPECIFIC TYPE OF EQUIPMENT.
D. EM SHALL PROVIDE A MINIMUM OF THREE (3) BOUND COPIES OF MANUFACTURERS RECOMMENDED PREVENTIVE MAINTENANCE SCHEDULE, PROCEDURES AND RECOMMENDATIONS FOR EACH SPECIFIC TYPE OF EQUIPMENT.
E. EM SHALL PROVIDE A MINIMUM OF THREE (3) BOUND COPIES OF RECOMMENDED SPARE PARTS LISTING FOR EACH SPECIFIC TYPE OF EQUIPMENT WITH PARTS DESCRIPTIONS, MODEL NUMBERS, AND LOCAL SUPPLY HOUSE LISTINGS.

END OF SECTION

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PROCESS AHU

PART 1: GENERAL

1.1 SUMMARY

A. REFER TO THESE SPECIFICATIONS TO ASCERTAIN THE FULL EXTENT OF WORK REQUIRED FOR THE PROCESS (HYGIENIC) ROOFTOP AIR HANDLING UNITS. THE AHU SHALL BE PROVIDED WITH COOLING COIL, HEATING COIL, HEAT EXCHANGER, OR GAS FURNACE AS SPECIFIED IN THE PROCESS (HYGIENIC) AHU EQUIPMENT SCHEDULE. THE AHU SHALL BE SUPPPLIED WITH FACTORY PROVIDED AND INSTALLED CONTROLS WITH ACCESSORIES AND OPTIONS AS REFERENCED HEREIN.

B. THE FOLLOWING AHU COMPONENT SPECIFICATIONS AND SCHEDULES ARE MINIMUM REQUIREMENTS. EQUIPMENT SCHEDULES MAY HAVE MORE STRINGENT REQUIREMENTS AND TAKE PRECEDENT OVER THE SPECIFICATION.

C. THE EQUIPMENT SHALL BE RECEIVED AND INSTALLED AT THE SITE BY THE CONTRACTOR

D. THE EQUIPMENT MANUFACTURER WILL PROVIDE STARTUP AND COMMISSIONING SERVICES FOR EQUIPMENT.

E. THE EQUIPMENT MANUFACTURER WILL PROVIDE VERIFICATION OF CONTROL SYSTEM OPERATION AT START-UP AND AFTER INSTALLATION OF FACILITY PROCESS EQUIPMENT.

F. THE EQUIPMENT MANUFACTURER WILL PROVIDE ONSITE OWNER TRAINING AND REVIEW OF OM MANUALS.

1.2 SCOPE

A. THE SCOPE OF WORK OF THIS SECTION SHALL INCLUDE BUT NOT NECESSARILY BE LIMITED TO THE FOLLOWING:

1. PROVIDE PROCESS AIR HANDLING UNIT(S) AS SPECIFIED HEREIN AND SCHEDULED FOR THE FOLLOWING SPACES:

	EQUIPMENT TAG	ROOM SERVED
a.	AHU-01	BREAKING & FABRICATION – P105

2. THE AIR HANDLING UNIT SHALL BE FULLY DESIGNED BY THE EQUIPMENT MANUFACTURER TO MEET THE CRITERIA IN THIS SPECIFICATION AND SCHEDULES PROVIDED. THE AHU SHALL BE DESIGNED TO MEET CURRENT INTERNATIONAL ENERGY CODES AND ENVELOPE GUARANTEED NOT TO SWEAT.

3. THE AIR HANDLING UNIT MANUFACTURER SHALL SUPPLY A CONTROL PANEL INCLUDING PLC OR MICROPROCESSOR CONTROLLER THAT CONTAINS THE NECESSARY COMPONENTS TO MEET THE MECHANICAL, GAS, HEATING, COOLING, DEHUMIDIFICATION, AND SAFETY OPERATING REQUIREMENTS FOR EACH INDIVIDUAL UNIT. IN ADDITION, THE AIR HANDLING UNIT MANUFACTURER WILL SUPPLY PLC/CONTROLLER ELECTRICAL CONTROL COMPONENTS MOUNTED, WIRED AND TERMINATED IN THEIR PANEL FOR ALL AIR HANDLING UNITS.

4. EM SHALL PROVIDE SHOP DRAWING FOR ALL EQUIPMENT AND COMPONENTS PROVIDED BY THE MANUFACTURER.

5. PROVIDE A FACTORY RUN TEST OF EACH UNIT PRIOR TO SHIPMENT. THE TEST SHALL INCLUDE BUT NOT LIMITED TO AIR LEAKAGE, CASE DEFLECTION, AIR FLOW, AND FAN VIBRATION. A WRITTEN SYSTEM CHECKOUT REPORT/LIST SHALL BE MADE AVAILABLE PRIOR TO SHIPMENT.
    a. THE OWNER AND/OR ENGINEER SHALL RESERVE THE RIGHT TO MAKE PERIODIC TRIPS TO THE MANUFACTURERS' FACILITY FOR PROGRESS, QUALITY, AND FACTORY RUN TEST INSPECTIONS.

6. SHIPPING, HANDLING AND DELIVERY OF ALL EQUIPMENT AND COMPONENTS TO THE PROJECT SITE.
    a. LOCATION: THE EQUIPMENT SHALL BE DELIVERED AND INSTALLED IN WESTPORT, MA, USA.

7. PROVIDE STARTUP AND ON-SITE TESTING OF EQUIPMENT UPON COMPLETION OF EQUIPMENT INSTALLATION AND UTILITIES HOOK-UP.

8. PROVIDE THE NAME, ADDRESS AND DISTANCE FROM SITE OF THE NEAREST FACTORY CERTIFIED TECHNICIAN.

1.3 REGULATORY REQUIREMENTS

A. ALL MATERIALS AND WORKMANSHIP SHALL COMPLY WITH ALL APPLICABLE CODES, SPECIFICATIONS, LOCAL AND STATE ORDINANCES, LATEST EDITIONS.

B. IN CASE OF DIFFERENCE BETWEEN BUILDING CODES, STATE LAWS, LOCAL ORDINANCES AND INDUSTRY STANDARD THE MANUFACTURE SHALL PROMPTLY NOTIFY THE OWNER IN WRITING OF CONFLICTS.

C. IN CASE OF CONFLICT BETWEEN THESE SPECIFICATIONS AND THE REQUIREMENTS OF ANY CODE OR AUTHORITIES HAVING JURISDICTION, THE MOST STRINGENT REQUIREMENTS OF THE AFOREMENTIONED SHALL GOVERN.

D. SHOULD THE MANUFACTURER PERFORM ANY WORK THAT DOES NOT COMPLY WITH THE REQUIREMENTS OF THE APPLICABLE BUILDING CODES, STATE LAWS, LOCAL ORDINANCES AND INDUSTRY STANDARDS, THE MANUFACTURER WILL BEAR ALL COSTS ARISING IN CORRECTING THE DEFICIENCIES, AS APPROVED BY THE OWNER.

E. APPLICABLE CODES AND STANDARDS SHALL INCLUDE ALL STATE LAWS, LOCAL ORDINANCES AND THE APPLICABLE REQUIREMENTS OF THE FOLLOWING ACCEPTED CODES AND STANDARDS, WITHOUT LIMITING THE NUMBER, AS FOLLOWS:

1. INTERNATIONAL MECHANICAL CODE
2. INTERNATIONAL ENERGY CONSERVATION CODE
3. INTERNATIONAL FIRE CODE
4. OSHA
5. DEPARTMENT OF ENVIRONMENTAL PROTECTION

F. IN THESE SPECIFICATIONS, REFERENCES MADE TO THE FOLLOWING INDUSTRY STANDARDS AND CODE BODIES ARE INTENDED TO INDICATE THE LATEST VOLUME OR PUBLICATION OF THE STANDARD. ALL EQUIPMENT, MATERIALS AND DETAILS OF INSTALLATION SHALL COMPLY WITH THE REQUIREMENTS AND LATEST REVISIONS OF THE FOLLOWING BODIES, AS APPLICABLE:

1. AGA AMERICAN GAS ASSOCIATION
2. AMCA AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL, INC.
3. ANSI AMERICAN NATIONAL STANDARDS INSTITUTE
4. ARI AMERICAN REFRIGERATION INSTITUTE
5. ASHRAE AMERICAN SOCIETY OF HEATING, REFRIGERATION, AIR CONDITIONING ENGINEERS
6. ASTM AMERICAN SOCIETY OF TESTING MATERIALS
7. FM FACTORY MUTUAL
8. NEMA NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION
9. NFPA NATIONAL FIRE PROTECTION ASSOCIATION
10. UL UNDERWRITERS LABORATORIES
11. AMCA 99 (AIR MOVEMENT AND CONTROL ASSOCIATION) - STANDARDS HANDBOOK
12. AMCA 210 (AIR MOVEMENT AND CONTROL ASSOCIATION) - LABORATORY METHODS OF TESTING FANS FOR RATING
13. AMCA 500 (AIR MOVEMENT AND CONTROL ASSOCIATION) - TEST METHODS FOR LOUVERS, DAMPERS AND SHUTTERS
14. ARI 410 (AIR-CONDITIONING AND REFRIGERATION INSTITUTE) - STANDARD FOR FORCED-CIRCULATION AIR-COOLING AND AIR-HEATING COILS.
15. ARI 430 (AIR-CONDITIONING AND REFRIGERATION INSTITUTE) - STANDARD FOR CENTRAL-STATION AIR-HANDLING UNITS.
16. ARI GUIDELINE D (AIR-CONDITIONING AND REFRIGERATION INSTITUTE) - APPLICATION AND INSTALLATION OF CENTRAL STATION AIR-HANDLING UNITS

17. ASHRAE 90.1 (AMERICAN SOCIETY OF HEATING REFRIGERATION AND AIR CONDITIONING ENGINEERS) – ENERGY STANDARDS FOR BUILDINGS EXCEPT LOW-RISE RESIDENTIAL BUILDINGS
18. NEMA MG1 (NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION) - MOTORS AND GENERATORS
19. SMACNA (SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION) - HVAC DUCT CONSTRUCTION STANDARDS - METAL AND FLEXIBLE
20. UL 900 (UNDERWRITERS LABORATORIES, INC.) - STANDARD FOR AIR FILTER UNITS

1.4 DEFINITIONS

A. "EQUIPMENT MANUFACTURER"(EM), SHALL REFER TO THE MANUFACTURER RESPONSIBLE FOR FURNISHING OF EQUIPMENT.

B. PLC REFERS TO A PROGRAMMABLE LOGIC CONTROLLER.

1.5 SUBMITTALS

A. GENERAL:

1. AS PART OF THE BID, PROVIDE ONE (1) SUBMITTAL PACKAGE WITH EQUIPMENT SHOP DRAWINGS AND PRODUCT DATA FOR INFORMATIONAL PURPOSES AS DEFINED BELOW, FOR THE FOLLOWING EQUIPMENT.
    a. PROCESS AIR HANDLING UNITS.
        1) AUTOCAD DRAWINGS OF THE PROPOSED EQUIPMENT SHALL BE MADE AVAILABLE TO THE OWNER/ENGINEER UPON REQUEST.
2. UPON AWARD OF CONTRACT FOR EQUIPMENT PROVIDE THREE (3) ELECTRONIC COPIES OF THE UPDATED SUBMITTAL PACKAGES TO OWNER/ENGINEER. SUBMITTALS SHALL BE CHECKED AND APPROVED BY MANUFACTURER BEFORE SUBMITTING TO THE ENGINEER. THE EM WILL NOT SHIP AND EQUIPMENT OR COMPONENTS PRIOR TO THE ENGINEER'S SUBMITTAL REVIEW AND APPROVAL.

B. SHOP DRAWINGS: FOR EACH PROCESS AIR HANDLING UNIT SPECIFIED, MANUFACTURERS LITERATURE INCLUDING THE FOLLOWING INFORMATION:

1. ASSEMBLY AND CONSTRUCTION DETAILS
2. SHIPPING SPLITS AND DETAILED INSTRUCTION FOR FIELD LABOR REQUIRED TO ASSEMBLE UNITS
3. UNIT DIMENSIONS
4. CURB DIMENSIONS FOR UNITS SPECIFIED AS CURB MOUNTED.
5. WEIGHT LOADING AND DISTRIBUTION
6. REQUIRED CLEARANCES
7. FIELD CONNECTION DETAILS
8. ELECTRICAL CHARACTERISTICS AND CONNECTION REQUIREMENTS
9. COMPLETE WIRING DIAGRAMS

C. PRODUCT DATA: FOR EACH PROCESS AIR-HANDLING UNIT SPECIFIED, MANUFACTURERS LITERATURE INCLUDING THE FOLLOWING INFORMATION:

1. COOLING CAPACITIES AND RATINGS
    a. COIL FLOW RATES AND PRESSURE DROPS
2. MATERIAL GAGES AND FINISHES.
3. DATA FOR FILTER MEDIA, MANUFACTURER, FILTER PERFORMANCE DATA, FILTER ASSEMBLY, AND FILTER FRAMES.
    a. INCLUDE REPLACEMENT FILTER SIZES AND QUANTITIES.
4. CERTIFIED COIL-PERFORMANCE RATINGS WITH SYSTEM OPERATING CONDITIONS INDICATED. INCLUDE DATA FOR COIL TYPE, CONFIGURATION, MATERIALS, FIN SPACING AND HEADER CONNECTIONS.
5. CERTIFIED FAN-PERFORMANCE AND FAN CURVES WITH SPECIFIED OPERATING POINT CLEARLY PLOTTED, POWER, RPM.
6. SOUND POWER LEVEL DATA, FAN OUTLET AND CASING RADIATION AT RATED CAPACITY.

7. CONTROL SYSTEM DEVICES AND OPERATIONS.
8. MOTOR RATINGS AND ELECTRICAL CHARACTERISTICS PLUS MOTOR AND FAN ACCESSORIES.
9. ELECTRICAL REQUIREMENTS: POWER SUPPLY WIRING INCLUDING WIRING DIAGRAMS FOR INTERLOCK AND CONTROL WIRING, CLEARLY INDICATING FACTORY-INSTALLED AND FIELD-INSTALLED WIRING.

1.6 CLOSEOUT SUBMITTALS

A. SUBMIT THREE (3) ELECTRONIC COPIES ON "THUMB DIRVE" TYPE STORAGE DEVICE UPON DELIVERY OF EQUIPMENT OF THE FOLLOWING INFORMATION FOR EACH PIECE OF VARIED EQUIPMENT FOR RECORD PURPOSES. UPON REQUEST SUBMIT UP TO THREE (3) HARD COPIES FOR MAINTENACE DEPARTMENT RECORDS.
   1. INSTALLATION INSTRUCTIONS AND PROCEDURES
   2. SYSTEM OPERATION AND MAINTENANCE MANUAL
   3. EQUIPMENT WIRING DIAGRAMS
   4. RECOMMENDED SPARE PARTS AND MAINTENANCE MATERIALS LIST
   5. DETAILED PREVENTIVE MAINTENANCE PROGRAM AND GENERAL PLANT MAINTENANCE PROGRAM, FOR ALL EQUIPMENT FURNISHED UNDER THIS SECTION INCLUDING BUT NOT LIMITED TO: LUBRICATION, FILTER REPLACEMENT, MOTOR AND DRIVE REPLACEMENT.
   6. WARRANTY INFORMATION FOR EACH COMPONENT GROUP VARIOUS COVERAGE.

1.7 QUALITY ASSURANCE

A. THE EM SHALL NOTIFY THE OWNER/ENGINEER AT VARIOUS INTERVALS DURING THE MANUFACTURING PROCESS. THE EM SHALL NOTIFY THE OWNER/ENGINEER AT BEGINNING OF PRODUCTION OF FIRST UNIT, SUBSTANTIAL COMPLETION OF FIRST UNIT, AND COMPLETION AND FACTORY TESTING OF FIRST UNIT.
   1. THE EM SHALL BE RECEPTIVE TO INQUIRIES BY THE OWNER AND ENGINEER AS TO THE STATUS OF EQUIPMENT FABRICATION.
   2. THE EM SHALL ALLOW THE OWNER AND/OR ENGINEER SHOP VISITS FOR EQUIPMENT INSPECTION DURING THE FULL CYCLE OF FABRICATION AND TESTING

B. PROVIDE CAPACITY RATINGS WITH ARI CERTIFICATION.
C. PROVIDE EFFICIENCY RATINGS THAT MEET OR EXCEED ASHRAE 90.1.
D. UNIT SHALL BE ETL LABELED PER UL-1995 AND CSA C22.2 NO. 236 CURRENT EDITION.
E. ELECTRICAL COMPONENTS SHALL BE UL LISTED;
F. FANS SHALL BE TESTED IN AN AMCA CERTIFIED LABORATORY.
G. INSULATION SHALL COMPLY WITH NFPA 90A.
H. COILS SHALL BE TESTED IN ACCORDANCE TO ARI 410.
I. FILTERS SHALL BE TESTED IN ACCORDANCE TO ASHRAE 52.
J. ALL UNIT(S) SHALL BE FACTORY TESTED BEFORE SHIPPING. A PROOF COPY OF THE TEST SHALL BE PLACED IN THE UNIT CONTROL PANEL. ELECTRONIC COPY SHALL BE SENT TO THE ENGINEER UPON REQUEST.
   1. ALL CONTROL COMPONENTS PROVIDE AS PART OF THE AHU SYSTEM, EITHER FACTORY OR FIELD MOUNTED, SHALL BE TESTED AND CALIBRATED PRIOR TO FACTORY/FIELD TESTING AND SHIPMENT OF EQUIPMENT. DOCUMENTATION SHALL BE MADE AVAILABLE FOR ALL COMPONENT CALIBRATION UPON REQUEST.

1.8 DELIVERY, STORAGE AND HANDLING

A. EQUIPMENT SHALL BE HANDLED AND STORED AT THE MANUFACTURER'S FACTORY IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS. ONE (1) COPY OF THESE INSTRUCTIONS SHALL BE INCLUDED WITH THE EQUIPMENT AT TIME OF SHIPMENT.
B. THE EQUIPMENT SHALL BE SHIPPED TO THE CONSTRUCTION SITE IN ACCORDANCE WITH THE MILESTONE SCHEDULE INCLUDED WITH THE REQUEST FOR QUOTATION.
   1. THE CONTRACTOR SHALL RECEIVE, UNLOAD AND STORE THE UNIT AT THE PROJECT JOB SITE OR AT LOCATION AUTHORIZED BY THE OWNER OR CM.

C. EQUIPMENT SHALL NOT BE SHIPPED WITH INTERIOR OF UNIT OPEN, ALLOWING THE INTERIOR OF THE UNIT TO BE SOILED. OPEN ENDS OF EACH SECTION SHALL BE COVERED WITH PLYWOOD AND COVERED WITH PLASTIC WRAP. UNITS' EXTERIOR SHALL BE PROTECTED FROM ROAD DIRT AND DEBRIS DURING SHIPMENT. EM SHALL BE RESPONSIBLE TO MAKE RIGHT ANY EQUIPMENT RECEIVED IN UNCLEAN CONDITION.

1.9 GUARANTEE

A. ATTENTION IS DIRECTED TO PROVISIONS ISSUED BY THE CM REGARDING GUARANTEES AND WARRANTIES FOR WORK UNDER THIS CONTRACT.

B. MANUFACTURERS SHALL PROVIDE THEIR STANDARD WRITTEN GUARANTEES FOR WORK UNDER THIS CONTRACT, UNLESS SPECIFIED OTHERWISE. HOWEVER, SUCH GUARANTEES SHALL BE IN ADDITION TO AND NOT IN LIEU OF ALL OTHER LIABILITIES WHICH THE OWNER AND CONSTRUCTION MANAGER MAY REQUIRE BY LAW OR BY OTHER PROVISIONS OF THE CONTRACT DOCUMENTS. IN ANY CASE, SUCH GUARANTEES AND WARRANTIES SHALL COMMENCE WHEN THE OWNER ACCEPTS THE VARIOUS SYSTEMS, AS APPLICABLE AND ONLY AS DETERMINED BY THE ENGINEER. THE GUARANTEES AND WARRANTIES WILL REMAIN IN EFFECT FOR A PERIOD OF (1) YEAR THEREAFTER.

C. ALL MATERIALS, ITEMS OF EQUIPMENT AND WORKMANSHIP FURNISHED UNDER THIS CONTRACT, SHALL CARRY THE STANDARD WARRANTY AGAINST ALL DEFECTS IN MATERIAL AND WORKMANSHIP. ANY FAULT DUE TO DEFECTIVE OR IMPROPER MATERIAL, EQUIPMENT, WORKMANSHIP OR DESIGN WHICH MAY DEVELOP SHALL BE MADE GOOD, FORTHWITH, BY AND AT THE EXPENSE OF THE EM, INCLUDING ALL DAMAGE DONE TO AREAS, MATERIALS AND OTHER SYSTEMS RESULTING FROM THIS FAILURE. THE EM WILL COVER ALL COSTS INCLUDING LABOR AND MATERIALS.

D. THE EM SHALL GUARANTEE THAT ALL ELEMENTS OF THE SYSTEMS PROVIDED UNDER HIS CONTRACT, ARE OF SUFFICIENT CAPACITY TO MEET THE SPECIFIED PERFORMANCE REQUIREMENTS AS SET FORTH HEREIN OR AS INDICATED ON THE EQUIPMENT SCHEDULE.

E. UPON RECEIPT OF NOTICE FROM THE OWNER/ENGINEER OF FAILURE OF ANY PART OF THE SYSTEMS OR EQUIPMENT DURING THE GUARANTEE PERIOD, THE RESPONSIBLE EM SHALL REPLACE THE AFFECTED PART OR PARTS.

F. MINIMUM WARRANTY PERIODS FROM DATE OF DELIVERY TO PROJECT FOR SPECIFIC EQUIPMENT AND COMPONENTS SHALL BE AS FOLLOWS:

1. ALL AIR HANDLING EQUIPMENT, MOTORS, FANS, AND DAMPERS: MANUFACTURER'S MATERIAL REPLACEMENT WARRANTY FOR; TWELVE (12) MONTHS FROM SITE STARTUP OR EIGHTEEN (18) MONTHS FROM FACTORY SHIPMENT, WHICHEVER COMES FIRST.
2. ALL GAS HEAT EXCHANGER COMPONENTS: TEN (10) YEAR MANUFACTURER'S MATERIAL REPLACEMENT WARRANTY.
3. ALTERNATE COST TO BASE: PROVIDE A COST FOR DIAGNOSTIC AND LABOR WARRANTY FOR THE DURATION OF THE PART WARRANTY.

1.10 DAMAGE CORRECTION AND EXTRA WORK

A. THE CONTRACTOR SHALL PROMPTLY CORRECT ALL WORK PROVIDED UNDER HIS CONTRACT AND REJECTED BY THE ENGINEER AS DEFECTIVE OR AS FAILING TO CONFORM TO THE CONTRACT DOCUMENTS WHETHER OBSERVED BEFORE OR AFTER COMPLETION OF WORK AND WHETHER OR NOT FABRICATED, INSTALLED OR COMPLETED. THE EM SHALL BEAR ALL COSTS OF CORRECTING SUCH REJECTED WORK.

B. NO CLAIM FOR EXTRA WORK WILL BE ALLOWED UNLESS AUTHORIZED BY THE OWNER IN WRITING BEFORE COMMENCEMENT OF THE SAID EXTRA WORK. ALL WORK FURNISHED WITHOUT WRITTEN AUTHORIZATION SHALL BE AT THE RISK OF THE EM / CONTRACTOR.

1.11 EXTRA MATERIALS

A. PROVIDE ONE ADDITIONAL FAN BELT PER UNIT HAVING BELT DRIVEN FANS.

B. PROVIDE ONE ADDITIONAL SET OF PRE AND FINAL FILTERS PER UNIT. ADDITIONAL SET SHALL BE SENT TO FACILITY UPON COMPLETION OF START-UP AND TRAINING OR AS REQUESTED BY OWNER.

PART 2: PRODUCTS

2.1 PROCESS AIR HANDLING UNITS

A. FURNISH PROCESS ROOFTOP AIR HANDLING UNIT WITH FACTORY ASSEMBLED DX-REFRIGERATION COOLING SECTION AND IN-DIRECT FIRED GAS HEATING SECTION CONSISTING OF INSULATED CABINET AND FRAME WITH FOLLOWING CONFIGURATION AS FURTHER SPECIFIED HEREIN:

1. SUPPLY AIR FAN AND VFD AS SPECIFIED FOR SA VOLUME FLOW CONTROL/BALANCING.
2. RETURN AIR SECTION AND ASSOCIATED DAMPERS.
3. EXHAUST FAN AND VFD AS SPECIFIED FOR ECONOMIZER / SPACE PRESSURE CONTROL
4. OUTDOOR-AIR SECTION AND ASSOCIATED DAMPERS WITH INTAKE RAIN HOOD(S) (FOR OUTDOOR MOUNT APPLICATION).
5. MERV-8 PRE-FILTER SECTION
6. MERV-14 FINAL FILTER SECTION (OR HIGHER IF SCHEDULED)
7. COOLING-COIL SECTION AS SPECIFIED
8. HEATING SECTION AS SPECIFIED
9. ELECTRICAL POWER AND CONTROL CABINET.

B. THE PROCESS AHU SHALL BE CONSTRUCTED WITH SANITARY DESIGN THROUGHOUT. THE INTERIOR LINER, COMPONENTS AND MOUNTING HARDWARE ARE AREAS WHICH NEED PARTICULAR ATTENTION. THERE SHALL BE NO CREVICES, C-CHANNEL OR OVERLAPPING JOINTS. ALL WHICH CREATE THE POTENTIAL TO CAPTURE AND TRAP MOISTURE AND PARTICULATE.

C. AHUS WITH STANDALONE COMPRESSOR / CONDENSING UNITS:

1. AIR HANDLING UNIT AND COMPRESSOR / CONDENSING UNIT MAY BE SHIPPED AND INSTALLED SEPARATELY IF NOTED CLEARLY IN THE BID DOCUMENTS. THE EM SHALL ENGINEER AND FURNISH DRAWINGS, INSTALLATION DETAILS, AND DATA FOR ALL INTERCONNECTING PIPING, TUBE, AND WIRING TO MAKE A COMPLETE OPERATIONAL SYSTEM.

D. UNIT SHALL BE COMPLETELY FACTORY WIRED TO SINGLE POINT OF CONNECTION WITH FACTORY MOUNTED DISCONNECT DEEMED TO MEET THE REQUIRED EQUIPMENT AIC RATING AND EXTERNAL SERVICE OUTLET. THE UNIT SHALL BE SUPPLIED WITH A MINIMUM AIC OF 65KAIC FOR 480V EQUIPMENT.

2.2 STEEL FRAME MOUNT

A. ALL UNITS SCHEDULED AS ROOF MOUNTED ON FRAME OR DUNNAGE AS PART OF THIS PURCHASE SHALL BE DESIGNED FOR OUTDOOR MOUNTING ON STEEL FRAME WORK LOCATED ABOVE THE BUILDING ROOF.

2.3 ALL UNITS SCHEDULED AS CURB MOUNTED AS PART OF THIS PURCHASE SHALL BE DESIGNED FOR OUTDOOR MOUNTING ON 24"HIGH INSULATED ROOF CURB. ROOF CURB SHALL BE SUPPLIED BY EM FOR EACH UNIT PROVIDED.

2.4 FRAME CONSTRUCTION

A. FRAME SHALL BE CONSTRUCTED OF G235 GALVANIZED STEEL STRUCTURAL FRAME (FRAME SIZE DETERMINED BY DESIGN). THE FRAME SHALL BE INSTALLED TO THE UNIT AT THE FACTORY PRIOR TO SHIPMENT.

1. UNITS SHIPPED IN MULTIPLE SECTIONS SHALL BE FIT TOGETHER PRIOR TO SHIPMENT TO ENSURE PROPER ALIGNMENT. THE STRUCTURAL MEMBERS SHALL BE DESIGNED TO PREVENT DEFORMATION OF HOUSING.

B. REMOVABLE LIFTING LUGS SHALL BE PROVIDED AT THE CORNERS OF EACH SECTION.

1. LIFTING AND ASSEMBLY INSTRUCTIONS SHALL BE PROVIDED WITH EACH SECTION.

2.5 CASING

A. EXTERIOR SURFACES:

1. EXTERIOR CASING SHALL BE MINIMUM 18 GAUGE G235 GALVANIZED STEEL, OR BAKED ENAMEL FINISH.
2. THE EXTERIOR PANELS SHALL BE GALVANIZED STEEL FINISH WITH AN AIR-DRIED PAINT COATING CAPABLE OF WITHSTAND A MINIMUM 670 CONSECUTIVE-HOUR SALT SPRAY APPLICATION IN ACCORDANCE WITH STANDARD ASTM B117

B. INTERIOR SURFACES:
1. UNIT INTERIOR SHALL BE CONSTRUCTED OF MINIMUM 18 GAUGE GALVANIZED STEEL LINER, AND SHALL BE DESIGNED TO FACILITATE ROUTINE CLEANING. THE UNIT SHALL BE DESIGNED TO PREVENT AND AREAS WHERE MICROBIOLOGICAL GROWTH CAN OCCUR.
2. THE INTERIOR WALLS AND CEILING SHALL BE SOLID, SMOOTH AND SEALED TO ALLOW FOR UNIT WASH DOWN. EXPOSED FASTENERS, RIVETS, SCREW HEADS, ETC ARE NOT ACCEPTABLE. NO CREVICES SHALL BE PRESENT ON THE INSIDE OF THE UNIT THAT WILL ALLOW POSSIBLE COLLECTION OF PARTICLES OR MICROBIOLOGICAL GROWTH. FIELD JOINTS SHALL BE PROVIDED WITH FLASHING STRIPS TO ENSURE A CONTINUOUS SURFACE ON THE INSIDE OF THE UNIT WHEN INSTALLATION IS COMPLETE.
3. NO STRUCTURAL TUBE SHAPES WITH OPEN ENDS SHALL BE USED. ALL OF THE FAN, COIL, AND FILTER SUPPORTS AND FRAMES SHALL BE FABRICATED OF ANGLE OR TUBE SHAPED WITH THE ENDS COMPLETELY CLOSED AND SEALED. SQUARE TUBES SHALL BE ARRANGED AT A 45 DEGREE ANGLE TO THERE IS NO HORIZONTAL FLAT SURFACE ON THE SUPPORT.
4. THERE SHALL BE NO EXPOSED INSULATION IN THE AIR STREAM.
5. INTERIOR OF UNIT SHALL BE SEALED AIR AND WATER TIGHT TO ALLOW FOR CLEANING.

C. INTERIOR DRAINS:
1. EACH UNIT SHALL BE COMPLETE WITH CABINET DRAIN PANS THROUGHOUT. THE CABINET DRAIN PANS SHALL BE A MINIMUM OF 12 GAUGE, G235 GALVANIZED STEEL. EACH DRAIN PAN SHALL BE FULLY WELDED TO ENSURE LEAK FREE CONSTRUCTION. THE DRAIN PANS SHALL BE FORMED AND INSTALLED WITH NO WELDED SEAMS ON THE HORIZONTAL (WETTED) AREA OF THE DRAIN PAN. THE DRAIN PAN SHALL BE TURNED UP A MINIMUM OF 4" AT THE WALLS AND LATERAL JOINTS TO PROVIDE WASH DOWN CAPABILITY. THE DRAIN PANS SHALL SLOPE AT A MINIMUM OF 3/16" PER FOOT TOWARDS THE DRAIN OPENING. PROVIDE ALTERNATE FOR 12 GAUGE STAINLESS STEEL DRAIN PANS THROUGHOUT.
    a. THE DRAIN PAN UNDER THE COOLING COIL SECTION SHALL BE CONSTRUCTED OF MINIMUM 12 GAUGE, TYPE 304 STAINLESS STEEL REGARDLESS OF THE FINISH MATERIAL ON THE INTERIOR OF THE UNITS PANELS.
    b. THE DRAIN PAN CONNECTION TO THE EXTERIOR OF THE UNIT IS TO BE POSITIONED FOR 100% COMPLETE FREE DRAINING. THE DRAIN CONNECTION SHALL EXTEND TO THE EXTERIOR OF THE UNIT (NPT CONNECTION). THE DRAIN PAN SHALL BE CONSTRUCTED AND SLOPED TO PREVENT STANDING WATER IN THE DRAIN PANS DURING OPERATION AND AFTER CLEANING.
        1) CABINET DRAIN PANS SHALL BE PIPED THROUGH THE EXTERIOR OF THE UNIT AND CAPPED.
        2) COOLING COIL CONDENSATE DRAIN PANS SHALL BE PIPED THROUGH THE EXTERIOR AND LEFT OPEN ENDED FOR CONDENSATE PIPING BY MC.
        3) CONNECTIONS SHALL BE PIPED WITH A MINIMUM OF 6" EXTENSION FROM SIDE OF AHU. ALL CONNECTIONS SHALL BE ON THE SAME SIDE OF THE AHU.
    c. INTERMEDIATE DRAIN PANS SHALL BE USED FOR STACKED COILS. INTERMEDIATE DRAIN PANS SHALL BE CONSTRUCTED TO THE SAME SPECIFICATION AS THE PRIMARY COOLING COIL DRAIN PAN.

d. THE SPACE BETWEEN THE UNDERSIDE OF THE UNIT AND THE BASE OF THE DRAIN PAN SHALL BE INSULATED WITH A MINIMUM OF 2 INCHES OF INJECTED FOAM INSULATION.
    1) FOAM BOARD INSULATION IS NOT ACCEPTABLE.

D. WALL / FLOOR PANELS:
1. WALL AND FLOOR PANELS SHALL BE MINIMUM 2 INCH FOAM INJECTED POLYURETHANE INSULATION WITH ADDITIONAL INSULATION AS NEEDED TO PREVENT SWEATING.
2. FOAM BOARD INSULATION IS NOT ACCEPTABLE.
3. UNIT CASING SHALL BE DESIGNED TO PREVENT THERMAL AND VAPOR TRANSMISSION BETWEEN INTERIOR AND EXTERIOR OF UNIT PANELS. UNIT CASING SHALL BE GUARANTEED TO NOT SWEAT UNDER DESIGN CONDITIONS.
4. THE CASING PANELS SHALL BE LOAD BEARING AND CAPABLE OF FORMING AN INTEGRAL ENCLOSURE WITHOUT ADDITIONAL STRUCTURAL MEMBERS.
5. CASING SYSTEM SHALL HAVE RATINGS FOR FLAME SPREAD LESS THAN 25 AND SMOKE DEVELOPED LESS THAN 50.

E. ROOF:
1. THE ROOF SHALL BE DOUBLE WALL CONSTRUCTION TO MATCH ALL PANELS, PITCHED AWAY FROM THE ELECTRICAL ENCLOSURE, GAS BURNER CONTROL ENCLOSURE AND ACCESS DOOR SIDE OF THE UNIT AT A MINIMUM ROOF PITCH OF 1/4 IN. PER FOOT ACROSS THE WIDTH OF THE UNIT. NO PENETRATIONS SHALL BE MADE IN ROOF PANEL. ROOF SHALL INCORPORATE A STANDING TOP SEAM. ALL SEAMS IN THE ROOF SHALL BE GASKETED AND CAPPED TO PREVENT WATER INFILTRATION INTO THE UNIT. ALL CAP SEAMS SHALL BE SEALED WATERTIGHT WITH FDA SEALANT.

F. ALL SEALANTS USED IN THE UNIT SHALL BE FDA APPROVED SILICONE SEALANTS. ALL INTERIOR SEAMS ARE TO BE SEALED AIR AND WATER TIGHT WITH FDA APPROVED SEALANT SO THE INTERIOR IS WATERTIGHT.

G. CASING SHALL HAVE A HIGH PRESSURE SAFETY SHUT OFF SWITCH. SWITCH SHALL SHUT OFF SUPPLY AIR FAN IF INTERNAL PRESSURE IS TOO HIGH.

H. RETURN AIR AND SUPPLY AIR CONNECTIONS SHALL BE THROUGH THE ENDS OR SIDES OF THE AHU. THE DUCT CONNECTIONS SHALL BE REINFORCED WITH A STRUCTURAL FLANGE A MINIMUM OF 1-1/2" IN WIDTH ON THE OUTER FACE TO PROVIDE AN ATTACHMENT SURFACE FOR FIELD INSTALLED DUCTWORK.

I. HOUSING SPLITS:
1. WHEN UNIT MUST BE SPLIT TO ACCOMMODATE SHIPMENT, PROVIDE A PERIMETER OF STRUCTURAL MEMBERS (3"X4" ANGLE OR EQUAL) TO ASSIST IN THE UNIT RECONNECTION AND TO PREVENT DEFORMATION OF HOUSING.
2. EACH SHIPPING SECTION SHALL HAVE ITS BASE DESIGNED FOR INDIVIDUAL HANDLING AND RIGGING. EACH SECTION SHALL HAVE A MINIMUM OF FOUR REMOVABLE LIFTING LUGS ATTACHED TO THE STRUCTURAL BASE.

2.6 ACCESS DOORS AND PANELS

A. ACCESS DOORS SHALL BE PROVIDED WHERE REQUIRED FOR MAINTENANCE OR WHERE REQUIRED TO FACILITATE REMOVAL OF COMPONENTS INCLUDING RETURN SECTION, PRE-FILTER SECTION, COOLING COIL SECTION, UV LIGHT SECTION, SUPPLY AIR FAN, FINAL FILTER SECTION AND DISCHARGE PLENUM SECTION. ALL ACCESS DOORS SHALL HAVE 9-INCH HEAVY-DUTY STAINLESS STEEL HINGES OR CONTINUOUS PIANO STYLE HINGES. DOOR MATERIALS OF CONSTRUCTION, INCLUDING INSULATION, SHALL MATCH WALL PANELS. FILTER SECTIONS WILL HAVE ACCESS DOORS ON BOTH SIDES. DOORS SHALL HAVE TIEBACK CAPABILITY AND PADLOCKING PROVISION.

B. DOORS SHALL BE FULLY GASKETED (COMPRESSIBLE CLOSED CELL GASKET, FOAM IS UNACCEPTABLE) WITH 2 SEALS AND PROVIDED WITH THREE (3) NON-LOCKING LEVER TYPE HANDLES, OPERABLE FROM BOTH INTERIOR AND EXTERIOR OF UNIT. ACCESS DOORS SHALL BE

APPROXIMATELY 24 INCHES WIDE BY FULL HEIGHT OF UNIT OR MAXIMUM OF 72 INCHES. DOOR CONSTRUCTION SHALL BE SIMILAR TO UNIT AND HAVE FRAMES THAT WILL NOT ALLOW FOR THE COLLECTION OF PARTICLES OR MICROBIOLOGICAL GROWTH.

C. ACCESS DOORS SHALL OPEN OUTWARD FOR NEGATIVE-PRESSURE SECTIONS AND INWARD FOR POSITIVE-PRESSURE SECTIONS.
   1. THE DOORS SHALL NOT SWING INTO MAINTENANCE SPACE (I.E. AGAINST FILTERS OR COILS).
   2. EACH DOOR MUST BE EQUIPPED WITH A STATIC PRESSURE PORT.

D. ACCESS SECTIONS MUST BE PROVIDED WHEN NEEDED TO PROVIDE ADEQUATE TRANSITION LENGTH FROM ONE COMPONENT TO ANOTHER. ACCESS SECTIONS MUST ALSO BE PROVIDED AS NECESSARY TO ALLOW FOR THE SERVICING OF INTERNAL COMPONENTS.

E. PROVIDE REMOVABLE PANELS, WHERE ACCESS DOORS ARE INSUFFICIENT, TO ASSIST IN THE MAINTENANCE OF LARGE COMPONENTS SUCH AS FANS AND COILS. WHEN THE REMOVABLE PANEL IS REPLACED, IT MUST PROVIDE AN AIR AND WATERTIGHT SEAL THAT WILL MEET THE ORIGINAL LEAK TIGHTNESS REQUIREMENTS FOR THE UNIT.

F. DOORS AND PANELS SHALL BE INSPECTED AND TESTED TO OPEN, AND CLOSE FREELY PRIOR SHIPMENT.
   1. DOORS MUST BE GUARANTEED TO PROVIDE A TIGHT SEAL WHEN CLOSED.

G. ACCESS DOORS SHALL HAVE A SAFETY SWITCH TO SHUT DOWN THE UNIT IF OPENED WHILE THE UNIT IS RUNNING.

2.7 OUTDOOR AIR INLET HOOD

A. OUTDOOR-AIR INLET SHALL BE AN INTAKE HOOD WITH INSECT (MIN. 14 X 14 STRAND PATTERN STAINLESS STEEL MESH WITH MAX 0.017" DIA. WIRE) AND BIRD SCREEN (MIN. ½" X ½" STAINLESS STEEL MESH). THE INLET HOOD CONSTRUCTION SHALL MATCH THE UNIT MATERIAL CONSTRUCTION (18 GAUGE G235 GALVANIZED STEEL OR BAKED ENAMEL FINISH).
   1. INSECT / BIRD SCREEN SHALL BE EASILY REMOVABLE FOR CLEANING.

B. INTAKE HOOD SHALL BE SIZED FOR 100% OF SUPPLY AIR FLOW.

C. MAXIMUM AIR VELOCITY THROUGH THE HOOD SHALL NOT EXCEED MANUFACTURER'S MAXIMUM AIR VELOCITY FOR WATER PENETRATION. OUTDOOR AIR INLET HOOD SHALL BE DESIGNED TO PREVENT THE INFILTRATION OF WIND DRIVEN RAIN.

D. OUTDOOR AIR SECTION SHALL BE PROVIDED WITH A MOTOR OPERATED DAMPER.

2.8 DAMPERS

A. DAMPERS SHALL BE PARALLEL TYPE, CONSTRUCTED OF MINIMUM 16 GAUGE GALVANIZED STEEL BLADES AND A MINIMUM A 12 GAUGE GALVANIZED STEEL FRAME.

B. DAMPERS SHALL BE ULTRA LOW LEAK WITH JAMB SEALS AND BLADE EDGE SEALS. THE DAMPERS SHALL HAVE A LEAK RATING OF LESS THAN 6.5 CFM AT 4" W.G. DIFFERENTIAL PRESSURE. THE PRESSURE DROP ACROSS THE DAMPER SHALL BE LESS THAN 0.03" W.G. AT 1,500 FPM WHEN IN THE 100% OPEN POSITION.

C. MAXIMUM DAMPER VELOCITY SHALL BE 1,200 FPM.

D. BEARINGS SHALL BE NYLON TYPE AND HAVE A STAINLESS STEEL SPRING LOADED SIDE CLOSURE.
   1. DAMPERS SHALL BE GREENHECK MODEL SEVCD-23 OR EQUAL.

E. DAMPERS SHALL BE COMPLETE WITH DIRECT DRIVE ELECTRIC ACTUATORS.

F. AHUS SHALL BE PROVIDED WITH RETURN AIR, AND OUTSIDE AIR DAMPERS.

G. OUTSIDE AIR DAMPER AND RETURN AIR DAMPER SECTIONS SHALL BE SIZED FOR 100% OF THE UNIT AIR FLOW CAPACITY.
   1. THE RETURN AIR AND OUTSIDE AIR DAMPERS SHALL MODULATE TO ACHIEVE PROPER ROOM PRESSURE CONDITIONS AS DESCRIBED IN THE UNIT OPERATIONAL DESCRIPTION.

H. ACTUATORS:
   1. THE OUTDOOR-AIR AND RETURN-AIR DAMPERS SHALL HAVE MODULATING DIRECT DRIVE DAMPER ACTUATOR. THE OUTSIDE AIR DAMPER SHALL FAIL TO THE CLOSED POSITION AND THE RETURN AIR DAMPER SHALL FAIL TO THE OPEN POSITION.

2. DAMPER ACTUATOR TO ACCEPT 4-20 MA CONTROL SIGNAL FROM ROOM PRESSURE TRANSMITTER TO MODULATE DAMPER POSITIONS.
3. PROVIDE MULTIPLE ACTUATORS WHERE REQUIRED TO MEET TORQUE REQUIREMENTS OF DAMPER.
4. CAPACITY: DEMONSTRATE CAPACITY OF DAMPER TO WITHSTAND HVAC SYSTEM OPERATING CONDITIONS.
5. DAMPER ACTUATORS TO BE 120 VOLT WITH TWO SWITCHES. ONE SWITCH AT OPEN AND ONE SWITCH AT CLOSED POSITION.
6. DAMPER ACTUATOR TO PROVIDE 4-20MA POSITION FEEDBACK TO PLC FOR DISPLAY AT HMI.
7. DAMPER ACTUATOR TO BE EQUAL TO NEPTRONIC RM380 OR APPROVED EQUAL.

2.9 SUPPLY AND EXHAUST FANS

A. SUPPLY FANS:

1. FANS SHALL BE A CENTRIFUGAL AIRFOIL, PLENUM, AND DIRECT DRIVEN FAN. REFER TO SCHEDULE FOR SPECIFIC DRIVE TYPE WHERE APPLICABLE. THE MOST EFFICIENT FAN AVAILABLE FOR UNIT CONFIGURATION SHALL BE USED. FAN WHEEL SHALL BE OF ALUMINUM CONSTRUCTION.
2. FAN SECTIONS, SHALL EMPLOY AIRFOIL FANS WITH A MINIMUM ACMA CONSTRUCTION CLASS OF II. USE CLASS III FAN CONSTRUCTION IF THE FAN CHARACTERISTIC CURVE EXTENDS TO WITHIN 10% OF THE FANS CLASS III SELECTION ZONE. FANS SHALL BE V-BELT DRIVE, WITH FIXED PITCH MOTOR PULLEY AND RUBBER ISOLATED HINGE-MOUNTED MOTOR. THE MAXIMUM HEIGHT OF EXTENDED LUBE LINED SHALL BE 48" ABOVE BASE OF UNIT.
3. FANS SHAFTS SHALL BE SOLID STEEL, TURNED, PRECISION GROUND, POLISHED AND COATED WITH RUST PREVENTATIVE OIL, MOUNTED IN SELF-ALIGNING, PILLOW BLOCK GREASE TYPE (NON-SEALED) BALL BEARINGS RATED FOR AN AVERAGE LIFE OF 200,000 HRS. ALL UNITS SHALL BE PROVIDED WITH EXTENDED LUBRICATION LINES TO ALLOW LUBRICATION FROM THE EXTERIOR OF THE UNIT.
4. FAN SHAFTS AND FANS SHALL BE RATED FOR CONTINUOUS OPERATION AND SHALL BE STATICALLY AND DYNAMICALLY BALANCED IN ALL PLANES. FAN DRIVES SHALL BE SELECTED FOR A 1.5 SERVICE FACTOR.
5. FAN MOTORS: HEAVY DUTY, 1800-RPM, TEFC TYPE WITH GREASE TYPE (NON-SEALED) BALL BEARINGS AND OPERABLE AT 460 VOLTS, 60-HZ, 3-PHASE. MOTORS SHALL BE PREMIUM EFFICIENCY AND SHALL EXCEED EPACT REQUIREMENTS. THE MOTOR SHALL HAVE A FIXED PITCH SHEAVE AND ADJUSTABLE BASE FOR PROPER ALIGNMENT, BELT TENSION AND ADJUSTMENT. MOTORS SHALL BE INVERTER DUTY FOR VFD OPERATION.
    a. MOTOR HORSEPOWER SHALL EXCEED FAN BREAK HORSEPOWER BY A MINIMUM OF 15%.
6. MOUNTING: LOCATE FAN AND MOTOR INTERNALLY ON WELDED STEEL BASE COATED WITH CORROSION RESISTANT PAINT. FACTORY MOUNTED MOTOR SLIDE RAILS. PROVIDE ACCESS TO MOTOR, DRIVE, AND BEARINGS THROUGH HINGED ACCESS DOORS. MOUNT BASE ON 2-INCH DEFLECTION SPRING VIBRATION ISOLATORS.
7. PROVIDE OSHA APPROVED BELT AND SHAFT GUARDS TO ENCLOSE ENTIRE DRIVE. CONSTRUCT FACE OF GUARDS MINIMUM 60% FREE AREA TO ALLOW FOR VENTILATION AND PROVIDE TACHOMETER OPENINGS AT SHAFT LOCATIONS. PROVIDE OSHA APPROVED SCREENING OVER FAN WHEEL AND INLET. ALL GUARDS SHALL BE FABRICATED FROM STAINLESS STEEL.
8. ALL V-BELT DRIVES SHALL BE STANDARD CAPACITY AND FURNISHED WITH MATCHED SETS IN REINFORCED RUBBER BELTS. THE SHEAVES SHALL BE OF A CAST IRON TYPE AND SHALL HAVE A FIXED PITCH MOTOR SHEAVE AND A FIXED PITCH DRIVE SHEAVE. THE

OVERLOAD SERVICE FACTOR USED FOR V-BELT DRIVE SELECTION SHALL NOT BE LESS THAN 1.25. DRIVE ASSEMBLY SHALL BE PROVIDED WITH A BELT GUARD.

9. SUPPLY FAN SHALL BE LOCATED IN THE DRAW THROUGH POSITION.
10. AIR DIFFUSER SHALL BE INSTALLED DOWNSTREAM OF FAN IF DEEMED REQUIRED BY EM TO SPREAD AIRFLOW EVENLY INTO FILTERS.
11. SUPPLY FAN VFD SHALL BE CONTROLLED BY AN AIR FLOW STATION. THE SUPPLY FAN SHALL DISCHARGE A CONSTANT VOLUME OF AIR AS SPECIFIED, AND INCREASE IN SPEED AS THE FILTERS IN THE SYSTEM GET LOADED.

B. EXHAUST FAN

1. THE FOLLOWING UNITS SHALL BE PROVIDED WITH INTEGRAL EXHAUST FAN(S);
    a. AHU-01
2. EACH UNIT SHALL INCLUDE AN INTEGRAL DIRECT DRIVE POWERED EXHAUST FAN(S), UTILIZING ALUMINUM HUB AND POLYPROPYLENE OR ALUMINUM BLADES (WHERE SCHEDULED).
3. FAN MOTORS SHALL BE TOTALLY ENCLOSED FAN COOLED TYPE, HIGH EFFICIENCY AND SHALL BE INVERTED DUTY RATED.
4. EXHAUST FAN SHALL BE CONTROLLED BY A VARIABLE SPEED DRIVE. EXHAUST FAN SPEED SHALL BE CONTROLLED TO ENSURE THAT THE BUILDING IS NEVER UNDER NEGATIVE PRESSURE. EXHAUST FAN SHALL BE INITIATED ON HIGH ROOM PRESSURE AND ECONOMIZER CONTROL, AND SHALL MODULATE TO MAINTAIN THE ROOM PRESSURE SET POINT.
5. EXHAUST FAN SHALL BE CONTROLLED BY A VARIABLE SPEED DRIVE. EXHAUST FAN SPEED SHALL BE CONTROLLED TO REMOVE OUTSIDE AIR SUPPLIED TO THE SPACE DURING WASH-DOWN OPERATION. EXHAUST FAN SHALL BE INITIATED ON HIGH ROOM PRESSURE AND ECONOMIZER CONTROL, AND SHALL MODULATE TO MAINTAIN THE ROOM PRESSURE SET POINT. POWER EXHAUST FAN SECTIONS SHALL INCORPORATE DOUBLE BACK DRAFT DAMPERS FOR BACK FLOW PROTECTION.

2.10 FILTERS

A. FILTERS WILL BE LOCATED AT 2 SECTIONS OF THE UNIT FOR AHU-01

1. OUTSIDE AIR: MERV-8 PRE-FILTER
2. AFTER THE FAN/BEFORE UNIT DISCHARGE: MERV-14 FINAL FILTER

B. MATERIAL: NO FIBERGLASS WILL BE ALLOWED IN THE FILTER MEDIA.

C. PRE-FILTERS: PRE-FILTERS SHALL BE 2-INCH THICK DESIGN, PLEATED, DISPOSABLE TYPE. FILTER EFFICIENCY SHALL BE NO LESS THAN MERV-8 IN ACCORDANCE WITH ASHRAE TEST METHODS. MAXIMUM VELOCITIES THROUGH THE FILTER SHALL NOT EXCEED 500 FEET PER MINUTE. FILTERS SHALL BE HELD IN THEIR OWN INDIVIDUAL GALVANIZED STEEL HOLDING FRAMES. PROVIDE DIFFERENTIAL PRESSURE GAUGE WITH LOCAL INDICATION ACROSS FILTER BANK. PROVIDE DIFFERENTIAL PRESSURE TRANSMITTER ACROSS FILTER BANK FOR CONTROL SYSTEM INPUT. FILTER SHALL BE CAMFIL FARR 30/30 OR EQUAL.

D. FINAL FILTERS: FINAL FILTERS SHALL BE 12-INCH CARTRIDGE TYPE. THE AVERAGE EFFICIENCY OF THE FILTER BANK SHALL NOT BE LESS THAN MERV-14 PER ASHRAE TEST METHODS. MAXIMUM VELOCITIES THROUGH THE FILTER SHALL NOT EXCEED 500 FEET PER MINUTE. EACH FILTER SHALL BE COMPLETE WITH AN INDIVIDUAL GALVANIZED STEEL HOLDING FRAME, WITH SUITABLE GASKETS AND QUICK RELEASE RETAINING CLIPS TO MAINTAIN A POSITIVE PRESSURE SEAL BETWEEN THE FRAME AND FILTER. PROVIDE DIFFERENTIAL PRESSURE GAUGE WITH LOCAL INDICATION ACROSS FILTER BANK. PROVIDE DIFFERENTIAL PRESSURE TRANSMITTER ACROSS FILTER BANK FOR CONTROL SYSTEM INPUT. FILTER SHALL BE CAMFIL FARR DURAFIL OR EQUIVALENT.

E. DOUBLE WALL HINGED ACCESS DOOR SHALL BE PROVIDED FOR FILTER ACCESS ON BOTH SIDES OF UNITS.

2.11 COOLING COIL (COOLING COIL SHALL BE BASED ON REFRIGERANT AVAILABLE AND AS SCHEDULED)

A. GENERAL:
1. COILS SHALL HAVE A MAXIMUM OF 8 ROWS. IF REQUIRED COOLING CAPACITY CANNOT BE MEET WITH A SINGLE 8-ROW COIL. COOLING COILS SHALL BE PLACED IN SERIES WITH AN ACCESS SECTION BETWEEN COILS.
2. COILS SHALL HAVE A MAXIMUM OF 8 FINS PER INCH.
3. COIL FACE VELOCITY SHALL BE DESIGNED TO PREVENT CONDENSATE AND FOGGING CARRYOVER PAST COIL DRAIN PAN AND SHALL NOT EXCEED 475 FPM.
4. COOLING COIL FRAME SHALL BE TYPE 304 STAINLESS STEEL.
5. COOLING COILS SHALL BE LOCATED IN THE DRAW THROUGH POSITION.
6. COOLING COIL SHALL BE DESIGNED FOR MAXIMUM DEHUMIDIFICATION AND SHALL OBTAIN A LEAVING COIL SUPPLY AIR TEMPERATURE AS SCHEDULED.
7. ALL SECTIONS OF THE COOLING COIL PIPING SHALL BE INSULATED TO THE CONNECTION POINT OF THE COOLING COIL. ALL CONDENSATION ON THE COILS SHALL DROP INTO THE STAINLESS STEEL DRAIN PAN DESIGNED FOR THE COOLING COIL CONDENSATION.
    a. DRAIN PANS SHALL BE DESIGNED TO CAPTURE ALL CONDENSATE REMOVED BY THE COIL. PROVIDE INTERMEDIATE DRAIN PANS AS REQUIRED TO PREVENT CONDENSATE CARRYOVER.
    b. DRAIN PANS SHALL BE POSITIVELY SLOPED FOR NO STANDING WATER.
8. ACCESS SECTIONS SHALL BE PROVIDED UPSTREAM AND DOWNSTREAM OF COOLING COILS TO ALLOW CLEANING FROM BOTH SIDES.
9. COIL SHALL BE LEAK TESTED FOR A GREATER OF 300 PSIG OR 1.5X THE OPERATING PRESSURE OF THE PROPOSED SYSTEM.

B. SPLIT SYSTEM DX COOLING:
1. COOLING COILS SHALL BE DESIGNED FOR DIRECT EXPANSION COOLING WITH REFRIGERANT AS SCHEDULED.
2. COILS SHALL BE CONSTRUCTED OF COPPER TUBE AND ALUMINUM FINS.
    a. FINS SHALL BE MECHANICALLY EXPANDED TO COPPER TUBES. FINS SHALL BE FLAT, STRAIGHT FINS TO MINIMIZE CATCH POINTS. MAXIMUM FIN SPACING SHALL BE 8 FINS PER INCH. MINIMUM FIN THICKNESS SHALL BE 0.014 INCHES.
    b. TUBE SHALL BE A MINIMUM 5/8" DIAMETER CONSTRUCTED OF SEAMLESS COPPER WITH 0.025" WALL CONSTRUCTION. CONNECTION SIZE AND HEADER SIZE SHALL BE BASED ON MOST EFFICIENT COIL CIRCUITING.
3. COILS SHALL BE MANUFACTURED AND PERFORMANCE MATCHED TO COMPRESSORS AND CONDENSING UNIT. REFRIGERANT TUBING IN COILS SHALL BE INTERLACED SO AS TO AVOID HOT SPOTS ON COIL FACE DURING PART LOAD OPERATION.
4. REFRIGERANT PIPING THROUGH CASING SHALL INCLUDE PACKING GLAND. ALL SMALL TUBING AND SPECIALTIES SHALL BE FULLY ENCLOSED IN AN INTERNAL COMPARTMENT INSIDE THE UNIT CASING. ACCESS SHALL BE AVAILABLE FROM THE OUTSIDE THROUGH A REMOVABLE PANEL.

2.12 HEATING SECTION (HEATING TYPE SHALL BE BASED ON SYSTEM AS SCHEDULED)

A. GENERAL:
1. ALL HEATING CONTROLS SHALL BE FULLY INTEGRATED INTO THE AIR HANDLING UNIT WITH ALL FIELD CONNECTIONS IN MAIN CONTROL PANEL.

B. INDIRECT GAS FURNACE:
1. THE BURNER SHALL BE FULLY MODULATING INDIRECT-FIRED BURNER LOCATED INLINE IN THE REHEAT POSITION, SUITABLE FOR BURNING NATURAL GAS AND AIR MIXTURE WITH A MINIMUM STANDARD TURNDOWN RATIO OF 20:1.
2. THE HEATING SECTION SHALL HAVE A TUBULAR STAINLESS STEEL HEAT EXCHANGER DESIGN USING STAINLESS STEEL BURNERS AND STAINLESS STEEL THROUGHOUT. A COMBUSTION BLOWER SHALL BE USED TO PULL THE COMBUSTION PRODUCTS THROUGH THE FIRING TUBES. THE HEATER SHALL USE A DIRECT SPARK IGNITION (DSI) SYSTEM.

ON INITIAL CALL FOR HEAT, THE COMBUSTION BLOWER SHALL PURGE THE HEAT EXCHANGER FOR 20 SECONDS BEFORE IGNITION.

3. GAS TRAIN SHALL CONSIST OF MAIN INLET HAND OPERATED SHUT OFF VALVE, MAIN GAS REGULATOR, TWO MAIN GAS VALVES WITH OPERATORS, MODULATING GAS VALVE, PILOT HAND SHUTOFF, PILOT REGULATOR AND PILOT SOLENOID VALVE. GAS TRAIN IS FACTORY MUTUAL (FM) RATED. BURNER SHALL BE DESIGNED FOR 1-5-PSIG GAS PRESSURE UNLESS OTHERWISE SCHEDULED.
4. BURNER SHALL HAVE LOW SETTING TO PROVIDE HEAT TO THE BUILDING WHEN REQUIRED DURING THE PRODUCTION OPERATION.
5. HEAT EXCHANGER SHALL HAVE A CONDENSATE DRAIN PIPED TO THE EXTERIOR OF THE UNIT WITH NPT THREADS AND A SHUTOFF VALVE COMPATIBLE TO THE SERVICE.
6. FURNACE SHALL BE PROVIDED WITH A DOUBLE WALL FLUE STACK AND RAIN CAP.
7. GAS BURNER SAFETY CONTROLS SHALL CONSIST OF:
    a. LINE TO 110 VAC CONTROL TRANSFORMER.
    b. ELECTRONIC INTERMITTENT PILOT IGNITION
    c. PRESSURE DIFFERENTIAL AIRFLOW SWITCH
    d. HIGH LIMIT WITH MANUAL RESET
    e. FACTORY MUTUAL APPROVED FIRE-EYE FLAME RELAY AND UV DETECTOR OR EQUIVALENT.
    f. SUPPLY FAN CONTROL: PROVIDE TEMPERATURE SENSOR FOR BONNET TEMPERATURES, INDEPENDENT OF BURNER CONTROLS, OR ADJUSTABLE TIME-DELAY RELAYS WITH SWITCH FOR CONTINUOUS FAN OPERATION.
    g. THE PANEL SHALL BE UL LISTED AND LABELED.
    h. THE GAS BURNER SHALL BE MODULATED BY UNIT'S PLC/MICROPROCESSOR CONTROL SYSTEM.

2.13 ELECTRICAL POWER

A. EACH UNIT'S POWER CENTER SHALL HAVE THE FOLLOWING FEATURES:

1. THE POWER AND CONTROL CENTER SHALL BE INTEGRAL TO THE UNIT HOUSING OR SHALL BE WITHIN AN EXTERNAL WEATHERPROOF HOUSING ATTACHED TO UNIT. A SEPARATE ACCESS DOOR SHALL BE PROVIDED WITH AN APPROVED LOCKING DEVICE. ALL ELECTRICAL COMPONENTS CONTAINED IN THE PANEL SHALL BE UL/CSA CERTIFIED AND LABELED.
2. UNIT SHALL BE FACTORY WIRED FOR SINGLE POINT POWER CONNECTION CONFIGURED FOR 460-VOLT, 3-PHASE, 60-HERTZ INCOMING POWER.
3. FUSED "LOCKABLE" SAFETY DISCONNECT SWITCH, FACTORY MOUNTED IN THE PANEL.
    a. THE DISCONNECT SHALL BE DESIGNED TO ADHERE TO TAG & LOCKOUT PROCEDURES.
    b. DISCONNECTS NEMA CLASSIFICATION SHALL BE SUITABLE FOR AHU INSTALLATION LOCATION.
4. EXTERIOR GFCI SERVICE RECEPTACLE, POWERED FROM UNIT MAIN POWER SUPPLY VIA TRANSFORMER.
5. VOLTAGE TRANSFORMERS.
    a. PROVIDE STEP-DOWN VOLTAGE TRANSFORMERS FOR CONTROL POWER.
    b. TRANSFORMERS OF SUITABLE RATING SHALL BE PROVIDED AND INSTALLED IN THE EQUIPMENT TO SATISFY VOLTAGE LEVELS OF CONTROL CIRCUITS. CONTROL CIRCUITS SHALL NOT EXCEED 120 VOLT, UNLESS THE APPLICATION DICTATES THE USE OF HIGHER VOLTAGE.
    c. THE TRANSFORMERS PRIMARY SHALL HAVE BOTH LEGS ADEQUATELY FUSED AND THE SECONDARY SHALL HAVE ONE LEG ADEQUATELY FUSED AND THE OTHER GROUNDED.

B. VFD MOTOR CONTROL

1. PROVIDE VARIABLE FREQUENCY DRIVE FOR EACH FAN MOTOR (SUPPLY AND EXHAUST). EACH SHALL BE PROPERLY SIZED, MOUNTED, WIRED AND COMMISSIONED BY THE AHU MANUFACTURER. PACKAGE SHALL INCLUDE LOCKABLE DISCONNECT SWITCH, CONTROL TRANSFORMER, HANDS-OFF-AUTO (H-O-A) SWITCH, N.O. AUXILIARY CONTACT, ELECTRONIC OVERLOADS (FACTORY-SET FOR THE SPECIFIC MOTOR).
2. VFD SHALL BE LOCATED WITHIN THE ELECTRICAL POWER ENCLOSURE OF THE UNIT. VFD SHALL BE FACTORY WIRED TO FAN MOTOR PER REQUIRED NEC, UL, AND NFPA 90 REQUIREMENTS. CONTROL START-STOP SIGNAL WIRING SHALL BE FACTORY WIRED COMPLETE FROM THE CONTROLLER TO THE VFD.
3. ALL VFDS SHALL BE AS MANUFACTURED BY ROCKWELL AUTOMATION / ALLEN-BRADLEY, OR APPROVED EQUAL.

C. ALL ELECTRICAL COMPONENTS CONTAINED IN THE PANEL SHALL BE UL/CSA CERTIFIED AND LABELED.

D. SCCR RATINGS AND MOTOR INSULATION
1. ALL CONTROL PANELS SHALL BE DESIGNED, LISTED AND LABELED IN COMPLIANCE WITH THE 2008 NEC ARTICLE 409 INDUSTRIAL CONTROL PANELS. THE SYSTEM FAULT CURRENT CAPACITY AT THE INCOMING LINE TERMINAL IN THIS FACILITY SHALL BE 65KAIC AT 480 VOLTS. THE INDUSTRIAL CONTROL PANEL SCCR RATING SHALL MEET OR EXCEED THE AVAILABLE FAULT CURRENT ENERGY AT THE LINE TERMINAL OF THE EQUIPMENT.
2. ALL 460 VOLT AND ABOVE INVERTER DUTY MOTORS SHALL HAVE A MOTOR WINDING INSULATION VALUE OF 1600 VOLTS OR GREATER.

E. SUPPLY AND EXHAUST FANS SHALL NOT BE ALLOWED TO START SIMULTANEOUSLY TO AVOID IN RUSH CURRENT. SUPPLY FAN SHALL START FIRST THEN EXHAUST FAN SHALL BE ALLOWED TO START 10S AFTER SUPPLY FAN.

F. ALL CONDUIT PENETRATIONS THROUGH THE CASING WALL SHALL BE SEALED WITH A PACKING GLAND, AND MADE AIRTIGHT INSIDE THE CONDUIT IN THE VOID AROUND THE WIRING SUFFICIENT TO ELIMINATE ALL AIR, MOISTURE AND DIRT MIGRATION.

2.14 CONTROL SYSTEM

A. GENERAL:
1. CONTRACTOR SHALL REFERENCE 23 09 93 SEQUENCE OF OPERATIONS FOR ADDITIONAL INFORMATION.
2. THE PLANT WHERE THIS EQUIPMENT WILL BE LOCATED WILL BE CONTROLLED BY A BACNET DDC SYSTEM. AHU PLC SHALL BE COMPATIBLE WITH SELECTED BACNET DDC SYSTEM.
3. EACH AHU SHALL BE PROVIDED WITH A PLC TO CONTROL ALL FUNCTION OF THE AHU. THE PLC SHALL BE FACTORY PROVIDED, INSTALLED, WIRED, PROGRAMMED AND TESTED. EACH PLC SHALL HAVE AN ETHERNET CONNECTION FOR REMOTE MONITORING OF UNIT.
4. EM SHALL PROVIDE A REMOTE NEMA 4X CONTROL ENCLOSURE TO BE MOUNTED WITHIN THE PROCESS SPACE TO CONTROL THE SPACE TEMPERATURE THROUGH THE AHU'S OPERATION. SEE EQUIPMENT SCHEDULE FOR INFORMATION ENCLOSURE SHALL CONTAIN:
    a. OPERATION SELECTOR SWITCH
    b. SPACE TEMPERATURE SENSOR
    c. ADJUSTABLE THERMOSTAT
    d. ALARM LIGHTS
    e. MODE LIGHTS
5. THE PLC FOR EACH UNIT SHALL BE CAPABLE OF STAND-ALONE OPERATION.
6. EACH AHU SHALL HAVE INPUT TO SHUT DOWN UNIT ON SIGNAL FROM DUCT MOUNTED SUPPLY AND RETURN AIR SMOKE DETECTOR. ACTIVATION OF A DUCT SMOKE DETECTOR SHALL SHUT DOWN ALL FANS AND CLOSE OUTDOOR AIR AND RETURN AIR DAMPERS.

SHUT DOWN SHALL BE HARD WIRED; SHUT DOWN THROUGH SOFTWARE WILL NOT BE ACCEPTABLE.

7. THE EM SHALL FURNISH AND INSTALL ALL CONTROL TRANSFORMERS REQUIRED TO PROVIDE POWER OT THE PLC CONTROL PANEL.
8. THE EM WILL COMPLETE ALL WIRING FOR SUCCESSFUL SITE START-UP IN THE FIELD.

B. PANEL CLASSIFICATIONS:
1. ROOF MOUNTED UNIT CONTROL PANEL ENCLOSURE SHALL BE WITHIN AN EXTERNAL NEMA 3R WEATHERPROOF HOUSING ENCLOSURE ATTACHED TO UNIT WITH SEPARATE ACCESS DOOR PROVIDED WITH AN APPROVED LOCKING DEVICE.
2. INTERIOR REMOTE PANEL SHALL BE WITHIN A NEMA 4X HOUSING ENCLOSURE.
3. ALL ELECTRICAL COMPONENTS CONTAINED IN THE PANEL SHALL BE UL/CSA CERTIFIED AND LABELED.

C. REMOTE CONTROL AND MONITORING:
1. EACH AHU PLC SHALL HAVE AN ETHERNET CONNECTION FOR REMOTE MONITORING, COMMUNICATION AND ADJUSTMENT OF CONTROL PARAMETERS OF UNITS THROUGH A FACILITY BUILDING AUTOMATION CONTROL SYSTEM (BACS).
2. FOR EACH AHU, ALL CONTROL SET POINTS, MONITOR POINTS, CONTROL FUNCTIONS, ALARMS AND SYSTEM SOFTWARE PARAMETERS SHALL BE ACCESSIBLE AND ADJUSTABLE FROM THE OWNERS BACS.

2.15 CONTROL DEVICES AND SENSORS

A. EACH AHU SHALL BE PROVIDED WITH AN AHU PLC TO CONTROL ALL FUNCTIONS OF THE AHU. THE PLC SHALL BE FACTORY PROVIDED, INSTALLED, WIRED, PROGRAMMED AND TESTED. EACH PLC SHALL HAVE AN ETHERNET CONNECTION FOR REMOTE MONITORING AND SET POINT ADJUSTMENT OF THE AHU THROUGH THE FACILITY BACNET DDC SYSTEM.

B. EACH AHU SHALL BE PROVIDED WITH A SPACE TEMPERATURE SENSOR, HUMIDITY SENSOR AND MODE LIGHTS AS DESCRIBED ABOVE.
1. SPACE SENSORS SHALL BE RATED NEMA-X FOR INCIDENTAL WASH DOWN AREA.

C. EACH AHU SHALL BE PROVIDED WITH CONTROL VALVE AND ACTUATORS FOR COOLING.

D. EACH AHU SHALL BE PROVIDED WITH A SUPPLY AIR FLOW STATION TO CONTROL SUPPLY FAN VFD. THE FLOW STATION SHALL BE FACTORY MOUNTED AND WIRED BY EM.

E. EACH AHU SHALL BE PROVIDED WITH A SMOKE DETECTOR CONTACTS TO FACILITATE UNIT SHUT DOWN BY DUCT MOUNTED SMOKE DETECTORS.

F. EACH AHU SHALL HAVE A DIFFERENTIAL PRESSURE INDICATING TRANSMITTER INSTALLED ACROSS EACH FILTER BANK. THE INDICATOR SHALL BE MOUNTED ON THE EXTERIOR OF THE UNIT. THE PRESSURE SHALL BE TRANSMITTED TO THE AHU PLC/UNIT CONTROLLER FOR FILTER LOAD MONITORING.

G. EACH AHU SHALL BE PROVIDED WITH AN OUTDOOR AIR TEMPERATURE/HUMIDITY SENSOR, RETURN AIR TEMPERATURE/HUMIDITY SENSOR, MIXED AIR TEMPERATURE SENSOR, AND DISCHARGE AIR TEMPERATURE/HUMIDITY SENSOR.
1. THE MIXED AIR AND DISCHARGE AIR SHALL BE AN AVERAGING SENSOR WITH LENGTH TO COVER THE AIR STREAM AS MANUFACTURED BY MINCO OR EQUAL.

H. EACH AHU SHALL HAVE A CABINET HIGH PRESSURE SAFETY SWITCH TO SHUT THE UNIT DOWN IN THE EVENT OF EXCESSIVE PRESSURE IN THE CABINET.

I. EACH AHU SHALL HAVE DAMPER ACTUATORS (RETURN AND OUTSIDE AIR) WITH POSITION FEEDBACK.

J. EACH AHU SHALL HAVE MOTOR SECTION ACCESS DOOR LIMIT SWITCHES TO SHUT DOWN UNIT WHEN DOOR IS OPENED.

K. THE QUANTITY AND LOCATION OF SENSORS INTERIOR TO THE AHU SHALL BE DETERMINED BY THE DESIGN FROM THE EM. SENSOR QUANTITY AND MOUNTING LOCATION SHALL BE THAT AN ACCURATE MEASUREMENTS AND DATA TRANSMISSION OF THE SYSTEM IS IN PLACE.

1. ALL SENSORS AND DEVISES SHALL BE CLEARLY LABELED AND MATCH AS-BUILT AND FIELD WIRING DIAGRAMS. ALL SENSORS AND DEVICES SHALL MATCH FOR ALL UNITS PROVIDED. MISMATCHED SENSORS AND DEVICES FROM UNIT TO UNIT WILL NOT BE ACCEPTABLE.

L. CONTROL POINTS; THE UNIT CONTROL SYSTEM SHALL PROVIDE THE MINIMUM CONTROL POINTS AS LISTED BELOW.

1. SPACE TEMPERATURE AND HUMIDITY– ADJUSTABLE AT THE UNIT PLC AND DDC
2. RETURN AIR TEMPERATURE AND HUMIDITY
3. MIXED AIR TEMPERATURE
4. DISCHARGE AIR TEMPERATURE AND HUMIDITY
5. OUTSIDE AIR TEMPERATURE, AND HUMIDITY
6. RETURN AIR DAMPER POSITION (0-100 %)
7. OUTSIDE AIR DAMPER POSITION (0-100%)
8. MINIMUM OUTDOOR AIR SETPOINT
9. SUPPLY FAN VFD FREQUENCY AND STATUS
10. EXHAUST FAN VFD FREQUENCY AND STATUS
11. COOLING COIL VALVE POSITION INCLUDING FEEDBACK
12. HEATING COIL VALVE POSITION INCLUDING FEEDBACK
13. HEATING AND COOLING COIL DIFFERENTIAL PRESSURE
14. SUPPLY AIR FLOW VOLUME IN CFM
15. PRE-FILTER PRESSURE DROP WITH HIGH LEVEL ALARM
16. FINAL FILTER PRESSURE DROP WITH HIGH LEVEL ALARM
17. SA AND RA SMOKE DETECTOR ALARM AND UNIT SHUT DOWN
18. SHUTDOWN COMMAND/STATUS
19. WASHDOWN COMMAND/STATUS
20. ECONOMIZER STATUS
21. ACCESS DOOR STATUS
22. ALARM STATUS
23. THE EM SHALL PROVIDE A CONTROL POINT LIST OR TABLE AND DIAGRAM OF ALL CONTROL SET POINTS REQUIRED FOR THE CONTROLS CONTRACTOR BACS INTEGRATION. THE POINTS LIST AND DIAGRAM SHALL BE CLEARLY LABELED FOR EASE OF INCORPORATION.

2.16 PERFORMANCE

A. UNIT PERFORMANCE SHALL BE AS SPECIFIED OR SCHEDULED

PART 3: EXECUTION

3.1 FACTORY TESTING

A. THE MANUFACTURER SHALL FORMALLY NOTIFY IN WRITING (E-MAIL) THE OWNER/ENGINEER TWO (2) WEEKS PRIOR TO THE DATE THE TESTS ARE TO BE PERFORMED. THE OWNER/ENGINEER SHALL HAVE THE OPTION TO WITNESS THE FULL OPERATIONAL FACTORY TEST. ALL AIR DAMPERS WILL BE TESTED AND WITNESSED AT ALL FULL OPERATIONAL SETTINGS.

B. EQUIPMENT SHALL BE FACTORY TESTED PRIOR TO SHIPMENT.

C. UPON INSTALLATION AND FIELD WIRING THE EM SHALL OPERATE CONTROL SYSTEM THROUGH ALL MODES OF OPERATION TO ENSURE UNITS ARE OPERATIONAL.

D. FACTORY TESTING SHALL INCLUDE BUT NOT LIMITED TO COOLING COIL PRESSURE TESTING, DRAIN PAN LEAK / TRUE FLOW TEST, AND UNIT LEAKAGE TEST.

1. AHU LEAKAGE SHALL BE LESS THAN 1% OF UNIT FLOW RATE AT ±8"W.C.
2. AHU DEFLECTION TEST SHALL CONFIRM THE AHU BASE SHALL NOT EXCEED 1/240TH OF THE SHORTER OF EITHER AXIAL OR TRANSVERSE SPAN AT A LOADING OF 100 PSF DEAD LOAD AND ANY DYNAMIC LOADS IMPOSED BY THE AHU START-UP, OPERATION AND SHUTDOWN.

3. FAN VIBRATION TEST
4. UNIT TESTS SHALL VERIFY AIR VOLUME, STATIC PRESSURE CAPABILITY, CASING LEAKAGE RATE, ACCEPTABLE SOUND POWER LEVELS AT UNIT DISCHARGE AND INLET, AND ACCEPTABLE TRANSMITTED NOISE LEVELS EXTERNAL TO THE UNIT AT A DISTANCE OF 3' FROM THE UNIT CASING.

E. THE MANUFACTURER SHALL PROVIDE THREE (3) CERTIFIED COPIES OF FACTORY TEST REPORTS.

3.2 INSTALLATION

A. THE CONTRACTOR SHALL INSTALL THE EQUIPMENT AS SPECIFIED HEREIN AND AS SHOWN ON THE CONTRACT DRAWINGS.

B. THE CONTRACTOR SUPERVISED BY THE EM REPRESENTATIVE (WHEN ALTERNATE IS SELECTED) SHALL INSTALL ALL EQUIPMENT PER THE MANUFACTURER'S RECOMMENDATIONS, EM SUPPLIED ASSEMBLY AND RIGGING INSTRUCTIONS AND THE CONTRACT DRAWINGS.

C. MAKE WIRING DIAGRAMS AVAILABLE TO THE TRADE PERFORMING THE ELECTRICAL WORK WHEN SUCH ARE PROVIDED WITH EQUIPMENT. MAKE SUCH AVAILABLE AS SOON AS POSSIBLE AFTER DELIVERY OF EQUIPMENT. THE UNIT-WIRING DIAGRAM, MADE OF WATERPROOF MATERIALS, SHALL BE MOUNTED AND CLEARLY VISIBLE ON THE INSIDE OF THE ELECTRICAL ACCESS DOOR.

3.3 START UP

A. MANUFACTURER SHALL PROVIDE THREE HARD COPIES AND THREE ELECTRONIC COPIES OF THE OPERATION AND MAINTENANCE MANUAL.

B. THE EM SHALL PROVIDE ONSITE START UP AND COMMISSIONING OF ALL SUPPLIED EQUIPMENT AND FACTORY PROVIDED CONTROLS. THE EM SHALL WORK ALONGSIDE THE FACILITY CONTRACTOR TO INTEGRATE THE AHU CONTROL SYSTEM WITH THE FACILITY WIDE HVAC INTERFACE SYSTEM.

C. EM SHALL HAVE A FACTORY TRAINED TECHNICIAN ON SITE THE CHECK ALL OPERATIONS OF THE UNIT AFTER INSTALLATION. START UP SHALL INCLUDE BUT NOT LIMITED TO:

1. CONFIRM PLC/CONTROLLER SEQUENCE OF OPERATIONS INCLUDING BUT NOT LIMITED TO:
    a. COOLING (STAGES) AND HEATING FUNCTIONS AND SAFETIES
    b. DEHUMIDIFICATION (WHERE SPECIFIED)
    c. ECONOMIZER FUNCTION
    d. SPACE PRESSURE CONTROL FUNCTION UNDER NORMAL AND ECONOMIZER OPERATION
    e. EXHAUST FAN VFD OPERATION
    f. SUPPLY FAN VFD OPERATION AND AIR FLOW STATION FUNCTION
2. VERIFY CALIBRATION OF FACTORY MOUNTED SENSORS
3. VERIFY COMBUSTION SETTINGS ON GAS BURNER
4. CHECK FAN ALIGNMENT AND BELT TENSION PRIOR TO START UP.
5. CONFIRM ALL SHIPPING BLOCKS ARE REMOVED.
6. INSPECT ALL FIELD JOINTS AND CHECK FOR LEAKS.
7. VERIFY PROPER DEHUMIDIFICATION OPERATION.
8. VERIFY THAT ALL FIELD INSTALLED INSTRUMENTS ARE FUNCTIONING AS REQUIRED FOR THE PROPER OPERATION OF THE AHU.
9. CORRECT AND MAKE RIGHT ALL DEFICIENCIES DISCOVERED DURING START-UP.
10. PROVIDE ASSISTANCE TO THE FACILITY WIDE CONTROL CONTRACTOR TO ENSURE SEAMLESS COMMUNICATION VIA THE UNITS ETHERNET CONNECTION.

D. PROVIDE START UP REPORT WITHIN (1) WEEK AFTER THE COMPLETION OF START UP.

3.4 TRAINING

A. THE EM AND SHALL PROVIDE A TRAINING AND DEMONSTRATION SESSION FOR UP TO 10 OWNER'S REPRESENTATIVE FOR (2) SESSIONS/SHIFTS AT A JOBSITE LOCATION DETERMINED BY THE OWNER.

1. PROVIDE AN ALTERNATE COST FOR AN ADDITIONAL (1) SHIFT TRAINING SESSION PERFORMED (3) MONTHS AFTER INITIAL TRAINING SESSION.

B. A MANUFACTURER'S QUALIFIED REPRESENTATIVE SHALL CONDUCT THE TRAINING/DEMONSTRATION SESSION. THE TRAINING PROGRAM SHALL CONSIST OF INSTRUCTION ON OPERATION OF THE EQUIPMENT, CONTROLS, ALL MAJOR COMPONENTS WITHIN THE ASSEMBLY, AND RECOMMENDED CLEANING PRACTICES FOR THE UNITS SUPPLIED.

3.5 FINAL OWNER ACCEPTANCE

A. AFTER FINAL PAYMENT IS MADE AT COMPLETION OF START-UP, THE AHU WILL HAVE TO BE IN OPERATION THROUGH ONE ENTIRE SEASON AS PROOF OF FINAL ACCEPTABILITY.

END OF SECTION

SECTION 23 80 00

DECENTRALIZED HVAC EQUIPMENT

PART 1: GENERAL

1.1 THE WORK OF THIS SECTION SHALL INCLUDE:

A. ELECTRIC UNIT HEATERS
B. GAS FIRED UNIT HEATERS
C. INFRARED UNIT HEATERS
D. RADIANT CEILING PANELS
E. SPLIT SYSTEM AIR CONDITIONING UNITS
F. CHILLED WATER FAN COIL UNIT
G. CHILLED WATER BLOWER COIL UNIT
H. ELECTRO STATIC AIR PURIFIER
I. ELECTRIC DUCT COIL
J. ELECTRIC STEAM HUMIDIFIER

1.2 REFERENCES

A. ARI 410 (AIR-CONDITIONING AND REFRIGERATION INSTITUTE) FORCED CIRCULATION AIR COOLING AND AIR HEATING COILS.
B. UL 1096 (ANSI/UNDERWRITERS LABORATORIES, INC.) ELECTRIC CENTRAL AIR HEATING EQUIPMENT.
C. SMACNA (SHEET METAL AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION) HVAC DUCT CONSTRUCTION STANDARDS, METAL AND FLEXIBLE.

1.3 SUBMITTALS

A. SECTION 23 00 01 – MECHANICAL GENERAL PROVISIONS: SUBMITTAL PROCEDURES.
B. PROVIDE SUBMITTALS FOR ALL PRODUCTS SPECIFIED IN THIS SECTION.
C. SHOP DRAWINGS: INDICATE CROSS SECTIONS OF CABINETS, GRILLES, BRACING AND REINFORCING, AND TYPICAL ELEVATIONS. INDICATE SCHEDULES OF EQUIPMENT AND ENCLOSURES TYPICALLY INDICATING LENGTH AND NUMBER OF PIECES OF ELEMENT AND ENCLOSURE, CORNER PIECES, END CAPS, CAP STRIPS, ACCESS DOORS, PILASTER COVERS
D. PRODUCT DATA: SUBMIT COIL AND FRAME CONFIGURATIONS, DIMENSIONS, MATERIALS, ROWS, CONNECTIONS, AND ROUGH IN DIMENSIONS. SUBMIT MECHANICAL AND ELECTRICAL SERVICE LOCATIONS, CAPACITIES AND REQUIREMENTS.

1.4 CLOSEOUT SUBMITTALS

A. OPERATION AND MAINTENANCE DATA: SUBMIT MANUFACTURERS DESCRIPTIVE LITERATURE, OPERATING INSTRUCTIONS, INSTALLATION INSTRUCTIONS, MAINTENANCE AND REPAIR DATA, AND PARTS LISTINGS.

1.5 QUALIFICATIONS

A. MANUFACTURER: COMPANY SPECIALIZING IN MANUFACTURING PRODUCTS SPECIFIED IN THIS SECTION WITH MINIMUM THREE YEARS EXPERIENCE.
B. INSTALLER: COMPANY SPECIALIZING IN PERFORMING WORK OF THIS SECTION WITH MINIMUM THREE YEARS EXPERIENCE APPROVED BY MANUFACTURER.

1.6 DELIVERY, STORAGE, AND HANDLING

A. ACCEPT UNITS ON SITE IN FACTORY PACKING. INSPECT FOR DAMAGE. STORE UNDER ROOF.
B. PROTECT COIL FINS FROM CRUSHING AND BENDING BY LEAVING IN SHIPPING CASES UNTIL INSTALLATION, AND BY STORING INDOORS. PROTECT COILS FROM ENTRY OF DIRT AND DEBRIS WITH PIPE CAPS OR PLUGS.

PART 2: PRODUCTS

2.1 ELECTRIC UNIT HEATERS

A. ELECTRIC UNIT HEATERS SHALL BE HAVE BUILT-IN CONTROLS. UNIT HEATER SHALL BE UL LISTED. HEATER TO BE FORCED FAN TYPE OF THE KW RATING, VOLTAGE AND PHASE SPECIFIED IN THE DRAWING SCHEDULE.
B. THE HEATING ELEMENTS SHALL BE OF TYPE 304 STAINLESS STEEL FINNED TUBULAR CONSTRUCTION WITH STAINLESS STEEL FITTINGS.
C. THE MOTOR SHALL BE UL RECOGNIZED, WITH BUILT IN THERMAL PROTECTION.

D. HEATING ELEMENTS AND MOTOR TO BE ENCLOSED IN ROUND, HEAVY 16 GAUGE GALVANIZED STEEL SHROUD, WITH STAINLESS STEEL LOUVERED OUTLET GRILLE AND PLATED REAR GRILLE. UNIT HEATER SHALL HAVE BAKED ENAMEL FINISH.
E. SINGLE POINT, LINE VOLTAGE CONNECTION FOR INCOMING POWER FOR 480V HEATERS.
F. UNIT HEATER SHALL HAVE ELECTRICAL ENCLOSURE TO HOUSE ELEMENT TERMINALS AND THE FOLLOWING STANDARD BUILT-IN CONTROLS: AUTOMATIC RESET OVERTEMPERATURE CUTOUT, 24V CONTROL TRANSFORMER, FAN DELAY RELAY, REQUIRED CONTACTORS, AND TERMINAL BLOCK FOR FIELD WIRING. UNIT HEATER SHALL HAVE A SINGLE POINT ELECTRICAL POWER CONNECTION.
G. THE FOLLOWING OPTIONAL CONTROLS ARE TO BE BUILT-IN AND FACTORY-PREWIRED IN THE ENCLOSURE:
    1. THERMOSTAT WITH EXTERNAL ADJUSTMENT
        a. INDUSTIRAL TYPE EQUAL TO JOHNSON CONTROL A419 FOR SINGLE STAGE
    2. DISCONNECT SWITCH
H. PERFORMANCE:
    1. SEE DRAWING SCHEDULES FOR PERFORMANCE CHARACTERISTICS.
I. MANUFACTURERS
    1. INDEECO
    2. MODINE
    3. RAYWALL

2.2 ELECTRIC UNIT HEATERS - WASHDOWN AREA

A. ELECTRIC UNIT HEATERS SHALL BE HAVE BUILT-IN CONTROLS, UL AND CUL LISTED FOR CORROSIVE AREAS AND NEMA 4X HOSE DOWN REQUIREMENTS. HEATER TO BE FORCED FAN TYPE OF THE KW RATING, VOLTAGE AND PHASE SPECIFIED IN THE DRAWING SCHEDULE.
B. THE HEATING ELEMENTS SHALL BE OF TYPE 304 STAINLESS STEEL FINNED TUBULAR CONSTRUCTION WITH STAINLESS STEEL FITTINGS.
C. THE MOTOR SHALL BE UL RECOGNIZED, TOTALLY ENCLOSED WITH PERMANENTLY LUBRICATED BALL BEARINGS, DESIGNED TO RESIST MOISTURE AND CORROSION, FITTED WITH AN EPOXY-COATED FAN BLADE AND FACTORY WIRED TO NEMA 4X ENCLOSURE.
D. HEATING ELEMENTS AND MOTOR TO BE ENCLOSED IN ROUND, HEAVY 16 GAUGE STAINLESS STEEL SHROUD, WITH STAINLESS STEEL LOUVERED OUTLET GRILLE AND PLATED REAR GRILLE.
E. SINGLE POINT, LINE VOLTAGE CONNECTION FOR INCOMING POWER FOR 480V HEATERS.
F. NEMA 4X ENCLOSURE TO HOUSE ELEMENT TERMINALS AND THE FOLLOWING STANDARD BUILT-IN CONTROLS: AUTOMATIC RESET OVERTEMPERATURE CUTOUT, 24V CONTROL TRANSFORMER, FAN DELAY RELAY, REQUIRED CONTACTORS, AND TERMINAL BLOCK FOR FIELD WIRING.
G. THE FOLLOWING OPTIONAL CONTROLS ARE TO BE BUILT-IN AND FACTORY-PREWIRED IN THE NEMA 4X ENCLOSURE:
    1. THERMOSTAT WITH EXTERNAL ADJUSTMENT
        a. INDUSTIRAL TYPE EQUAL TO JOHNSON CONTROL A419 FOR SINGLE STAGE
    2. DISCONNECT SWITCH
H. PERFORMANCE:
    1. SEE DRAWING SCHEDULES FOR PERFORMANCE CHARACTERISTICS.
I. MANUFACTURERS
    1. INDEECO
    2. MODINE
    3. RAYWALL

2.3 EXPLOSION PROOF ELECTRIC UNIT HEATERS

A. CLASSIFICATION AND DIVISION – U.L. LISTING
    1. UNIT HEATER SHALL BE DESIGNED FOR INSTALLATION IN CLASS I, GROUPS C AND D, DIVISION 1 AND 2 AREAS.

B. UNIT HEATERS SHALL HAVE DUAL AUTOMATIC RESET THERMAL CUTOUTS FOR REDUNDANT OVER TEMPERATURE PROTECTION, CONTROLLING MAGNETIC CONTACTOR AND 24 VOLT CONTROL CIRCUIT TRANSFORMER HOUSED IN A CAST ALUMINUM ENCLOSURE.

C. THE HEAT EXCHANGER SHALL BE LIQUID-TO-AIR DESIGN, UTILIZING A COPPER TUBE CORE WITH INTEGRAL ALUMINUM FINS. NONTOXIC, INHIBITED, PROPYLENE GLYCOL HEAT TRANSFER FLUID SHALL BE USED THAT PROVIDES FREEZE PROTECTION DOWN TO –49°F (–45°C). PRESSURE RELIEF VALVE SETTING TO BE 70 PSIG. THE HEAT EXCHANGER SHALL INCLUDE INDUSTRIAL GRADE ELECTRIC HEATING ELEMENTS.

D. HEAT EXCHANGER AND ALUMINUM FAN BLADE TO BE ENCLOSED IN AN INDUSTRIAL GRADE, CORROSION RESISTANT CABINET FABRICATED FROM POWDER COATED, 14 GAUGE STEEL. ADJUSTABLE OUTLET LOUVERS TO HAVE MINIMUM OPENING SAFETY STOPS.

E. FAN MOTOR SHALL INCLUDE PERMANENTLY LUBRICATED BALL BEARINGS AND BUILT-IN THERMAL OVERLOAD PROTECTION. MOTOR TO OPERATE AT LINE VOLTAGE AND BE PREWIRED TO THE CONTROL ENCLOSURE TO ELIMINATE THE NEED FOR SEPARATE FIELD WIRING TO THE MOTOR.

F. THE HEATER SHALL BE PROVIDED WITH AN ACCESSORY MOUNTING KIT DESIGNED TO BEAR THE WEIGHT OF THE HEATER ASSEMBLY: MOUNTING KITS SHALL BE WALL MOUNTING KITS

G. THE FOLLOWING FACTORY INSTALLED AND PREWIRED CONTROL OPTIONS ARE TO BE SUPPLIED:
   1. ADJUSTABLE BUILT-IN THERMOSTAT
   2. DISCONNECT SWITCH WITH EXTERNAL HANDLE
   3. MANUAL RESET THERMAL CUTOUT FOR TRIPLE OVERTEMPERATURE PROTECTION

H. PERFORMANCE:
   1. SEE DRAWING SCHEDULES FOR PERFORMANCE CHARACTERISTICS.

I. MANUFACTURERS
   1. INDEECO
   2. MODINE
   3. RAYWALL

2.4 ELECTRIC CABINET HEATERS

A. CONTRACTOR SHALL SUPPLY AND INSTALL ELECTRIC CABINET HEATERS OF THE CAPACITY, WATTAGE AND VOLTAGE AS INDICATED ON THE PLANS. UNIT SHALL BE COMPLETELY FACTORY ASSEMBLED INCLUDING ELECTRIC COIL, FAN, MOTOR, FILTERS AND CONTROLS IN AN INSULATED CASING THAT CAN BE APPLIED IN RECESSED WALL INSTALLATION.

B. UNITS SHALL HAVE A SHEET METAL PANEL AND STEEL FRAME CONSTRUCTION AND SHALL BE PAINTED WITH AN ENAMEL FINISH. CASING SHALL BE INSULATED AND KNOCKOUTS FOR ELECTRICAL POWER WIRING. FRONT SHALL BE AN ARCHITECTURAL LOUVERED FRONT.

C. FAN: FORWARD CURVED, DYNAMICALLY BALANCED AND STATICALLY BALANCED WITH 3 SPEED DIRECT DRIVE SHALL BE STANDARD, FAN MOTOR BEARING SHALL BE PERMANENTLY LUBRICATED.

D. MOTOR: LONG LIFE THERMALLY PROTECTED, PERMANENTLY LUBRICATED, DIRECT DRIVE MOTOR - NO BELTS TO ADJUST OR SLIP. MOTOR SHALL BE THREE SPEED MOTOR DESIGNED FOR USE WITH AIR CONDITIONING CAPABILITY AS WELL AS HEATING.

E. HEATING ELEMENTS: QUICK HEATING LONG LIFE NICHROME ELEMENTS SIZED TO PROVIDE PROPER WATT DENSITY FOR MAXIMUM HEAT DISSIPATION BY FAN FORCED AIR CONVECTION CURRENTS.

F. TRANSFORMER: EQUIP WITH A HEAVY DUTY LOW VOLTAGE (24 VOLT) TRANSFORMER FOR THE THERMOSTAT CONTROL CIRCUIT. THERMOSTAT SHALL BE BUILT IN TO THE UNIT.

G. UNIT SHALL HAVE A BUILT IN POWER DISCONNECT SWITCH.

H. CONTACTOR OR TIME DELAY SEQUENCER: ACTUATES HEATING ELEMENT BANKS AT RANDOM INTERVALS TO MINIMIZE ELECTRICAL SURGES IN COMPLIANCE WITH EEI AND NEMA STANDARDS.

I. LIMIT CONTROL: INTEGRAL AUTOMATIC HIGH TEMPERATURE LIMIT CONTROL IN EACH HEATING ELEMENT BANK TO PREVENT DELIVERY OF AIR AT UNSAFE TEMPERATURES.

2.5 GAS FIRED UNIT HEATERS

A. SELF CONTAINED, SEPARATED COMBUSTION, PACKAGED, FACTORY ASSEMBLED, PRE WIRED UNIT CONSISTING OF CABINET, SUPPLY FAN, HEAT EXCHANGER, BURNER, CONTROLS, AND ACCESSORIES:

B. CABINET:
   1. GALVANIZED PAINTED STEEL, EASILY REMOVED AND SECURED ACCESS PANELS, INSULATED OR DOUBLE PANEL CONSTRUCTION.
   2. 30 DEGREE NOZZLE WITH DISCHARGE LOUVERS: INDIVIDUALLY ADJUSTABLE HORIZONTAL LOUVERS TO MATCH CABINET FINISH.

C. SUPPLY FAN: CENTRIFUGAL BLOWER TYPE.

D. HEAT EXCHANGER: TYPE 409 STAINLESS STEEL WELDED CONSTRUCTION.

E. GAS BURNER:
   1. FORCED DRAFT TYPE.
   2. HEATING FUEL: NATURAL GAS FIRED.
   3. GAS CONTROL: SINGLE STAGE.
   4. IGNITION SYSTEM: ELECTRIC DIRECT SPARK IGNITION.
   5. UL LISTED, AGA CERTIFIED.

F. VENTS: POWER-VENTED WITH NON- CORROSIVE AIR BLOWER WITH PERMANENTLY LUBRICATED MOTOR.
   1. COMBUSTION AIR SHALL BE DIRECT FROM THE OUTDOORS. A CONCENTRIC VENT ADAPTOR MAY BE USED.

G. THE FOLLOWING OPTIONAL CONTROLS ARE TO BE BUILT-IN AND FACTORY-PREWIRED IN THE CONTROL ENCLOSURE:
   1. CONTACTS FOR THERMOSTAT WITH EXTERNAL ADJUSTMENT
      a. INDUSTIRAL TYPE EQUAL TO JOHNSON CONTROL A419 FOR SINGLE STAGE
   2. DISCONNECT SWITCH

H. CONTROL VOLTAGE: 24 VOLT, 60 HERTZ WITH INTEGRAL LINE VOLTAGE TO CONTROL VOLTAGE TRANSFORMER.

I. GAS BURNER SAFETY CONTROLS:
   1. THERMOCOUPLE SENSOR: PREVENTS OPENING OF GAS VALVE UNTIL PILOT FLAME IS PROVEN AND STOPS GAS FLOW ON IGNITION FAILURE.
   2. FLAME ROLLOUT SWITCH: INSTALLED ON BURNER BOX AND PREVENTS OPERATION.
   3. VENT SAFETY SHUTOFF SENSOR: TEMPERATURE SENSOR INSTALLED ON DRAFT HOOD AND PREVENTS OPERATION, MANUAL RESET.
   4. LIMIT CONTROL: FIXED STOP AT MAXIMUM PERMISSIBLE SETTING, DE ENERGIZES BURNER ON EXCESSIVE BONNET TEMPERATURE, AUTOMATIC RESET.

J. OPERATING CONTROLS:
   1. INTEGRATED CIRCUIT BOARD TO MONITOR HEATER OPERATION WITH LED DIAGNOSTIC INDICATOR LIGHTS.
   2. ROOM THERMOSTAT: CYCLES BURNER TO MAINTAIN ROOM TEMPERATURE SETTING.
   3. SUPPLY FAN CONTROL: ENERGIZE EITHER FROM DISCHARGE TEMPERATURE INDEPENDENT OF BURNER CONTROLS OR WITH TIMED OFF DELAY AND TIMED ON DELAY, WITH MANUAL SWITCH FOR CONTINUOUS FAN OPERATION.

K. PERFORMANCE:
   1. SEE SCHEDULES FOR UNIT PERFORMANCE.

L. MANUFACTURERS
   1. REZNOR
   2. MODINE
   3. STERLING
   4. TRANE

2.6 INFRARED GAS HEATERS

A. PACKAGED, FACTORY ASSEMBLED, PRE WIRED UNIT CONSISTING OF CABINET, BURNER, HEAT EXCHANGER, RADIANT TUBE, REFLECTOR AND CONTROLS FOR NATURAL GAS
B. HEAT EXCHANGER: ALUMINIZED TUBULAR STEEL COMBUSTION CHAMBER WITH ALUMINIZED STEEL TUBE WITH ALUMINUM REFLECTOR.
C. GAS BURNER:
    1. GAS BURNER: FORCED DRAFT TYPE WITH ADJUSTABLE COMBUSTION AIR SUPPLY.
    2. GAS VALVE PROVIDES 100 PERCENT SAFETY GAS SHUT OFF; 24-VOLT COMBINING PRESSURE REGULATION, SAFETY PILOT, MANUAL SET (ON OFF), PILOT FILTRATION AND AUTOMATIC ELECTRIC VALVE.
    3. ELECTRONIC PILOT IGNITION, WITH ELECTRIC SPARK IGNITER.
    4. NON-CORROSIVE BURNER AIR BLOWER WITH PERMANENTLY LUBRICATED MOTOR.
    5. UL LISTED, AGA CERTIFIED.
D. GAS BURNER SAFETY CONTROLS: THERMO COUPLE SENSOR PREVENTS OPENING OF SOLENOID GAS VALVE UNTIL PILOT FLAME IS PROVEN AND STOPS GAS FLOW ON IGNITION FAILURE.
E. OPERATING CONTROLS: LOW VOLTAGE ROOM THERMOSTAT CYCLES BURNER TO MAINTAIN ROOM TEMPERATURE SETTING.
F. THE FOLLOWING OPTIONAL CONTROLS ARE TO BE BUILT-IN AND FACTORY-PREWIRED IN THE CONTROL ENCLOSURE:
    1. CONTACTS FOR THERMOSTAT WITH EXTERNAL ADJUSTMENT
        a. INDUSTIRAL TYPE EQUAL TO JOHNSON CONTROL A419 FOR SINGLE STAGE
    2. DISCONNECT SWITCH
G. PERFORMANCE:
    1. SEE SCHEDULES FOR UNIT PERFORMANCE.
H. MANUFACTURERS
    1. SEE SCHEDULS FOR MANUFACTURERS

2.7 RADIENT CEILING PANELS

A. PACKAGED, FACTORY ASSEMBLED, PRE WIRED UNIT CONSISTING OF HIGH QUALITY ALLOY RESISTANCE WIRE OF ELECTRICALLY INSULATED WITH UL LISTED TEFCEL COMPOUND RATED FOR 392 F. HEATING WIRES SHALL BE COVERED WITH HIGH EFFICIENCY REFLECTIVE FOIL.
B. PANEL SHALL BE MADE OF MINIMUM 22-GAUGE GALVANIZED STEEL WITH A WHITE BAKED-ON POWDER PAINT FINISH. PANEL SHALL BE CRIMPED, NOT RIVETED.
C. EACH PANEL SHALL CONTAIN 2 INCHES OF HIGH TEMPERATURE/HIGH DENSITY MINERAL WOOL INSULATION.
D. ELECTRICAL: A JUNCTION BOX SHALL BE ATTACHED TO EACH PANEL FOR FIELD WIRING.
E. OPTIONS:
    1. PROVIDE WITH STAINLESS STEEL CONSTRUCTION (WHERE SCHEDULED)
    2. PROVIDE WITH REMOTE ROOM THERMOSTAT. THERMOSTAT SHALL BE 7 DAY PROGRAMMABLE WITH WEEKEND AND NIGHT SET-BACK OPTION.
F. PERFORMANCE:
    1. SEE SCHEDULES FOR UNIT PERFORMANCE
G. MANUFACTURERS
    1. SEE SCHEDULS FOR MANUFACTURERS

2.8 STEAM UNIT HEATERS

A. ASSEMBLY: UL LISTED AND LABELED ASSEMBLY WITH TERMINAL BOX AND COVER, AND BUILT IN CONTROLS.
B. COILS: COILS SHALL BE EXTENDED SURFACE TYPE, UTILIZING ALUMINUM FINS AND COPPER TUBES WITH MALLEABLE IRON SUPPLY AND CONDENSATE CONNECTIONS. TUBES ARE MECHANICALLY BONDED TO THE COLLARS OF THE FINS. THE CONDENSERS ARE WARRANTED FOR OPERATION AT STEAM PRESSURES AND TEMPERATURES UP TO 150 PSIG AND 375°F.
C. CABINET: 20 GAUGE THICK STEEL WITH EASILY REMOVED FRONT PANEL WITH INTEGRAL AIR INLET FAN GUARD AND ADJUSTABLE AIR OUTLET LOUVER. BAKED ENAMEL FINISH.

D. HANGERS: CASING SHALL HAVE THREADED HANGER CONNECTIONS FOR MOUNTING.
E. FAN: DIRECT-DRIVE PROPELLER TYPE, STATICALLY AND DYNAMICALLY BALANCED, WITH FAN GUARD.
F. MOTOR: TOTALLY ENCLOSED FAN MOTOR. PERMANENTLY LUBRICATED, SLEEVE BEARINGS FOR HORIZONTAL MODELS. MOTOR SHALL BE RATED FOR HIGH TEMPERATURE APPLICATIONS.
    1. MOTOR SHALL BE RATED FOR CONTINUOUS OPERATION IN A 115 DEGREE F ENVIRONMENT. SPACE WILL BE MAINTAINED AT 115 DEGREES F.
G. ELECTRICAL AND CONTROLS:
    1. SEE DRAWING SCHEDULES FOR ELECTRICAL CHARACTERISTICS
    2. INTEGRAL 120 VOLT CONTROLS CIRCUIT. THERMOSTAT SHALL PROVIDE FAN CONTROL, COIL SHALL REMAIN HOT.
    3. ALL UNITS ARE PROVIDED WITH AN ELECTRICAL JUNCTION BOX. JUNCTION BOXES ARE FACTORY WIRED TO THE MOTOR OR ATTACHED TO THE UNIT CASING.
    4. BUILT-IN AUTOMATIC RESET THERMAL OVERLOAD PROTECTION.
H. ACCESSORIES: CEILING MOUNTING BRACKETS.
I. PERFORMANCE:
    1. SEE DRAWING SCHEDULES FOR PERFORMANCE CHARACTERISTICS.
J. MANUFACTURERS
    1. MODINE
    2. STERLING
    3. VULCAN
    4. TRANE

2.9 SPLIT SYSTEM AIR CONDITIONING UNITS

A. FAN COIL
    1. BLOWER COIL UNITS SHALL BE COMPLETELY FACTORY ASSEMBLED INCLUDING COIL, CONDENSATE DRAIN PAN, SECONDARY DRAIN PAN (OR HIGH LEVEL WATER SENSING), FAN, MOTOR, FILTERS AND CONTROLS IN AN INSULATED CASING THAT CAN BE APPLIED IN HORIZONTAL CONFIGURATION.
    2. UNITS SHALL BE UL LISTED.
    3. UNITS SHALL HAVE A SHEET METAL PANEL AND STEEL FRAME CONSTRUCTION AND SHALL BE PAINTED WITH AN ENAMEL FINISH. CASING SHALL BE INSULATED AND KNOCKOUTS FOR ELECTRICAL POWER AND CONTROL WIRING.
    4. REFRIGERANT CIRCUITS: UNITS HAVE A SINGLE REFRIGERANT CIRCUIT. A FACTORY-INSTALLED THERMAL EXPANSION VALVE SHALL CONTROL REFRIGERANT CIRCUIT.
    5. DX COIL: ALUMINUM FIN SURFACE SHALL BE MECHANICALLY BONDED TO 3/8 INCH OD COPPER TUBING. COILS ARE FACTORY PRESSURE AND LEAK TESTED AND DESIGNED FOR USE WITH REFRIGERANT AS SCHEDULED.
    6. FAN: FORWARD CURVED, DYNAMICALLY BALANCED AND STATICALLY BALANCED WITH 3 SPEED DIRECT DRIVE SHALL BE STANDARD, FAN MOTOR BEARING SHALL BE PERMANENTLY LUBRICATED.
    7. ELECTRIC HEAT WHERE SCHEDULED: UNIT SHALL HAVE A FACTORY MOUNTED ELECTRIC HEATING COIL. COIL SHALL HAVE 5KW CAPACITY.
    8. CONTROLS: LOW VOLTAGE TERMINAL BOARD, FAN CONTACTOR, AND PLUG IN MODULE FOR ACCESSORY ELECTRIC HEAT CONTROL SHALL BE INCLUDED.
    9. FILTERS SHALL BE INCLUDED AS STANDARD, ONE INCH LOW VELOCITY SEMI-PERMANENT TYPE.
B. PERFORMANCE:
    1. SEE SCHEDULE FOR UNIT PERFORMANCE.
C. CONDENSING UNIT
    1. UNIT SHALL BE FULLY CHARGED FROM THE FACTORY FOR UP TO 15 FEET OF PIPING. THIS UNIT IS DESIGNED TO OPERATE AT OUTDOOR AMBIENT TEMPERATURES AS HIGH AS

115°F. COOLING CAPACITIES MATCHED WITH A WIDE SELECTION OF AIR HANDLERS AND FURNACE COILS THAT ARE A.R.I. CERTIFIED. THE UNIT IS UL LISTED FOR OUTDOOR APPLICATION.

2. CASING: UNIT CASING IS CONSTRUCTED OF HEAVY GAUGE, GALVANIZED STEEL AND PAINTED WITH A WEATHER-RESISTANT POWDER PAINT.
3. REFRIGERANT CONTROLS: REFRIGERATION SYSTEM CONTROLS INCLUDE CONDENSER FAN AND COMPRESSOR CONTACTOR. HIGH AND LOW PRESSURE CONTROLS ARE INHERENT TO THE COMPRESSOR. A FACTORY INSTALLED LIQUID LINE DRYER SHALL BE STANDARD.
4. COMPRESSOR: THE COMPRESSOR SHALL HAVE A 5-YEAR LIMITED WARRANTY, INTERNAL OVER TEMPERATURE AND PRESSURE PROTECTION, TOTAL DIPPED HERMETIC MOTOR WINDINGS. ROTO LOCK SUCTION AND DISCHARGE REFRIGERANT CONNECTIONS, CENTRIFUGAL OIL PUMP AND LOW VIBRATION AND NOISE.
5. CONDENSER COIL: THE CONDENSER COIL IS CONTINUOUSLY WRAPPED, CORROSION RESISTANT ALUMINUM WITH MINIMUM BRAZED JOINTS. THIS COIL IS 3/8 INCH O.D. SEAMLESS ALUMINUM GLUED TO A CONTINUOUS ALUMINUM FIN. THE COIL IS PROTECTED ON ALL FOUR SIDES BY LOUVERED PANELS AND HAS A 5-YEAR LIMITED WARRANTY.
6. LOW AMBIENT COOLING: THE UNIT SHALL HAVE AN EVAPORATOR DEFROST CONTROL PERMITS OPERATION TO 30°F.
7. THERMOSTATS – 7 DAY PROGRAMMABLE, HEAT/ COOLING WITH AUTOMATIC CHANGEOVER.
8. PROVIDE REFRIGERANT LINE SETS AND LIQUID LINE SOLENOID VALVE.

D. PERFORMANCE:
   1. SEE SCHEDULE FOR UNIT PERFORMANCE.
E. MANUFACTURERS
   1. SEE SCHEDULES FOR MANUFACTURERS

2.10 CHILLED WATER FAN COIL UNITS (REFRIGERATION STYLE)

A. GENERAL:
   1. FACTORY-ASSEMBLED, HORIZONTAL, DRAW-THRU TYPE FAN COIL UNIT SUITABLE FOR EXPOSED INSTALLATION. UNIT SHALL BE COMPLETE WITH WATER COILS, FAN(S), MOTOR, BELT DRIVE, DRAIN PAN, AND FILTER.
B. CASING:
   1. CABINETS SHALL BE MADE OF HEAVY GAUGE, RUST-PROOF SMOOTH FINISH ALUNLINUM HOUSING. ALL HARDWARE SHALL BE CORROSION RESISTANT. FULL DIE-FORMED VENTURIES MINIMIZE NOISE WITH MAXIMUM AIR THROW. FAN GUARDS SHALL BE HEAVY GAUGE WIRE BASKET TYPE COATED FOR CORROSION PROTECTION.
C. FANS:
   1. FANS SHALL BE HEAVY-DUTY ALUMINUM BLADES WITH STEEL HUBS, STATICALLY AND DYNAMICALLY BALANCED FOR SMOOTH OPERATION. FANS SHALL BE SELECTED FOR MAXIMUM AIR THROW.
D. COILS:
   1. COILS SHALL BE COPPER TUBE, FILL1 COLLARED DIE-FORTNED ALUMINUM PLATE FIN AND TUBE SHEETS. TUBES SHALL BE MECHANICALLY EXPANDED FOR MAXIMUM HEAT TRANSFER. COILS SHALL BE LEAK TESTED AT 350 PSIG UNDER WATER. SOLDER AND FLARE TYPE DISTRIBUTORS HAVE REMOVABLE NOZZLES. EACH NOZZLE SHALL BE SIZED FOR THE SPECIFIED REFRIGERANT AND TEMPERATURE RANGE. ALL COILS REQUIRE EXTERNAL EQUALIZED EXPANSION VALVE. EXPANSION VALVE IS LOCATED WITHIN THE CABINET. THE EXPANSION VALVE COMPARTMENT SHALL BE HEATED DURING THE DEFROST CYCLE ON ELECTRIC DEFROST MODELS.
E. MOTOR(S):

1. MOTORS SHALL BE PERMANENTLY LUBRICATED AND SUITABLE FOR LOW TEMPERATURE APPLICATIONS. MOTORS SHALL BE HEAVY DUTY, HIGH EFFICIENCY, FULL BALL BEARING AND HAVE INTERNAL THERMAL OVERLOADS. FAN MOTORS SHALL BE PRE-WIRED TO TERMINAL BLOCKS.
2. MOTORS WITHOUT THERMAL OVERLOAD WILL HAVE MOTOR STARTERS WITH OVERLOAD PROTECTION.

F. INSULATION:
1. UNITS SHALL BE EQUIPPED WITH 1-IN. THICK. UNITS SHALL BE EQUIPPED WITH DOUBLE WALLED SEALED WITH 1-IN. THICK INSULATION.

G. UNITS TO BE PROVIDED WITH ETL LISTED MOTOR START STOP STATION WITH 24V TRANSFORMER AND DISCONNECT SWITCH.

H. PROVIDE SPRING ISOLATORS MOUNTING KIT.

I. PERFORMANCE:
1. SEE SCHEDULE FOR UNIT PERFORMANCE.

J. MANUFACTURERS:
1. CENTURY REFRIGERATION
2. APPROVED EQUAL

2.11 CHILLED WATER BLOWER COIL UNIT

A. BLOWER COIL UNIT
1. BLOWER COIL UNITS SHALL BE COMPLETELY FACTORY ASSEMBLED INCLUDING COIL, CONDENSATE DRAIN PAN, SECONDARY DRAIN PAN (OR HIGH LEVEL WATER SENSING), FAN, MOTOR, FILTERS AND CONTROLS IN AN INSULATED CASING THAT CAN BE APPLIED IN HORIZONTAL OR VERTICAL CONFIGURATION AS SCHEDULED. INSULATION SHALL BE CLOSED CELL.
2. UNITS SHALL COMPLY WITH NFPA 90 AND BE UL LISTED.
3. UNITS CABINET WALLS, ACCESS DOORS, ROOF AND FLOOR SHALL BE A HIGH PERFORMANCE COMPOSITE PANEL CONSTRUCTED WITH 18-GAUGE GALVANIZED STEEL ON BOTH SIDES AND A CLOSED CELL POLYURETHANE FOAM INTERIOR CORE PROVIDING A RIGID, IMPACT RESISTANT SURFACE. CASING SHALL BE INSULATED AND KNOCKOUTS FOR ELECTRICAL POWER AND CONTROL WIRING.
4. WATER COIL: ALUMINUM FIN SURFACE SHALL BE MECHANICALLY BONDED TO 3/8 INCH OD COPPER TUBING. COILS ARE FACTORY PRESSURE AND LEAK TESTED AND DESIGNED FOR USE WITH 30% PROPYLENE GLYCOL. COILS SHALL HAVE A MINIMUM OF 4 ROWS AND 12 FINS PER INCH.
5. FAN: FORWARD CURVED, DYNAMICALLY BALANCED AND STATICALLY BALANCED WITH BELT DRIVE SHALL BE STANDARD; FAN MOTOR BEARING SHALL BE PERMANENTLY LUBRICATED.
6. FAN MOTOR SHALL BE PREMIUM EFFICIENCY.
7. FILTERS SHALL BE INCLUDED SHALL BE MERV-8 DISPOSABLE FILTER.
8. TESTING: UNITS SHALL BE TESTED IN ACCORDANCE WITH ARI 430 AND ARI 260.

B. PERFORMANCE:
1. SEE SCHEDULE FOR UNIT PERFORMANCE.

C. MANUFACTURERS
1. TRANE
2. APPROVED EQUAL

2.12 ELECTRO STATIC AIR PURIFIER (SMOKE EATER)

A. PACKAGED, FACTORY ASSEMBLED, PRE WIRED UNIT CONSISTING OF CABINET, CONTROLS, FAN, AND FILTERS.

B. FILTER SECTION SHALL A 97% EFFICIENCY. UNIT SHALL BE PROVIDED WITH ACTIVATED CARBON FILTERS.

C. MOUNTING: THE AIR PURIFIER SHALL BE RECESSED MOUNTED IN CEILING.

D. MOTOR: THE MOTOR SHALL BE 1/10 HP SHADED POLE FAN MOTOR. THE FAN MOTOR SHALL BE FACTORY MOUNTED ON VIBRATION ISOLATORS.

E. MANUFACTURER:

1. MODEL: UNIT SHALL BE SMOKEMASTER HIGH EFFICIENCY ELECTRONIC AIR CLEANER MODEL X-11Q OR APPROVED EQUAL.

2.13 ELECTRIC STEAM HUMIDIFIER

A. CONTRACTOR SHALL SUPPLY AND INSTALL ELECTRIC STEAM HUMIDIFIER OF THE CAPACITY AS INDICATED ON THE PLANS. UNIT SHALL BE COMPLETELY FACTORY ASSEMBLED.

B. THE ELECTRODE STEAM GENERATOR SHALL BE MANUFACTURE TO USE POTABLE WATER SUPPLY FOR STEAM GENERATION.

C. THE STEAM HUMIDIFIER SHALL BE PACKAGED, WITH WALL MOUNT HARDWARE, AND BUILT ON BLOWER PACK (BOBP).

D. UNIT SHALL BE COMPLETE WITH:

1. DISPOSABLE STEAM CYLINDERS WITH PUBLISHED LIFE EXPECTANCY
2. AUTO-ADAPTIVE CONTROL SYSTEM TO OPTIMIZE CONTAINED WATER CONDUCTIVITY, CONTROL AUTOMATIC DRAIN/FLUSH CYCLES, MINIMIZE ENERGY WASTE, AND MAXIMIZE CYLINDER LIFE.
3. MODULAR PLUMBING AND ELECTRICAL FULLY ASSEMBLED AND PREWIRED.
4. HIGH WATER SENSOR.
5. CYLINDER REPLACEMENT SENSOR.
6. SELF DIAGNOSTIC SHUT DOWN ON HIGH CURRENT OR SLOW FILLING.
7. FILL VALVE, DRAIN VALVE AND FILL CUP ASSEMBLY WITH AIR GAP.
8. CABINET OF 18 GAUGE POWDER COAT PAINT FINISH WITH SWING DOWN REMOVABLE DOORS.

E. MANUFACTURER:

1. NORTEC NHB SERIES OR APPROVED EQUAL.

PART 3: EXECUTION

3.1 EXAMINATION

A. SECTION 01300 - ADMINISTRATIVE REQUIREMENTS: COORDINATION AND PROJECT CONDITIONS.

B. VERIFY WALL CONSTRUCTION AND DUCTWORK ARE READY FOR INSTALLATION.

C. VERIFY CONCEALED BLOCKING AND SUPPORTS ARE IN PLACE AND CONNECTIONS ARE CORRECTLY LOCATED.

3.2 INSTALLATION

A. PROTECTION: PROVIDE FINISHED CABINET UNITS WITH PROTECTIVE COVERS DURING BALANCE OF CONSTRUCTION.

B. UNIT HEATERS:

1. HANG FROM BUILDING STRUCTURE. RESTRAIN FROM LATERAL MOVEMENT BY HORIZONTAL BRACING TO ADJACENT WALL OR BUILDING STRUCTURAL ELEMENT, OR WITH ANGLED BRACING TO BUILDING STRUCTURE. UNITS SHALL NOT BE SUPPORTED FROM INSULATED METAL PANEL WALLS.
2. MOUNT AT HEIGHTS INDICATED ON DRAWINGS OR AS HIGH AS POSSIBLE NOT EXCEEDING MANUFACTURES RECOMMENDED MAXIMUM HEIGHT.
3. PROVIDE FLUE VENT WITH VENT CAP. PROVIDE COMBUSTION AIR VENT WITH INLET VENT CAP. VENTS SHALL BE RUN THROUGH THE ROOF.
    a. INSTALLING CONTRACTOR SHALL HAVE THE OPTION THE USE A CONCENTRIC VENT ADAPTOR AND CONCENTRIC VENT PIPING.
4. EQUIPMENT LOCATED IN PROCESS AREAS DEFINED IN SECTION 23 00 01 - MECHANICAL GENERAL PROVISIONS SHALL BE SUPPORTED PER THE REQUIREMENTS OF SECTION 23 05 29 - HANGERS AND SUPPORTS.

C. FAN COIL UNITS:

1. HANG FROM BUILDING STRUCTURE. RESTRAIN FROM LATERAL MOVEMENT BY HORIZONTAL BRACING TO ADJACENT WALL OR BUILDING STRUCTURAL ELEMENT, OR WITH ANGLED BRACING TO BUILDING STRUCTURE. UNITS SHALL NOT BE SUPPORTED FROM INSULATED METAL PANEL WALLS.
2. MOUNT AT HEIGHTS INDICATED ON DRAWINGS OR AS HIGH AS POSSIBLE NOT EXCEEDING MANUFACTURES RECOMMENDED MAXIMUM HEIGHT.
3. LOCATE UNITS IN COORDINATION WITH REFLECTED CEILING PLAN, LIGHTING AND SPRINKLER LAYOUT. UNITS SHALL BE INSTALLED WITH SO THAT ALL ACCESS AND CONTROL PANELS SHALL BE EASILY REACHED FROM A FLOOR MOUNTED LADDER ONCE THE CEILING HAS BEEN INSTALLED.

3.3 CLEANING

A. AFTER CONSTRUCTION IS COMPLETED, INCLUDING PAINTING, CLEAN EXPOSED SURFACES OF UNITS. REMOVE ALL PLASTIC OR PROTECTIVE FILMS AND STICKERS FROM CABINETS. VACUUM CLEAN COILS AND INSIDE OF CABINETS.

B. TOUCH UP MARRED OR SCRATCHED SURFACES OF FACTORY FINISHED CABINETS, USING FINISH MATERIALS FURNISHED BY MANUFACTURER.

END OF SECTION

SECTION 00 00 00

ARCHITECTURAL GENERAL NOTES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. CONSTRUCTION DRAWINGS, SPECIFICATIONS AND PROVISIONS OF THE CONTRACT INCLUDING GENERAL AND SUPPLEMENTAL CONDITIONS AND OTHER DIVISION 1 SPECIFICATION SECTIONS, ARE HEREBY MADE A PART OF THESE SPECIFICATIONS SHEETS / SECTIONS AS FULLY AND COMPLETELY AS IF REPEATED HEREIN.

1.02 ITEMS REQUIRED BUT NOT SPECIFIED

A. IF ITEMS OR MATERIALS; ASSOCIATED WITH SPECIFICATION SECTIONS, ARE INDICATED ON DRAWINGS, BUT NOT SPECIFICALLY LISTED IN THE ASSOCIATED SPECIFICATION SECTIONS, THE CONTRACTOR IS TO PROVIDE SUCH ITEMS OR MATERIALS AT A STANDARD OF QUALITY EQUAL TO THE STANDARD ESTABLISHED FOR THE BALANCE OF THE WORK SPECIFIED, IN ACCORDANCE WITH THE ARCHITECT'S INTERPRETATION.

1.03 EXECUTION, CORRELATION AND INTENT

A. IN THE CASE OF INCONSISTENCY BETWEEN DRAWINGS AND SPECIFICATION SECTIONS, OR WITHIN DOCUMENTS NOT CLARIFIED BY ADDENDUM, THE BETTER QUALITY OR GREATER QUANTITY OF WORK IS TO BE PROVIDED, IN ACCORDANCE WITH THE ARCHITECT'S INTERPRETATION.

1.04 DRAWING NOTES AND CLARIFICATIONS

A. ALL CONSTRUCTION METHODS AND MATERIALS SHALL COMPLY WITH ALL APPLICABLE STATE AND LOCAL CODES AND ORDINANCES FOR THE JURISDICTION OF THE PROJECT.

B. ELECTRICAL, MECHANICAL, AND PLUMBING SYSTEMS SHALL BE AS PER DRAWINGS AND CALCULATIONS FURNISHED BY QUALIFIED ENGINEERS AND / OR CONTRACTORS LICENSED IN THE JURISDICTION OF THE PROJECT.

C. ANY DISCREPANCY WITHIN THE CONSTRUCTION DOCUMENTS SHALL BE BROUGHT TO THE ATTENTION OF THE ARCHITECT PRIOR TO THE COMMENCEMENT OF ANY WORK.

D. ALL DIMENSIONS ARE TO FACE OF WALL (F.O.W.), FACE OF STUD, CENTERLINE OF BEAMS AND COLUMNS, AND FACE OF CONCRETE (F.O.C.) UNLESS OTHERWISE NOTED.

E. THE FIGURED DIMENSIONS ON THE DRAWINGS OR NOTES INDICATING DIMENSIONS SHALL BE USED INSTEAD OF MEASUREMENTS OF THE DRAWINGS BY SCALE, AND SHALL BE STRICTLY COMPLIED WITH.

F. WHEREVER A DETAIL IS REFERENCED AND DEVELOPED FOR A SPECIFIC CONDITION, SAME OR SIMILAR DETAIL SHALL APPLY TO IDENTICAL OR SIMILAR CONDITIONS ELSEWHERE ON THE PROJECT EVEN THOUGH NOT SPECIFICALLY REFERENCED.

G. CONTRACTOR SHALL FIELD VERIFY ALL ELEVATIONS, DIMENSIONS, BUILDING LOCATIONS, CURBS, FLOW LINES, EXISTING CONDITIONS AND POINTS OF CONNECTIONS TO

UTILITIES. IN THE EVENT OF CONFLICT, CONTACT THE ARCHITECT FOR INSTRUCTION PRIOR TO PROCEEDING.

H. CONTRACTOR SHALL CONFORM TO ALL APPLICABLE LOCAL, STATE AND FEDERAL SAFETY AND HEALTH STANDARDS, LAWS, PERMITS AND REGULATIONS.

END OF SECTION

SECTION 04 20 00

UNIT MASONRY ASSEMBLIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. CONSTRUCTION DRAWINGS, SPECIFICATIONS AND PROVISIONS OF THE CONTRACT INCLUDING GENERAL AND SUPPLEMENTAL CONDITIONS AND OTHER DIVISION 01 SPECIFICATION SECTIONS, ARE HEREBY MADE A PART OF THIS SECTION AS FULLY AND COMPLETELY AS IF REPEATED HEREIN.

1.2 ITEMS REQUIRED BUT NOT SPECIFIED

A. IF AN ITEM OR MATERIAL OF THIS TRADE IS INDICATED ON THE DRAWINGS BUT NOT SPECIFICALLY LISTED IN THIS SECTION, PROVIDE SUCH ITEM OR MATERIAL AT A STANDARD OF QUALITY EQUAL TO THE STANDARD ESTABLISHED FOR THE BALANCE OF THE WORK SPECIFIED, IN ACCORDANCE WITH THE ARCHITECT'S INTERPRETATION.

1.3 EXECUTION, CORRELATION AND INTENT

A. IN CASE OF AN INCONSISTENCY BETWEEN DRAWINGS AND SPECIFICATIONS, OR WITHIN EITHER DOCUMENT NOT CLARIFIED BY ADDENDUM, THE BETTER QUALITY OR GREATER QUANTITY OF WORK IS TO BE PROVIDED, IN ACCORDANCE WITH THE ARCHITECT'S INTERPRETATION.

1.4 SECTION INCLUDES

A. FURNISH AND INSTALL:

1. REINFORCED UNIT MASONRY CONSTRUCTION AS SHOWN ON THE DRAWINGS AND DESCRIBED HEREIN.

2. CONCRETE MASONRY UNITS.

A. STANDARD UNITS.

B. BULLNOSED UNITS.

C. BOND BEAM UNITS.

3. PRECAST LINTELS.

4. MORTAR AND GROUT.

5. GROUT FILL FOR HOLLOW METAL STEEL FRAMES, AND WHEREVER TIES OR ANCHORAGE ITEMS OCCUR, AND AS FURTHER INDICATED IN THE DRAWINGS.

6. VERTICAL AND HORIZONTAL REINFORCING, TIES, ANCHORS, AND OTHER METAL ACCESSORIES, FOR ANCHORING UNIT MASONRY TOGETHER AND TO OTHER MATERIALS.

7. COMPRESSIBLE JOINT FILLERS FOR CONTROL JOINTS IN UNIT MASONRY WORK AND JOINTS WITH STRUCTURAL STEEL.

B. INSTALL THE FOLLOWING FURNISHED UNDER THE INDICATED SECTIONS:

1. PLACEMENT AND BUILDING-IN OF, AS WORK PROGRESSES, ANCHOR BOLTS, WOOD

BLOCKING, AND ANCHORAGE FOR ITEMS FURNISHED OR SET BY OTHER TRADES AS SPECIFIED IN INDIVIDUAL SECTIONS.

2. CLEAN AND POINT EXPOSED TO VIEW SURFACE MASONRY.

1.5 RELATED SECTIONS

A. SECTION 06 1000 - ROUGH CARPENTRY: SETTING AND TEMPORARY BRACING OF HOLLOW METAL FRAMES OCCURRING IN MASONRY, AND REMOVAL OF TEMPORARY CENTERING WHEN FRAMES HAVE BEEN BUILT INTO THE MASONRY.

B. SECTION 07 9200 - JOINT SEALERS: SEALANT, CAULKING MATERIALS, AND COMPRESSIBLE JOINT BEAD BACK-UP, IN CONJUNCTION WITH MASONRY WORK.

1.6 REFERENCES

A. COMPLY WITH APPLICABLE REQUIREMENTS OF THE FOLLOWING STANDARDS AND THOSE OTHERS REFERENCED IN THIS SECTION.

1. AMERICAN CONCRETE INSTITUTE (ACI) AND AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE): ACI 530.1/ASCE 6 - “SPECIFICATIONS FOR MASONRY STRUCTURES”

2. ASTM (AMERICAN SOCIETY OF TESTING AND MATERIALS)

   A. ASTM A 123 - ZINC (HOT-DIP GALVANIZED) COATING ON IRON AND STEEL PRODUCTS.

   B. ASTM A 153 - ZINC COATING (HOT-DIP) ON IRON AND STEEL HARDWARE.

   C. ASTM A 615 - DEFORMED AND PLAIN BILLET-STEEL BAR FOR CONCRETE REINFORCEMENT.

   D. ASTM C 90 - LOAD-BEARING CONCRETE MASONRY UNITS.

   E. ASTM C 144 - AGGREGATE FOR MASONRY MORTAR.

   F. ASTM C 150 - PORTLAND CEMENT.

   G. ASTM C 270 - MORTAR FOR UNIT MASONRY.

   H. ASTM C 404 - AGGREGATES FOR MASONRY GROUT.

   I. ASTM C 476 - GROUT FOR MASONRY.

   J. ASTM C 1142 - READY-MIX MORTAR FOR UNIT MASONRY.

   K. ASTM E 119 - FIRE TESTS OF BUILDING CONSTRUCTION AND MATERIALS.

3. AMERICAN NATIONAL STANDARDS INSTITUTE BUILDING CODE REQUIREMENTS.

4. IMIAC (INTERNATIONAL MASONRY INDUSTRY ALL-WEATHER COUNCIL)

   A. IMIAC - RECOMMENDED PRACTICES AND GUIDE SPECIFICATIONS FOR HOT/COLD WEATHER MASONRY CONSTRUCTION

B. THE FOLLOWING REFERENCE MATERIALS ARE HEREBY MADE A PART OF THIS SECTION

SECTION 04 20 00

UNIT MASONRY ASSEMBLIES

BY REFERENCE THERETO:

1. UL FIRE RESISTANCE DIRECTORY.

2. IMI: MASONRY CONSTRUCTION GUIDE MANUAL.

3. PCA, “CONCRETE MASONRY HANDBOOK”.

4. NCMA (NATIONAL CONCRETE MASONRY ASSOCIATION)

A. NCMA APPLICABLE TEK BULLETINS.

1.7 SUBMITTALS

A. SUBMIT THE FOLLOWING UNDER PROVISIONS OF DIVISION 1:

1. LITERATURE: MANUFACTURER'S PRODUCT DATA SHEETS, SPECIFICATIONS, PERFORMANCE DATA, PHYSICAL PROPERTIES FOR EACH ITEM FURNISHED HEREUNDER.

2. MATERIAL CERTIFICATES: PROVIDE FOR THE FOLLOWING, SIGNED BY MANUFACTURER AND SUBCONTRACTOR CERTIFYING THAT EACH MATERIAL COMPLIES WITH REQUIREMENTS.

A. EACH DIFFERENT CEMENT PRODUCT REQUIRED FOR MORTAR AND GROUT, INCLUDING NAME OF MANUFACTURER, BRAND, TYPE, AND WEIGHT SLIPS AT TIME OF DELIVERY.

B. EACH MATERIAL AND GRADE INDICATED FOR REINFORCING BARS.

C. EACH TYPE AND SIZE OF JOINT REINFORCEMENT.

D. EACH TYPE AND SIZE OF ANCHORS, TIES, AND METAL ACCESSORIES.

3. MATERIAL TEST REPORTS FROM A QUALIFIED INDEPENDENT LABORATORY EMPLOYED AND PAID BY SUBCONTRACTOR INDICATING AND INTERPRETING TEST RESULTS RELATIVE TO COMPLIANCE OF THE FOLLOWING PROPOSED MASONRY MATERIALS WITH REQUIREMENTS INDICATED:

A. MORTAR COMPLYING WITH PROPERTY REQUIREMENTS OF ASTM C 270.

B. GROUT MIXES: INCLUDE DESCRIPTION OF TYPE AND PROPORTIONS OF GROUT INGREDIENTS.

C. MASONRY UNITS; REPORT FOR TESTS PERFORMED WITHIN THE PREVIOUS SIX MONTHS.

4. SAMPLES:

A. SAMPLES OF EACH MASONRY ACCESSORY OR ANCHORAGE ITEM REQUIRED.

5. SUBCONTRACTOR'S COLD WEATHER AND HOT WEATHER PROCEDURES: SHOW EVIDENCE OF COMPLIANCE WITH REQUIREMENTS SPECIFIED IN REFERENCED UNIT MASONRY STANDARD.

6. REINFORCING SHOP DRAWINGS.

1.8 QUALIFICATIONS

A. INSTALLER: COMPANY SPECIALIZING IN PERFORMING THE MASONRY WORK OF THIS

SECTION WITH MINIMUM OF 10 YEARS DOCUMENTED EXPERIENCE. WORK SHALL BE DONE BY SKILLED WORKMEN, FULLY INSTRUCTED AS TO THE REQUIREMENTS OF THE SPECIFICATIONS AND ADEQUATELY SUPERVISED DURING THE WORK.

1.9 QUALITY ASSURANCE

A. SINGLE-SOURCE RESPONSIBILITY FOR CONCRETE MASONRY UNITS: OBTAIN CONCRETE MASONRY UNITS FOR THE PROJECT FROM A SINGLE MANUFACTURER.

B. SINGLE-SOURCE RESPONSIBILITY FOR MORTAR MATERIALS: OBTAIN MORTAR INGREDIENTS OF UNIFORM QUALITY, INCLUDING COLOR FOR EXPOSED MASONRY, FROM ONE MANUFACTURER FOR EACH CEMENTITIOUS COMPONENT AND FROM ONE SOURCE AND PRODUCER FOR EACH AGGREGATE.

1.10 REGULATORY REQUIREMENTS

A. FIRE PERFORMANCE CHARACTERISTICS: WHERE INDICATED, PROVIDE MATERIALS AND CONSTRUCTION IDENTICAL TO THOSE OF ASSEMBLIES WHOSE FIRE RESISTANCE HAS BEEN DETERMINED PER ASTM E 119 BY A TESTING AND INSPECTING ORGANIZATION, BY EQUIVALENT CONCRETE MASONRY THICKNESS, OR BY ANOTHER MEANS, AS ACCEPTABLE TO AUTHORITIES HAVING JURISDICTION.

1.11 DELIVERY, STORAGE, AND HANDLING

A. GENERAL: DO NOT DELIVER CEMENT, LIME, AND SIMILAR PERISHABLE MATERIALS TO THE SITE UNTIL SUITABLE STORAGE IS AVAILABLE. STORE SUCH MATERIALS IN WEATHERPROOF STRUCTURES, AND ENSURE THAT MATERIALS ARE IN PERFECTLY FRESH CONDITION WHEN BROUGHT FOR USE. PROTECT MASONRY UNITS AND MANUFACTURED PRODUCTS OF ALL TYPES FROM WETTING BY RAIN OR SNOW, AND KEEP COVERED WHEN NOT IN USE.

B. MASONRY FACE UNITS: HANDLE ALL MASONRY UNITS CAREFULLY IN TRANSIT AND ON THE SITE, SO AS TO KEEP UNITS WHOLE, WITH EDGES SHARP, AND FACES CLEAN AND UNDAMAGED. DELIVER ALL MASONRY UNITS ON PALLETS; OR HANDLE UNITS INDIVIDUALLY, AND PROPERLY STACK SAME.

C. AGGREGATES: DELIVER, STORE AND HANDLE AGGREGATE MATERIALS SO AS TO PREVENT CONTAMINATION WITH EARTH OR OTHER FOREIGN MATERIALS.

D. STORE CEMENT, LIME AND SIMILAR PRODUCTS UNDER COVER AND FROM DIRECT CONTACT WITH EARTH OR FLOOR SLABS.

E. MANUFACTURED ITEMS: DELIVER MANUFACTURED PRODUCTS IN ORIGINAL CONTAINERS PLAINLY MARKED WITH PRODUCT IDENTIFICATION AND MANUFACTURER'S NAME.

F. STORE METAL ACCESSORIES AND THE LIKE UNDER COVER AND FROM DIRECT CONTACT WITH GROUND, AND IN MANNER TO PREVENT RUST.

G. DAMAGED MATERIAL: REMOVE ANY DAMAGED OR CONTAMINATED MATERIALS FROM JOB SITE IMMEDIATELY, INCLUDING MATERIALS IN BROKEN PACKAGES, PACKAGES CONTAINING WATER MARKS, OR WHICH SHOW OTHER EVIDENCE OF DAMAGE, UNLESS ARCHITECT SPECIFICALLY AUTHORIZES CORRECTION THEREOF AND USAGE ON PROJECT.

1.12 ENVIRONMENTAL CONDITIONS

A. HOT AND COLD WEATHER REQUIREMENTS AS SPECIFIED BY THE IMIAC (INTERNATIONAL MASONRY INDUSTRY ALL-WEATHER COUNCIL).

1. HOT WEATHER REQUIREMENTS SHALL BE ENFORCED WHEN AMBIENT TEMPERATURES ARE ABOVE 90 DEGREES FAHRENHEIT (32 DEGREES CELSIUS).

2. COLD WEATHER REQUIREMENTS SHALL BE ENFORCED WHEN AMBIENT TEMPERATURES BELOW 40 DEGREES FAHRENHEIT (5 DEGREES CELSIUS).

1.13 COORDINATION AND SEQUENCING

A. COORDINATE WORK WITH THAT OF OTHER TRADES WHICH REQUIRE PLACEMENT AND BUILDING-IN OF, AS WORK PROGRESSES, ANCHOR BOLTS, WOOD BLOCKING, HOLLOW METAL FRAMES, AND ANCHORAGE ITEMS.

B. EXAMINE ALL DRAWINGS AS TO REQUIREMENTS FOR THE ACCOMMODATION OF WORK OF OTHER TRADES. PROVIDE ALL REQUIRED RECESSES, CHASES, SLOTS, AND CUTOUTS. PLACE ANCHORS, BOLTS, SLEEVES AND OTHER ITEMS OCCURRING IN THE MASONRY WORK. TAKE EVERY PRECAUTION TO MINIMIZE FUTURE CUTTING AND PATCHING. CLOSELY COORDINATE THE LOCATION AND PLACEMENT OF SUCH ITEMS.

PART 2 PRODUCTS

2.1 CONCRETE MASONRY UNITS

A. LOAD BEARING HOLLOW AND SOLID, LIGHT WEIGHT CONCRETE MASONRY UNITS: CONFORM TO ASTM C90, TYPE 1, CLASS 1, LIGHT WEIGHT, 2-CORE, 58 PERCENT SOLID FOR 2 HOUR FIRE RESISTANT CONSTRUCTION:

1. PLAIN-FACED UNITS OF NOMINAL THICKNESS INDICATED ON THE DRAWINGS, LIGHT GRAY COLOR WITH UNIFORM MEDIUM-FINE TEXTURE, SOUND, TRUE TO PLANE AND LINE, AND FREE FROM CHIPS, CRACKS, AND OTHER DEFECTS. NOMINAL DIMENSIONS AS FOLLOWS:

A. NOMINAL 8” X 16” FACE DIMENSIONS.

2. SPECIAL SHAPES: PROVIDE SPECIAL BLOCK TYPES WHERE REQUIRED FOR CORNERS, CONTROL JOINTS AND OTHER SPECIAL CONDITIONS, WHETHER OR NOT SPECIFICALLY INDICATED ON THE DRAWINGS AS “SPECIAL”.

A. BULLNOSE CORNERS AT OUTSIDE CORNERS

B. DOUBLE BULLNOSE AT DOOR AND WINDOW ROUGH OPENINGS.

C. BOND BEAMS.

3. U.L. FIRE RATED CONCRETE MASONRY UNITS: PROVIDE IN ALL FIRE WALL LOCATIONS AS INDICTED ON THE DRAWINGS.

4. AGGREGATE: SAND AND GRAVEL: CONFORM TO ASTM C 331.

5. MINIMUM ALLOWABLE COMPRESSIVE STRENGTH FOR AN INDIVIDUAL UNIT OF NOT LESS THAN 1700 PSI (NET AREA); AND NOT LESS THAN 1,900 PSI. (NET AREA) FOR AVERAGE OF 3 UNITS; WHEN TESTED IN ACCORDANCE WITH ASTM C 140.

6. OVEN DRY DENSITY: 105 POUNDS PER CUBIC FOOT.

7. MOISTURE CONTENT FOR AVERAGE OF 3 UNITS, WHEN DELIVERED, NOT EXCEEDING 35

PERCENT OF THE TOTAL ABSORPTION, WHEN TESTED IN ACCORDANCE WITH ASTM C 140.

2.2 MORTAR

A. MORTAR: SITE-MIXED PORTLAND CEMENT MORTAR COMPLYING WITH ASTM C 270 AS SPECIFIED HEREIN.

1. ADMIXTURES ARE NOT PERMITTED EXCEPT WHERE EXPRESSLY SPECIFIED HEREIN OR AS OTHERWISE APPROVED BY THE ARCHITECT FOR SPECIFIC FIELD CONDITIONS.

B. MORTAR MATERIALS FOR SITE MIXED MORTAR:

1. PORTLAND CEMENT FOR MASONRY CONFORMING TO ASTM C 150, TYPE I, NON-STAINING, WITHOUT AIR ENTRAINMENT. USE TYPE III AS NECESSARY FOR LAYING MASONRY IN COLD WEATHER.

2. FOR CONCRETE MASONRY, USE GRAY COLOR PORTLAND CEMENT

3. AGGREGATES FOR GROUT: CONFORMING TO ASTM C 144 FOR FINE AGGREGATE AND ASTM C 404, SIZE 8 OR 89.

4. AGGREGATE FOR CONCRETE MASONRY MORTAR: CLEAN, WASHED UNIFORMLY WELL GRADED SAND CONFORMING TO ASTM C 144, WITH THE FOLLOWING GRADATION, AND HAVING A FINENESS MODULUS BETWEEN 2.15 AND 2.35:

SEIVE SIZE	PERCENTAGE PASSING
#4	100%
#8	95 TO 100%
#16	70 TO 100%
#30	40 TO 75%
#50	10 TO 35%
#100	2 TO 15%
#200	0 TO 5%

5. LIME: APPROVED BRAND OF PLASTIC HYDRATED LIME, CONFORMING TO ASTM C 207, TYPE “S”.

6. WATER: CLEAN AND FRESH WITHOUT CONTAMINANTS.

C. MORTAR TYPES:

1. MORTAR FOR LOAD BEARING MASONRY: ASTM C 270 TYPE S USING THE PROPERTY SPECIFICATION.

2. MORTAR FOR POINTING, DIRT AND STAIN RESISTANT TYPE: ASTM C 270 TYPE N USING THE PROPERTY SPECIFICATION WITH ADDED ALUMINUM TRISTEARATE, CALCIUM STEARATE, OR AMMONIUM STEARATE TO A QUANTITY OF 3 PERCENT OF PORTLAND CEMENT WEIGHT.

D. MORTAR MIX COLOR(S):

1. STANDARD MORTAR COLOR AS APPROVED BY THE ARCHITECT.

2.3 GROUT MIXES

A. PREPACKAGED GROUT (READY MIX) COMPLYING WITH ASTM C 1107, OR SITE-MIXED PORTLAND CEMENT GROUT COMPLYING WITH ASTM C 476 MAY BE USED.

1. FIVE STAR PRODUCTS, INC. PRODUCT “FIVE STAR GROUT”.

2. L&M CONSTRUCTION CHEMICALS, INC., PRODUCT “CRYSTEX”.

3. SYMONS CORPORATION, DESPLAINES, IL., PRODUCT “SYMONS MULTI_PURPOSE GROUT”.

B. GROUT FOR ENGINEERED MASONRY: COURSE GROUT HAVING A COMPRESSIVE STRENGTH OF 1,800 POUNDS PER SQUARE INCH AT 28 DAYS; SLUMP 8 TO 10 INCHES.

2.4 REINFORCEMENT AND ANCHORAGE MATERIALS

A. SINGLE WYTHE LONGITUDINAL REINFORCEMENT FOR CONCRETE MASONRY UNIT WALLS AND PARTITIONS: IN OVERALL WIDTH 1-5/8 INCHES LESS THAN THE OVERALL WALL THICKNESS, AS MANUFACTURED BY DUR-O-WAL, HOHMANN, HECKMANN BUILDING PRODUCTS, INC., OR ARCHITECT APPROVED SUBSTITUTE.

1. INTERIOR PARTITIONS: LADDER TYPE, 9 GAGE ASTM A 641 CLASS 1 GALVANIZED WIRE.

2. PROVIDE PREFORMED REINFORCING SECTIONS AT INTERSECTIONS OF MASONRY WALLS AND PARTITIONS, AND WHENEVER WALLS AND PARTITIONS CHANGE DIRECTION.

B. REINFORCING STEEL, ADDITIONAL TO RODS WHICH ARE EMBEDDED IN CONCRETE: SOLID STEEL REINFORCING BARS, CONFORMING TO ASTM A 615, GRADE 60. ALL REINFORCING BARS FOR THIS SCOPE OF WORK ARE TO BE #4 AT 48” O.C, UNLESS NOTED OTHERWISE.

1. AT EACH SIDE OF CONTROL JOINT.

2. BOND BEAMS.

2.5 ACCESSORIES

A. COMPRESSIBLE FILLER: CLOSED CELL POLYVINYL CHLORIDE; OVERSIZED 50 PERCENT TO JOINT WIDTH; SELF-EXPANDING, CONTINUOUS IN LENGTH, AND IN WIDTH TO FILL THE JOINT TO A POINT 3/4 INCH BACK FROM EACH FACE OF WALL OR PARTITION.

B. COMPRESSIBLE FILLER FOR JOINTS AT TOPS OF NON-LOAD BEARING MASONRY PARTITIONS, AND FOR EXPANSION JOINTS IN MASONRY WALLS: CLOSED CELL PVC FOAM BOARD, SOFT GRADE, 25 PERCENT THICKER THAN JOINT WIDTH, CONTINUOUS IN LENGTH, AND IN WIDTH TO FILL THE JOINT TO A POINT 3/4 INCH BACK FROM EACH FACE OF WALL OR PARTITION.

1. HOHMANN & BARNARD, INC.; #NS CLOSED CELL NEOPRENE SPONGE

A. THICKNESS & WIDTH AS REQUIRED BY WALL CONSTRUCTION.

C. PREMOLDED CONTROL JOINTS FOR CONCRETE MASONRY CONSTRUCTION: SOLID RUBBER OF PROFILE AS INDICATED (TO MAINTAIN LATERAL STABILITY OF WALL), 60-80 SHORE A HARDNESS.

1. HOHMANN & BARNARD, INC.; #RS SERIES RUBBER CONTROL JOINT

    A. STYLE & SIZE AS DICTATED BY MASONRY CONSTRUCTION.

2.6 MIXING MORTARS AND GROUT

A. MIX MORTAR AND GROUT IN ACCORDANCE WITH THE REQUIREMENTS OF ASTM C 270, ASTM C 94, AND ASTM C 476 AS APPLICABLE. CONTROL BATCHING PROCEDURE TO ENSURE PROPER PROPORTIONS BY MEASURING MATERIALS BY VOLUME. AMOUNT OF MIXING WATER AND MORTAR CONSISTENCY SHALL BE CONTROLLED BY MASON.

B. MAINTAIN SAND UNIFORMLY DAMP IMMEDIATELY BEFORE MIXING PROCESS.

C. ADD MORTAR COLOR AND ADMIXTURES IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS. PROVIDE UNIFORMITY OF MIX AND COLORATION.

D. DO NOT USE ANTI-FREEZE COMPOUNDS TO LOWER THE FREEZING POINT OF MORTAR OR GROUT.

E. POURING GROUT SHALL BE FLUID CONSISTENCY (AS FLUID AS POSSIBLE FOR POURING WITHOUT SEPARATION OF CONSTITUENT PARTS).

F. RETEMPERING WILL BE PERMITTED ONLY WITHIN THE FIRST TWO HOURS OF INITIAL MIX. DISCARD MORTAR THAT HAS PARTIALLY SET.

2.7 MASONRY CLEANER

A. ACIDIC CLEANER: GENERAL-PURPOSE CLEANER DESIGNED FOR NEW MASONRY SURFACES, COMPRISED OF BLENDED ACIDS COMBINED WITH SPECIAL WETTING SYSTEMS AND APPROVED BY MANUFACTURER OF MASONRY UNITS.

1. PRODUCTS OF THE FOLLOWING MANUFACTURER'S PROVIDED THEY COMPLY WITH THE REQUIREMENTS OF THE CONTRACT DOCUMENTS WILL BE AMONG THOSE CONSIDERED ACCEPTABLE.

    A. SURE-KLEAN NO. 600 DETERGENT; PROSOCO, INC.

    B. SURE-KLEAN NO. 101 LIME SOLVENT; PROSOCO. INC.

PART 3. EXECUTION

3.1 EXAMINATION

A. VERIFY THAT FIELD CONDITIONS ARE ACCEPTABLE AND ARE READY TO RECEIVE THE WORK OF THIS SECTION.

B. VERIFY BUILT-IN AND OTHER ITEMS PROVIDED BY SEPARATE SECTIONS OF THE WORK ARE PROPERLY SIZED AND LOCATED.

C. VERIFY FOUNDATION WALLS SUPPORTING MASONRY IS CONSTRUCTED WITHIN TOLERANCES REQUIRED BY CODE.

D. BEGINNING OF INSTALLATION MEANS ACCEPTANCE OF SITE CONDITIONS.

3.2 PREPARATION

A. DIRECT AND COORDINATE PLACEMENT OF METAL ANCHORS SUPPLIED TO OTHER SECTIONS.

B. FOUNDATIONS:

1. DO NOT COMMENCE INSTALLATION UNTIL FOUNDATIONS ARE CLEAN, ROUGH, AND LEVEL.

2. SANDBLAST THE FOUNDATION TOPS, IF NECESSARY, AND REMOVE ALL LAITANCE AND FOREIGN MATERIAL.

3. VERIFY THAT THE FOUNDATION ELEVATION IS SUCH THAT THE BED JOINT THICKNESS SHALL NOT VARY FROM SPECIFIED THICKNESS, AND THAT THE FOUNDATION EDGE IS TRUE TO LINE WITH MASONRY NOT PROJECTING OVER MORE THAN 1/4".

C. PROVIDE TEMPORARY BRACING DURING INSTALLATION OF MASONRY WORK. MAINTAIN IN PLACE UNTIL BUILDING STRUCTURE PROVIDES PERMANENT BRACING.

D. PROTECT SURFACES OF WINDOWS, DOOR FRAMES, LOUVERS AND VENTS AS WELL AS SIMILAR FINISH PRODUCTS WITH PAINTED AND INTEGRAL FINISHES FROM MORTAR DROPPINGS AND STAINS.

3.3 INSTALLATION - GENERAL

A. BUILD CHASES AND RECESSES AS SHOWN OR REQUIRED TO ACCOMMODATE ITEMS SPECIFIED IN THIS AND OTHER SECTIONS OF THE SPECIFICATIONS. PROVIDE NOT LESS THAN 8 INCHES OF MASONRY BETWEEN CHASE RECESS AND JAMB OF OPENINGS AND BETWEEN ADJACENT CHASES AND RECESSES.

B. LEAVE OPENINGS FOR EQUIPMENT TO BE INSTALLED BEFORE COMPLETION OF MASONRY. AFTER INSTALLATION OF EQUIPMENT, COMPLETE MASONRY TO MATCH CONSTRUCTION IMMEDIATELY ADJACENT TO THE OPENING.

C. ESTABLISH LINES, LEVELS AND COURSING INDICATED. PROTECT FROM DISPLACEMENT.

D. MAINTAIN MASONRY COURSES TO UNIFORM DIMENSION. FORM VERTICAL AND HORIZONTAL JOINTS OF UNIFORM THICKNESS.

E. ISOLATE MASONRY PARTITIONS FROM VERTICAL STRUCTURAL FRAMING AND WHERE INDICATED ON THE DRAWINGS. MAINTAIN JOINTS FREE FROM MORTAR, READY TO RECEIVE SEALANT AND JOINT BEAD BACK-UP.

F. PROVIDE COMPRESSIBLE FILLER AT TOPS OF INTERIOR MASONRY PARTITIONS ABUTTING STRUCTURE ABOVE.

3.4 CONSTRUCTION TOLERANCES

A. COMPLY WITH TOLERANCES IN ACI 530.1 / ASCE 6/TMS 602.

B. MAXIMUM VARIATION FROM TRUE SURFACE LEVEL FOR EXPOSED TO VIEW WALLS AND PARTITIONS:

C. UNIT-TO-UNIT TOLERANCE: 1/16 INCH.

D. SURFACE, OVERALL TOLERANCE: 1/4 INCH IN 10 FEET IN ANY DIRECTION AND 1/2 INCH IN 20 FEET OR MORE.

1. WHERE BOTH FACES OF SINGLE WYTHE WALL OR PARTITION WILL BE EXPOSED TO VIEW, REQUEST AND OBTAIN DECISION FROM THE ARCHITECT AS TO WHICH FACE WILL BE REQUIRED TO CONFORM TO THE SPECIFIED SURFACE LEVEL TOLERANCE.

E. MAXIMUM VARIATION FROM PLUMB: FOR LINES AND SURFACES OF WALLS DO NOT EXCEED 1/4 INCH IN 10 FEET, 3/8 INCH IN ANY STORY UP TO 20 FEET MAXIMUM. AT EXPANSION JOINTS AND OTHER CONSPICUOUS LINES, DO NOT EXCEED 1/4 INCH IN 20 FEET.

F. MAXIMUM VARIATION FROM LEVEL: FOR LINES OF SILLS, TOPS OF WALLS AND OTHER CONSPICUOUS LINES, DO NOT EXCEED 1/8 INCH IN 3 FEET, OR 1/4 INCH IN 10 FEET AND 1/2 INCH IN 30 FEET.

G. MAXIMUM VARIATION OF LINEAR BUILDING LINE: FOR POSITION SHOWN IN PLAN RELATING TO COLUMNS, WALLS AND PARTITIONS, DO NOT EXCEED 1/2 INCH IN 20 FEET OR 3/4 INCH IN 40 FEET.

H. MAXIMUM VARIATION IN SPECIFIED HEIGHT: 1/2 INCH PER STORY.

I. MAXIMUM VARIATION OF JOINT THICKNESS: 1/8 INCH IN 3 FEET.

J. MAXIMUM HORIZONTALLY PROJECTED UNSUPPORTED MASONRY UNIT: 1-1/8 INCHES

3.5 COURSING, BONDS AND JOINTS

A. COURSING, JOINTS AND BOND PATTERN: RUNNING BOND EXCEPT AS OTHERWISE INDICATED ON THE DRAWINGS.

B. EXPOSED TO VIEW MASONRY: EXCEPT AS SPECIFIED BELOW, FILL ALL JOINTS WITH MORTAR, STRIKE OFF FLUSH, AND WHEN MORTAR IS THUMB PRINT HARD TOOL JOINTS FLUSH WITH A NON-STAINING TOOL. JOINTS SHALL BE FREE OF DRYING CRACK.

3.6 CONTROL JOINTS

A. DO NOT CONTINUE HORIZONTAL JOINT REINFORCEMENT THROUGH CONTROL JOINTS.

B. INSTALL PREFORMED CONTROL JOINT DEVICE IN CONTINUOUS LENGTHS. SEAL BUTT AND CORNER JOINTS IN ACCORDANCE WITH MANUFACTURERS RECOMMENDATION.

C. LOCATE CONTROL JOINTS WHERE SHOWN ON DRAWINGS, AT CORNERS ADJACENT TO OPENINGS IN MASONRY, CHANGES IN WALL HEIGHT AND INTERSECTIONS WITH STRUCTURAL WALLS AS APPROVED BY ARCHITECT.

D. SIZE CONTROL JOINTS IN ACCORDANCE WITH THE REQUIREMENTS OF SECTION 07 9200 - JOINT SEALERS.

3.7 LAYING MASONRY - GENERAL

A. BUILD THE MASONRY WALLS AND PARTITIONS IN THE VARIOUS COMBINATIONS AND THICKNESS AS INDICATED ON THE DRAWINGS.

B. ERECT ALL MASONRY WORK IN COMPLIANCE WITH THE LINE AND LEVEL TOLERANCES SPECIFIED HEREIN. HOLD UNIFORM JOINT SIZES. CORRECT, OR REPLACE, AS DIRECTED BY THE ARCHITECT, NON-CONFORMING MASONRY WORK AT NO ADDITIONAL COST TO THE CONTRACT.

C. LAY OUT COURSING BEFORE SETTING TO MINIMIZE CUTTING CLOSURES OR JUMPING BOND, AVOID THE USE OF LESS-THAN-HALF-SIZE UNITS.

D. LAYING MASONRY UNITS:

1. LAY MASONRY UNITS IN FULL BED OF MORTAR, WITH FULL HEAD JOINTS; UNIFORMLY JOINT WITH OTHER WORK.

2. LAY HOLLOW MASONRY UNITS WITH FACE SHELL BEDDING ON HEAD AND BED JOINTS.

3. BUTTERING CORNERS OF JOINTS OR EXCESSIVE FURROWING OF MORTAR JOINTS ARE NOT PERMITTED.

4. INTERLOCK INTERSECTIONS AND EXTERNAL CORNERS.

5. CUT ALL EXPOSED MASONRY WITH A MOTOR-DRIVEN CARBORUNDUM BLADE SAW TO ENSURE STRAIGHT AND CLEAN, UNCHIPPED EDGES.

A. LAY NO UNIT HAVING CHIPPED EDGES OR FACE DEFECTS WHERE SUCH UNIT WOULD BE EXPOSED TO VIEW. REMOVE ANY SUCH UNIT, IF INSTALLED, AND REPLACE WITH AN UNDAMAGED UNIT, AND BEAR ALL COSTS THEREFORE.

6. DO NOT SPREAD ANY MORE MORTAR THAN CAN BE COVERED BEFORE SURFACE OF MORTAR HAS BEGUN TO DRY.

7. DO NOT SHIFT OR TAP MASONRY UNITS AFTER MORTAR HAS ACHIEVED INITIAL SET. WHERE ADJUSTMENT MUST BE MADE, REMOVE ENTIRELY, CLEAN OFF MORTAR, AND RESET WITH FRESH MORTAR.

8. EXCEPT FOR CLEANING DOWN AND REPOINTING, FINISH ALL MASONRY AS THE WALLS AND PARTITIONS ARE CARRIED UP.

E. BUILD-IN REINFORCEMENT AND ANCHORAGE ITEMS AS THE WORK PROGRESSES, GROUTING FOR SECURE ANCHORAGE.

1. WHERE STEEL REINFORCING RODS HAVE BEEN CAST INTO CONCRETE SLABS, AND LEFT WITH UPTURNED ENDS, CAREFULLY PLACE MASONRY UNITS DOWN OVER THE UPTURNED ENDS OF THE RODS, AND FILL CELLS OF MASONRY UNITS WITH SPECIFIED GROUT.

F. EXCEPT AS INDICATED OTHERWISE, ISOLATE MASONRY FROM OVERHEAD STRUCTURE:

1. ISOLATE MASONRY PARTITIONS FROM VERTICAL STRUCTURAL FRAMING MEMBERS WITH A CONTROL JOINT.

2. ISOLATE TOP JOINT OF MASONRY PARTITIONS FROM HORIZONTAL STRUCTURAL FRAMING MEMBERS AND SLABS OR DECKS WITH COMPRESSIBLE JOINT FILLER.

G. PROVIDE CONTROL JOINTS AT 24 FEET ON CENTER MAXIMUM SPACING OR AS NOTED ON DRAWINGS, AND KEEP CLEAN OF MORTAR DROPPINGS.

H. PROVIDE COMPLETE PROTECTION AGAINST BREAKAGE AND WEATHER DAMAGE TO ALL MASONRY WORK, INCLUDING SUBSTANTIAL WOOD BOXING AROUND DOOR JAMBS, OVER THE TOPS OF WALLS AND WHEREVER NECESSARY TO PROTECT WORK AT ALL STAGES OF COMPLETION. PROTECT MASONRY WHEN NOT ROOFED OVER, AT ALL TIMES WHEN MASONS ARE NOT WORKING ON THE WALLS. APPLY TARPAULINS OR WATERPROOF PAPER, PROPERLY WEIGHTED, OR NAILED, TO ASSURE THEIR REMAINING IN PLACE TO PROTECT MASONRY FROM ALL POSSIBLE HAZARDS.

I. POINT AND FILL ALL HOLES AND CRACKS IN NEW MORTAR JOINTS WITH ADDITIONAL FRESH MORTAR; DO NOT MERELY SPREAD ADJACENT MORTAR OVER DEFECT OR USE DEAD MORTAR DROPPINGS. DO ALL POINTING WHILE MORTAR IS STILL SOFT AND PLASTIC. IF HARDENED, CHISEL DEFECT OUT AND REFILL SOLIDLY WITH FRESH ADDITIONAL MORTAR, AND TOOL OR RAKE JOINTS AS SPECIFIED HEREIN.

J. PROTECT ALL MASONRY FROM RAIN PRIOR TO, AND DURING THE INSTALLATION THEREOF. IF THE TEMPERATURE IS IN EXCESS OF 80 DEGREES FAHRENHEIT AT TIME OF INSTALLATION, LIGHTLY MOISTEN CONTACT SURFACES OF MASONRY UNITS BY BRUSHING WITH WATER.

K. COLD/HOT WEATHER PROCEDURES: NO MASONRY WORK SHALL BE LAID IN TEMPERATURES BELOW 40 DEGREES FAHRENHEIT WITHOUT THE SUBMITTAL TO AND REVIEW BY THE ARCHITECT OF COLD WEATHER PROCEDURES.

1. IN AMBIENT TEMPERATURES BELOW 40 DEGREES FAHRENHEIT MAKE PROVISIONS TO ADEQUATELY PROTECT THE MASONRY MATERIALS AND THE FINISHED WORK FROM FROST BY HEATING MATERIALS, ENCLOSING THE WORK OR HEATING THE ENCLOSED SPACES.

2. NO FROZEN WORK SHALL BE BUILT UPON NOR SHALL ANTI-FREEZE ADMIXTURES BE PERMITTED IN THE MORTAR MIX.

3. ANY COMPLETED WORK FOUND TO BE AFFECTED BY FROST SHALL BE TAKEN DOWN AND REBUILT AT NO ADDITIONAL EXPENSE.

3.8 ENGINEERED MASONRY

A. LAY MASONRY UNITS WITH CORE CELLS VERTICALLY ALIGNED AND CLEAR OF MORTAR AND UNOBSTRUCTED.

B. PLACE MORTAR IN MASONRY UNIT BED JOINTS BACK 1/4 INCH FROM EDGE OF UNIT GROUT SPACES, BEVEL BACK AND UPWARD. PERMIT MORTAR TO CURE 7 CALENDAR DAYS BEFORE PLACING GROUT.

C. REFER TO THE DRAWINGS FOR LOCATIONS WHERE VERTICAL STEEL REINFORCING RODS WILL BE REQUIRED IN MASONRY WALLS. REINFORCE MASONRY UNIT CORES WITH REINFORCEMENT BARS AND GROUT.

D. RETAIN VERTICAL REINFORCEMENT IN POSITION AT TOP AND BOTTOM OF CELLS AND AT INTERVALS NOT EXCEEDING 192 BAR DIAMETERS.

E. WET MASONRY UNIT SURFACES IN CONTACT WITH GROUT JUST PRIOR TO GROUT PLACEMENT.

F. GROUT SPACES LESS THAN 2 INCHES IN WIDTH WITH FINE GROUT USING LOW LIFT GROUTING TECHNIQUES. GROUT SPACES 2 INCHES OR GREATER IN WIDTH WITH COURSE GROUT USING HIGH OR LOW GROUTING TECHNIQUES.

G. WHEN GROUTING IS STOPPED FOR MORE THAN ONE HOUR, TERMINATE GROUT 1_1/2 INCH BELOW TOP OF UPPER MASONRY UNIT TO FORM A POSITIVE KEY FOR SUBSEQUENT GROUT PLACEMENT.

H. LOW LIFT GROUTING: PLACE FIRST LIFT OF GROUT TO A HEIGHT OF THREE CONCRETE MASONRY UNIT COURSES AND ROD FOR GROUT CONSOLIDATION. PLACE SUBSEQUENT LIFTS IN 8 INCH INCREMENTS AND ROD FOR GROUT CONSOLIDATION.

3.9 BUILDING-IN WORK

A. AS WORK PROGRESSES INSTALL BUILT-IN METAL DOOR AND GLAZED FRAMES, FABRICATED METAL FRAMES, WOOD NAILING STRIPS, ANCHOR BOLTS, PLATES AND OTHER ITEMS TO BE BUILT-IN THE WORK.

B. INSTALL BUILT-IN ITEMS PLUMB AND LEVEL; TAKE CARE NOT TO DISTORT ALIGNMENT OF SUCH ITEMS.

C. BED ANCHORS OF METAL FRAMES IN ADJACENT MORTAR JOINTS. FILL FRAME VOIDS SOLID WITH GROUT EXCEPT WHERE JOINTS ARE INDICATED TO RECEIVE CAULKING AND SEALANT. FILL ADJACENT MASONRY CORES WITH GROUT MINIMUM 12 INCHES FROM FRAMED OPENINGS.

1. RAKE JOINTS TO RECEIVE SEALANT TO A UNIFORM DEPTH OF 3/4 INCH FOR INSTALLATION OF CAULKING AND SEALANT.

D. DO NOT BUILD-IN ORGANIC MATERIALS SUBJECT TO DETERIORATION.

3.10 REINFORCEMENT AND ANCHORAGE

A. REINFORCE HORIZONTAL JOINTS WITH CONTINUOUS MASONRY JOINT REINFORCEMENT, SPACED 16 INCHES VERTICALLY COMMENCING ONE COURSE ABOVE SUPPORTING CONCRETE SLAB.

B. PLACE MASONRY JOINT REINFORCEMENT IN FIRST AND SECOND HORIZONTAL JOINT ABOVE AND BELOW OPENINGS. EXTEND 16 INCHES EACH SIDE OF OPENING.

C. PLACE JOINT REINFORCEMENT IN FIRST AND SECOND JOINT BELOW TOP OF WALLS.

D. LAP JOINT REINFORCEMENT ENDS MINIMUM 6 INCHES.

E. INSTALL PREFORMED UNITS (OR OPTIONAL FIELD-FORMED UNITS) AT CORNERS, REVEALS, AND OFFSETS IN EXTERIOR MASONRY, AT INTERSECTIONS OF ALL MASONRY WALLS AND PARTITIONS, AND WHEREVER WALLS AND PARTITIONS CHANGE DIRECTIONS.

F. DO NOT BRIDGE CONTROL AND EXPANSION JOINTS IN THE WALL SYSTEM.

G. ANCHOR ENDS OF WALLS TO STRUCTURE WITH ANCHORS SPACED 24 INCHES, EXCEPT AS OTHERWISE SHOWN.

H. SUPPORT AND SECURE REINFORCING BARS FROM DISPLACEMENT. MAINTAIN POSITION WITHIN 1/2 INCH OF DIMENSIONED POSITION.

3.11 LINTELS

A. INSTALL STEEL LINTELS WHERE INDICATED.

B. PROVIDE MASONRY LINTELS WHERE SHOWN AND WHERE OPENINGS OF MORE THAN 12 INCHES FOR BRICK-SIZE UNITS AND 24 INCHES FOR BLOCK-SIZE UNITS ARE SHOWN WITHOUT STRUCTURAL STEEL OR OTHER SUPPORTING LINTELS.

1. PROVIDE PREFABRICATED OR BUILT-IN-PLACE MASONRY LINTELS. USE SPECIALLY FORMED BOND BEAM UNITS WITH REINFORCING BARS PLACED AS INDICATED AND FILLED WITH COARSE GROUT. CURE PRECAST LINTELS BEFORE HANDLING AND INSTALLING. TEMPORARILY SUPPORT BUILT-IN-PLACE LINTELS UNTIL CURED.

C. PROVIDE MINIMUM BEARING OF 8 INCHES AT EACH JAMB, UNLESS OTHERWISE INDICATED.

3.12 PROTECTION OF WORK

A. LOADING: DO NOT APPLY LOADING FOR AT LEAST 12 HOURS AFTER BUILDING MASONRY WALLS AND PARTITIONS. DO NOT APPLY CONCENTRATED LOADS FOR AT LEAST 3 DAYS AFTER BUILDING MASONRY COLUMNS, WALLS OR PARTITIONS.

B. PROTECTION OF MASONRY: DURING ERECTION, COVER TOPS OF WALLS, PROJECTIONS, AND SILLS WITH WATERPROOF SHEETING AT END OF EACH DAY'S WORK. COVER PARTIALLY COMPLETED MASONRY WHEN CONSTRUCTION IS NOT IN PROGRESS.

1. EXTEND COVER A MINIMUM OF 24 INCHES DOWN BOTH SIDES AND HOLD COVER SECURELY IN PLACE.

2. WHERE ONE WYTHE OF MULTI-WYTHE MASONRY WALLS IS COMPLETED IN ADVANCE OF OTHER WYTHES, SECURE COVER A MINIMUM OF 24 INCHES DOWN FACE NEXT TO UN-CONSTRUCTED WYTHE AND HOLD COVER IN PLACE.

C. STAIN PREVENTION: PROVIDE PROTECTION AND PREVENT GROUT, MORTAR, AND SOIL FROM STAINING THE FACE OF EXPOSED MASONRY AND BUILDING FINISHES. PROTECT BASE OF WALLS FROM RAIN-SPLASHED MUD AND MORTAR SPLATTER.

1. REMOVE IMMEDIATELY ALL GROUT, MORTAR, AND SOIL THAT COME IN CONTACT WITH SUCH MASONRY.

3.13 FIELD QUALITY CONTROL

A. TESTING AND INSPECTING: OWNER WILL ENGAGE A SPECIAL INSPECTOR TO PERFORM FIELD TEST AND INSPECTIONS AND PREPARE TEST REPORTS.

1. INSPECTIONS:

A. VERIFICATION OF TYPE, QUANTITY, AND INSTALLATION OF REINFORCEMENT, ANCHORS, AND TIES. A MINIMUM OF 50% REINFORCEMENT INSTALLATION AT ALL SHEAR WALLS, BEARING WALLS, AND ELEVATOR WALLS, AND A MINIMUM OF 25% IN PARTITION WALLS.

B. DIMENSION AND CONDITIONS OF GROUT SPACE, CLEAN-OUTS. 95% OF ALL GROUTING

C. CONSTRUCTION OF MORTAR JOINTS, INCLUDING TOOLING AND FILLING OF JOINTS.

D. MASONRY UNITS PRIOR TO AND DURING INSTALLATION.

2. PRISM TESTS: FOR EACH TYPE OF WALL CONSTRUCTION INDICATED, MASONRY PRISMS WILL BE TESTED PER ASTM C1314.

3. MORTAR PROPERTIES WILL BE TESTED PER PROPERTY SPECIFICATION OF ASTM C 270.

4. MORTAR EFFLORESCENCE: TEST EACH MORTAR TYPE PER ASTM C780. TEST EACH MORTAR TYPE WHICH WILL BE EXPOSED TO WEATHER FOR EFFLORESCENCE IN ACCORDANCE WITH THE “WICK TEST” PROCEDURE IN BIA RESEARCH REPORT NUMBER 15, THE CAUSES AND CONTROL OF EFFLORESCENCE IN BRICKWORK”, SECTION 4.4. MORTAR MIXES WHICH SHOW EFFLORESCENCE SHALL NOT BE USED IN THE WORK.

5. MORTAR COMPOSITION AND PROPERTIES WILL BE FIELD EVALUATED PER ASTM C 780

FOR COMPRESSIVE STRENGTH, CONSISTENCY, MORTAR AGGREGATE RATIO, WATER CONTENT, AIR CONTENT, AND SPLITTING TENSILE STRENGTH.

6. GROUT COMPRESSIVE STRENGTH WILL BE TESTED PER ASTM C 1019 FOR COMPRESSIVE STRENGTH AND SLUMP.

3.14 CLEANING

A. DURING THE PROGRESS OF THE WORK, KEEP THE EXPOSED SURFACES OF MASONRY CLEAN AT ALL TIMES, AND PROTECTED AGAINST DAMAGE. AS EACH SEGMENT OF THE MASONRY IS ERECTED, DRY-BRUSH THE SURFACES FREE FROM MORTAR SPOTS AND DROPPINGS.

B. PRIOR TO PERFORMING THE FINAL CLEANING WORK, EXAMINE ALL FACE JOINTS IN EXPOSED MASONRY TO LOCATE CRACKS, HOLES OR OTHER DEFECTS IN THE MORTAR; AND POINT UP ALL SUCH DEFECTS AND FILL WITH MORTAR AS SPECIFIED HEREIN. WHERE NECESSARY, IN THE OPINION OF THE CONSTRUCTION MANAGER AND/OR ARCHITECT, CUT OUT DEFECTIVE JOINTS IN MASONRY AND REPLACE WITH NEW MATERIALS, EXERCISING EXTREME CARE TO MATCH ORIGINAL WORK.

C. AT A TIME APPROVED BY THE ARCHITECT, PERFORM FINAL CLEANING OPERATIONS ON ALL MASONRY AS SPECIFIED HEREIN.

1. PERFORM THE FINAL CLEANING WORK ONLY WHEN THE AMBIENT TEMPERATURE IS ABOVE 40 DEGREES FAHRENHEIT, AND RISING.

2. DO NOT USE WIRE BRUSHES OR OTHER ABRASIVE TOOLS IN THE CLEANING OPERATIONS.

3. PERFORM FINAL CLEANING OPERATIONS FROM THE TOP DOWN. IF MASONRY CLEANING WORK IS PERFORMED AFTER WINDOWS, DOORS, FRAMES, AND OTHER WORK HAS BEEN INSTALLED, PROVIDE COMPLETE PROTECTION FOR SAID ITEMS; BE FULLY RESPONSIBLE FOR ANY DAMAGE DUE TO THE CLEANING OPERATIONS.

4. REMOVE LARGE MORTAR PARTICLES BY HAND WITH WOODEN PADDLES AND NON-METALLIC SCRAPE HOES OR CHISELS.

5. PERFORM FINAL CLEANING OF MASONRY UNITS BY SCRUBBING WITH STIFF BRISTLE FIBER BRUSHES AND CLEAR WATER, CHANGING THE WATER FREQUENTLY.

D. PROVIDE SUITABLE PROTECTIVE COVERINGS FOR ALL OTHER SURFACES AND MATERIALS DURING THE FINAL CLEANING PROCEDURES, AND BEAR FULL RESPONSIBILITY FOR CORRECTING ANY DAMAGE CAUSED BY THESE OPERATIONS, TO THE SATISFACTION OF THE ARCHITECT.

E. CLEAN CONCRETE MASONRY BY CLEANING METHOD INDICATED IN NCMA TEK 8-2 APPLICABLE TO TYPE OF STAIN ON EXPOSED SURFACES.

END OF SECTION

SECTION 05 40 00

COLD FORMED METAL FRAMING

PART 1 - GENERAL

1.01 ITEMS REQUIRED BUT NOT SPECIFIED

A. IF AN ITEM OR MATERIAL OF THIS TRADE IS INDICATED ON THE DRAWINGS BUT NOT SPECIFICALLY LISTED IN THIS SECTION, PROVIDE SUCH ITEM OR MATERIAL AT A STANDARD OF QUALITY EQUAL TO THE STANDARD ESTABLISHED FOR THE BALANCE OF THE WORK SPECIFIED, IN ACCORDANCE WITH THE ARCHITECT'S INTERPRETATION.

1.02 EXECUTION, CORRELATION AND INTENT

A. IN CASE OF AN INCONSISTENCY BETWEEN DRAWINGS AND SPECIFICATIONS, OR WITHIN EITHER DOCUMENT NOT CLARIFIED BY ADDENDUM, THE BETTER QUALITY OR GREATER QUANTITY OF WORK IS TO BE PROVIDED, IN ACCORDANCE WITH THE ARCHITECT'S INTERPRETATION.

1.03 SECTION INCLUDES

A. FURNISH THE FOLLOWING PRODUCTS TO BE INSTALLED UNDER THE DESIGNATED SECTIONS:

1. HEAVY GAGE EXTERIOR WALL AND ROOF FRAMING.

2. ACCESSORIES SUCH AS CLIPS, STIFFENERS, BRIDGING BRACING AND FASTENERS.

B. RELATED SECTIONS INCLUDE THE FOLLOWING:

1. 06 10 00 - ROUGH CARPENTRY.

2. 07 20 10 - BUILDING INSULATION.

1.04 SUBMITTALS

A. PRODUCT DATA

1.05 QUALITY ASSURANCE

A. WELDING: QUALIFY WELDING PROCEDURES AND EACH WELDER IN ACCORDANCE WITH AMERICAN WELDING SOCIETY (AWS) D1.3, “STRUCTURAL WELDING CODE - SHEET STEEL”.

1.06 DELIVERY, STORAGE, AND PROTECTION

A. DELIVER, STORE AND HANDLE PRODUCTS IN A MANNER TO PREVENT DAMAGE AND DETERIORATION, INCLUDING RUST.

B. STORE MATERIALS ABOVE GROUND IN A DRY AREA AND IN MANUFACTURER'S ORIGINAL PACKAGING. KEEP LABELS SHOWING PRODUCT TYPE, NAME AND GRADE INTACT.

1.07 COORDINATION

A. COORDINATE THE WORK WITH PLACEMENT OF ANCHORS AND STRUCTURAL ASSEMBLIES.

PART 2 - PRODUCTS

2.02 MANUFACTURERS

A. PRODUCTS OF THE FOLLOWING MANUFACTURES, PROVIDED THEY COMPLY WITH THE REQUIREMENTS OF THE CONTRACT DOCUMENTS, WILL BE AMONG THOSE CONSIDERED ACCEPTABLE FOR FURNISHING OF COLD-FORMED METAL FRAMING:

1. DIETRICH INDUSTRIES, INC.

2. CLARK STEEL FRAMING INDUSTRIES.

3. MARINO/WARE; DIV. OF WARE INDUSTRIES, INC.

B. PRODUCTS OF THE FOLLOWING MANUFACTURES, PROVIDED THEY COMPLY WITH THE REQUIREMENTS OF THE CONTRACT DOCUMENTS, WILL BE AMONG THOSE CONSIDERED ACCEPTABLE FOR FURNISHING OF DEFLECTION AND BRIDGE CLIPS:

1. SIGNATURE INDUSTRIES, LLC, THE STEEL NETWORK, INC.

2. DIETRICH INDUSTRIES, INC.

3. PRODUCTS OF APPROVED FRAMING MANUFACTURERS LISTED ABOVE PARAGRAPH 'A'.

2.03 COLD FORMED METAL FRAMING

A. FABRICATE METAL FRAMING UNITS FROM ASTM A446, A570 OR A611 STEEL SHEET.

1. YIELD STRENGTH: MANUFACTURER'S STANDARD FOR METAL THICKNESS USED, BUT NOT LESS THAN 33,000PSI.

2. FINISH: GALVANIZED (ZINC-COATED), CLASS G60, MINIMUM.

B. C-SHAPED STUDS: PROVIDE LOAD-BEARING STUDS FABRICATED FROM STEEL AND SIZED AS INDICATED; C-SHAPED IN CROSS SECTION, 1.625 INCH FLANGE, WITH FLANGE RETURN LIP.

1. GAGE: AS INDICATED ON DRAWINGS.

C. FRAMING ACCESSORIES: FABRICATE FROM MINIMUM 16 GAGE STEEL SHEET OF THE TYPE AND FINISH USED FOR FRAMING MEMBERS. PROVIDE MANUFACTURER'S STANDARD CONFIGURATION FOR THE FOLLOWING ACCESSORY ITEMS AS REQUIRED BY THE TYPE OF CONSTRUCTION:

1. TRACK CHANNEL.

2. DEEP-LEG TRACK CHANNEL.

3. HAT CHANNELS.

4. V-BRIDGING.

5. COLD-ROLLED CHANNELS, 1-1/2 INCH DEPTH.

6. CLIP ANGLES.

7. FLAT STRAPPING.

8. WEB STIFFENERS.

9. VERTICAL SLIDE CLIPS.

10. JOIST HANGERS.

2.04 ACCESSORY MATERIALS

A. WELDING MATERIALS: CONFORM TO REQUIREMENTS OF AWS CODE.

B. FASTENERS:

1. THREADED FASTENERS: ASTM A90, HOT-DIP GALVANIZED.

2. ANCHORAGE DEVICES: HOT-DIP GALVANIZED STEEL OR STAINLESS STEEL. ACCEPTABLE TYPES INCLUDE:

A. POWER ACTUATED FASTENERS.

B. POWER-DRIVEN ANCHOR SCREWS.

C. DRILLED EXPANSION BOLTS.

C. TOUCH-UP PAINT: FS TT-P-645, ZINC-MOLYBDATE ALKYD.

D. INSULATION: TYPE AS SPECIFIED IN SECTION 07210.

E. SHEATHING: MOISTURE-RESISTANT INORGANIC, GLASS FIBER REINFORCED BOARDS.

1. PROVIDE THE FOLLOWING:

A. “DENS-GLASS GOLD”; GEORGIA-PACIFIC CORPORATION.

2. FASTENERS: ASTM C954; SELF-DRILLING, SELF-TAPPING, BUGLE HEAD GALVANIZED OR CADMIUM-PLATED STEEL SCREWS.

PART 3 - EXECUTION

3.02 EXAMINATION

A. INSPECTION: VERIFY THAT PROJECT CONDITIONS AND SUBSTRATES ARE APPROPRIATE TO BEGIN INSTALLATION OF COLD FORMED METAL FRAMING SYSTEMS.

1. VERIFY THAT INSERTS, CLIPS AND SIMILAR ATTACHMENT DEVICES INSTALLED AS WORK OF OTHER SECTIONS ARE LOCATED AND INSTALLED PROPERLY.

B. BEGINNING INSTALLATION SHALL SIGNIFY THE STRUCTURE AND ADJACENT CONDITIONS AS BEING PROPER AND ACCEPTABLE TO THE INSTALLER.

3.03 INSTALLATION

A. COMPLY WITH REQUIREMENTS OF ASTM C1007 EXCEPT WHERE EXCEEDED BY OTHER REQUIREMENTS.

B. INSTALL FRAMING ACCESSORIES SUCH AS WEB STIFFENERS, DIAGONAL BRACING AND BRIDGING AS INDICATED OR REQUIRED.

C. INSTALL INSULATION TO FILL SPACES AT EXTERIOR WHICH WILL BE INACCESSIBLE AFTER FRAMING IS ERECTED.

D. FASTENING: JOIN COMPONENTS BY WELDING OR BY USING SCREWS OR BOLTS, AS RECOMMENDED BY FRAMING COMPONENT MANUFACTURER FOR MEMBERS TO BE JOINED.

1. WIRE TYING OF FRAMING ELEMENTS IS PROHIBITED.

2. CLEAN WELDS, REMOVING SPATTER AND SLAG AND APPLY ONE COAT OF TOUCH-UP PAINT.

3.04 WALL AND ROOF FRAMING

A. CORRECTLY POSITION RUNNER TRACKS AT BASE AND TOP OF STUDS.

1. ATTACH RUNNER TRACKS TO STRUCTURE IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS FOR SUBSTRATE AND FASTENER TYPE USED. USE FASTENERS AT ALL TRACK TERMINATIONS AND CORNERS.

B. PLACE STUDS AND RAFTERS AT SPACING INDICATED ON DRAWINGS.

C. CONSTRUCT CORNERS USING A MINIMUM OF 3 STUDS.

D. DOUBLE STUD AT WALL OPENINGS, DOOR AND WINDOW JAMBS.

E. ERECT STUDS ONE PIECE, FULL LENGTH. SPLICING OF STUDS IS NOT PERMITTED. BRACE AND REINFORCE TO DEVELOP FULL STRENGTH.

F. MAKE PROVISIONS FOR MOVEMENT OF BUILDING STRUCTURE TO PREVENT TRANSFER OF STRUCTURAL LOAD OR MOVEMENT TO CURTAIN WALL FRAMING.

3.05 WALL SHEATHING

A. INSTALL SHEATHING SO THAT LONG EDGES ARE PARALLEL TO STUDS. CENTER EDGES OVER STUDS.

B. PROVIDE SOLID WOOD BLOCKING OR METAL FRAMING TO SUPPORT HORIZONTAL EDGES WHICH DO NOT BEAR ON HORIZONTAL FRAMING MEMBERS.

C. COORDINATE INSTALLATION OF FLASHINGS, ANCHORS AND SIMILAR ITEMS NECESSARY TO CONSTRUCT A WEATHERPROOF WALL SYSTEM, AS NECESSARY

3.06 TOLERANCES

A. MAXIMUM VARIANCE FROM TRUE POSITION: 1/4 INCH.

B. MAXIMUM OFFSET OF ANY MEMBER FROM PLANE: 1/8 INCH.

END OF SECTION

SECTION 05 50 00

METAL FABRICATION

PART 1 GENERAL

1.01 SUMMARY OF SCOPE UNDER THIS SECTION

A. FURNISH, FABRICATE AND FULLY INSTALL:

1. LADDERS

2. PIPE BOLLARDS

3. PIPE GUARD RAILS

B. PERFORM ALL DRILLING AND CUTTING OF MISCELLANEOUS METAL ITEMS REQUIRED FOR THE ATTACHMENT OF OTHER ITEMS INCLUDED IN THE SCOPE.

C. PERFORM ALL SHOP-PAINTING FOR ALL SURFACES OF EXPOSED TO VIEW GALVANIZED AND NON-GALVANIZED METALS, AND POST-ERECTION TOUCH-UP OF SHOP PRIME COAT, USING THE SAME MATERIAL AS SHOP-PRIME COATING.

D. PERFORM APPLICATION OF LIQUID ZINC TOUCH-UP TO ALL WELDS OF GALVANIZED STEEL ITEMS FURNISHED HEREUNDER.

PART 2 PRODUCTS

2.01 PRODUCTS AND / OR MATERIALS

A. ALL MATERIALS SHALL BE NEW STOCK, FREE FROM DEFECTS IMPAIRING STRENGTH, DURABILITY OR APPEARANCE AND OF BEST COMMERCIAL QUALITY FOR EACH INTENDED PURPOSE. UNLESS SPECIFICALLY CALLED FOR OTHERWISE, WORK SHALL BE FABRICATED FROM THE FOLLOWING:

1. STEEL SHAPES, PLATES AND BARS: ASTM DESIGNATION A 36.

2. STEEL PIPE: ASTM A53, GRADE A, SEAMLESS PIPE.

3. STRUCTURAL STEEL TUBING, SQUARE AND RECTANGULAR SHAPES; ASTM A500, GRADE B.

4. STEEL PLATES TO BE BENT OR COLD-FORMED: ASTM A283, GRADE C.

5. STEEL BARS AND BAR-SIZE SHAPES: ASTM A306, GRADE 65, OR ASTM A36.

6. COLD-ROLLED CARBON STEEL SHEETS: ASTM A336.

7. STAINLESS STEEL: ASTM A 167, NON-MAGNETIC CORROSION RESISTANT CHROMIUM-NICKEL STEEL, TYPE 304 (18-8 ALLOY) POLISHED TO A Nº 4, BRUSHED FINISH TO ALL EXPOSED TO VIEW SURFACES.

8. BOLTS, NUTS AND WASHERS: ASTM A307, GALVANIZED TO ASTM A153 FOR GALVANIZED COMPONENTS.

B. METAL SURFACES, GENERAL: FOR METAL FABRICATIONS EXPOSED TO VIEW UPON COMPLETION OF THE WORK, PROVIDE MATERIALS SELECTED FOR THEIR SURFACE FLATNESS, SMOOTHNESS AND FREEDOM FROM SURFACE BLEMISHES. DO NOT USE MATERIALS WHOSE EXPOSED SURFACES EXHIBIT PITTING, SEAM MARKS, ROLLER MARKS, ROLLED TRADE NAMES,

ROUGHNESS, AND, FOR STEEL SHEET, VARIATIONS IN FLATNESS EXCEEDING THOSE PERMITTED BY REFERENCE STANDARDS FOR STRETCHER-LEVELED SHEET.

C. STEEL MATERIALS: TO BE HOT DIP-GALVANIZED, PROVIDE STEEL CHEMICALLY SUITABLE FOR METAL COATINGS COMPLYING WITH THE FOLLOWING REQUIREMENTS: CARBON BELOW 0.25 PERCENT, SILICON BELOW 0.24 PERCENT, PHOSPHOROUS BELOW 0.05 PERCENT, AND MANGANESE BELOW 1.35 PERCENT. NOTIFY GALVANIZER IF STEEL DOES NOT COMPLY WITH THESE REQUIREMENTS TO DETERMINE SUITABILITY FOR PROCESSING.

D. PROVIDE ALL FASTENERS AND ATTACHMENTS OF THE SAME MATERIAL AND FINISH AS THE METAL TO WHICH IT IS APPLIED UNLESS OTHERWISE NOTED. PROVIDE ALL FASTENERS AND ATTACHMENTS AS REQUIRED FOR WORK SPECIFIED HEREIN AND AS INDICATED ON THE DRAWINGS.

E. WELDING RODS: AWS E70XX GRADE, OR SELECT IN ACCORDANCE WITH AWS SPECIFICATIONS FOR THE METAL ALLOY TO BE WELDED AND IN ACCORDANCE WITH THE RECOMMENDATION OF THE WELDING ROD MANUFACTURER.

2.02 ACCESSORIES

A. GROUT: READY MIXED, NON-METALLIC HIGH STRENGTH CONTROLLED EXPANSION GROUT OF FLOWABLE CONSISTENCY, CONFORMING TO ASTM C 1107 WITH MINIMUM COMPRESSIVE STRENGTH OF 8,000 POUNDS PER SQUARE INCH (55.2 MPA) AT 28 DAYS. MANUFACTURERS OFFERING SIMILAR PRODUCTS WHICH MAY BE CONSIDERED AS EQUAL INCLUDE THE FOLLOWING:

1. FIVE STAR PRODUCTS, INC., FAIRFIELD CT, PRODUCT “FIVE STAR GROUT.”

2. L&M CONSTRUCTION CHEMICALS, OMAHA NE, PRODUCT: “DURAGROUT”

3. US MIX PRODUCTS CO., DENVER, CO, "MULTI PURPOSE NON-SHRINK GROUT".

B. LIQUID ZINC COATING, FOR TOUCH-UP OF WELDS, SCRATCHES, AND ABRASIONS IN GALVANIZED STEEL: GALVANIC ZINC-RICH COATING CONTAINING 95 PERCENT METALLIC ZINC, BY WEIGHT IN THE DRIED FILM; RECOGNIZED UNDER THE COMPONENT PROGRAM OF UNDERWRITER'S LABORATORIES, INC. AS AN EQUIVALENT TO HOT-DIP GALVANIZING; CONFORMING TO FS DOD-P-21035A (FORMALLY MIL-P-21035A) FOR REPAIR OF HOT-DIP GALVANIZING AND MEETING THE REQUIREMENTS OF MIL-P-26915A USAF SPECIFICATION FOR ZINC-RICH PAINTS. ACCEPTABLE PRODUCTS INCLUDE:

1. Z.R.C. CHEMICAL PRODUCTS COMPANY, QUINCY MA, PRODUCT: “Z.R.C.”

2. AMERICAN POLYWATER CORP., STILLWATER, MN, “CG ZINC-RICH COLD GALVANIZING”.

C. PRIMER FOR NON-GALVANIZED STEEL SURFACES, MODIFIED ALKYD RUST-INHIBITIVE, HIGH SOLIDS PRIMER, EQUAL TO THE FOLLOWING:

1. RUST-OLEUM: HEAVY DUTY RUST INHIBITIVE GREY PRIMER.

2. SHERWIN WILLIAMS: KEM FLASH PRIMER HS, GREY.

3. TNEMEC: GREY PRIMER.

2.03 FABRICATION - GENERAL

A. METAL SURFACES SHALL BE CLEAN AND FREE FROM MILL SCALE, FLAKE, RUST AND RUST PITTING; WELL FORMED AND FINISHED TO SHAPE AND SIZE, TRUE TO DETAILS WITH

STRAIGHT, SHARP LINES, AND ANGLES AND SMOOTH SURFACES. CURVED WORK SHALL BE TO TRUE RADII. EXPOSED SHEARED EDGES SHALL BE EASED.

B. SHOP FABRICATE ITEMS WHEREVER PRACTICABLE, ACCURATELY FITTING ALL PARTS AND MAKING ALL JOINTS TIGHT. DO NOT FABRICATE MATERIALS UNTIL ALL SPECIFIED SUBMITTALS HAVE BEEN SUBMITTED TO, AND APPROVED BY, THE ARCHITECT.

C. DO ALL CUTTING, PUNCHING, DRILLING, AND TAPPING REQUIRED FOR ATTACHMENT OF ANCHOR BOLTS AND OTHER HARDWARE AND FOR ATTACHMENT OF WORK BY OTHER TRADES. ALL SUCH WORK SHALL BE DONE PRIOR TO HOT-DIP GALVANIZING OF THE VARIOUS COMPONENTS.

D. GRIND ALL EDGES OF BARS AND PLATES COMPLETELY FREE FROM NICKS AND MACHINE MARKS, PRIOR TO GALVANIZING AND/OR SHOP PRIMING.

E. WELD ALL PERMANENT CONNECTIONS, MAKE ALL WELDS IN A CONTINUOUS MANNER; TACK-WELD ONLY WHERE SPECIFICALLY INDICATED ON THE DRAWINGS. GRIND ALL EXPOSED-TO-VIEW WELDS COMPLETELY SMOOTH AND FLUSH TO THE SURFACE PLANE OF THE BASE METALS. PERFORM WELDING WORK PRIOR TO GALVANIZING IN ALL CASES, EXCEPT WHERE FIELD WELDING IS NECESSARY, IN WHICH CASE, COMPLETELY COAT ALL SUCH WELDS WITH TWO COATS OF SPECIFIED LIQUID ZINC COATING, AFTER PERFORMING GRINDING OPERATIONS.

F. USE SCREWS AND BOLTS, ONLY WHERE WELDING CANNOT BE PERFORMED, OF SUFFICIENT SIZE TO ENSURE AGAINST LOOSENING FROM NORMAL USAGE OF MISCELLANEOUS METAL ITEMS FURNISHED HEREUNDER.

1. COUNTERSINK ALL SCREW HEADS AND BOLT HEADS AS FAR AS PRACTICABLE. USE NOT LESS THAN TWO SCREWS, BOLTS, OR OTHER ANCHORAGE ITEMS, AT EACH CONNECTION POINT.

2. DRAW UP ALL THREADED CONNECTIONS TIGHTLY, AFTER BUTTERING SAME WITH PIPE JOINT COMPOUND, TO EXCLUDE WATER.

G. CAREFULLY COORDINATE THE INSTALLATION OF METAL FABRICATIONS WITH THE WORK OF TRADES RESPONSIBLE FOR THE INSTALLATION OF INTERFACING WORK, AND FOR THE INSTALLATION OF WORK INTO THE VARIOUS ASSEMBLIES FURNISHED HEREUNDER, AND PERMIT THE INSTALLATION OF THE RELATED MATERIALS TO BE MADE AT THE APPROPRIATE TIMES.

H. FIT AND ASSEMBLE METAL FABRICATIONS IN LARGEST PRACTICAL SECTIONS FOR DELIVERY TO SITE, READY FOR INSTALLATION.

1. GALVANIZED ASSEMBLIES: WHERE SIZE OF ASSEMBLY IS TOO LARGE FOR GALVANIZING KETTLE, GALVANIZE COMPONENTS PRIOR TO FABRICATION AND ASSEMBLE AFTER GALVANIZING.

2.04 FABRICATION - RAILINGS & GUARDRAILS

A. REFER TO THE DRAWINGS FOR LOCATION AND DETAILS OF RAILINGS, AND GUARDRAILS TO BE FURNISHED AND INSTALLED HEREUNDER.

B. RAILING PERFORMANCE REQUIREMENTS; CONFORM TO ALL REQUIREMENTS OF APPLICABLE CODES AND REGULATIONS.

2.05 FABRICATION - PIPE BOLLARDS

A. REFER TO THE DRAWINGS FOR LOCATION AND DETAILS OF BOLLARDS AND GOALPOSTS TO BE FURNISHED AND INSTALLED HEREUNDER.

PART 3 EXECUTION

3.01 EXECUTION, ERECTION AND/OR INSTALLATION

A. ACCURATELY SET ALL WORK TO ESTABLISHED LINES AND ELEVATIONS, AND RIGIDLY FASTEN IN PLACE WITH SUITABLE ATTACHMENTS TO THE CONSTRUCTION OF THE BUILDING. AT THE COMPLETION OF THE WORK, CHECK ALL WORK, RE-ADJUST AS REQUIRED, AND LEAVE IN PERFECT CONDITION. GRIND ALL EXPOSED TO VIEW WELDS SMOOTH TO THE TOUCH.

END OF SECTION

SECTION 05 50 05

STAINLESS STEEL METAL FABRICATION

PART 1 GENERAL

1.01 SUMMARY AND RELATED SCOPE

A. FURNISH, FABRICATE AND FULLY INSTALL:

1. REFER TO SCOPE OF WORK DOCUMENT AND DRAWINGS FOR COMPLETE LIST OF STAINLESS STEEL ITEMS.

2. STAINLESS STEEL DOOR SUBFRAMES.

3. MISCELLANEOUS STAINLESS STEEL ITEMS

4. PERFORM ALL DRILLING AND CUTTING IN MISCELLANEOUS METAL ITEMS REQUIRED FOR THE ATTACHMENT OF OTHER ITEMS.

PART 2 PRODUCTS

2.01 PRODUCT AND / OR MATERIALS

A. ALL MATERIALS SHALL BE NEW STOCK, FREE FROM DEFECTS IMPAIRING STRENGTH, DURABILITY OR APPEARANCE AND OF BEST COMMERCIAL QUALITY FOR EACH INTENDED PURPOSE. UNLESS SPECIFICALLY CALLED FOR OTHERWISE, WORK SHALL BE FABRICATED FROM THE FOLLOWING:

1. STAINLESS STEEL: ASTM A 167, NON-MAGNETIC CORROSION RESISTANT CHROMIUM-NICKEL STEEL, TYPE 304 (18-8 ALLOY) POLISHED TO A Nº 4, BRUSHED FINISH TO ALL EXPOSED TO VIEW SURFACES.

B. METAL SURFACES, GENERAL: FOR METAL FABRICATIONS EXPOSED TO VIEW UPON COMPLETION OF THE WORK, PROVIDE MATERIALS SELECTED FOR THEIR SURFACE FLATNESS, SMOOTHNESS AND FREEDOM FROM SURFACE BLEMISHES. DO NOT USE MATERIALS WHOSE EXPOSED SURFACES EXHIBIT PITTING, SEAM MARKS, ROLLER MARKS, ROLLED TRADE NAMES, ROUGHNESS, AND, FOR STEEL SHEET, VARIATIONS IN FLATNESS EXCEEDING THOSE PERMITTED BY REFERENCE STANDARDS FOR STRETCHER-LEVELED SHEET.

C. PROVIDE ALL FASTENERS AND ATTACHMENTS OF THE SAME MATERIAL AND FINISH AS THE METAL TO WHICH IT IS APPLIED UNLESS OTHERWISE NOTED. PROVIDE ALL FASTENERS AND ATTACHMENTS AS REQUIRED FOR WORK SPECIFIED HEREIN AND AS INDICATED ON THE DRAWINGS.

D. WELDING RODS: AWS E70XX GRADE, OR SELECT IN ACCORDANCE WITH AWS SPECIFICATIONS FOR THE METAL ALLOY TO BE WELDED AND IN ACCORDANCE WITH THE RECOMMENDATION OF THE WELDING ROD MANUFACTURER.

2.02 ACCESSORIES

A. STAINLESS STEEL SCREWS AND EXPANSION BOLT CONCRETE FASTENERS.

2.03 FABRICATION - GENERAL

A. METAL SURFACES SHALL BE CLEAN AND FREE FROM MILL SCALE, FLAKE, RUST AND RUST PITTING; WELL FORMED AND FINISHED TO SHAPE AND SIZE, TRUE TO DETAILS WITH STRAIGHT, SHARP LINES AND ANGLES, AND SMOOTH SURFACES. CURVED WORK SHALL BE TO TRUE RADII. EXPOSED SHEARED EDGES SHALL BE EASED.

B. SHOP FABRICATE ITEMS WHEREVER PRACTICABLE, ACCURATELY FITTING ALL PARTS AND MAKING ALL JOINTS TIGHT. DO NOT FABRICATE MATERIALS UNTIL ALL SPECIFIED SUBMITTALS HAVE BEEN SUBMITTED TO, AND APPROVED BY, THE ARCHITECT.

C. DO ALL CUTTING, PUNCHING, DRILLING, AND TAPPING REQUIRED FOR ATTACHMENT OF ANCHOR BOLTS AND OTHER HARDWARE AND FOR ATTACHMENT OF WORK BY OTHER TRADES.

D. WELD ALL PERMANENT CONNECTIONS, MAKE ALL WELDS IN A CONTINUOUS MANNER; TACK-WELD ONLY WHERE SPECIFICALLY INDICATED ON THE DRAWINGS. GRIND ALL EXPOSED-TO-VIEW WELDS COMPLETELY SMOOTH AND FLUSH TO THE SURFACE PLANE OF THE BASE METALS.

E. USE SCREWS AND BOLTS, ONLY WHERE WELDING CANNOT BE PERFORMED, OF SUFFICIENT SIZE TO ENSURE AGAINST LOOSENING FROM NORMAL USAGE OF MISCELLANEOUS METAL ITEMS FURNISHED HEREUNDER.

1. COUNTERSINK ALL SCREW HEADS AND BOLT HEADS AS FAR AS PRACTICABLE. USE NOT LESS THAN TWO SCREW, BOLTS, OR OTHER ANCHORAGE ITEMS, AT EACH CONNECTION POINT.

2. DRAW UP ALL THREADED CONNECTIONS TIGHTLY, AFTER BUTTERING SAME WITH PIPE JOINT COMPOUND, TO EXCLUDE WATER.

F. CAREFULLY COORDINATE THE INSTALLATION OF METAL FABRICATIONS WITH THE WORK OF TRADES RESPONSIBLE FOR THE INSTALLATION OF INTERFACING WORK, AND FOR THE INSTALLATION OF WORK INTO THE VARIOUS ASSEMBLIES FURNISHED HEREUNDER, AND PERMIT THE INSTALLATION OF THE RELATED MATERIALS TO BE MADE AT THE APPROPRIATE TIMES.

G. FIT AND ASSEMBLE METAL FABRICATIONS IN LARGEST PRACTICAL SECTIONS FOR DELIVERY TO SITE, READY FOR INSTALLATION.

2.04 FABRICATION - STAINLESS STEEL

A. WELD AND FORM EDGES, ENDS, AND JOINTS, BY ELECTRIC PROCESS, WITH ALL WELDED JOINTS GROUND AND POLISHED SMOOTH. PERFORM ALL WELDING SO THAT NO MARK OF ANY KIND SHALL BE NOTICED ON THE FINISHED SURFACES. WELDS AND ADJOINING COMPONENTS SHALL BE HOMOGENOUS, NON-POROUS, FREE FROM PITS, CRACKS, IMPERFECTIONS OR DISCOLORATION.

1. HAMMER AND PEEN FLUSH WITH ADJOINING SURFACE WHEREVER MATERIALS HAVE BEEN DEPRESSED OR SUNKEN BY A WELDING OPERATION, AND, IF NECESSARY RE-WELD AND GRIND TO ELIMINATE LOW SPOTS.

2. EXCESSIVE DISTORTIONS CAUSED BY WELDING WILL NOT BE ACCEPTABLE AND SHALL BE CAUSE FOR REJECTION AND REMOVAL FROM PROJECT SITE.

B. EXERCISE CARE IN GRINDING OPERATIONS TO AVOID EXCESSIVE HEATING OF METAL AND DISCOLORATION. USE IRON-FREE ABRASIVES, WHEELS AND BELTS ON STAINLESS STEEL; DO NOT USE THE SAME ABRASIVES, WHEELS OR BELTS FOR BOTH STEEL AND STAINLESS STEEL. PROVIDE A UNIFORM AND SMOOTH FINAL POLISHING WITH A UNI-DIRECTION GRAIN FOR TOTAL LENGTH OF MATERIALS. CROSS GRAINS AND RANDOM POLISHING WILL NOT BE ACCEPTABLE

AND SHALL BE CAUSE FOR REJECTION.

C. PROVIDE A FINISH CONSISTENT THROUGHOUT THE WORK OF THIS SECTION.

1. BRAKE ENDS FREE OF OPEN TEXTURE OR ORANGE PEEL APPEARANCE. WHERE BRAKE WORK MARS THE FINISH OF THE MATERIALS, REMOVE MARKS BY GRINDING, POLISHING AND FINISHING.

2. SHEAR EDGES FREE OF BURRS, PROJECTION OR FINS TO ELIMINATE ALL DANGER OF LACERATION.

3. NEATLY FINISH MITER JOINTS AND BULL-NOSED CORNERS WITH UNDER EDGE OF THE MATERIAL NEATLY GROUND TO A UNIFORM CONDITION AND IN NO CASE WILL OVERLAPPING MATERIALS BE ACCEPTABLE.

PART 3 EXECUTION

3.01 EXECUTION, ERECTION AND / OR INSTALLTION

A. ACCURATELY SET ALL WORK TO ESTABLISHED LINES AND ELEVATIONS, AND RIGIDLY FASTEN IN PLACE WITH SUITABLE ATTACHMENTS TO THE CONSTRUCTION OF THE BUILDING. AT THE COMPLETION OF THE WORK, CHECK ALL WORK, RE-ADJUST AS REQUIRED, AND LEAVE IN PERFECT CONDITION. GRIND ALL EXPOSED TO VIEW WELDS SMOOTH TO THE TOUCH.

END OF SECTION

SECTION 05 51 00

METAL STAIRS

PART 1 - GENERAL

1.01 SUMMARY

A. THIS SECTION INCLUDES THE FOLLOWING:

1. STRAIGHT RUN, STEEL-FRAMED STAIRS.

B. RELATED SECTIONS:

1. 05 52 13 - PIPE & TUBE RAILINGS.

1.02 PERFORMANCE REQUIREMENTS

A. STRUCTURAL PERFORMANCE: ENGINEER, FABRICATE, AND INSTALL STEEL STAIRS TO WITHSTAND THE FOLLOWING STRUCTURAL LOADS WITHOUT EXCEEDING THE ALLOWABLE DESIGN WORKING STRESS OF THE MATERIALS INVOLVED, INCLUDING ANCHORS AND CONNECTIONS. APPLY EACH LOAD TO PRODUCE THE MAXIMUM STRESS IN EACH COMPONENT OF STEEL STAIRS.

1. TREADS OF STEEL STAIRS: CAPABLE OF WITHSTANDING A UNIFORM LOAD OF 100 LB PER SQ. FT. (4.8 KN/SQ. M) OR A CONCENTRATED LOAD OF 300 LB (1.35 KN) ON AN AREA OF 4 SQ. INCHES (26 SQ. CM) LOCATED IN THE CENTER OF THE TREAD, WHICHEVER PRODUCES THE GREATER STRESS.

2. PLATFORMS OF STEEL STAIRS: CAPABLE OF WITHSTANDING A UNIFORM LOAD OF 100 LB PER SQ. FT. (4.8 KN/SQ. M).

3. STAIR FRAMING: CAPABLE OF WITHSTANDING STRESSES RESULTING FROM LOADS SPECIFIED ABOVE AS WELL AS STRESSES RESULTING FROM RAILING SYSTEM LOADS.

B. STRUCTURAL PERFORMANCE OF HANDRAILS AND RAILING SYSTEMS: ENGINEER, FABRICATE, AND INSTALL HANDRAILS AND RAILING SYSTEMS TO COMPLY WITH REQUIREMENTS OF ASTM E 985 FOR STRUCTURAL PERFORMANCE BASED ON STRUCTURAL COMPUTATIONS.

1.03 SUBMITTALS

A. GENERAL: SUBMIT EACH ITEM IN THIS ARTICLE ACCORDING TO THE CONDITIONS OF THE CONTRACT AND DIVISION 1 SPECIFICATION SECTIONS.

B. PRODUCT DATA FOR METAL STAIRS, SAFETY STAIR NOSINGS, PAINT PRODUCTS, AND GROUT.

C. SHOP DRAWINGS DETAILING FABRICATION AND INSTALLATION OF STEEL STAIRS. INCLUDE PLANS, ELEVATIONS, SECTIONS, AND DETAILS OF STEEL STAIRS AND THEIR CONNECTIONS. SHOW ANCHORAGE AND ACCESSORY ITEMS. PROVIDE TEMPLATES FOR ANCHORS AND BOLTS SPECIFIED FOR INSTALLATION UNDER OTHER SECTIONS.

1.04 QUALITY ASSURANCE

A. FABRICATOR QUALIFICATIONS: FIRM EXPERIENCED IN PRODUCING STEEL STAIRS SIMILAR TO THOSE INDICATED FOR THIS PROJECT WITH A RECORD OF SUCCESSFUL IN-SERVICE PERFORMANCE AND WITH SUFFICIENT PRODUCTION CAPACITY TO PRODUCE REQUIRED UNITS WITHOUT DELAYING THE WORK.

B. WELDING STANDARDS: COMPLY WITH APPLICABLE PROVISIONS OF AWS D1.1 "STRUCTURAL WELDING CODE--STEEL" AND AWS D1.3 "STRUCTURAL WELDING CODE-SHEET STEEL."

PART 2 - PRODUCTS

2.01 FERROUS METALS

A. METAL SURFACES, GENERAL: FOR SURFACES EXPOSED TO VIEW IN THE COMPLETED WORK, PROVIDE MATERIALS SELECTED FOR THEIR SURFACE FLATNESS, SMOOTHNESS, AND FREEDOM FROM SURFACE BLEMISHES. DO NOT USE MATERIALS WITH EXPOSED PITTING, SEAM MARKS, ROLLER MARKS, ROLLED TRADE NAMES, ROUGHNESS, OR, FOR STEEL SHEET, VARIATIONS IN FLATNESS EXCEEDING THOSE PERMITTED BY REFERENCED STANDARDS FOR STRETCHER-LEVELED SHEET.

B. STEEL PLATES, SHAPES, AND BARS: ASTM A 36/A 36M.

C. STEEL TUBING: PRODUCT TYPE (MANUFACTURING METHOD) AND AS FOLLOWS:

1. COLD-FORMED STEEL TUBING: ASTM A 500.

D. STEEL PIPE: ASTM A 53, STANDARD WEIGHT (SCHEDULE 40), UNLESS OTHERWISE INDICATED, OR ANOTHER WEIGHT REQUIRED BY STRUCTURAL LOADS.

1. BLACK FINISH, UNLESS OTHERWISE INDICATED.

E. UNCOATED STRUCTURAL STEEL SHEET: PRODUCT TYPE (MANUFACTURING METHOD), QUALITY, AND GRADE AS FOLLOWS:

1. COLD-ROLLED STRUCTURAL STEEL SHEET: ASTM A 611, GRADE A, UNLESS OTHERWISE INDICATED OR REQUIRED BY DESIGN LOADING.

F. UNCOATED STEEL SHEET: COMMERCIAL QUALITY, PRODUCT TYPE (METHOD OF MANUFACTURE) AS FOLLOWS:

1. COLD-ROLLED STEEL SHEET: ASTM A 366/A 366M.

G. FLOOR DECK FOR SUB-PLATFORMS: FLAT PLATES WITH ANGLE REINFORCING ON TOP AS INDICATED ON DRAWINGS.

H. WELDING RODS AND BARE ELECTRODES: SELECT ACCORDING TO AWS SPECIFICATIONS FOR THE METAL ALLOY TO BE WELDED.

2.02 FASTENERS

A. GENERAL: PROVIDE PLATED FASTENERS COMPLYING WITH ASTM B 633, CLASS FE/ZN 25 FOR ELECTRODEPOSITED ZINC COATING, FOR EXTERIOR USE OR WHERE BUILT INTO EXTERIOR WALLS. SELECT FASTENERS FOR THE TYPE, GRADE, AND CLASS REQUIRED.

2.03 PAINT

A. SHOP PRIMER FOR FERROUS METAL: FAST-CURING, LEAD- AND CHROMATE-FREE, UNIVERSAL MODIFIED-ALKYD PRIMER COMPLYING WITH PERFORMANCE REQUIREMENTS OF FS TT-P-664, SELECTED FOR GOOD RESISTANCE TO NORMAL ATMOSPHERIC CORROSION,

COMPATIBILITY WITH FINISH PAINT SYSTEMS INDICATED, AND CAPABILITY TO PROVIDE A SOUND FOUNDATION FOR FIELD-APPLIED TOPCOATS DESPITE PROLONGED EXPOSURE.

2.04 EXTRUDED ABRASIVE NOSINGS FOR CONCRETE STAIRS

A. FABRICATE UNITS OF MATERIAL, SIZES, AND CONFIGURATIONS INDICATED. PROVIDE EXTRUDED ALUMINUM UNITS WITH ABRASIVE FILLER CONSISTING OF ALUMINUM OXIDE OR SILICON CARBIDE GRITS, OR A COMBINATION OF BOTH, IN AN EPOXY-RESIN BINDER. FURNISH IN LENGTHS AS REQUIRED TO ACCURATELY FIT EACH OPENING OR CONDITIONS, FULL STEP LENGTH LESS APPROXIMATELY 3” CLEARANCE AT EACH END.

1. PROVIDE RIBBED UNITS, WITH ABRASIVE FILLER STRIPS PROJECTING 1/16 INCH (1.5 MM) ABOVE THE ALUMINUM EXTRUSION.

B. MANUFACTURERS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE PRODUCTS BY THE FOLLOWING:

1. WOOSTER PRODUCTS INC.; SAFETY NOSING, SUPERGRIT, TYPE 231BF.

C. PROVIDE INTEGRAL ANCHORS FOR EMBEDDING UNITS IN CONCRETE, AS STANDARD WITH THE MANUFACTURER.

2.05 CONCRETE FILL AND REINFORCING MATERIALS

A. CONCRETE MATERIALS AND PROPERTIES: COMPLY WITH REQUIREMENTS OF DIVISION 3 SECTION "CAST-IN-PLACE CONCRETE" FOR NORMAL-WEIGHT, READY-MIXED CONCRETE WITH A MINIMUM 28-DAY COMPRESSIVE STRENGTH OF 3,000 PSI, UNLESS HIGHER STRENGTHS INDICATED.

B. REINFORCING BARS: ASTM A 615 (ASTM A 615M), GRADE 60 (GRADE 400), UNLESS OTHERWISE INDICATED.

2.06 FABRICATION, GENERAL

A. FORM STEEL STAIRS FROM MATERIALS OF SIZE, THICKNESS, AND SHAPES INDICATED, BUT NOT LESS THAN THAT NEEDED TO COMPLY WITH PERFORMANCE REQUIREMENTS INDICATED. WORK TO DIMENSIONS INDICATED OR ACCEPTED ON SHOP DRAWINGS, USING PROVEN DETAILS OF FABRICATION AND SUPPORT.

B. FORM EXPOSED WORK TRUE TO LINE AND LEVEL WITH ACCURATE ANGLES AND SURFACES AND STRAIGHT SHARP EDGES.

C. SHEAR AND PUNCH METALS CLEANLY AND ACCURATELY.

D. REMOVE SHARP OR ROUGH AREAS ON EXPOSED SURFACES.

E. EASE EXPOSED EDGES TO A RADIUS OF APPROXIMATELY 1/32 INCH (1 MM), UNLESS OTHERWISE INDICATED. FORM BENT-METAL CORNERS TO SMALLEST RADIUS POSSIBLE WITHOUT CAUSING GRAIN SEPARATION OR OTHERWISE IMPAIRING WORK.

F. WELD CORNERS AND SEAMS CONTINUOUSLY TO COMPLY WITH THE FOLLOWING:

1. USE MATERIALS AND METHODS THAT MINIMIZE DISTORTION AND DEVELOP STRENGTH AND CORROSION RESISTANCE OF BASE METALS.

2. OBTAIN FUSION WITHOUT UNDERCUT OR OVERLAP.

3. REMOVE WELDING FLUX IMMEDIATELY.

G. FORM EXPOSED CONNECTIONS WITH HAIRLINE JOINTS, FLUSH AND SMOOTH, USING CONCEALED FASTENERS WHEREVER POSSIBLE. USE EXPOSED FASTENERS OF TYPE INDICATED OR, IF NOT INDICATED, PHILLIPS FLAT-HEAD (COUNTERSUNK) SCREWS OR BOLTS. LOCATE JOINTS WHERE LEAST CONSPICUOUS.

H. SHOP ASSEMBLY: PREASSEMBLE IN SHOP TO GREATEST EXTENT POSSIBLE TO MINIMIZE FIELD SPLICING AND ASSEMBLY. USE CONNECTIONS THAT MAINTAIN STRUCTURAL VALUE OF JOINED PIECES. CLEARLY MARK UNITS FOR FIELD ASSEMBLY AND COORDINATED INSTALLATION.

I. FABRICATE JOINTS THAT WILL BE EXPOSED TO WEATHER IN A MANNER TO EXCLUDE WATER, OR PROVIDE WEEP HOLES WHERE WATER MAY ACCUMULATE.

2.07 STEEL-FRAMED STAIRS

A. GENERAL: CONSTRUCT STAIRS TO CONFORM TO SIZES AND ARRANGEMENTS INDICATED. JOIN PIECES TOGETHER BY WELDING, UNLESS OTHERWISE INDICATED. PROVIDE COMPLETE STAIR ASSEMBLIES, INCLUDING METAL FRAMING, HANGERS, COLUMNS, HANDRAILS, RAILING SYSTEMS, NEWELS, BALUSTERS, STRUTS, CLIPS, BRACKETS, BEARING PLATES, OR OTHER COMPONENTS NECESSARY FOR THE SUPPORT OF STAIRS AND PLATFORMS, AND AS REQUIRED TO ANCHOR AND CONTAIN THE STAIRS ON THE SUPPORTING STRUCTURE.

1. NAAMM STAIR STANDARD: COMPLY WITH "RECOMMENDED VOLUNTARY MINIMUM STANDARDS FOR FIXED METAL STAIRS" IN NAAMM "METAL STAIR MANUAL" FOR CLASS OF STAIR DESIGNATED, EXCEPT WHERE MORE STRINGENT REQUIREMENTS ARE INDICATED.

A. INDUSTRIAL CLASS, UNLESS OTHERWISE INDICATED.

B. STAIR FRAMING: FABRICATE INTERIOR STRINGERS OF STRUCTURAL STEEL PLATES OR TUBES AS INDICATED, NO CHANNELS ARE TO BE USED IN STAIR CONSTRUCTION FOR CLEANLINESS. CONSTRUCT PLATFORMS OF STRUCTURAL STEEL TUBES HEADERS AND MISCELLANEOUS FRAMING MEMBERS AS INDICATED. BOLT OR WELD HEADERS TO STRINGERS; AND BOLT OR WELD NEWELS AND FRAMING MEMBERS TO STRINGERS AND HEADERS. IF USING BOLTS, FABRICATE AND JOIN SO BOLTS ARE NOT EXPOSED ON FINISH SURFACES.

C. METAL PAN RISERS, SUB-TREADS, AND SUB-PLATFORMS: SHAPE METAL PANS FOR RISERS AND SUBTREADS TO CONFORM TO CONFIGURATION SHOWN. PROVIDE THICKNESSES OF STRUCTURAL STEEL SHEET FOR METAL PANS INDICATED, BUT NOT LESS THAN THAT REQUIRED, TO SUPPORT TOTAL DESIGN LOADING.

1. FORM METAL PANS OF UNCOATED COLD-ROLLED, HOT-ROLLED STEEL SHEET, UNLESS OTHERWISE INDICATED.

2. ATTACH RISERS AND SUB-TREADS TO STRINGERS WITH BRACKETS MADE OF STEEL ANGLES OR BARS. WELD BRACKETS TO STRINGERS AND ATTACH METAL PANS TO BRACKETS BY WELDING, RIVETING, OR BOLTING.

3. SHAPE METAL PANS TO INCLUDE NOSING INTEGRAL WITH RISER.

4. PROVIDE SUB-PLATFORMS OF CONFIGURATION AND CONSTRUCTION INDICATED; IN THICKNESSES REQUIRED TO SUPPORT DESIGN LOADING. ATTACH SUB-PLATFORM TO PLATFORM FRAMING MEMBERS WITH WELDS.

5. PROVIDE TOE PLATES AT OPEN-SIDED EDGES OF PLATFORMS.

D. SEALING: SEAL FILL ALL JOINTS AND CRACKS WITH SEALANT UNDERNEATH STAIR.

E. NOSING'S FOR CONCRETE STEPS: FURNISH FOR JOB SITE INSTALLATION.

F. EXTERIOR FLOOR GRATING TREADS AND PLATFORMS: PROVIDE PATTERNS, SPACING, AND BAR SIZES INDICATED; FABRICATE TO COMPLY WITH ANSI/NAAMM MBG 531 "METAL BAR GRATING MANUAL."

1. FABRICATE TREADS FROM WELDED STEEL GRATING WITH 1-1/2-BY-3/16-INCH BEARING BARS AT 13/16 INCH O.C. AND CROSS BARS AT 4 INCHES O.C.

2. SURFACE: SERRATED.

3. FINISH: GALVANIZED.

G. FABRICATE EXTERIOR GRATING TREADS WITH STEEL CHECKER PLATE NOSING AND WITH STEEL ANGLE OR STEEL PLATE CARRIER AT EACH END FOR STRINGER CONNECTIONS. BAND ALL RAW EDGES. SECURE TREADS TO STRINGERS WITH BOLTS.

H. FABRICATE EXTERIOR GRATING PLATFORMS WITH NOSING MATCHING THAT ON GRATING TREADS AT ALL LANDINGS. SECURE GRATING TO PLATFORM FRAME WITH WELDS.

2.08 FINISHES

A. GENERAL: FINISH METAL STAIRS AFTER ASSEMBLY.

1. COMPLY WITH NAAMM "METAL FINISHES MANUAL" FOR RECOMMENDATIONS ON APPLICATION AND DESIGNATIONS OF FINISHES.

B. PREPARATION FOR SHOP PRIMING: PREPARE UNCOATED FERROUS METAL SURFACES TO COMPLY WITH MINIMUM REQUIREMENTS INDICATED BELOW FOR SSPC SURFACE PREPARATION SPECIFICATIONS AND ENVIRONMENTAL EXPOSURE CONDITIONS OF INSTALLED UNITS:

1. EXTERIORS (SSPC ZONE 1B): SSPC SP 6 "COMMERCIAL BLAST CLEANING."

2. INTERIORS (SSPC ZONE 1A): SSPC SP 3 "POWER TOOL CLEANING."

C. APPLY SHOP PRIMER TO UNCOATED SURFACES, EXCEPT THOSE TO BE EMBEDDED IN CONCRETE OR MASONRY, UNLESS OTHERWISE INDICATED. COMPLY WITH REQUIREMENTS OF SSPC-PA 1 "PAINT APPLICATION SPECIFICATION NO. 1" FOR SHOP PAINTING.

1. STRIPE PAINT CORNERS, CREVICES, BOLTS, WELDS, AND SHARP EDGES.

PART 3 - EXECUTION

3.01 PREPARATION

A. COORDINATE AND FURNISH ANCHORAGES, SETTING DRAWINGS, DIAGRAMS, TEMPLATES, INSTRUCTIONS, AND DIRECTIONS FOR INSTALLING ANCHORAGES, INCLUDING CONCRETE INSERTS, WELD PLATES, AND ANCHOR BOLTS. COORDINATE DELIVERY OF SUCH ITEMS TO PROJECT SITE.

3.02 INSTALLATION, GENERAL

A. FASTENING TO IN-PLACE CONSTRUCTION: PROVIDE ANCHORAGE DEVICES AND FASTENERS WHERE NECESSARY FOR SECURING STEEL STAIRS TO IN-PLACE CONSTRUCTION; INCLUDE THREADED FASTENERS FOR CONCRETE AND MASONRY INSERTS, THROUGH-BOLTS, LAG BOLTS, AND OTHER CONNECTORS AS REQUIRED.

B. CUTTING, FITTING, AND PLACEMENT: PERFORM CUTTING, DRILLING, AND FITTING REQUIRED FOR INSTALLING STEEL STAIRS. SET UNITS ACCURATELY IN LOCATION, ALIGNMENT, AND ELEVATION; WITH EDGES AND SURFACES LEVEL, PLUMB, TRUE, AND FREE OF RACK; AND MEASURED FROM ESTABLISHED LINES AND LEVELS.

C. PROVIDE TEMPORARY BRACING OR ANCHORS IN FORMWORK FOR ITEMS THAT ARE TO BE BUILT INTO CONCRETE, MASONRY, OR SIMILAR CONSTRUCTION.

D. FIT EXPOSED CONNECTIONS ACCURATELY TOGETHER TO FORM HAIRLINE JOINTS. WELD CONNECTIONS THAT ARE NOT TO BE LEFT AS EXPOSED JOINTS BUT CANNOT BE SHOP-WELDED BECAUSE OF SHIPPING SIZE LIMITATIONS.

E. FIELD WELDING: COMPLY WITH THE FOLLOWING REQUIREMENTS:

1. USE MATERIALS AND METHODS THAT MINIMIZE DISTORTION AND DEVELOP STRENGTH AND CORROSION RESISTANCE OF BASE METALS.

2. OBTAIN FUSION WITHOUT UNDERCUT OR OVERLAP.

3. REMOVE WELDING FLUX IMMEDIATELY.

3.03 INSTALLING STEEL PIPE RAILINGS AND HANDRAILS

A. ADJUST HANDRAILS AND RAILING SYSTEMS PRIOR TO ANCHORING TO ENSURE MATCHING ALIGNMENT AT ABUTTING JOINTS. SPACE POSTS AT SPACING INDICATED OR, IF NOT INDICATED, AS REQUIRED BY DESIGN LOADINGS. PLUMB POSTS IN EACH DIRECTION. SECURE POSTS AND RAILING ENDS TO BUILDING CONSTRUCTION AS FOLLOWS:

1. ANCHOR POSTS TO STEEL BY WELDING DIRECTLY TO STEEL SUPPORTING MEMBERS.

2. ANCHOR HANDRAIL ENDS INTO CONCRETE AND MASONRY WITH STEEL ROUND FLANGES WELDED TO RAIL ENDS AND ANCHORED INTO WALL CONSTRUCTION WITH DRILLED-IN EXPANSION ANCHORS.

B. SECURE HANDRAILS TO WALL WITH WALL BRACKETS AND END FITTINGS. PROVIDE BRACKET WITH 1-1/2-INCH (38-MM) CLEARANCE FROM INSIDE FACE OF HANDRAIL AND FINISHED WALL SURFACE. LOCATE BRACKETS AS INDICATED OR, IF NOT INDICATED, AT SPACING REQUIRED TO SUPPORT STRUCTURAL LOADS. SECURE WALL BRACKETS AND WALL RETURN FITTINGS TO BUILDING CONSTRUCTION AS FOLLOWS:

1. USE TYPE OF BRACKET WITH PREDRILLED HOLE FOR EXPOSED BOLT ANCHORAGE.

2. FOR CONCRETE AND SOLID MASONRY ANCHORAGE, USE DRILLED-IN EXPANSION ANCHOR.

3. FOR HOLLOW MASONRY ANCHORAGE, USE TOGGLE BOLTS HAVING SQUARE HEADS.

3.04 ADJUSTING AND CLEANING

A. TOUCHUP PAINTING: CLEANING AND TOUCHUP PAINTING OF FIELD WELDS, BOLTED CONNECTIONS, AND ABRADED AREAS OF SHOP PAINT ON STEEL STAIRS ARE SPECIFIED IN DIVISION 9 SECTION "PAINTING."

B. UPON COMPLETION OF THE WORK OF THIS SECTION, REMOVE TOOLS AND ALL RUBBISH AND DEBRIS FROM THE WORK AREA; LEAVE AREA IN BROOM-CLEAN CONDITION.

END OF SECTION

SECTION 05 52 00

PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. DRAWINGS AND GENERAL PROVISIONS OF THE CONTRACT, INCLUDING GENERAL AND SUPPLEMENTARY CONDITIONS AND DIVISION 1 SPECIFICATION SECTIONS, APPLY TO THIS SECTION.

1.02 SUMMARY

A. THIS SECTION INCLUDES THE FOLLOWING:

1. STEEL PIPE AND TUBE HANDRAILS AND GUARD RAILINGS BOTH INTERIOR AND EXTERIOR.

B. RELATED SECTIONS INCLUDE THE FOLLOWING:

1. DIVISION 5 SECTION "METAL STAIRS" FOR STEEL PIPE HANDRAILS AND RAILINGS INCLUDED WITH METAL STAIRS.

1.03 PERFORMANCE REQUIREMENTS

A. GENERAL: IN ENGINEERING HANDRAILS AND RAILINGS TO WITHSTAND STRUCTURAL LOADS INDICATED, DETERMINE ALLOWABLE DESIGN WORKING STRESSES OF HANDRAIL AND RAILING MATERIALS BASED ON THE FOLLOWING:

1. STRUCTURAL STEEL: AISC S335, "SPECIFICATION FOR STRUCTURAL STEEL BUILDINGS ALLOWABLE STRESS DESIGN AND PLASTIC DESIGN WITH COMMENTARY."

B. STRUCTURAL PERFORMANCE OF HANDRAILS AND RAILINGS: PROVIDE HANDRAILS AND RAILINGS COMPLYING WITH REQUIREMENTS OF ASTM E 985 FOR STRUCTURAL PERFORMANCE, BASED ON TESTING PERFORMED ACCORDING TO ASTM E 894 AND ASTM E 935.

C. THERMAL MOVEMENTS: PROVIDE HANDRAILS AND RAILINGS THAT ALLOW FOR THERMAL MOVEMENTS RESULTING FROM THE FOLLOWING MAXIMUM CHANGE (RANGE) IN AMBIENT AND SURFACE TEMPERATURES BY PREVENTING BUCKLING, OPENING OF JOINTS, OVERSTRESSING OF COMPONENTS, FAILURE OF CONNECTIONS, AND OTHER DETRIMENTAL EFFECTS. BASE ENGINEERING CALCULATION ON SURFACE TEMPERATURES OF MATERIALS DUE TO BOTH SOLAR HEAT GAIN AND NIGHTTIME-SKY HEAT LOSS.

1. TEMPERATURE CHANGE (RANGE): 120 DEG F (67 DEG C), AMBIENT; 180 DEG F (100 DEG C), MATERIAL SURFACES.

D. CONTROL OF CORROSION: PREVENT GALVANIC ACTION AND OTHER FORMS OF CORROSION BY INSULATING METALS AND OTHER MATERIALS FROM DIRECT CONTACT WITH INCOMPATIBLE MATERIALS.

1.04 SUBMITTALS

A. PRODUCT DATA: FOR THE FOLLOWING:

1. MANUFACTURER'S PRODUCT LINES OF MECHANICALLY CONNECTED HANDRAILS AND RAILINGS.

2. GROUT, ANCHORING CEMENT, AND PAINT PRODUCTS.

B. SHOP DRAWINGS: SHOW FABRICATION AND INSTALLATION OF HANDRAILS AND RAILINGS. INCLUDE PLANS, ELEVATIONS, SECTIONS, COMPONENT DETAILS, AND ATTACHMENTS TO OTHER WORK.

1. FOR INSTALLED HANDRAILS AND RAILINGS INDICATED TO COMPLY WITH DESIGN LOADS, INCLUDE STRUCTURAL ANALYSIS DATA AND METHOD OF ACCOMMODATING THERMAL EXPANSION MOVEMENT OF EXTERIOR RAILS, SIGNED AND SEALED BY THE QUALIFIED PROFESSIONAL ENGINEER RESPONSIBLE FOR THEIR PREPARATION.

C. QUALIFICATION DATA: FOR FIRMS AND PERSONS SPECIFIED IN "QUALITY ASSURANCE" ARTICLE TO DEMONSTRATE THEIR CAPABILITIES AND EXPERIENCE. INCLUDE LISTS OF COMPLETED PROJECTS WITH PROJECT NAMES AND ADDRESSES, NAMES AND ADDRESSES OF ARCHITECTS AND OWNERS, AND OTHER INFORMATION SPECIFIED.

1.05 QUALITY ASSURANCE

A. PROFESSIONAL ENGINEER QUALIFICATIONS: A PROFESSIONAL ENGINEER WHO IS LEGALLY QUALIFIED TO PRACTICE IN JURISDICTION WHERE PROJECT IS LOCATED AND WHO IS EXPERIENCED IN PROVIDING ENGINEERING SERVICES OF THE KIND INDICATED. ENGINEERING SERVICES ARE DEFINED AS THOSE PERFORMED FOR INSTALLATIONS OF HANDRAILS AND RAILINGS THAT ARE SIMILAR TO THOSE INDICATED FOR THIS PROJECT IN MATERIAL, DESIGN, AND EXTENT.

B. SOURCE LIMITATIONS: OBTAIN EACH TYPE OF HANDRAIL AND RAILING THROUGH ONE SOURCE FROM A SINGLE MANUFACTURER.

1.06 STORAGE

A. STORE HANDRAILS AND RAILINGS IN A DRY, WELL-VENTILATED, WEATHER TIGHT PLACE.

1.07 PROJECT CONDITIONS

A. FIELD MEASUREMENTS: VERIFY HANDRAIL AND RAILING DIMENSIONS BY FIELD MEASUREMENTS BEFORE FABRICATION AND INDICATE MEASUREMENTS ON SHOP DRAWINGS. COORDINATE FABRICATION SCHEDULE WITH CONSTRUCTION PROGRESS TO AVOID DELAYING THE WORK.

1.08 COORDINATION

A. COORDINATE INSTALLATION OF ANCHORAGES FOR HANDRAILS AND RAILINGS. FURNISH SETTING DRAWINGS, TEMPLATES, AND DIRECTIONS FOR INSTALLING ANCHORAGES, INCLUDING SLEEVES, CONCRETE INSERTS, ANCHOR BOLTS, AND ITEMS WITH INTEGRAL ANCHORS, THAT ARE TO BE EMBEDDED IN CONCRETE OR MASONRY. DELIVER SUCH ITEMS TO PROJECT SITE IN TIME FOR INSTALLATION.

1.09 SCHEDULING

A. SCHEDULE INSTALLATION SO HANDRAILS AND RAILINGS ARE MOUNTED ONLY ON COMPLETED WALLS. DO NOT SUPPORT TEMPORARILY BY ANY MEANS THAT DOES NOT SATISFY STRUCTURAL PERFORMANCE REQUIREMENTS.

PART 2 - PRODUCTS

2.01 METALS

A. GENERAL: PROVIDE METAL FREE FROM PITTING, SEAM MARKS, ROLLER MARKS, STAINS,

DISCOLORATIONS, AND OTHER IMPERFECTIONS WHERE EXPOSED TO VIEW ON FINISHED UNITS.

B. STEEL AND IRON: PROVIDE STEEL AND IRON IN THE FORM INDICATED, COMPLYING WITH THE FOLLOWING REQUIREMENTS:

1. STEEL PIPE: ASTM A 53; FINISH, TYPE, AND WEIGHT CLASS AS FOLLOWS:

A. BLACK FINISH, UNLESS OTHERWISE INDICATED.

B. GALVANIZED FINISH FOR EXTERIOR INSTALLATIONS AND WHERE INDICATED.

C. TYPE F, OR TYPE S, GRADE A, STANDARD WEIGHT (SCHEDULE 40), UNLESS ANOTHER GRADE AND WEIGHT ARE REQUIRED BY STRUCTURAL LOADS.

2. STEEL TUBING: COLD-FORMED STEEL TUBING, ASTM A 500, GRADE A, UNLESS ANOTHER GRADE IS REQUIRED BY STRUCTURAL LOADS.

C. BRACKETS, FLANGES, AND ANCHORS: CAST OR FORMED METAL OF SAME TYPE OF MATERIAL AND FINISH AS SUPPORTED RAILS, UNLESS OTHERWISE INDICATED.

2.02 WELDING MATERIALS, FASTENERS, AND ANCHORS

A. WELDING ELECTRODES AND FILLER METAL: PROVIDE TYPE AND ALLOY OF FILLER METAL AND ELECTRODES AS RECOMMENDED BY PRODUCER OF METAL TO BE WELDED AND AS REQUIRED FOR COLOR MATCH, STRENGTH, AND COMPATIBILITY IN FABRICATED ITEMS.

B. FASTENERS FOR ANCHORING HANDRAILS AND RAILINGS TO OTHER CONSTRUCTION: SELECT FASTENERS OF TYPE, GRADE, AND CLASS REQUIRED TO PRODUCE CONNECTIONS SUITABLE FOR ANCHORING HANDRAILS AND RAILINGS TO OTHER TYPES OF CONSTRUCTION INDICATED AND CAPABLE OF WITHSTANDING DESIGN LOADS.

2.03 PAINT

A. SHOP PRIMERS: PROVIDE PRIMERS TO COMPLY WITH APPLICABLE REQUIREMENTS IN DIVISION 9 SECTION "PAINTING."

B. SHOP PRIMER FOR FERROUS METAL: FAST-CURING, LEAD- AND CHROMATE-FREE, UNIVERSAL MODIFIED-ALKYD PRIMER COMPLYING WITH PERFORMANCE REQUIREMENTS IN FS TT-P-664; SELECTED FOR GOOD RESISTANCE TO NORMAL ATMOSPHERIC CORROSION, COMPATIBILITY WITH FINISH PAINT SYSTEMS INDICATED, AND CAPABILITY TO PROVIDE A SOUND FOUNDATION FOR FIELD-APPLIED TOPCOATS DESPITE PROLONGED EXPOSURE.

C. SHOP PRIMER FOR GALVANIZED STEEL: ZINC-DUST, ZINC-OXIDE PRIMER FORMULATED FOR PRIMING ZINC-COATED STEEL AND FOR COMPATIBILITY WITH FINISH PAINT SYSTEMS INDICATED, AND COMPLYING WITH SSPC-PAINT 5.

D. BITUMINOUS PAINT: COLD-APPLIED ASPHALT MASTIC COMPLYING WITH SSPC-PAINT 12, EXCEPT CONTAINING NO ASBESTOS FIBERS, OR COLD-APPLIED ASPHALT EMULSION COMPLYING WITH ASTM D 1187.

2.04 GROUT AND ANCHORING CEMENT

A. NON-SHRINK, NONMETALLIC GROUT: PREMIXED, FACTORY-PACKAGED, NON-STAINING, NON-CORROSIVE, NONGASEOUS GROUT COMPLYING WITH ASTM C 1107. PROVIDE GROUT SPECIFICALLY RECOMMENDED BY MANUFACTURER FOR INTERIOR AND EXTERIOR APPLICATIONS.

B. EROSION-RESISTANT ANCHORING CEMENT: FACTORY-PACKAGED, NON-SHRINK, NON-STAINING, HYDRAULIC-CONTROLLED EXPANSION CEMENT FORMULATION FOR MIXING WITH WATER AT PROJECT SITE TO CREATE POURABLE ANCHORING, PATCHING, AND GROUTING COMPOUND. PROVIDE FORMULATION THAT IS RESISTANT TO EROSION FROM WATER EXPOSURE WITHOUT NEEDING PROTECTION BY A SEALER OR WATERPROOF COATING AND THAT IS RECOMMENDED BY MANUFACTURER FOR EXTERIOR USE.

2.05 FABRICATION

A. GENERAL: FABRICATE HANDRAILS AND RAILINGS TO COMPLY WITH REQUIREMENTS INDICATED FOR DESIGN, DIMENSIONS, MEMBER SIZES AND SPACING, DETAILS, FINISH, AND ANCHORAGE, BUT NOT LESS THAN THAT REQUIRED TO SUPPORT STRUCTURAL LOADS.

B. ASSEMBLE HANDRAILS AND RAILINGS IN THE SHOP TO GREATEST EXTENT POSSIBLE TO MINIMIZE FIELD SPLICING AND ASSEMBLY. DISASSEMBLE UNITS ONLY AS NECESSARY FOR SHIPPING AND HANDLING LIMITATIONS. CLEARLY MARK UNITS FOR REASSEMBLY AND COORDINATED INSTALLATION. USE CONNECTIONS THAT MAINTAIN STRUCTURAL VALUE OF JOINED PIECES.

C. FORM CHANGES IN DIRECTION OF RAILING MEMBERS AS FOLLOWS:

1. BY MITERING AT ELBOW BENDS.

D. WELDED CONNECTIONS: FABRICATE HANDRAILS AND RAILINGS FOR CONNECTING MEMBERS BY WELDING. COPE COMPONENTS AT PERPENDICULAR AND SKEW CONNECTIONS TO PROVIDE CLOSE FIT, OR USE FITTINGS DESIGNED FOR THIS PURPOSE. WELD CONNECTIONS CONTINUOUSLY TO COMPLY WITH THE FOLLOWING:

1. USE MATERIALS AND METHODS THAT MINIMIZE DISTORTION AND DEVELOP STRENGTH AND CORROSION RESISTANCE OF BASE METALS.

2. OBTAIN FUSION WITHOUT UNDERCUT OR OVERLAP.

3. REMOVE FLUX IMMEDIATELY.

4. AT EXPOSED CONNECTIONS, FINISH EXPOSED SURFACES SMOOTH AND BLENDED SO NO ROUGHNESS SHOWS AFTER FINISHING AND WELDED SURFACE MATCHES CONTOURS OF ADJOINING SURFACES.

E. NON-WELDED CONNECTIONS: FABRICATE HANDRAILS AND RAILINGS BY CONNECTING MEMBERS WITH CONCEALED MECHANICAL FASTENERS AND FITTINGS, UNLESS OTHERWISE INDICATED. FABRICATE MEMBERS AND FITTINGS TO PRODUCE FLUSH, SMOOTH, RIGID, HAIRLINE JOINTS.

1. FABRICATE SPLICE JOINTS FOR FIELD CONNECTION USING AN EPOXY STRUCTURAL ADHESIVE WHERE THIS IS MANUFACTURER'S STANDARD SPLICING METHOD.

F. PROVIDE INSERTS AND OTHER ANCHORAGE DEVICES FOR CONNECTING HANDRAILS AND RAILINGS TO CONCRETE OR MASONRY WORK. FABRICATE ANCHORAGE DEVICES CAPABLE OF WITHSTANDING LOADS IMPOSED BY HANDRAILS AND RAILINGS. COORDINATE ANCHORAGE DEVICES WITH SUPPORTING STRUCTURE.

G. FOR REMOVABLE RAILING POSTS, FABRICATE SLIP-FIT SOCKETS FROM STEEL TUBE WHOSE ID IS SIZED FOR A CLOSE FIT WITH POSTS; LIMIT MOVEMENT OF POST WITHOUT LATERAL LOAD, MEASURED AT TOP, TO NOT MORE THAN ONE-FORTIETH OF POST HEIGHT. PROVIDE SOCKET COVERS DESIGNED AND FABRICATED TO RESIST BEING DISLODGED.

1. PROVIDE CHAIN WITH EYE, SNAP HOOK, AND STAPLE ACROSS GAPS FORMED BY REMOVABLE RAILING SECTIONS AT LOCATIONS INDICATED. FABRICATE FROM SAME METAL AS RAILINGS.

H. SHEAR AND PUNCH METALS CLEANLY AND ACCURATELY. REMOVE BURRS FROM EXPOSED CUT EDGES.

I. EASE EXPOSED EDGES TO A RADIUS OF APPROXIMATELY 1/32 INCH (1 MM), UNLESS OTHERWISE INDICATED. FORM BENT-METAL CORNERS TO SMALLEST RADIUS POSSIBLE WITHOUT CAUSING GRAIN SEPARATION OR OTHERWISE IMPAIRING THE WORK.

J. CUT, REINFORCE, DRILL, AND TAP COMPONENTS, AS INDICATED, TO RECEIVE FINISH HARDWARE, SCREWS, AND SIMILAR ITEMS.

K. FABRICATE JOINTS THAT WILL BE EXPOSED TO WEATHER IN A WATERTIGHT MANNER.

L. CLOSE EXPOSED ENDS OF HANDRAIL AND RAILING MEMBERS WITH PREFABRICATED END FITTINGS.

M. PROVIDE WALL RETURNS AT ENDS OF WALL-MOUNTED HANDRAILS, UNLESS OTHERWISE INDICATED. CLOSE ENDS OF RETURNS.

N. TOE BOARDS: WHERE INDICATED, PROVIDE TOE BOARDS AT RAILINGS AROUND OPENINGS AND AT EDGE OF OPEN-SIDED FLOORS AND PLATFORMS. FABRICATE TO DIMENSIONS AND DETAILS INDICATED.

O. FILLERS: PROVIDE FILLERS MADE FROM STEEL PLATE, OR OTHER SUITABLY CRUSH-RESISTANT MATERIAL, WHERE NEEDED TO TRANSFER WALL BRACKET LOADS THROUGH WALL FINISHES TO STRUCTURAL SUPPORTS. SIZE FILLERS TO SUIT WALL FINISH THICKNESSES AND TO PRODUCE ADEQUATE BEARING AREA TO PREVENT BRACKET ROTATION AND OVERSTRESSING OF SUBSTRATE.

2.06 FINISHES, GENERAL

A. COMPLY WITH NAAMM'S "METAL FINISHES MANUAL FOR ARCHITECTURAL AND METAL PRODUCTS" FOR RECOMMENDATIONS FOR APPLYING AND DESIGNATING FINISHES.

B. APPEARANCE OF FINISHED WORK: VARIATIONS IN APPEARANCE OF ABUTTING OR ADJACENT PIECES ARE ACCEPTABLE IF THEY ARE WITHIN ONE-HALF OF THE RANGE OF APPROVED SAMPLES. NOTICEABLE VARIATIONS IN THE SAME PIECE ARE NOT ACCEPTABLE. VARIATIONS IN APPEARANCE OF OTHER COMPONENTS ARE ACCEPTABLE IF THEY ARE WITHIN THE RANGE OF APPROVED SAMPLES AND ARE ASSEMBLED OR INSTALLED TO MINIMIZE CONTRAST.

C. PROVIDE EXPOSED FASTENERS WITH FINISH MATCHING APPEARANCE, INCLUDING COLOR AND TEXTURE, OF HANDRAILS AND RAILINGS.

D. HOT-DIP GALVANIZING

1. SURFACE PREPARATION PRIOR TO GALVANIZING: PICKLE STEEL PRIOR TO GALVANIZING IN CONFORMANCE WITH SSPC-SP8. REMOVE ALL RUST, DIRT, WELD FLUX, WELD SPATTER, AND OTHER FOREIGN MATTER.

2. HOT-DIP GALVANIZING: PROVIDE COATING FOR STEEL FABRICATIONS APPLIED BY THE HOT-DIP PROCESS. COMPLY WITH ASTM A 123 FOR FABRICATED PRODUCTS AND ASTM A 153 FOR BOLTS, NUTS, WASHERS, AND OTHER ROUGH HARDWARE. PROVIDE THICKNESS OF GALVANIZING SPECIFIED IN REFERENCED STANDARDS.

A. WHEREVER POSSIBLE, PERFORM GALVANIZING AFTER ASSEMBLY OF ITEMS.

B. GALVANIZED ITEMS SHALL BE STRAIGHTENED TO REMOVE ALL WARPING AND DISTORTION CAUSED BY THE GALVANIZATION PROCESS.

C. TOUCH-UP OF GALVANIZED SURFACES WITH LIQUID ZINC COATING, SILVER PAINT, BRIGHT PAINT, OR ALUMINUM PAINTS IS NOT ACCEPTABLE.

2.07 STEEL FINISHES

A. GALVANIZED HANDRAILS AND RAILINGS: HOT-DIP GALVANIZE EXTERIOR STEEL AND IRON HANDRAILS AND RAILINGS TO COMPLY WITH ASTM A 123. HOT-DIP GALVANIZE HARDWARE FOR EXTERIOR STEEL AND IRON HANDRAILS AND RAILINGS TO COMPLY WITH ASTM A 153/A 153M.

B. FILL VENT AND DRAIN HOLES THAT WILL BE EXPOSED IN FINISHED WORK, UNLESS INDICATED TO REMAIN AS WEEP HOLES, BY PLUGGING WITH ZINC SOLDER AND FILING OFF SMOOTH.

C. FOR GALVANIZED HANDRAILS AND RAILINGS, PROVIDE GALVANIZED FITTINGS, BRACKETS, FASTENERS, SLEEVES, AND OTHER FERROUS COMPONENTS.

D. FOR NON-GALVANIZED STEEL HANDRAILS AND RAILINGS, PROVIDE NON-GALVANIZED FERROUS-METAL FITTINGS, BRACKETS, FASTENERS, AND SLEEVES, EXCEPT GALVANIZE ANCHORS TO BE EMBEDDED IN EXTERIOR CONCRETE OR MASONRY.

E. PREPARATION FOR SHOP PRIMING: AFTER GALVANIZING, THOROUGHLY CLEAN HANDRAILS AND RAILINGS OF GREASE, DIRT, OIL, FLUX, AND OTHER FOREIGN MATTER, AND TREAT WITH METALLIC-PHOSPHATE PROCESS.

F. PREPARATION FOR SHOP PRIMING: PREPARE UNCOATED FERROUS-METAL SURFACES TO COMPLY WITH MINIMUM REQUIREMENTS INDICATED BELOW FOR SSPC SURFACE-PREPARATION SPECIFICATIONS AND ENVIRONMENTAL EXPOSURE CONDITIONS OF INSTALLED HANDRAILS AND RAILINGS:

1. EXTERIORS (SSPC ZONE 1B): SSPC-SP 6, "COMMERCIAL BLAST CLEANING."

2. INTERIORS (SSPC ZONE 1A): SSPC-SP 7, "BRUSH-OFF BLAST CLEANING."

G. APPLY SHOP PRIMER TO PREPARED SURFACES OF HANDRAIL AND RAILING COMPONENTS, UNLESS OTHERWISE INDICATED. COMPLY WITH REQUIREMENTS IN SSPC-PA 1, "PAINT APPLICATION SPECIFICATION NO. 1," FOR SHOP PAINTING. PRIMER NEED NOT BE APPLIED TO SURFACES TO BE EMBEDDED IN CONCRETE OR MASONRY.

PART 3 - EXECUTION

3.01 EXAMINATION

A. EXAMINE PLASTER AND GYPSUM BOARD ASSEMBLIES, WHERE REINFORCED TO RECEIVE ANCHORS, TO VERIFY THAT LOCATIONS OF CONCEALED REINFORCEMENTS HAVE BEEN CLEARLY MARKED FOR INSTALLER. LOCATE REINFORCEMENTS AND MARK LOCATIONS IF NOT ALREADY DONE.

3.02 INSTALLATION, GENERAL

A. FIT EXPOSED CONNECTIONS TOGETHER TO FORM TIGHT, HAIRLINE JOINTS.

B. PERFORM CUTTING, DRILLING, AND FITTING REQUIRED TO INSTALL HANDRAILS AND RAILINGS. SET HANDRAILS AND RAILINGS ACCURATELY IN LOCATION, ALIGNMENT, AND ELEVATION; MEASURED FROM ESTABLISHED LINES AND LEVELS AND FREE FROM RACK.

1. DO NOT WELD, CUT, OR ABRADE SURFACES OF HANDRAIL AND RAILING COMPONENTS THAT HAVE BEEN COATED OR FINISHED AFTER FABRICATION AND THAT ARE INTENDED FOR FIELD CONNECTION BY MECHANICAL OR OTHER MEANS WITHOUT FURTHER CUTTING OR FITTING.

2. SET POSTS PLUMB WITHIN A TOLERANCE OF 1/16 INCH IN 3 FEET (2 MM IN 1 M).

3. ALIGN RAILS SO VARIATIONS FROM LEVEL FOR HORIZONTAL MEMBERS AND FROM PARALLEL WITH RAKE OF STEPS AND RAMPS FOR SLOPING MEMBERS DO NOT EXCEED 1/4 INCH IN 12 FEET (5 MM IN 3 M).

C. ADJUST HANDRAILS AND RAILINGS BEFORE ANCHORING TO ENSURE MATCHING ALIGNMENT AT ABUTTING JOINTS. SPACE POSTS AT INTERVAL INDICATED, BUT NOT LESS THAN THAT REQUIRED BY STRUCTURAL LOADS.

3.03 RAILING CONNECTIONS

A. WELDED CONNECTIONS: USE FULLY WELDED JOINTS FOR PERMANENTLY CONNECTING RAILING COMPONENTS. COMPLY WITH REQUIREMENTS FOR WELDED CONNECTIONS IN "FABRICATION" ARTICLE WHETHER WELDING IS PERFORMED IN THE SHOP OR IN THE FIELD.

B. EXPANSION JOINTS: INSTALL EXPANSION JOINTS AT LOCATIONS INDICATED BUT NOT FARTHER APART THAN REQUIRED TO ACCOMMODATE THERMAL MOVEMENT. PROVIDE SLIP-JOINT INTERNAL SLEEVE EXTENDING 2 INCHES (50 MM) BEYOND JOINT ON EITHER SIDE, FASTEN INTERNAL SLEEVE SECURELY TO ONE SIDE, AND LOCATE JOINT WITHIN 6 INCHES (150 MM) OF POST.

3.04 ANCHORING POSTS

A. FORM OR CORE-DRILL HOLES NOT LESS THAN 5 INCHES (125 MM) DEEP AND 3/4 INCH (20 MM) LARGER THAN OD OF POST FOR INSTALLING POSTS IN CONCRETE. CLEAN HOLES OF LOOSE MATERIAL, INSERT POSTS, AND FILL ANNULAR SPACE BETWEEN POST AND CONCRETE WITH THE FOLLOWING ANCHORING MATERIAL, MIXED AND PLACED TO COMPLY WITH ANCHORING MATERIAL MANUFACTURER'S WRITTEN INSTRUCTIONS:

1. NON-SHRINK, NONMETALLIC GROUT.

B. LEAVE ANCHORAGE JOINT EXPOSED; WIPE OFF SURPLUS ANCHORING MATERIAL; AND LEAVE 1/8-INCH (3-MM) BUILD-UP, SLOPED AWAY FROM POST.

1. FOR STEEL PIPE RAILINGS, WELD FLANGES TO POST TO METAL SUPPORTING SURFACES.

C. INSTALL REMOVABLE RAILING SECTIONS, WHERE INDICATED, IN SLIP-FIT METAL SOCKETS.

3.05 ATTACHING HANDRAILS TO WALLS

A. ATTACH HANDRAILS TO WALL WITH WALL BRACKETS. PROVIDE BRACKET WITH 1-1/2-INCH (38-MM) CLEARANCE FROM INSIDE FACE OF HANDRAIL AND FINISHED WALL SURFACE.

B. LOCATE BRACKETS AS INDICATED OR, IF NOT INDICATED, AT SPACING REQUIRED TO

SUPPORT STRUCTURAL LOADS.

C. SECURE WALL BRACKETS TO BUILDING CONSTRUCTION AS FOLLOWS:

1. FOR CONCRETE AND SOLID MASONRY ANCHORAGE, USE DRILLED-IN EXPANSION SHIELDS AND HANGER OR LAG BOLTS.

2. FOR HOLLOW MASONRY ANCHORAGE, USE TOGGLE BOLTS.

3.06 CLEANING

A. TOUCHUP PAINTING: CLEANING AND TOUCHUP PAINTING OF FIELD WELDS, BOLTED CONNECTIONS, AND ABRADED AREAS OF SHOP PAINT ARE SPECIFIED IN DIVISION 9 SECTION "PAINTING."

3.07 PROTECTION

A. PROTECT FINISHES OF HANDRAILS AND RAILINGS FROM DAMAGE DURING CONSTRUCTION PERIOD WITH TEMPORARY PROTECTIVE COVERINGS APPROVED BY RAILING MANUFACTURER. REMOVE PROTECTIVE COVERINGS AT THE TIME OF SUBSTANTIAL COMPLETION.

B. RESTORE FINISHES DAMAGED DURING INSTALLATION AND CONSTRUCTION PERIOD SO NO EVIDENCE REMAINS OF CORRECTION WORK. RETURN ITEMS THAT CANNOT BE REFINISHED IN THE FIELD TO THE SHOP; MAKE REQUIRED ALTERATIONS AND REFINISH ENTIRE UNIT, OR PROVIDE NEW UNITS.

END OF SECTION

SECTION 05 53 00

GRATINGS

PART 1 - GENERAL

1.01 SUMMARY

A. THIS SECTION INCLUDES THE FOLLOWING:

1. METAL BAR GRATINGS.

2. METAL FRAMES AND SUPPORTS FOR GRATINGS.

B. RELATED SECTIONS INCLUDE THE FOLLOWING:

1. DIVISION 5 SECTION "STRUCTURAL STEEL" FOR STRUCTURAL-STEEL FRAMING SYSTEM COMPONENTS.

2. DIVISION 5 SECTION "METAL STAIRS" FOR STEEL-FRAMED STAIRS WITH GRATING TREADS.

3. DIVISION 5 SECTION "PIPE AND TUBE RAILINGS" FOR METAL PIPE AND TUBE HANDRAILS AND RAILINGS.

1.02 PERFORMANCE REQUIREMENTS

A. STRUCUTRAL PERFORMANCE: PROVIDE GRATINGS CAPABLE OF WITHSTANDING THE FOLLOWING STRUCTURAL LOADS WITHOUT EXCEEDING THE ALLOWABLE DESIGN WORKING STRESS OF THE MATERIALS INVOLVED, INCLUDING ANCHORS AND CONNECTIONS:

1. FLOORS: CAPABLE OF WITHSTANDING A UNIFORM LOAD OF 100 LBF/SQ. FT. OR A CONCENTRATED LOAD OF 2000 LBF (8.90 KN), WHICHEVER PRODUCES THE GREATER STRESS.

1.03 SUBMITTALS

A. PRODUCT DATA: FOR THE FOLLOWING:

1. FORMED-METAL PLANK GRATINGS.

2. CLIPS AND ANCHORAGE DEVICES FOR GRATINGS.

3. PAINT PRODUCTS.

B. SHOP DRAWINGS: SHOW FABRICATION AND INSTALLATION DETAILS FOR GRATINGS. INCLUDE PLANS, ELEVATIONS, SECTIONS, AND DETAILS OF CONNECTIONS. SHOW ANCHORAGE AND ACCESSORY ITEMS. PROVIDE TEMPLATES FOR ANCHORS AND BOLTS SPECIFIED FOR INSTALLATION UNDER OTHER SECTIONS.

1. FOR INSTALLED PRODUCTS INDICATED TO COMPLY WITH DESIGN LOADS, INCLUDE STRUCTURAL ANALYSIS DATA SIGNED AND SEALED BY THE QUALIFIED PROFESSIONAL ENGINEER RESPONSIBLE FOR THEIR PREPARATION.

C. MILL CERTIFICATES: SIGNED BY MANUFACTURERS OF STAINLESS-STEEL SHEET CERTIFYING THAT PRODUCTS FURNISHED COMPLY WITH REQUIREMENTS.

D. WELDING CERTIFICATES: COPIES OF CERTIFICATES FOR WELDING PROCEDURES AND PERSONNEL.

E. QUALIFICATION DATA: FOR FIRMS AND PERSONS SPECIFIED IN "QUALITY ASSURANCE"

ARTICLE TO DEMONSTRATE THEIR CAPABILITIES AND EXPERIENCE. INCLUDE LISTS OF COMPLETED PROJECTS WITH PROJECT NAMES AND ADDRESSES, NAMES AND ADDRESSES OF ARCHITECTS AND OWNERS, AND OTHER INFORMATION SPECIFIED.

1.04 QUALITY ASSURANCE

A. PROFESSIONAL ENGINEER QUALIFICATIONS: A PROFESSIONAL ENGINEER WHO IS LEGALLY QUALIFIED TO PRACTICE IN JURISDICTION WHERE PROJECT IS LOCATED AND WHO IS EXPERIENCED IN PROVIDING ENGINEERING SERVICES OF THE KIND INDICATED. ENGINEERING SERVICES ARE DEFINED AS THOSE PERFORMED FOR INSTALLATIONS OF GRATINGS THAT ARE SIMILAR TO THOSE INDICATED FOR THIS PROJECT IN MATERIAL, DESIGN, AND EXTENT.

B. FABRICATOR QUALIFICATIONS: A FIRM EXPERIENCED IN PRODUCING GRATINGS SIMILAR TO THOSE INDICATED FOR THIS PROJECT AND WITH A RECORD OF SUCCESSFUL IN-SERVICE PERFORMANCE, AS WELL AS SUFFICIENT PRODUCTION CAPACITY TO PRODUCE REQUIRED UNITS.

C. METAL BAR GRATING STANDARDS: COMPLY WITH APPLICABLE REQUIREMENTS OF THE FOLLOWING:

1. NON-HEAVY-DUTY METAL BAR GRATINGS: COMPLY WITH NAAMM MBG 531, "METAL BAR GRATING MANUAL FOR STEEL, STAINLESS STEEL, AND ALUMINUM GRATINGS AND STAIR TREADS."

2. HEAVY-DUTY METAL BAR GRATINGS: COMPLY WITH NAAMM MBG 532, "HEAVY-DUTY METAL BAR GRATING MANUAL."

D. WELDING: QUALIFY PROCEDURES AND PERSONNEL ACCORDING TO THE FOLLOWING:

1. AWS D1.1, "STRUCTURAL WELDING CODE--STEEL."

2. CERTIFY THAT EACH WELDER HAS SATISFACTORILY PASSED AWS QUALIFICATION TESTS FOR WELDING PROCESSES INVOLVED AND, IF PERTINENT, HAS UNDERGONE RECERTIFICATION.

1.05 PROJECT CONDITIONS

A. FIELD MEASUREMENTS: WHERE GRATINGS ARE INDICATED TO FIT TO OTHER CONSTRUCTION, VERIFY DIMENSIONS OF OTHER CONSTRUCTION BY FIELD MEASUREMENTS BEFORE FABRICATION AND INDICATE MEASUREMENTS ON SHOP DRAWINGS. COORDINATE FABRICATION SCHEDULE WITH CONSTRUCTION PROGRESS TO AVOID DELAYING THE WORK.

1. ESTABLISHED DIMENSIONS: WHERE FIELD MEASUREMENTS CANNOT BE MADE WITHOUT DELAYING THE WORK, ESTABLISH DIMENSIONS AND PROCEED WITH FABRICATING GRATINGS WITHOUT FIELD MEASUREMENTS. COORDINATE CONSTRUCTION TO ENSURE THAT ACTUAL DIMENSIONS CORRESPOND TO ESTABLISHED DIMENSIONS. ALLOW FOR TRIMMING AND FITTING.

1.06 COORDINATION

A. COORDINATE INSTALLATION OF ANCHORAGES FOR GRATINGS, GRATING FRAMES, AND SUPPORTS. FURNISH SETTING DRAWINGS, TEMPLATES, AND DIRECTIONS FOR INSTALLING ANCHORAGES, INCLUDING SLEEVES, CONCRETE INSERTS, ANCHOR BOLTS, AND ITEMS WITH INTEGRAL ANCHORS, THAT ARE TO BE EMBEDDED IN CONCRETE OR MASONRY. DELIVER SUCH ITEMS TO PROJECT SITE IN TIME FOR INSTALLATION.

PART 2 - PRODUCTS

SECTION 05 53 00

GRATINGS

2.01 FERROUS METALS

A. STEEL PLATES, SHAPES, AND BARS: ASTM A 36/A 36M.

B. WIRE ROD FOR GRATING CROSSBARS: ASTM A 510 (ASTM A 510M).

C. GALVANIZED STEEL SHEET: ASTM A 653/A 653M, STRUCTURAL QUALITY, GRADE 33 (GRADE 230), WITH G90 (Z275) COATING.

D. WELDING RODS AND BARE ELECTRODES: SELECT ACCORDING TO AWS SPECIFICATIONS FOR METAL ALLOY TO BE WELDED.

2.02 PAINT

A. GALVANIZING REPAIR PAINT: HIGH-ZINC-DUST-CONTENT PAINT FOR REGALVANIZING WELDS IN STEEL, COMPLYING WITH SSPC-PAINT 20.

2.03 FASTENERS

A. GENERAL: PROVIDE TYPE 304 OR 316 STAINLESS-STEEL FASTENERS FOR EXTERIOR USE AND ZINC-PLATED FASTENERS WITH COATING COMPLYING WITH ASTM B 633, CLASS FE/ZN 5, WHERE BUILT INTO EXTERIOR WALLS. SELECT FASTENERS FOR TYPE, GRADE, AND CLASS REQUIRED.

2.04 FABRICATION

A. SHOP ASSEMBLY: FABRICATE GRATING SECTIONS IN SHOP TO GREATEST EXTENT POSSIBLE TO MINIMIZE FIELD SPLICING AND ASSEMBLY. DISASSEMBLE UNITS ONLY AS NECESSARY FOR SHIPPING AND HANDLING LIMITATIONS. USE CONNECTIONS THAT MAINTAIN STRUCTURAL VALUE OF JOINED PIECES. CLEARLY MARK UNITS FOR REASSEMBLY AND COORDINATED INSTALLATION.

B. FORM FROM MATERIALS OF SIZE, THICKNESS, AND SHAPES INDICATED, BUT NOT LESS THAN THAT NEEDED TO SUPPORT INDICATED LOADS.

C. SHEAR AND PUNCH METALS CLEANLY AND ACCURATELY. REMOVE BURRS.

D. EASE EXPOSED EDGES TO A RADIUS OF APPROXIMATELY 1/32 INCH (1 MM), UNLESS OTHERWISE INDICATED.

E. FIT EXPOSED CONNECTIONS ACCURATELY TOGETHER TO FORM HAIRLINE JOINTS.

F. WELDING: COMPLY WITH AWS RECOMMENDATIONS AND THE FOLLOWING:

1. OBTAIN FUSION WITHOUT UNDERCUT OR OVERLAP.

2. REMOVE WELDING FLUX IMMEDIATELY.

G. PROVIDE FOR ANCHORAGE OF TYPE INDICATED; COORDINATE WITH SUPPORTING STRUCTURE. FABRICATE AND SPACE ANCHORING DEVICES TO SECURE GRATINGS, FRAMES, AND SUPPORTS RIGIDLY IN PLACE AND TO SUPPORT INDICATED LOADS.

2.05 METAL BAR GRATINGS

A. FABRICATE WELDED, HEAVY-DUTY STEEL GRATINGS AS FOLLOWS: 1 ½" X 1/8" BEARING BARS AT 1 3/16" O.C. CROSS BARS AT 4" O.C.

B. TRAFFIC SURFACE FOR STEEL BAR GRATINGS: PLAIN.

C. STEEL FINISH: GALVANIZED.

D. FABRICATE REMOVABLE GRATING SECTIONS WITH BANDING BARS ATTACHED BY WELDING TO ENTIRE PERIMETER OF EACH SECTION. INCLUDE ANCHORS AND FASTENERS OF TYPE INDICATED OR, IF NOT INDICATED, AS RECOMMENDED BY MANUFACTURER FOR ATTACHING TO SUPPORTS.

1. PROVIDE NOT LESS THAN FOUR WELD LUGS FOR EACH HEAVY-DUTY GRATING SECTION, WITH EACH LUG SHOP WELDED TO TWO BEARING BARS 3/16 INCH OR LESS IN THICKNESS AND SPACED NOT LESS THAN 15/16 INCH O.C., WITH EACH CLIP DESIGNED AND FABRICATED TO FIT OVER 2 BEARING BARS.

2. FURNISH SELF-DRILLING FASTENERS WITH WASHERS FOR SECURING GRATING TO SUPPORTS.

3. FURNISH GALVANIZED MALLEABLE-IRON FLANGE CLAMP WITH GALVANIZED BOLT FOR SECURING GRATING TO SUPPORTS. FURNISH AS A SYSTEM DESIGNED TO BE INSTALLED FROM ABOVE GRATING BY ONE PERSON.

A. AVAILABLE PRODUCT: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, A PRODUCT THAT MAY BE INCORPORATED INTO THE WORK INCLUDES, BUT IS NOT LIMITED TO, "GRATE-FAST" BY STRUCT-FAST INC.

E. FABRICATE CUTOUTS IN GRATING SECTIONS FOR PENETRATIONS INDICATED. ARRANGE CUTOUTS TO PERMIT GRATING REMOVAL WITHOUT DISTURBING ITEMS PENETRATING GRATINGS.

1. EDGE-BAND OPENINGS IN GRATING THAT INTERRUPT FOUR OR MORE BEARING BARS WITH BARS OF THE SAME SIZE AND MATERIAL AS BEARING BARS.

F. DO NOT NOTCH BEARING BARS AT SUPPORTS TO MAINTAIN ELEVATION.

2.06 FINISHES

A. COMPLY WITH NAAMM'S "METAL FINISHES MANUAL FOR ARCHITECTURAL AND METAL PRODUCTS" FOR RECOMMENDATIONS FOR APPLYING AND DESIGNATING FINISHES.

B. FINISH GRATINGS, FRAMES, AND SUPPORTS AFTER ASSEMBLY.

C. GALVANIZING: FOR THOSE ITEMS INDICATED FOR GALVANIZING, APPLY ZINC COATING BY THE HOT-DIP PROCESS COMPLYING WITH ASTM A 123.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

A. FASTENING TO IN-PLACE CONSTRUCTION: PROVIDE ANCHORAGE DEVICES AND FASTENERS WHERE NECESSARY FOR SECURING GRATINGS TO IN-PLACE CONSTRUCTION. INCLUDE THREADED FASTENERS FOR CONCRETE AND MASONRY INSERTS, THROUGH-BOLTS, LAG BOLTS, AND OTHER CONNECTORS.

B. CUTTING, FITTING, AND PLACEMENT: PERFORM CUTTING, DRILLING, AND FITTING REQUIRED FOR INSTALLING GRATINGS. SET UNITS ACCURATELY IN LOCATION, ALIGNMENT,

AND ELEVATION; MEASURED FROM ESTABLISHED LINES AND LEVELS AND FREE FROM RACK.

C. PROVIDE TEMPORARY BRACING OR ANCHORS IN FORMWORK FOR ITEMS THAT ARE TO BE BUILT INTO CONCRETE OR MASONRY.

D. FIT EXPOSED CONNECTIONS ACCURATELY TOGETHER TO FORM HAIRLINE JOINTS. WELD CONNECTIONS THAT ARE NOT TO BE LEFT AS EXPOSED JOINTS BUT CANNOT BE SHOP WELDED BECAUSE OF SHIPPING SIZE LIMITATIONS. DO NOT WELD, CUT, OR ABRADE THE SURFACES OF EXTERIOR UNITS THAT HAVE BEEN HOT-DIP GALVANIZED AFTER FABRICATION AND ARE FOR BOLTED OR SCREWED FIELD CONNECTIONS.

E. FIELD WELDING: COMPLY WITH THE FOLLOWING REQUIREMENTS:

1. USE MATERIALS AND METHODS THAT MINIMIZE DISTORTION AND DEVELOP STRENGTH AND CORROSION RESISTANCE OF BASE METALS

2. OBTAIN FUSION WITHOUT UNDERCUT OR OVERLAP.

3. REMOVE WELDING FLUX IMMEDIATELY.

3.02 INSTALLING METAL BAR GRATINGS

A. GENERAL: INSTALL GRATINGS TO COMPLY WITH RECOMMENDATIONS OF REFERENCED METAL BAR GRATING STANDARDS THAT APPLY TO GRATING TYPES AND BAR SIZES INDICATED, INCLUDING INSTALLATION CLEARANCES AND STANDARD ANCHORING DETAILS.

B. ATTACH REMOVABLE UNITS TO SUPPORTING MEMBERS WITH TYPE AND SIZE OF CLIPS AND FASTENERS INDICATED OR, IF NOT INDICATED, AS RECOMMENDED BY GRATING MANUFACTURER FOR TYPE OF INSTALLATION CONDITIONS SHOWN.

C. ATTACH NON-REMOVABLE UNITS TO SUPPORTING MEMBERS BY WELDING WHERE BOTH MATERIALS ARE THE SAME; OTHERWISE, FASTEN BY BOLTING AS INDICATED ABOVE.

3.03 ADJUSTING AND CLEANING

A. GALVANIZED SURFACES: CLEAN FIELD WELDS, BOLTED CONNECTIONS, AND ABRADED AREAS AND REPAIR GALVANIZING TO COMPLY WITH ASTM A 780

END OF SECTION

SECTION 06 10 00

ROUGH CARPENTRY

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. CONSTRUCTION DRAWINGS, SPECIFICATIONS AND PROVISIONS OF THE CONTRACT INCLUDING GENERAL AND SUPPLEMENTAL CONDITIONS AND OTHER DIVISION 01 SPECIFICATION SECTIONS, ARE HEREBY MADE A PART OF THIS SECTION AS FULLY AND COMPLETELY AS IF REPEATED HEREIN.

1.02 ITEMS REQUIRED BUT NOT SPECIFIED

A. IF AN ITEM OR MATERIAL OF THIS TRADE IS INDICATED ON THE DRAWINGS BUT NOT SPECIFICALLY LISTED IN THIS SECTION, PROVIDE SUCH ITEM OR MATERIAL AT A STANDARD OF QUALITY EQUAL TO THE STANDARD ESTABLISHED FOR THE BALANCE OF THE WORK SPECIFIED, IN ACCORDANCE WITH THE ARCHITECT'S INTERPRETATION.

1.03 EXECUTION, CORRELATION AND INTENT

A. IN CASE OF AN INCONSISTENCY BETWEEN DRAWINGS AND SPECIFICATIONS, OR WITHIN EITHER DOCUMENT NOT CLARIFIED BY ADDENDUM, THE BETTER QUALITY OR GREATER QUANTITY OF WORK IS TO BE PROVIDED, IN ACCORDANCE WITH THE ARCHITECT'S INTERPRETATION.

1.04 SUMMARY

A. THIS SECTION INCLUDES THE FOLLOWING:

1. PRESSURE TREATED WOOD BLOCKING, CANTS AND NAILERS.

2. PRESSURE TREATED SUPPORT CURBS.

3. ALL WOOD GROUNDS FOR FASTENERS, FLASHING, GRILLS, ETC IS TO BE CONSTRUCTED FROM PRESSURE TREATED LUMBER.

4. MISCELLANEOUS PRESSURE TREATED LUMBER FOR ATTACHMENT AND SUPPORT OF OTHER WORK.

5. WOOD FURRING AND GROUNDS.

6. PLYWOOD BACKING PANELS.

7. APPROPRIATE CORROSION RESISTANT ROUGH INSTALLATION HARDWARE, INCLUDING BOLTS, SCREWS, SPIKES, NAILS AND CONNECTION ASSEMBLIES AS NEEDED FOR INSTALLATION OF THE ROUGH CARPENTRY WORK.

B. RELATED SECTIONS:

1. SECTION 06 4020 - INTERIOR ARCHITECTURAL WOODWORK

2. SECTION 07 7100 - MANUFACTURED ROOF SPECIALTIES

3. SECTION 08 1100 - HOLLOW METAL DOORS AND FRAMES

4. SECTION 08 3800 - SPECIALTY DOORS

6. SECTION 10 1550 - TOILET COMPARTMENTS

7. SECTION 10 8010 - TOILET ACCESSORIES

1.05 DEFFINITIONS

A. ROUGH CARPENTRY: CARPENTRY WORK NOT SPECIFIED IN OTHER SECTIONS AND NOT EXPOSED, UNLESS OTHERWISE INDICATED.

B. EXPOSED FRAMING: DIMENSION LUMBER NOT CONCEALED BY OTHER CONSTRUCTION.

C. LUMBER GRADING AGENCIES, AND THE ABBREVIATIONS USED TO REFERENCE THEM, INCLUDE THE FOLLOWING:

1. NELMA - NORTHEASTERN LUMBER MANUFACTURERS ASSOCIATION.

2. NLGA - NATIONAL LUMBER GRADES AUTHORITY.

3. RIS - REDWOOD INSPECTION SERVICE.

4. SPIB - SOUTHERN PINE INSPECTION BUREAU.

5. WCLIP - WEST COAST LUMBER INSPECTION BUREAU.

6. WWPA - WESTERN WOOD PRODUCTS ASSOCIATION.

1.06 SUBMITTALS

A. SUBMIT THE FOLLOWING UNDER THE PROVISIONS OF DIVISION 01:

1. PRODUCT DATA: FOR EACH TYPE OF PROCESS AND FACTORY-FABRICATED PRODUCT. INDICATE COMPONENT MATERIALS AND DIMENSIONS AND INCLUDE CONSTRUCTION AND APPLICATION DETAILS.

A. INCLUDE DATA FOR WOOD-PRESERVATIVE TREATMENT FROM CHEMICAL TREATMENT MANUFACTURER AND CERTIFICATION BY TREATING PLANT THAT TREATED MATERIALS COMPLY WITH REQUIREMENTS. INDICATE TYPE OF WOOD PRESERVATIVE TREATMENT USED, TREATMENT METHOD, NET AMOUNT OF PRESERVATIVE RETAINED, CHEMICAL TREATMENT MANUFACTURER'S WRITTEN INSTRUCTIONS FOR HANDLING, STORING, INSTALLING, AND FINISHING TREATED MATERIAL AND CONFORMANCE TO THE REQUIREMENTS SPECIFIED HEREIN.

B. INCLUDE DATA FOR FIRE-RETARDANT TREATMENT FROM CHEMICAL TREATMENT MANUFACTURER AND CERTIFICATION BY TREATING PLANT THAT TREATED MATERIALS COMPLY WITH REQUIREMENTS. INCLUDE PHYSICAL PROPERTIES OF TREATED MATERIALS, BOTH BEFORE AND AFTER EXPOSURE TO ELEVATED TEMPERATURES WHEN TESTED ACCORDING TO ASTM D 5516 AND ASTM D 5664.

C. FOR PRODUCTS RECEIVING A WATERBORNE TREATMENT, INCLUDE STATEMENT THAT MOISTURE CONTENT OF TREATED MATERIALS WAS REDUCED TO LEVELS SPECIFIED BEFORE SHIPMENT TO PROJECT SITE.

D. INCLUDE COPIES OF WARRANTIES FROM CHEMICAL TREATMENT MANUFACTURERS FOR EACH TYPE OF TREATMENT.

2. MATERIAL CERTIFICATES: FOR DIMENSION LUMBER SPECIFIED TO COMPLY WITH MINIMUM ALLOWABLE UNIT STRESSES. INDICATE SPECIES AND GRADE SELECTED FOR EACH

USE AND DESIGN VALUES APPROVED BY THE AMERICAN LUMBER STANDARDS COMMITTEE BOARD OF REVIEW.

3. RESEARCH/EVALUATION REPORTS: FOR THE FOLLOWING, SHOWING COMPLIANCE WITH BUILDING CODE IN EFFECT FOR PROJECT:

A. PRESERVATIVE-TREATED WOOD.

B. FIRE-RETARDANT-TREATED WOOD.

1.07 QUALITY ASSURANCE

A. TESTING AGENCY QUALIFICATIONS: AN INDEPENDENT TESTING AGENCY, ACCEPTABLE TO AUTHORITIES HAVING JURISDICTION, WITH THE EXPERIENCE AND CAPABILITY TO CONDUCT THE TESTING INDICATED, AS DOCUMENTED ACCORDING TO ASTM E 548.

B. SOURCE LIMITATIONS FOR ENGINEERED WOOD PRODUCTS: OBTAIN EACH TYPE OF ENGINEERED WOOD PRODUCT THROUGH ONE SOURCE FROM A SINGLE MANUFACTURER.

C. SOURCE LIMITATIONS FOR FIRE-RETARDANT-TREATED WOOD: OBTAIN EACH TYPE OF FIRE-RETARDANT-TREATED WOOD PRODUCT THROUGH ONE SOURCE FROM A SINGLE PRODUCER.

D. LUMBER: COMPLY WITH PS 20 AND APPROVED GRADING RULES AND INSPECTION AGENCIES.

1. ACCEPTABLE LUMBER INSPECTING AGENCIES: RIS, SPIB, WCLB, AND WWPA.

2. BE NEW, DRESSED FOUR SIDES (S4S), CLEAR AND FREE FROM WARPING AND OTHER DEFECTS.

3. HAVE A MOISTURE CONTENT NOT EXCEEDING 19 PERCENT WHEN DELIVERED TO THE PROJECT.

E. PLYWOOD: CONFORM TO THE REQUIREMENTS OF PRODUCT STANDARD PS-1 AND BEAR APPLICABLE APA GRADE TRADEMARKS.

F. GRADE STAMPS FOR CONCEALED LUMBER: EACH PIECE OF LUMBER, APPLIED BY INSPECTION AGENCY AND SHOWING COMPLIANCE WITH EACH SPECIFIED REQUIREMENT.

1.08 DELIVERY, STORAGE AND HANDLING

A. PROTECT WOOD PRODUCTS AGAINST MOISTURE AND DIMENSIONAL CHANGES. SUPPORT STACKS AT SEVERAL UNIFORMLY SPACED POINTS TO PREVENT DEFORMATION. STORE RACKS RAISED ABOVE GROUND. COVER TO PROTECT FROM RAIN AND SNOW. SELECT AND ARRANGE COVER TO ALLOW AIR CIRCULATION UNDER AND ALL AROUND STACKS TO PREVENT CONDENSATION. MAINTAIN AND RESTORE DISPLACED COVERINGS. REMOVE FROM SITE ANY WOOD PRODUCTS THAT HAVE BEEN SUBJECT TO MOISTURE OR THAT DO NOT COMPLY WITH THE SPECIFIED MOISTURE REQUIREMENTS.

PART 2 - PRODUCTS

2.01 MATERIALS

A. LUMBER: DOC PS 20 AND APPLICABLE RULES OF LUMBER GRADING AGENCIES CERTIFIED BY THE AMERICAN LUMBER STANDARDS COMMITTEE BOARD OF REVIEW.

1. FACTORY MARK EACH PIECE OF LUMBER WITH GRADE STAMP OF GRADING AGENCY.

2. PROVIDE DRESSED LUMBER, S4S, UNLESS OTHERWISE INDICATED.

B. PRESSURE TREATED LUMBER FOR BLOCKING, NAILERS, CURBS AND AS INDICATED OR REQUIRED: HEM_FIR, DOUGLAS FIR, EASTERN SPRUCE, EASTERN HEMLOCK, OR SOUTHERN PINE, SURFACED DRIED STUD OR UTILITY GRADE. WOOD MEMBERS SHALL BE OF SIZES INDICATED ON THE DRAWINGS OR OF THE SAME SIZE AS THE MEMBERS BEING BRACED.

C. MOISTURE CONTENT: KILN-DRY, MC15 OR AS OTHERWISE INDICATED.

D. FOR UNSPECIFIED CONCEALED FROM VIEW LOCATIONS: APA GRADED C-D PLUGGED INT, GROUP 2 SPECIES, THICKNESS AS INDICATED ON THE DRAWINGS.

2.02 WOOD-PRESERVATIVE-TREATED MATERIALS

A. PRESSURE PRESERVATIVE TREATED WOOD. DESIGNATED AS “PT”

1. CHEMICAL MANUFACTURER: SUBJECT TO COMPLIANCE WITH THE REQUIREMENTS SPECIFIED HEREIN, PRODUCTS WHICH MAY BE INCORPORATED IN THE WORK INCLUDE:

A. HICKSON CORPORATION.

B. HOOVER TREATED WOOD PRODUCTS, INC.

C. APPROVED EQUAL

B. PRESERVATIVE TREATMENT BY PRESSURE PROCESS: AWPA C2 (LUMBER) AND AWPA C9 (PLYWOOD), EXCEPT THAT LUMBER THAT IS NOT IN CONTACT WITH THE GROUND AND IS CONTINUOUSLY PROTECTED FROM LIQUID WATER MAY BE TREATED ACCORDING TO AWPA C31 WITH INORGANIC BORON (SBX).

1. PRESERVATIVE CHEMICALS: FREE OF SODIUM AND SULPHATES. REGISTERED BY THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY AS A PESTICIDE. ACCEPTABLE TO AUTHORITIES HAVING JURISDICTION AND ONE OF THE FOLLOWING:

A. CHROMATED COPPER ARSENATE (CCA).

B. AMMONIACAL COPPER ZINC ARSENATE (ACZA).

C. AMMONIACAL, OR AMINE, COPPER QUAT (ACQ).

D. COPPER BIS (DIMETHYLDITHIOCARBAMATE) (CDDC).

E. AMMONIACAL COPPER CITRATE (CC).

F. COPPER AZOLE, TYPE A (CBA-A).

G. OXINE COPPER (COPPER-8-QUINOLINOLATE) IN A LIGHT PETROLEUM SOLVENT.

2. FOR EXPOSED ITEMS INDICATED TO RECEIVE A STAINED OR NATURAL FINISH, USE CHEMICAL FORMULATIONS THAT DO NOT REQUIRE INCISING, CONTAIN COLORANTS, BLEED THROUGH, OR OTHERWISE ADVERSELY AFFECT FINISHES.

3. MINIMUM PRESERVATIVE RETENTION: ALL PRESSURE PRESERVATIVE TREATED LUMBER AND PLYWOOD MUST HAVE AN ALSC-RECOGNIZED AGENCY QUALITY MARK SIGNIFYING A

CHEMICAL RETENTION LEVEL OF 0.40 POUNDS PER CUBIC FOOT OF OXIDE CHEMICAL, RATED FOR “GROUND CONTACT”.

4. FIXATION OF CHEMICAL: TREATED WOOD SHALL NOT BE SHIPPED FROM TREATMENT PLANT UNTIL FIXATION OF THE PRESERVATIVE HAS OCCURRED IN THE WOOD.

C. KILN-DRY MATERIAL AFTER TREATMENT TO A MAXIMUM MOISTURE CONTENT OF 19 PERCENT FOR LUMBER AND 15 PERCENT FOR PLYWOOD. DO NOT USE MATERIAL THAT IS WARPED OR DOES NOT COMPLY WITH REQUIREMENTS FOR UNTREATED MATERIAL.

D. MARK EACH TREATED ITEM WITH THE TREATMENT QUALITY MARK OF AN INSPECTION AGENCY APPROVED BY THE AMERICAN LUMBER STANDARDS COMMITTEE BOARD OF REVIEW.

1. FOR EXPOSED LUMBER INDICATED TO RECEIVE A STAINED OR NATURAL FINISH, MARK END OR BACK OF EACH PIECE, OR OMIT MARKING AND PROVIDE CERTIFICATES OF TREATMENT COMPLIANCE ISSUED BY INSPECTION AGENCY.

E. APPLICATION: TREAT ALL ROUGH CARPENTRY, UNLESS OTHERWISE INDICATED.

1. WOOD CANTS, NAILERS, CURBS, EQUIPMENT SUPPORT BASES, BLOCKING, STRIPPING, AND SIMILAR MEMBERS IN CONNECTION WITH ROOFING, FLASHING, VAPOR BARRIERS, AND WATERPROOFING.

2. WOOD SILLS, SLEEPERS, BLOCKING, FURRING, STRIPPING, AND SIMILAR CONCEALED MEMBERS IN CONTACT WITH MASONRY OR CONCRETE.

3. WOOD FRAMING MEMBERS LESS THAN 18 INCHES (460 MM) ABOVE GRADE.

4. WOOD FLOOR PLATES THAT ARE INSTALLED OVER CONCRETE SLABS DIRECTLY IN CONTACT WITH EARTH.

2.03 FIRE-RETARDANT-TREATED MATERIALS

A. FIRE-RETARDANT TREATED WOOD. DESIGNATED AS “FRT”

B. GENERAL: WHERE FIRE-RETARDANT-TREATED MATERIALS ARE INDICATED, PROVIDE MATERIALS THAT COMPLY WITH PERFORMANCE REQUIREMENTS IN AWPA C20 (LUMBER) AND AWPA C27 (PLYWOOD). IDENTIFY FIRE-RETARDANT-TREATED WOOD WITH APPROPRIATE CLASSIFICATION MARKING OF UL, U.S. TESTING, TIMBER PRODUCTS INSPECTION, OR ANOTHER TESTING AND INSPECTING AGENCY ACCEPTABLE TO AUTHORITIES HAVING JURISDICTION.

1. USE TREATMENT FOR WHICH CHEMICAL MANUFACTURER PUBLISHES PHYSICAL PROPERTIES OF TREATED WOOD AFTER EXPOSURE TO ELEVATED TEMPERATURES, WHEN TESTED BY A QUALIFIED INDEPENDENT TESTING AGENCY ACCORDING TO ASTM D 5664, FOR LUMBER AND ASTM D 5516, FOR PLYWOOD.

2. USE TREATMENT THAT DOES NOT PROMOTE CORROSION OF METAL FASTENERS.

3. USE EXTERIOR TYPE FOR EXTERIOR LOCATIONS AND WHERE INDICATED.

4. USE INTERIOR TYPE A HIGH TEMPERATURE (HT), UNLESS OTHERWISE INDICATED.

2.04 DIMENSION LUMBER

A. GENERAL: PROVIDE DIMENSION LUMBER OF GRADES INDICATED ACCORDING TO THE AMERICAN LUMBER STANDARDS COMMITTEE NATIONAL GRADING RULE PROVISIONS OF THE GRADING AGENCY INDICATED.

2.05 PLYWOOD BACKING PANELS

A. TELEPHONE AND ELECTRICAL EQUIPMENT BACKING PANELS: DOC PS 1, EXPOSURE 1, C-D PLUGGED, FIRE-RETARDANT TREATED, IN THICKNESS INDICATED OR, IF NOT INDICATED, NOT LESS THAN 1/2 INCH (12.7MM) THICK.

2.06 ACCESSORIES

A. FASTENERS AND ANCHORS:

1. GENERAL: PROVIDE FASTENERS OF SIZE AND TYPE INDICATED THAT COMPLY WITH REQUIREMENTS SPECIFIED IN THIS ARTICLE FOR MATERIAL AND MANUFACTURE.

A. WHERE ROUGH CARPENTRY IS EXPOSED TO WEATHER, IN GROUND CONTACT, IN AREAS OF HIGH RELATIVE HUMIDITY, OR IN TREATED WOOD LOCATIONS, PROVIDE FASTENERS WITH HOT-DIP ZINC COATING COMPLYING WITH ASTM A 153/A 153M.

2. NAILS, BRADS, AND STAPLES: ASTM F 1667.

3. POWER-DRIVEN FASTENERS: CABO NER-272.

4. WOOD SCREWS: ASME B18.6.1.

5. SCREWS FOR FASTENING TO COLD-FORMED METAL FRAMING: ASTM C 954, EXCEPT WITH WAFER HEADS AND REAMER WINGS, LENGTH AS RECOMMENDED BY SCREW MANUFACTURER FOR MATERIAL BEING FASTENED.

6. LAG BOLTS: ASME B18.2.1 (ASME B18.2.3.8M).

7. BOLTS: STEEL BOLTS COMPLYING WITH ASTM A 307, GRADE A (ASTM F 568M, PROPERTY CLASS 4.6); WITH ASTM A 563 (ASTM A 563M) HEX NUTS AND, WHERE INDICATED, FLAT WASHERS.

8. EXPANSION ANCHORS: ANCHOR BOLT AND SLEEVE ASSEMBLY OF MATERIAL INDICATED BELOW WITH CAPABILITY TO SUSTAIN, WITHOUT FAILURE, A LOAD EQUAL TO 6 TIMES THE LOAD IMPOSED WHEN INSTALLED IN UNIT MASONRY ASSEMBLIES AND EQUAL TO 4 TIMES THE LOAD IMPOSED WHEN INSTALLED IN CONCRETE AS DETERMINED BY TESTING PER ASTM E 488 CONDUCTED BY A QUALIFIED INDEPENDENT TESTING AND INSPECTING AGENCY.

A. MATERIAL: CARBON-STEEL COMPONENTS, ZINC PLATED TO COMPLY WITH ASTM B 633, CLASS FE/ZN 5.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

A. SET ROUGH CARPENTRY TO REQUIRED LEVELS AND LINES, WITH MEMBERS' PLUMB, TRUE TO LINE, CUT AND FITTED. PLACE HORIZONTAL MEMBERS WITH CROWN SIDE UP. FIT ROUGH CARPENTRY TO OTHER CONSTRUCTION; SCRIBE AND COPE AS NEEDED FOR ACCURATE FIT. LOCATE FURRING, NAILERS, BLOCKING, GROUNDS AND SIMILAR SUPPORTS TO COMPLY WITH REQUIREMENTS FOR ATTACHING OTHER CONSTRUCTION.

B. ALL MATERIALS SHALL BE INSPECTED BEFORE USE, WITH ALL CHECKED, SPLIT AND OTHERWISE DEFICIENT STOCK REJECTED, OR USED ONLY FOR MISCELLANEOUS BLOCKING, FURRING OR OTHER INCIDENTAL USE. THE SUBCONTRACTOR SHALL BE RESPONSIBLE FOR REPLACING ALL LUMBER WHICH, DUE TO WARPAGE, TWIST, SPLITTING, OR CHECKING, RESULTS IN UNSATISFACTORY WORK. SUCH REPLACEMENT SHALL BE REQUIRED AT ANY TIME, WHETHER BEFORE OR AFTER APPLICATION OF FINISH MATERIAL UNDER OTHER SECTIONS

C. DO NOT USE MATERIALS WITH DEFECTS THAT IMPAIR QUALITY OF ROUGH CARPENTRY OR PIECES THAT ARE TOO SMALL TO USE WITH MINIMUM NUMBER OF JOINTS OR OPTIMUM ARRANGEMENT.

D. APPLY FIELD TREATMENT COMPLYING WITH AWPA M4 TO CUT SURFACES OF PRESERVATIVE-TREATED LUMBER AND PLYWOOD.

E. SECURELY ATTACH ROUGH CARPENTRY WORK TO SUBSTRATE BY ANCHORING AND FASTENING AS INDICATED, COMPLYING WITH THE FOLLOWING:

1. ACCORDING TO BUILDING CODE AND AUTHORITY HAVING JURISDICTION.

2. INDUSTRY STANDARD GOOD PRACTICES.

3. CABO NER-272 FOR POWER-DRIVEN FASTENERS.

E. USE COMMON WIRE NAILS, UNLESS INDICATED OTHERWISE. SELECT FASTENERS OF SIZE THAT WILL NOT FULLY PENETRATE MEMBERS WHERE OPPOSITE SIDE WILL BE EXPOSED TO VIEW OR WILL RECEIVE FINISH MATERIALS. MAKE TIGHT CONNECTIONS BETWEEN MEMBERS. INSTALL FASTENERS WITHOUT SPLITTING WOOD; PRE-DRILL AS REQUIRED.

F. USE FINISHING NAILS FOR EXPOSED WORK, UNLESS INDICATED OTHERWISE. COUNTERSINK NAIL HEADS AND FILL HOLES WITH WOOD FILLER.

G. FRAMING STANDARD: COMPLY WITH AFPA'S “MANUAL FOR WOOD FRAME CONSTRUCTION,” UNLESS INDICATED OTHERWISE.

3.02 INSTALLATION - WOOD BLOCKING

A. INSTALL WHERE INDICATED AND WHERE REQUIRED FOR ATTACHING OTHER WORK. FORM TO SHAPES INDICATED AND CUT AS REQUIRED FOR TRUE LINE AND LEVEL OF ATTACHED WORK. COORDINATE LOCATIONS WITH OTHER WORK INVOLVED.

B. ATTACH ITEMS TO SUBSTRATE TO SUPPORT APPLIED LOADING. RECESS BOLTS, NUTS AND WASHERS FLUSH WITH SURFACES, UNLESS OTHERWISE INDICATED.

C. CONSTRUCT CURBS AT ROOF OPENINGS EXCEPT WHERE PREFABRICATED CURB UNITS ARE PROVIDED. FORM CORNERS BY ALTERNATING LAPPING SIDE MEMBERS.

3.03 INSTALLATION - METAL DOOR FRAMES

A. PLACE IN POSITION ALL STEEL FRAMES, FURNISHED UNDER SECTION 081100 -STEEL DOORS AND FRAMES, IN ACCORDANCE WITH THE APPROVED SHOP DRAWINGS AND FRAME SCHEDULE.

B. COORDINATE INSTALLATION OF FRAMES WITH THE VARIOUS TRADES INSTALLING ABUTTING WALL CONSTRUCTION FOR ANCHOR PLACEMENT.

C. COORDINATE INSTALLATION OF FRAMES WITH INSTALLATION OF HARDWARE UNDER SECTION 064020 - FINISH CARPENTRY AND AS FURNISHED UNDER SECTION 087100 - HARDWARE.

D. INSTALL FRAMES AND DOORS IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS, ANSI/SDI_100, SDI_105, AND THE DOOR HARDWARE INSTITUTE (DHI) RECOMMENDATIONS.

E. PROVIDE RIGID TEMPORARY BRACING FOR FRAMES AS REQUIRED TO ENSURE MAINTENANCE OF POSITIONING, AND REMOVE ONLY AFTER FRAMES HAVE BEEN

PERMANENTLY ANCHORED.

F. SECURE FRAMES, OCCURRING IN EXISTING MASONRY, WITH EXPANSION BOLTS AND SLEEVES.

G. WHERE EXPOSED FASTENER HEADS OCCUR IN FRAMES, FILL WITH AUTOMOTIVE BODY FILLER AND SAND SMOOTH.

3.04 CLEANING

A. DAILY CLEAN WORK AREAS BY SWEEPING AND DISPOSING OF SCRAPS AND SAWDUST.

B. UPON COMPLETION OF THE WORK OF THIS SECTION IN ANY GIVEN AREA, REMOVE TOOLS, EQUIPMENT AND ALL RUBBISH AND DEBRIS FROM THE WORK AREA; LEAVE AREA IN BROOM-CLEAN CONDITION.

END OF SECTION

SECTION 06 40 23

INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.00 ITEMS REQUIRED BUT NOT SPECIFIED

A. IF AN ITEM OR MATERIAL OF THIS TRADE IS INDICATED ON THE DRAWINGS BUT NOT SPECIFICALLY LISTED IN THIS SECTION, PROVIDE SUCH ITEM OR MATERIAL AT A STANDARD OF QUALITY EQUAL TO THE STANDARD ESTABLISHED FOR THE BALANCE OF THE WORK SPECIFIED, IN ACCORDANCE WITH THE ARCHITECT'S INTERPRETATION.

1.01 EXECUTION, CORRELATION AND INTENT

A. IN CASE OF AN INCONSISTENCY BETWEEN DRAWINGS AND SPECIFICATIONS OR WITHIN EITHER DOCUMENT NOT CLARIFIED BY ADDENDUM, THE BETTER QUALITY OR GREATER QUANTITY OF WORK IS TO BE PROVIDED, IN ACCORDANCE WITH THE ARCHITECT'S INTERPRETATION.

1.02 SECTION INCLUDES

A. THIS SECTION CONSISTS OF FURNISHING ALL MATERIALS, LABOR AND EQUIPMENT FOR THE WORK AS SHOWN ON THE DRAWINGS AND OR DESCRIBED HEREIN, BUT NOT LIMITED TO:

1. SCOPE OF WORK:

A. SOLID SURFACE COUNTERTOPS

B. SOLID SURFACE WINDOW SILLS

C. BASE CABINETS

D. UPPER CABINETS

E. CABINET HARDWARE

F. COUNTER SUPPORTS

G. MISCELLANEOUS FINISH CARPENTRY AS INDICATED ON DRAWINGS

1.03 RELATED SECTIONS

A. 06 10 00 - ROUGH CARPENTRY: BLOCKING AND GROUNDS FOR ATTACHMENT OF WOODWORK.

B. 07 92 10 - JOINT SEALERS

1.04 REFERENCES

A. COMPLY WITH APPLICABLE REQUIREMENTS OF THE FOLLOWING STANDARDS AND THOSE OTHERS REFERENCED IN THIS SECTION. WHERE THESE STANDARDS CONFLICT WITH OTHER SPECIFIED REQUIREMENTS, THE MOST RESTRICTIVE REQUIREMENTS SHALL GOVERN.

1. ALL APPLICABLE FEDERAL, STATE AND MUNICIPAL CODES, LAWS AND REGULATIONS.

1.05 SUBMITTALS:

A. SUBMIT 4 COPIES OF LARGE SCALE SHOP DRAWINGS: PLANS AND ELEVATIONS; DETAILS AT A LARGE SCALE; SHOW LOCATION OF EACH ITEM; IDENTIFY COMPONENTS USED AND

INDICATED METHOD OF ATTACHMENT.

1. SHOW FIELD MEASUREMENTS.

B. LUMBER/CORE MATERIAL: SAMPLES OF EACH SPECIES AND CUT; 1 INCH BY 12 INCH LONG PIECES.

C. PLASTIC LAMINATE, SOLID SURFACE AND ACID RESISTANT MATERIAL:

1. PRODUCT DATA

2. SAMPLES FOR SELECTION: MANUFACTURER'S FULL COLOR AND PATTERN RANGE.

D. CABINET HARDWARE:

1. PRODUCT DATA.

2. ONE SAMPLE OF EACH TYPE.

3. SAMPLES SHOWING EACH FINISH ON EACH ITEM OF HARDWARE EXPOSED TO VIEW.

1.06 QUALITY ASSURANCE

A. QUALITY OF MATERIALS AND WORKMANSHIP: PROVIDE WOODWORK THAT COMPLIES WITH REQUIREMENTS OF “ARCHITECTURAL WOODWORK QUALITY STANDARDS,” PUBLISHED BY ARCHITECTURAL WOODWORK INSTITUTE (AWI) (HEREINAFTER REFERRED TO AS “WOODWORKING”).

B. WHERE CONTRACT DOCUMENTS INDICATE REQUIREMENTS WHICH ARE LESS RESTRICTIVE THAN IN THE WOODWORKING STANDARD, COMPLY WITH THE MINIMUM REQUIREMENTS OF THE WOODWORKING STANDARD.

C. FABRICATOR QUALIFICATIONS:

1. ALL WORK OF THIS SECTION SHALL BE FABRICATED BY A SINGLE FIRM.

1.07 DELIVERY, STORAGE AND HANDLING

A. STORE MATERIALS FOR INTERIOR WOODWORK INDOORS IN AIR CONDITIONED SPACES MAINTAINED WITHIN DESIGN TEMPERATURE AND HUMIDITY RANGE.

1.08 PROJECT CONDITIONS

A. MAINTAIN FINAL DESIGN TEMPERATURE AND HUMIDITY IN AREAS WHERE WOODWORK IS INSTALLED.

B. FIT WOODWORK TO ACTUAL CONSTRUCTION. TAKE FIELD MEASUREMENTS BEFORE FABRICATING WOODWORK.

C. COORDINATE INSTALLATION OF WOODWORK WITH OTHER WORK TO AVOID DAMAGE.

D. COORDINATE DATA:

1. FURNISH LOCATIONS AND TYPES OF ALL BLOCKING AND OTHER ANCHORS TO BE BUILT INTO SUBSTRATES TO INSTALLERS OF SUCH WORK.

PART 2 - PRODUCTS

2.00 MATERIALS

A. HIGH-PRESSURE PLASTIC LAMINATE: NEMA LD 3 (2005).

1. GRADES AND THICKNESSES AS INDICATED.

H. ALL PLASTIC LAMINATE SHALL BE GENERAL PURPOSE TYPE 107, WITH A MINIMUM CLASS II RATING IN ACCORDANCE WITH ATSM-E84 AS FOLLOWS:

B. SMOKE DEVELOPED: NOT GREATER THAN 100.

II. FLAME SPREAD: NOT GREATER THAN 40.

I. MANUFACTURERS: PROVIDE PRODUCTS COMPLYING WITH REQUIREMENTS OF THE CONTRACT DOCUMENTS AND MADE BY ONE OF THE FOLLOWING:

I. WILSONART, LLC

II. ARCHITECT APPROVED SUBSTITUTE

2. COLOR AND PATTERN: AS SELECTED BY THE ARCHITECT.

B. ADHESIVE FOR BONDING PLASTIC LAMINATE: CONTACT ADHESIVE, BY MANUFACTURER OF PLASTIC LAMINATE PRODUCT. CONFIRM TYPE OF ADHESIVE WITH MANUFACTURER FOR SPECIFIC SUBSTRATE(S).

C. SOLID-SURFACING MATERIAL: HOMOGENEOUS SOLID SHEETS OF FILLED PLASTIC RESIN COMPLYING WITH MATERIAL AND PERFORMANCE REQUIREMENTS IN ANSI Z124.3, FOR TYPE 5 OR TYPE 6 WITHOUT PRE-COATED FINISH.

1. PRODUCTS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE ONE OF THE FOLLOWING AS SELECTED BY THE ARCHITECT:

A. CORIAN; DUPONT POLYMERS.

B. AVONITE; AVONITE, INC.

C. FOUNTAINHEAD; INTERNATIONAL PAPER, DECORATIVE PRODUCTS DIV.

2. COLOR AND PATTERN: AS SELECTED BY THE ARCHITECT FORM MANUFACTURER'S STANDARD COLORS.

3. SINKS: REFER TO PLUMBING SCHEDULE FOR SINK SELECTIONS.

2.01 WOOD MATERIALS

A. LUMBER: SPECIES AND GRADE AS INDICATED; LUMBER READY FOR INSTALLATION SHALL COMPLY WITH WM 4, “GENERAL REQUIREMENTS FOR WOOD MOLDING,” WOOD MOLDING AND MILLWORK PRODUCERS (WMMP).

1. CABINET LUMBER: SPECIES AND GRADE AS SPECIFIED IN WOODWORKING STANDARD, UNLESS OTHERWISE INDICATED.

2. COMPLY WITH APPLICABLE REQUIREMENTS OF AWI SECTION 100.

3. MOISTURE CONTENT AT TIME OF FABRICATION: NOT GREATER THAN OPTIMUM MOISTURE CONTENT AS SPECIFIED IN WOODWORKING STANDARD.

4. SOFTWOOD: COMPLY WITH NIST PS 20 AND GRADE IN ACCORDANCE WITH THE GRADING RULES OF THE GRADING AND INSPECTION AGENCY APPLICABLE TO THE SPECIES.

5. HARDWOOD: GRADE IN ACCORDANCE WITH NATIONAL HARDWOOD LUMBER ASSOCIATION GRADING RULES.

6. FOR TRANSPARENT FINISH, USE ONLY SOLID PIECES OF LUMBER; WM 4 N-GRADE.

7. MOISTURE CONTENT: NOT GREATER THAN THAT REQUIRED BY APPLICABLE GRADING RULES; PROVIDE KILN-DRIED LUMBER.

8. PROVIDE LUMBER DRESSED ON ALL EXPOSED FACES, UNLESS OTHERWISE INDICATED.

9. DO NOT USE TWISTED, WARPED, BOWED, OR OTHERWISE DEFECTIVE LUMBER.

10. SIZES INDICATED ARE NOMINAL, UNLESS OTHERWISE INDICATED.

11. DO NOT MARK OR COLOR LUMBER, EXCEPT WHERE SUCH MARKING WILL BE CONCEALED IN FINISH WORK.

B. PLYWOOD: TYPES, GRADES AND CORES AS INDICATED.

1. COMPLY WITH APPLICABLE REQUIREMENTS OF AWI SECTION 200.

2. PLYWOOD IN CONCEALED LOCATIONS: COMPLY WITH NBS PS 1, GRADE C MINIMUM.

3. FACE GRADE FOR APPLICATION OF LAMINATES: GRADE A, MINIMUM.

C. PARTICLEBOARD: ANSI A208.1, M-2, OR BETTER; EXTERIOR GLUE WHEN USED IN COUNTERS WITH SINKS.

D. MEDIUM DENSITY FIBERBOARD: ANSI A208.2, GRADE 140.

2.02 CABINET HARDWARE

A. CABINET HARDWARE: PROVIDE HARDWARE AND ACCESSORIES INDICATED.

B. FINISHES ON EXPOSED HARDWARE: SATIN CHROMIUM PLATED (BHMA 626).

1. CONCEALED HARDWARE: MANUFACTURER'S STANDARD FINISH, COMPLYING WITH APPLICABLE REQUIREMENTS OF BHMA A156.9.

C. CABINET HARDWARE SCHEDULE:

1. HINGES: TWO (2) PER DOOR UP TO 36” HIGH; THREE (3) PER DOOR OVER 36” HIGH. CONCEALED STYLE, FOR TOP AND BOTTOM OF DOOR. KV 2623F NP100.

2. DRAWER SLIDES: TWO (2) PER DRAWER. SIDE MOUNTED, FULL EXTENSION, WITH BALL-BEARING ROLLERS: ACCURIDE #3832.

3. DRAWER GUIDES: AS REQUIRED.

4. PULLS: ONE PER DOOR, DRAWER. EPCO 402-4 OR HAFELE 117.31.436.

5. CATCHES: MAGNETIC TYPE - STANLEY NO. 41.

6. CABINET-MOUNTED SHELF SUPPORTS: DRILLED HOLES AT 1-1/4 INCH SPACING, WITH 4 SELF SUPPORT CLIPS FOR EACH SHELF INDICATED. SUPPORTS TO BE: KV 346BR.

7. COUNTER SUPPORT: HAMBURG LEG, 2-3/8 INCH DIAMETER. HEIGHT TO BE ADJUSTABLE. CAPACITY: 660 LBS. FLAT BLACK TEXTURED FINISH.

8. COUNTER SUPPORT BRACKETS: 1/8 INCH STEEL BRACKETS. CAPACITY 1,000 LBS. MINIMUM. PROVIDE 3 INCH X 3 INCH 45 DEGREE NOTCH FOR WIRE RUN. POWDER COAT FINISH. COLOR AS SELECTED BY THE ARCHITECT FORM MANUFACTURER'S STANDARD COLORS.

9. GROMMET: 2-1/2-INCH I.D., BLACK WITH MATCHING CAPS WITH SLOT FOR WIRE PASSAGE.

10. MISCELLANEOUS HARDWARE: PROVIDE ALL OTHER MISCELLANEOUS HARDWARE REQUIRED FOR CABINETRY AS INDICATED ON DRAWINGS OR REQUIRED FOR FABRICATION.

2.03 FABRICATION, GENERAL:

A. WOOD MOISTURE CONTENT: COMPLY WITH REQUIREMENTS OF REFERENCED QUALITY STANDARD FOR MOISTURE CONTENT OF LUMBER IN RELATION TO RELATIVE HUMIDITY CONDITIONS EXISTING DURING TIME OF FABRICATION AND IN INSTALLATION AREAS.

B. FABRICATE WOODWORK TO DIMENSIONS, PROFILES AND DETAILS INDICATED.

1. EASE EDGES OF SOLID LUMBER MEMBERS WHERE INDICATED, USING:

A. 1/16-INCH RADIUS FOR MEMBERS 1 INCH OR LESS NOMINAL THICKNESS.

B. 1/8-INCH RADIUS FOR MEMBERS MORE THAN 1 INCH NOMINAL THICKNESS.

C. COMPLETE FABRICATIONS INCLUDING ASSEMBLY, FINISHING AND HARDWARE APPLICATIONS IN SHOP BEFORE SHIPMENT TO PROJECT SITE TO MAXIMUM EXTENT POSSIBLE. DISASSEMBLE COMPONENTS ONLY AS NECESSARY FOR SHIPMENT AND INSTALLATION. WHERE NECESSARY FOR FITTING AT SITE, PROVIDE AMPLE ALLOWANCE FOR SCRIBING, TRIMMING AND FITTING.

1. VERIFY THAT VARIOUS PARTS FIT AS INTENDED AND CHECK MEASUREMENTS OF ASSEMBLIES AGAINST FIELD MEASUREMENTS INDICATED ON SHOP DRAWINGS BEFORE DISASSEMBLING FOR SHIPMENT.

2. EDGES AND TRIM TO BE SCRIBED TO FIT MAY BE LEFT LOOSE.

3. FOR FIELD-APPLIED HARDWARE, DRILL MOUNTING HOLES IN SHOP.

D. SHOP-CUT OPENINGS, TO MAXIMUM EXTENT POSSIBLE, TO RECEIVE HARDWARE, ELECTRICAL WORK AND SIMILAR ITEMS (INCLUDING 2-1/2 INCH I.D. GROMMETS). LOCATE OPENINGS ACCURATELY AND USE TEMPLATES OR ROUGHING-IN DIAGRAMS TO PRODUCE ACCURATELY SIZED AND SHAPED OPENINGS. SMOOTH EDGES OF CUTOUTS AND WHERE LOCATED IN COUNTERTOPS AND SIMILAR EXPOSURES, SEAL EDGES OF CUTOUTS WITH A WATER-RESISTANT COATING.

1. FOR APPLIED FIXTURES AND FITTINGS, CUT OPENINGS IN SHOP.

E. WHERE WOODWORK IS INDICATED TO BE FINISHED, SAND SMOOTH, FILL NAIL HOLES, CLEAN THOROUGHLY AND OTHERWISE PREPARE FOR FINISHING IN ACCORDANCE WITH WOODWORKING STANDARD.

2.04 PLASTIC-LAMINATE COUNTERTOPS

A. QUALITY STANDARD: COMPLY WITH AWI SECTION 400C REQUIREMENTS FOR HIGH-PRESSURE DECORATIVE LAMINATE COUNTERTOPS.

B. GRADE: CUSTOM.

C. HIGH-PRESSURE DECORATIVE LAMINATE GRADE: GENERAL PURPOSE TYPE 107.

D. COLORS, PATTERNS AND FINISHES: PROVIDE MATERIALS AND PRODUCTS THAT RESULT IN COLORS AND TEXTURES OF EXPOSED LAMINATE SURFACES COMPLYING WITH THE FOLLOWING REQUIREMENTS:

1. MATCH COLOR, PATTERN, AND FINISH AS INDICATED BY MANUFACTURER'S DESIGNATIONS FOR THESE CHARACTERISTICS, AS INDICATED ON THE DRAWINGS OR AS OTHERWISE SELECTED BY THE ARCHITECT FROM THE MANUFACTURER'S FULL RANGE.

E. GRAIN DIRECTION: PARALLEL TO CABINET FRONTS.

F. EDGE TREATMENT: PLASTIC LAMINATE

G. CORE MATERIAL: MDF GRADE 140.

1. PANEL THICKNESS: 1-1/8 INCH MINIMUM COUNTER TOPS.

H. GROMMETS: PROVIDE PLASTIC GROMMETS IN COUNTERTOPS AS INDICATED ON DRAWINGS.

2.05 SOLID-SURFACING MATERIAL COUNTERTOPS

A. QUALITY STANDARD: COMPLY WITH AWI SECTION 400C REQUIREMENTS FOR COUNTERTOPS.

B. GRADE: PREMIUM.

C. MATERIAL THICKNESS: ½-INCH OR AS INDICATED ON THE DRAWINGS.

D. COLORS, PATTERNS AND FINISHES: PROVIDE MATERIALS AND PRODUCTS THAT RESULT IN COLORS AND TEXTURES OF SOLID SURFACES COMPLYING WITH THE FOLLOWING REQUIREMENTS:

1. MATCH COLOR, PATTERN, AND FINISH AS INDICATED BY MANUFACTURER'S DESIGNATIONS FOR THESE CHARACTERISTICS, AS INDICATED ON THE DRAWINGS OR AS OTHERWISE SELECTED BY THE ARCHITECT FROM THE MANUFACTURER'S FULL RANGE.

E. FABRICATE TOPS IN ONE PIECE WITH SHOP-APPLIED BACKSPLASHES AND EDGES, UNLESS OTHERWISE INDICATED. COMPLY WITH SOLID SURFACING MATERIAL MANUFACTURER'S WRITTEN RECOMMENDATIONS FOR ADHESIVES, SEALERS, FABRICATION AND FINISHING.

F. PROVIDE AND INSTALL SOLID SURFACING MATERIAL WHERE SHOWN ON CABINETWORK.

1. ROUT EDGES TO CONTOUR SHOWN.

2. LAMINATE LAYER FOR THICKNESS REQUIRED.

3. SUBMIT INSTALLER QUALIFICATIONS.

4. SUBMIT MANUFACTURER'S INSTRUCTIONS ON FABRICATION AND INSTALLATION.

5. SUBMIT CARE AND MAINTENANCE OF PRODUCT.

6. USE JOINT ADHESIVE AND JOINT FILLER AS RECOMMENDED BY MANUFACTURER.

A. JOINT TO BE SUBMITTED WITH SHOP DRAWING.

7. ALLOW FOR EXPANSION AND CONTRACTION AS REQUIRED BY MANUFACTURER.

G. GROMMETS: PROVIDE PLASTIC GROMMETS IN COUNTERTOPS AS INDICATED ON DRAWINGS.

2.06 PLASTIC LAMINATE CABINETS

A. QUALITY STANDARD: COMPLY WITH AWI SECTION 400 ITS DIVISION 400B “LAMINATE CLAD CABINETS”.

B. GRADE: CUSTOM.

C. AWI TYPE OF CABINET CONSTRUCTION: REVEAL OVERLAY.

D. LAMINATE CLADDING: HIGH PRESSURE DECORATIVE LAMINATE COMPLYING WITH THE FOLLOWING REQUIREMENTS:

1. COLORS, PATTERNS AND FINISHES: PROVIDE MATERIALS AND PRODUCTS THAT RESULT IN COLORS AND TEXTURES OF EXPOSED LAMINATE SURFACES COMPLYING WITH THE FOLLOWING REQUIREMENTS:

A. MATCH COLOR, PATTERN, AND FINISH AS INDICATED BY MANUFACTURER'S DESIGNATIONS FOR THESE CHARACTERISTICS, AS INDICATED ON THE DRAWINGS OR AS OTHERWISE SELECTED BY THE ARCHITECT FROM THE MANUFACTURER'S FULL RANGE.

2. LAMINATE GRADE FOR ALL SURFACES: PROVIDE LAMINATE CLADDING COMPLYING WITH THE FOLLOWING REQUIREMENTS FOR TYPE OF SURFACE AND GRADE.

A. HORIZONTAL SURFACES OTHER THAN TOPS: GENERAL PURPOSE TYPE 107.

B. VERTICAL SURFACES: GENERAL PURPOSE TYPE 107.

C. EDGES: GENERAL PURPOSE TYPE 107 OR WOOD EDGING AS INDICATED ON THE DRAWINGS.

E. DOORS:

1. ALL CABINET DOORS SHALL BE ¾-INCH SOLID CORE PLYWOOD WITH PLASTIC LAMINATE ON ALL FACES AND EDGES.

F. FIXED AND ADJUSTABLE SHELVES: PLASTIC LAMINATE COVERED.

1. ALL LOCATIONS SHALL BE 3/4-INCH PLYWOOD. FACE OF GRAIN RUNNING LONG WAY OF SHELF. DEPTH OF SHELVES SHALL BE THE FULL WIDTH OF CABINETS.

G. ACCEPTABLE PANEL TYPES:

1. MDF GRADE 140.

2. VENEER CORE PLYWOOD.

A. PANEL THICKNESS 3/4 INCH MINIMUM, 1-1/8 INCH MINIMUM COUNTER TOPS.

H. CONCEAL ALL FASTENERS

2.07 MISCELLANEOUS MATERIALS

A. WOOD FILLER FOR TRANSPARENT FINISH WOODWORK: MATCH FINAL FINISH COLOR.

B. ACCESSORIES.

C. FASTENERS: STYLE, SIZE, MATERIAL AND FINISH AS REQUIRED FOR THE PURPOSE.

PART 3 - EXECUTION

3.00 PREPARATION

A. CONDITION WOODWORK TO AVERAGE PREVAILING HUMIDITY CONDITIONS IN INSTALLATION AREAS BEFORE INSTALLING.

B. BEFORE INSTALLING ARCHITECTURAL WOODWORK/CASEWORK/COUNTERTOPS, EXAMINE SHOP-FABRICATED WORK FOR COMPLETION AND COMPLETE AS REQUIRED, INCLUDING REMOVAL OF PACKING.

3.01 INSTALLATION

A. QUALITY STANDARD: INSTALL WOODWORK TO COMPLY WITH AWI SECTION 1700 FOR SAME GRADE SPECIFIED IN PART 2 OF THIS SPECIFICATION SECTION FOR TYPE OF WOODWORK INVOLVED.

B. DO NOT BEGIN INSTALLATION OF INTERIOR WOODWORK UNTIL POTENTIALLY DAMAGING CONSTRUCTION OPERATIONS ARE COMPLETE IN THE INSTALLATION AREA.

C. CABINETS: INSTALL WITHOUT DISTORTION SO THAT DOORS AND DRAWERS FIT OPENINGS PROPERLY AND ARE ACCURATELY ALIGNED. ADJUST HARDWARE TO CENTER DOORS AND DRAWERS IN OPENINGS AND TO PROVIDE UNENCUMBERED OPERATION. COMPLETE INSTALLATION OF HARDWARE AND ACCESSORY ITEMS AS INDICATED.

1. INSTALL CABINETS WITH NO MORE THAN 1/8-INCH IN 96 INCHES OF SAG, BOW OR OTHER VARIATIONS FROM A STRAIGHT LINE.

2. FASTEN WALL CABINETS THROUGH BACK NEAR TOP AND BOTTOM, AT ENDS AND NOT MORE THAN 16 INCHES O.C. WITH NO. 10 WAFER-HEAD SCREWS SIZED FOR 1-INCH PENETRATION INTO WOOD FRAMING, BLOCKING AND HANGING STRIPS OR NO.10 WAFER-HEAD SHEET METAL SCREWS THROUGH METAL BACKING OR METAL FRAMING BEHIND WALL FINISH.

D. COUNTERTOPS: ANCHOR SECURELY BY SCREWING THROUGH CORNER BLOCKS OF BASE CABINETS OR OTHER SUPPORTS INTO UNDERSIDE OF COUNTERTOP.

1. ALIGN ADJACENT COUNTERTOPS AND FORM SEAMS TO COMPLY WITH MANUFACTURER'S WRITTEN RECOMMENDATIONS USING MECHANICAL OR ADHESIVE JOINERY.

A. INSTALL COUNTERTOPS WITH NO MORE THAN 1/8-INCH IN 96 INCHES OF SAG, BOW OR OTHER VARIATIONS FROM A STRAIGHT LINE.

B. SECURE BACKSPLASHES TO TOPS WITH CONCEALED METAL BRACKETS AT 16 INCHES O.C. AND TO WALLS WITH ADHESIVE.

C. CAULK SPACE BETWEEN BACKSPLASH AND WALL WITH SEALANT SPECIFIED IN SECTION 07 92 10.

E. SCRIBE AND CUT WOODWORK TO FIT ADJOINING WORK AND REFINISH CUT SURFACES AND REPAIR DAMAGED FINISH AT CUTS.

F. CONCEAL ALL SHIMS.

3.02 ADJUSTMENT AND CLEANING

A. CLEAN EXPOSED SURFACES.

B. REPAIR DAMAGED AND DEFECTIVE WOODWORK/CASEWORK/COUNTERTOP WHERE POSSIBLE TO ELIMINATE DEFECTS FUNCTIONALLY AND VISUALLY; WHERE NOT POSSIBLE TO REPAIR, REPLACE WOODWORK/CASEWORK/COUNTERTOP. ADJUST JOINERY FOR UNIFORM APPEARANCE.

C. ADJUST DOORS FOR PROPER OPERATION; COORDINATE WITH HARDWARE ADJUSTMENT; REPLACE DOORS WHICH CANNOT BE PROPERLY ADJUSTED.

D. CLEAN, LUBRICATE AND ADJUST HARDWARE.

E. UPON COMPLETION OF THE WORK OF THIS SECTION, REMOVE TOOLS, AND ALL RUBBISH AND DEBRIS FROM THE WORK AREA; LEAVE AREA IN BROOM-CLEAN CONDITION.

3.03 PROTECTION

A. PROVIDE FINAL PROTECTION AND MAINTAIN CONDITIONS IN A MANNER ACCEPTABLE TO THE MANUFACTURER AND INSTALLER THAT ENSURE THAT WOODWORK WILL BE WITHOUT DAMAGE OR DETERIORATION AT TIME OF SUBSTANTIAL COMPLETION.

END OF SECTION

SECTION 07 11 13

BITUMINOUS DAMP PROOFING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. FURNISHING AND INSTALLING BITUMINOUS DAMPPROOFING EMULSION COATING OF PERIMETER FOUNDATIONS.

B. SUBSTRATE PREPARATION.

C. PRIMER.

1.02 RELATED SECTIONS

A. SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

B. SECTION 07 21 10 - BUILDING INSULATION

1.03 SUBMITTALS

A. SUBMIT THE FOLLOWING UNDER THE PROVISIONS OF DIVISION 1:

1. LITERATURE: MANUFACTURER'S PRODUCT DATA SHEETS, SPECIFICATIONS, PERFORMANCE DATA, PHYSICAL PROPERTIES FOR EACH ITEM FURNISHED HEREUNDER WHICH DEMONSTRATES THAT PRODUCTS COMPLY WITH PROJECT REQUIREMENTS.

1.04 QUALITY ASSURANCE

A. MANUFACTURER: A COMPANY REGULARLY ENGAGED IN MANUFACTURING OF THE PRODUCTS SPECIFIED IN THIS SECTION AND WHOSE PRODUCTS HAVE BEEN IN SATISFACTORY USE UNDER SIMILAR SERVICE CONDITIONS FOR NOT LESS THAN FIVE YEARS.

B. INSTALLER: COMPANY SPECIALIZING IN PERFORMING THE WORK OF THIS SECTION WITH MINIMUM FIVE YEARS DOCUMENTED EXPERIENCE AND APPROVED BY MANUFACTURER.

1.05 DELIVERY, STORAGE, AND PROTECTION

A. DELIVER MATERIALS IN ORIGINAL PACKAGES, CONTAINERS OR BUNDLES BEARING BRAND NAME AND IDENTIFICATION OF MANUFACTURER OR SUPPLIER.

B. STORE MATERIALS IN DRY, WELL-VENTILATED SPACE.

1.06 PROJECT CONDITIONS

A. INSTALL DAMPPROOFING ONLY WHEN SITE WEATHER CONDITIONS ARE ACCEPTABLE PER MANUFACTURER'S RECOMMENDATIONS.

B. VENTILATION: PROVIDE SUFFICIENT VENTILATION DURING APPLICATION AND CURING OF DAMPPROOFING TO PREVENT BUILD-UP OF TOXIC OR FLAMMABLE FUMES.

PART 2 - PRODUCTS

2.01 BITUMINOUS DAMPPROOFING MATERIALS

A. COLD-APPLIED ASPHALT EMULSION MASTIC: BRUSH GRADE, FIBRATED DAMPPROOFING

MASTIC OF TROWELING (HEAVY) CONSISTENCY, MEETING THE REQUIREMENTS OF ASTM D 1227, TYPE IV; ASBESTOS FREE.

1. PERMEABILITY: 0.5 MG PER SQ. CM.

2. COLOR: BLACK.

3. SERVICE TEMPERATURE RANGE: 0D TO 180D F.

B. ASPHALT PRIMER: ASTM D 41.

2.02 INSTALLATION ACCESSORIES

A. DETAILING MASTIC: ASPHALT-BASED PLASTIC ROOF CEMENT, TROWEL CONSISTENCY, MEETING THE REQUIREMENTS OF ASTM D 4586.

PART 3 - EXECUTION

3.01 EXAMINATION

A. VERIFY THAT CONDITIONS CONFORM TO THE REQUIREMENTS OF THE CONTRACT DOCUMENTS.

B. VERIFY THAT RELATED WORK TO BE PERFORMED WITHIN INDICATED SPACES BEFORE INSTALLATION OF INSULATION HAS BEEN COMPLETED.

C. DO NOT PROCEED UNTIL UNSATISFACTORY CONDITIONS HAVE BEEN CORRECTED. COMMENCEMENT OF INSTALLATION INDICATES ACCEPTANCE OF CONDITIONS.

3.02 PREPARATION OF SUBSTRATES

A. REMOVE HONEYCOMB, AGGREGATE POCKETS, FINS, RIDGES AND PROJECTING ROUGH AREAS.

B. FILL CRACKS, HOLES, DEPRESSIONS AND IRREGULARITIES WITH LATEX PATCHING MORTAR OR DETAILING MASTIC AS RECOMMENDED BY MEMBRANE MANUFACTURER.

C. FORM FILLETS (CANTS) AT INSIDE CORNERS AND AROUND PROJECTING ELEMENTS USING LATEX PATCHING MORTAR OR DETAILING MASTIC.

3.03 INSTALLATION - GENERAL

A. COMPLY WITH THE DAMPPROOFING MANUFACTURE'S INSTRUCTIONS FOR HANDLING, PREPARATION, APPLICATION AND PROTECTION OF DAMPPROOFING MATERIALS.

3.04 BELOW-GRADE DAMPPROOFING - TO EXTERIOR OF ALL BELOW GRADE FOUNDATION WALLS AND WALL BELOW GRADE STRUCTURAL STEEL.

A. APPLY ONE COAT OF PRIMER AT THE RATE OF 200-300 SQUARE FEET PER GALLON AND ALLOW TO DRY.

B. TROWEL-APPLY A UNIFORM COAT OF FIBRATED MASTIC DAMPPROOFING. COVERAGE, 6-1/2 TO 7-1/2 GALLONS PER 100 SQUARE FEET TO PROVIDE AN AVERAGE DRY FILM THICKNESS OF AT LEAST 60 MILS WITH NO LESS THAN 30 MILS THICKNESS AT ANY POINT.

C. APPLY A “TOUCH-UP” COATING OVER AREAS WHERE COATING IS THIN OR HAS NOT FORMED A SMOOTH LUSTROUS SURFACE.

3.05 INSPECTION

A. BEFORE COVERING OR BACKFILLING DAMPPROOFING, NOTIFY THE CONSTRUCTION MANAGER THAT THE DAMPPROOFING IS READY FOR INSPECTION.

3.06 PROTECTION AND CLEANING

A. TAKE MEASURES REQUIRED TO PROTECT COMPLETED DAMPPROOFING AFTER INSTALLATION.

B. CLEAN SPILLAGE AND SOILING FROM ADJACENT SURFACES USING CLEANING AGENTS AND PROCEDURES RECOMMENDED BY THE MANUFACTURER OF THE SURFACE CONTAMINATED.

END OF SECTION

SECTION 07 20 10

BUILDING INSULATION

PART 1 - GENERAL

1.01 ITEMS REQUIRED BUT NOT SPECIFIED

A. IF AN ITEM OR MATERIAL OF THIS TRADE IS INDICATED ON THE DRAWINGS BUT NOT SPECIFICALLY LISTED IN THIS SECTION, PROVIDE SUCH ITEM OR MATERIAL AT A STANDARD OF QUALITY EQUAL TO THE STANDARD ESTABLISHED FOR THE BALANCE OF THE WORK SPECIFIED, IN ACCORDANCE WITH THE ARCHITECT'S INTERPRETATION.

1.02 EXECUTION, CORRELATION AND INTENT

A. IN CASE OF AN INCONSISTENCY BETWEEN DRAWINGS AND SPECIFICATIONS, OR WITHIN EITHER DOCUMENT NOT CLARIFIED BY ADDENDUM, THE BETTER QUALITY OR GREATER QUANTITY OF WORK IS TO BE PROVIDED, IN ACCORDANCE WITH THE ARCHITECT'S INTERPRETATION.

1.03 SECTION INCLUDES

A. FURNISH THE FOLLOWING PRODUCTS TO BE INSTALLED UNDER THE DESIGNATED SECTIONS:

1. EXTRUDED POLYSTYRENE BOARD.

A. UNDER SLABS.

B. PERIMETER WALLS.

2. THERMAL INSULATION.

A. AT EXTERIOR WALLS.

B. ABOVE CEILINGS.

3. VAPOR BARRIER.

4. SOUND ATTENUATION INSULATION.

5. FOAMED IN-PLACE INSULATION.

6. FIRESAFING / SMOKE SEALING.

B. RELATED SECTIONS INCLUDE THE FOLLOWING:

1. SECTION 07 42 00 - INSULATED METAL WALL PANELS.

1.04 SUBMITTALS

A. SUBMIT THE FOLLOWING UNDER THE PROVISIONS OF DIVISION 1:

1. LITERATURE: MANUFACTURER'S PRODUCT DATA SHEETS, SPECIFICATIONS, PERFORMANCE DATA, PHYSICAL PROPERTIES FOR EACH ITEM FURNISHED HEREUNDER WHICH DEMONSTRATE THAT PRODUCTS COMPLY WITH PROJECT REQUIREMENTS.

1.05 QUALITY ASSURANCE

A. MANUFACTURER: A COMPANY REGULARLY ENGAGED IN MANUFACTURING OF THE

PRODUCTS SPECIFIED IN THIS SECTION AND WHOSE PRODUCTS HAVE BEEN IN SATISFACTORY USE UNDER SIMILAR SERVICE CONDITIONS FOR NOT LESS THAN FIVE YEARS.

B. INSTALLER: COMPANY SPECIALIZING IN PERFORMING THE WORK OF THIS SECTION WITH MINIMUM FIVE YEARS DOCUMENTED EXPERIENCE AND APPROVED BY MANUFACTURER.

1.06 DELIVERY, STORAGE, AND PROTECTION

A. DELIVER MATERIALS IN ORIGINAL PACKAGES, CONTAINERS OR BUNDLES BEARING BRAND NAME AND IDENTIFICATION OF MANUFACTURER OR SUPPLIER.

B. FOAMED PLASTIC INSULATION: MINIMIZE PERIOD BETWEEN PRODUCT DELIVERY AND ACTUAL INSTALLATION. PROTECT AGAINST EXPOSURE TO FLAME, SPARKS OR EXCESSIVE HEAT. MINIMIZE EXPOSURE TO SUNLIGHT.

PART 2 - PRODUCTS

2.02 EXTRUDED POLYSTYRENE

A. EXTRUDED POLYSTYRENE BOARD INSULATION: ASTM C 578-01, TYPE VII. COMPRESSIVE STRENGTH TESTED IN ACCORDANCE WITH ASTM D 1621.

1. UNDER SLABS:

A. COMPRESSIVE STRENGTH: 60 PSI.

B. DENSITY: 2.2 LBS/CU.FT. MIN.

C. EDGES: PROVIDE BOARD WITH SQUARE EDGES.

D. BOARD SIZE: 24” X 96”.

E. THICKNESS: (2) LAYERS OF 3 INCH (TOTAL R-30.0).

2. PRODUCTS FROM THE FOLLOWING MANUFACTURERS, PROVIDED THEY COMPLY WITH THE REQUIREMENTS OF THE CONTRACT DOCUMENTS, WILL BE AMONG THOSE CONSIDERED ACCEPTABLE:

A. DOW CHEMICAL CORP.

B. OWENS-CORNING.

B. EXTRUDED POLYSTYRENE BOARD INSULATION: ASTM C 578, TYPE IV. COMPRESSIVE STRENGTH TESTED IN ACCORDANCE WITH ASTM D 1621.

1. AT FOUNDATIONS:

A. COMPRESSIVE STRENGTH: 25 PSI.

B. EDGES: PROVIDE BOARD WITH TONGUE AND GROOVE EDGES ON LONG DIMENSION.

C. BOARD SIZE: 24” X 96”.

D. THICKNESS: 2 INCHES (R-10.0).

2. PRODUCTS FROM THE FOLLOWING MANUFACTURERS, PROVIDED THEY COMPLY WITH THE REQUIREMENTS OF THE CONTRACT DOCUMENTS, WILL BE AMONG THOSE CONSIDERED ACCEPTABLE:

A. DOW CHEMICAL CORP.

B. OWENS-CORNING.

2.03 THERMAL INSULATION

A. GLASS FIBER INSULATION AT EXTERIOR PERIMETER WALLS

1. UNFACED BLANKET/BATT: ASTM C655, TYPE I, NONCOMBUSTIBLE AS TESTED IN ACCORDANCE WITH ASTM E136. THICKNESS: 6" (R-19.0)

2. PRODUCTS FROM THE FOLLOWING MANUFACTURERS, PROVIDED THEY COMPLY WITH THE REQUIREMENTS OF THE CONTRACT DOCUMENTS, WILL BE AMONG THOSE CONSIDERED ACCEPTABLE:

A. OWENS-CORNING FIBERGLASS CORP.

B. CERTAINTEED CORP.

C. KNAUF FIBER GLASS.

2.04 VAPOR RETARDER (REFER TO SPECIFICATION SECTION 03310)

A. TWO-PLY HIGH DENSITY CROSS LAMINATED POLYETHELENE WITH TAPED JOINTS. 3 MIL THICKNESS WITH A PERM RATING OF .045

1. PRODUCTS FROM THE FOLLOWING MANUFACTURERS, PROVIDED THEY COMPLY WITH THE REQUIREMENTS OF THE CONTRACT DOCUMENTS, WILL BE AMONG THOSE CONSIDERED ACCEPTABLE:

A. RAVEN INDUSTRIES.

2.05 SOUND ATTENUATION INSULATION

A. SEMI-RIGID MINERAL WOOL FIBER.

1. UNFACED BLANKET/BATT: ASTM C655, TYPE I, NONCOMBUSTIBLE AS TESTED IN ACCORDANCE WITH ASTM E136.

2. THICKNESS: AS REQUIRED AND INDICATED FOR WALL CONSTRUCTION AND STC RATING.

3. R-VALUE: 3.8 PER INCH.

4. PRODUCTS FROM THE FOLLOWING MANUFACTURERS, PROVIDED THEY COMPLY WITH THE REQUIREMENTS OF THE CONTRACT DOCUMENTS, WILL BE AMONG THOSE CONSIDERED ACCEPTABLE:

A. OWENS-CORNING FIBERGLASS CORP.

B. CERTAINTEED CORP.

C. KNAUF FIBER GLASS.

2.06 FOAMED-IN-PLACE INSULATION

A. TWO COMPONENT URETHANE; SELF FROTHING

B. UL CLASS I FIRE-RATED.

C. PRODUCTS FROM THE FOLLOWING MANUFACTURERS, PROVIDED THEY COMPLY WITH THE REQUIREMENTS OF THE CONTRACT DOCUMENTS, WILL BE AMONG THOSE CONSIDERED ACCEPTABLE:

1. BASF CORP., POLYMERS DIV., STYROPAR GROUP.

2. INSTA-FOAM PRODUCTS INC.

3. UNIVERSAL PROTECTIVE COATINGS.

2.07 FIRE SAFING / SMOKE SEALING

A. MINERAL FIBER FIRE SAFING INSULATION: COMPOSED OF THERMOSETTING RESIN BINDERS AND SEMI REFRACTORY MINERAL FIBERS DERIVED FROM ROCK SLAG.

1. UNFACED BLANKET/BATT: ASTM C655, TYPE I, NONCOMBUSTIBLE AS TESTED IN ACCORDANCE WITH ASTM E136.

A. INSTALL IN ALL CONTINUOUS JOINTS IN FIRE RATED WALLS AND IN LOCATIONS WHERE FIRE-STOP SEALANT IS INDICATED ON THE DRAWINGS.

I. THICKNESS 4-INCH OR AS OTHERWISE REQUIRED

II. INCLUDE GALVANIZED STEEL SAFING IMPALING CLIPS, UL LABELED.

B. PRODUCTS FROM THE FOLLOWING MANUFACTURERS, PROVIDED THEY COMPLY WITH THE REQUIREMENTS OF THE CONTRACT DOCUMENTS, WILL BE AMONG THOSE CONSIDERED ACCEPTABLE:

I. USG CORPORATION

B. SILICONE FIRESTOP SEALANT: SINGLE COMPONENT, NON-COMBUSTIBLE SILICONE ELASTOMER FIRESTOP SEALANT, UL CLASSIFIED AS A “FILL, VOID OR CAVITY MATERIAL” FOR THROUGH PENETRATION FIRESTOP SYSTEM WHEN TESTED IN ACCORDANCE WITH ASTM E 814 / UL 1479.

1. PRODUCTS FROM THE FOLLOWING MANUFACTURERS, PROVIDED THEY COMPLY WITH THE REQUIREMENTS OF THE CONTRACT DOCUMENTS, WILL BE AMONG THOSE CONSIDERED ACCEPTABLE:

A. 3M COMPANY - “FIRE BARRIER SILICONE SEALANTS”.

C. FIRESTOP PUTTY: STICKS OR PADS.

1. PRODUCTS FROM THE FOLLOWING MANUFACTURERS, PROVIDED THEY COMPLY WITH THE REQUIREMENTS OF THE CONTRACT DOCUMENTS, WILL BE AMONG THOSE CONSIDERED ACCEPTABLE:

A. 3M COMPANY - “FIRE BARRIER SILICONE SEALANTS”.

2.08 ACCESSORIES

A. PROVIDE ACCESSORIES AS NECESSARY TO PROPERLY INSTALL SPECIFIED PRODUCTS.

1. ADHESIVE: INSULATION MANUFACTURER'S RECOMMENDED ADHESIVE.

2. MASTIC SEALER: INSULATION MANUFACTURER'S RECOMMENDED MASTIC SEALER FOR APPLICATION ON BOARD EDGES DURING INSTALLATION AND FOR FILLING VOIDS.

PART 3 - EXECUTION

3.02 EXAMINATION

A. VERIFY THAT CONDITIONS CONFORM TO THE REQUIREMENTS OF THE CONTRACT DOCUMENTS.

B. VERIFY THAT RELATED WORK TO BE PERFORMED WITHIN INDICATED SPACES BEFORE INSTALLATION OF INSULATION HAS BEEN COMPLETED.

C. DO NOT PROCEED UNTIL UNSATISFACTORY CONDITIONS HAVE BEEN CORRECTED. COMMENCEMENT OF INSTALLATION INDICATES ACCEPTANCE OF CONDITIONS.

3.03 INSTALLATION

A. FOUNDATION INSULATION BOARDS.

1. PROVIDE INSTALLATION CAPABLE OF SUSTAINING SUBSEQUENT CONSTRUCTION WORK WITHOUT DAMAGE OR DISPLACEMENT.

A. ADHESIVE: USE MANUFACTURER'S RECOMMENDED ADHESIVE TO ATTACH INSULATION BOARDS TO FOUNDATION. MAXIMIZE CONTACT BETWEEN BOARD SURFACE AND SUBSTRATE.

2. CUT INSULATION NEATLY AS REQUIRED TO FIT TIGHTLY AROUND OBSTRUCTIONS

3. INSTALL BOARDS AS INDICATED. BUTT (T&G) EDGES AND ENDS TIGHTLY. FORM SOLID JOINTS WHERE INSULATION BOARDS MEET PROTRUSIONS AND BETWEEN ADJACENT BOARDS. STAGGER JOINTS.

END OF SECTION

SECTION 07 24 00

EIFS

PART 1 GENERAL

1.01 TEMS REQUIRED BUT NOT SPECIFIED

A. IF AN ITEM OR MATERIAL OF THIS TRADE IS INDICATED ON THE DRAWINGS BUT NOT SPECIFICALLY LISTED IN THIS SECTION, PROVIDE SUCH ITEM OR MATERIAL AT A STANDARD OF QUALITY EQUAL TO THE STANDARD ESTABLISHED FOR THE BALANCE OF THE WORK SPECIFIED, IN ACCORDANCE WITH THE ARCHITECT'S INTERPRETATION.

1.02 EXECUTION, CORRELATION AND INTENT

A. A. IN CASE OF AN INCONSISTENCY BETWEEN DRAWINGS AND SPECIFICATIONS, OR WITHIN EITHER DOCUMENT NOT CLARIFIED BY ADDENDUM, THE BETTER QUALITY OR GREATER QUANTITY OF WORK IS TO BE PROVIDED, IN ACCORDANCE WITH THE ARCHITECT'S INTERPRETATION.

1.03 SUMMARY

A. A. SECTION INCLUDES: CLASS PB TYPE A EXTERIOR INSULATION AND FINISH SYSTEM.

B. SECTION DOES NOT INCLUDE: CONSTRUCTION OR INSTALLATION OF SUBSTRATES.

C. RELATED SECTIONS: COLD FORMED METAL FRAMING AND JOINT SEALANTS.

1.04 DEFINITIONS

A. CLASS PB TYPE A EXTERIOR INSULATION AND FINISH SYSTEM:

A. THE MATERIALS FORMING THE OUTER THERMAL AND WEATHER ENVELOPE OF A BUILDING, EXCLUDING DOORS AND WINDOWS, AND COMPRISING RIGID THERMAL INSULATION, PROTECTIVE AND DECORATIVE COATINGS, MEANS OF FASTENING TO THE SUPPORTING SUBSTRATE, AND RELATED ACCESSORIES AS SPECIFIED HEREIN.

B. CLASS PB DESIGNATES A BASE COATINGS OF THE CHARACTERISTICS AS DEFINED BY THE EXTERIOR INSULATION MANUFACTURER'S ASSOCIATION.

C. TYPE A DESIGNATES THAT THE PROTECTIVE COATING IS REINFORCED WITH A FABRIC MESH OF THE TYPE INDICATED.

D. SYSTEM MANUFACTURER: THE MANUFACTURER OF THE BASE AND FINISH COATINGS.

1.05 SYSTEM DESCRIPTION

A. PROVIDE A CLASS PB TYPE A EXTERIOR INSULATION AND FINISH SYSTEM, INCLUDING THE FOLLOWING MATERIALS SPECIFIED IN THIS SECTION:

A. THERMAL INSULATION BOARD.

B. MATERIALS USED FOR ATTACHMENT OF INSULATION BOARD TO SUBSTRATES.

C. PROTECTIVE COATINGS APPLIED SEQUENTIALLY TO INSULATION BOARD.

D. REINFORCING FABRICS.

B. PROVIDE SYSTEM COMPLYING WITH THE FOLLOWING REQUIREMENTS:

A. FIRE TESTS:

I. FLAME SPREAD INDEX (ASTM E 84) OF FOAM PLASTIC INSULATION, COATINGS, AND FACINGS (EACH TESTED SEPARATELY): 25, MAXIMUM.

II. SMOKE-DEVELOPED INDEX (ASTM E 84) OF FOAM PLASTIC INSULATION, COATINGS, AND FACINGS (EACH TESTED SEPARATELY): 450, MAXIMUM.

B. BUILDING CODE GOVERNING LOCATION OF PROJECT'S JURISDICTION INCLUDING LOCAL AMMENDMENTS.

C. DURABILITY REQUIREMENTS:

I. ACCELERATED WEATHERING, ASTM G 23, METHOD 1, OR ASTM G 26:

1. TEST PERIOD: 2000 HOURS.

2. TEST SPECIMEN: MANUFACTURER'S STANDARD FINISH APPLIED TO 1-INCH-THICK INSULATION MOUNTED ON 1/2-INCH GYPSUM BOARD, CURED FOR 28 DAYS, MINIMUM.

3. TEST RESULTS: NO CRACKING, FLAKING, PEELING, BLISTERING OR OTHER DELETERIOUS EFFECTS.

II. SALT SPRAY RESISTANCE, ASTM B 117:

1. TEST PERIOD: 300 HOURS.

2. TEST SPECIMEN: MANUFACTURER'S STANDARD FINISH MOUNTED ON 1/2-INCH GYPSUM BOARD, CURED FOR 28 DAYS, MINIMUM.

3. TEST RESULTS: NO DELETERIOUS EFFECTS.

III. ABSORPTION-FREEZE RESISTANCE:

1. TEST METHOD: SUBJECT SPECIMENS TO 4-DAY UNDERWATER SOAK FOLLOWED BY 60 CYCLES OF ALTERNATING EXPOSURE TO TEMPERATURES OF MINUS 10 DEGREES C FOR 2 HOURS AND POSITIVE 20 DEGREES C FOR 2 HOURS.

2. TEST SPECIMEN: MANUFACTURER'S STANDARD FINISH APPLIED ON ALL SIDES TO 4- BY 8- BY 1-INCH INSTALLATION, CURED FOR 28 DAYS, MINIMUM.

3. TEST RESULTS: NO VISIBLE CHANGE.

IV. MILDEW RESISTANCE, ML STANDARD 810, METHOD 508:

1. TEST SPECIMEN: MANUFACTURER'S STANDARD FINISH COAT APPLIED IN ACCORDANCE WITH MANUFACTURER'S PRINTED INSTRUCTIONS TO 2- BY 2-INCH GLASS SLIDES, CURED FOR 28 DAYS, MINIMUM.

2. TEST RESULTS: NO GROWTH SUPPORTED.

V. ABRASION RESISTANCE:

1. TEST METHOD: EXPOSE SPECIMENS TO 500 LITERS OF SAND IN ACCORDANCE WITH ASTM

D 968, METHOD A.

2. TEST SPECIMEN: MANUFACTURER'S STANDARD FINISH APPLIED TO 1-INCH-THICK INSULATION MOUNTED ON 1/2-INCH GYPSUM BOARD, CURED FOR 28 DAYS, MINIMUM.

3. TEST RESULTS: NO CRACKING, CHECKING, OR LOSS OF FILM INTEGRITY.

VI. IMPACT RESISTANCE, EIMA 101.86:

1. MEDIUM IMPACT RESISTANCE CLASSIFICATION OR BETTER.

VII. ATTACHMENT REQUIREMENTS:

1. WHERE INDICATED, SECURE INSULATION BOARD TO SUBSTRATE USING ADHESIVE ATTACHMENT.

2. IF RECOMMENDED BY SYSTEM MANUFACTURER, ATTACHMENT TYPES OTHER THAN THOSE INDICATED MAY BE USED IF APPROVED BY THE ARCHITECT.

1.06 DESIGN REQUIREMENTS

A. WIND LOAD

A. DESIGN FOR MAXIMUM ALLOWABLE SYSTEM DEFLECTION, NORMAL TO THE PLANE OF THE WALL AS OUTLINED IN SECTION 05 40 00 - COLD FORMED METAL FRAMING.

B. DESIGN FOR WIND LOAD IN CONFORMANCE WITH CODE REQUIREMENTS.

B. MOISTURE CONTROL

A. PREVENT THE ACCUMULATION OF WATER BEHIND THE EIFS, EITHER BY CONDENSATION OR LEAKAGE THROUGH THE WALL CONSTRUCTION, IN THE DESIGN AND DETAILING OF THE WALL ASSEMBLY.

I. PROVIDE FLASHING TO DIRECT WATER TO THE EXTERIOR WHERE IT IS LIKELY TO PENETRATE COMPONENTS IN THE WALL ASSEMBLY, INCLUDING, ABOVE WINDOW AND DOOR HEADS, BENEATH WINDOW AND DOOR SILLS, AT ROOF/WALL INTERSECTIONS, DECKS, ABUTMENTS OF LOWER WALLS WITH HIGHER WALLS, ABOVE PROJECTING FEATURES, AND AT THE BASE OF THE WALL.

II. AIR LEAKAGE PREVENTION-- PROVIDE CONTINUITY OF AIR BARRIER SYSTEM AT FOUNDATION, ROOF, WINDOWS, DOORS AND OTHER PENETRATIONS THROUGH THE SYSTEM WITH CONNECTING AND COMPATIBLE AIR BARRIER COMPONENTS TO MINIMIZE CONDENSATION AND LEAKAGE CAUSED BY AIR MOVEMENT.

III. VAPOR DIFFUSION AND CONDENSATION-- PERFORM A DEW POINT ANALYSIS OF THE WALL ASSEMBLY TO DETERMINE THE POTENTIAL FOR ACCUMULATION OF MOISTURE IN THE WALL ASSEMBLY AS A RESULT OF WATER VAPOR DIFFUSION AND CONDENSATION. ADJUST INSULATION THICKNESS AND/OR OTHER WALL ASSEMBLY COMPONENTS ACCORDINGLY TO MINIMIZE THE RISK OF CONDENSATION. AVOID THE USE OF VAPOR RETARDERS ON THE INTERIOR SIDE OF THE WALL IN WARM, HUMID CLIMATES.

C. THERMAL INSULATION

A. PROVIDE GLASS FIBER INSULATION IN CAVITY:

1. UNFACED BLANKET/BATT: ASTM C655, TYPE I, NONCOMBUSTIBLE AS TESTED IN ACCORDANCE WITH ASTM E136.

2. THICKNESS: 3 ½" (R-11.0)

3. PRODUCTS FROM THE FOLLOWING MANUFACTURERS, PROVIDED THEY COMPLY WITH THE REQUIREMENTS OF THE CONTRACT DOCUMENTS, WILL BE AMONG THOSE CONSIDERED ACCEPTABLE:

A. OWENS-CORNING FIBERGLASS CORP.

B. CERTAINTEED CORP.

C. KNAUF FIBER GLASS.

A.

D. JOINTS

A. DESIGN MINIMUM 3/4 INCH (19 MM) WIDE EXPANSION JOINTS IN THE EIFS WHERE THEY EXIST IN THE SUBSTRATE OR SUPPORTING CONSTRUCTION, WHERE THE EIFS ADJOINS DISSIMILAR CONSTRUCTION OR MATERIALS, AT CHANGES IN BUILDING HEIGHT, AND AT FLOOR LINES IN MULTI-LEVEL WOOD FRAME CONSTRUCTION.

I. COORDINATE LOCATION OF EXPANSION JOINTS WITH CONSTRUCTION MANAGER AND ARCHITECT.

B. DESIGN MINIMUM 1/2 INCH (13 MM) WIDE SEALANT JOINTS AT ALL PENETRATIONS THROUGH THE EIFS (WINDOWS, DOORS, ETC.).

C. SPECIFY COMPATIBLE BACKER ROD AND SEALANT THAT HAS BEEN EVALUATED IN ACCORDANCE WITH ASTM C 1382, "TEST METHOD FOR DETERMINING TENSILE ADHESION PROPERTIES OF SEALANTS WHEN USED IN EXTERIOR INSULATION AND FINISH SYSTEM (EIFS) JOINTS," AND THAT MEETS MINIMUM 50% ELONGATION AFTER CONDITIONING.

I. ALL SEALANTS MUST MEET THE CRITERIA FOR LEED NC VERSION 3. SEE SECTION 07 92 00 - JOINT SEALANTS FOR MORE INFORMATION.

D. DESIGN JOINTS SO THAT AIR BARRIER CONTINUITY IS MAINTAINED ACROSS THE JOINT AND DRAIN JOINTS TO THE EXTERIOR.

E. TRIM, PROJECTING ARCHITECTURAL FEATURES AND REVEALS

A. ALL TRIM AND PROJECTING ARCHITECTURAL FEATURES MUST HAVE A MINIMUM 1:2 [27°] SLOPE ALONG THEIR TOP SURFACE. ALL HORIZONTAL REVEALS MUST HAVE A MINIMUM 1:2 [27°] SLOPE ALONG THEIR BOTTOM SURFACE. WHERE TRIM/FEATURE OR BOTTOM SURFACE OF REVEAL PROJECTS MORE THAN 2 INCHES (51 MM) FROM THE FACE OF THE EIFS WALL PLANE, PROTECT THE TOP SURFACE WITH WATERPROOF BASE COAT. AVOID THE USE OF TRIM AND FEATURES THAT EXCEED THE MAXIMUM ALLOWABLE THICKNESS OF EPS PERMITTED BY CODE. PERIODIC INSPECTIONS AND INCREASED MAINTENANCE MAY BE REQUIRED TO MAINTAIN SURFACE INTEGRITY OF EIFS ON WEATHER EXPOSED SLOPED SURFACES. LIMIT PROJECTING FEATURES TO EASILY ACCESSIBLE AREAS AND LIMIT TOTAL AREA TO FACILITATE MAINTENANCE AND MINIMIZE MAINTENANCE BURDEN.

B. DO NOT USE EIFS ON WEATHER EXPOSED PROJECTING LEDGES, SILLS, OR OTHER PROJECTING FEATURES UNLESS SUPPORTED BY FRAMING OR OTHER STRUCTURAL SUPPORT AND PROTECTED WITH METAL COPING OR FLASHING.

1.07 SUBMITTALS

A. PRODUCT DATA:

A. PRODUCT DATA FOR EACH MATERIAL SPECIFIED.

B. MANUFACTURER'S DETAILED STORAGE, MIXING AND INSTALLATION INSTRUCTIONS.

C. INDEPENDENT LABORATORY TEST REPORTS OR CERTIFICATES DEMONSTRATING COMPLIANCE WITH SPECIFIED REQUIREMENTS.

D. WARRANTY DRAFT.

B. SELECTION SAMPLES: SUBMIT MANUFACTURER'S FULL, STANDARD RANGE.

A. COLOR SAMPLES OF FINISH COAT.

I. ARCHITECT TO CHOOSE WALL COLOR FROM MANUFACTURER'S FULL, STANDARD COLOR RANGE.

B. TEXTURE SAMPLES OF FINISH COAT.

I. ARCHITECT TO CHOOSE WALL FINISH COAT TEXTURE FROM MANUFACTURER'S FULL, STANDARD RANGE OF FINISHES.

C. CERTIFICATES SIGNED BY MANUFACTURER.

A. INSTALLERS ARE APPROVED BY SYSTEM MANUFACTURER FOR INSTALLATION OF THE SYSTEM.

B. SUBSTRATES INDICATED ARE APPROVED FOR SYSTEM.

C. THESE SPECIFICATIONS AND THE DETAILS SHOW ON THE DRAWINGS CONFORM TO MANUFACTURER'S RECOMMENDATIONS.

1.08 QUALITY ASSURANCE

A. MANUFACTURER REQUIREMENTS

A. MEMBER IN GOOD STANDING OF THE EIFS INDUSTRY MEMBERS ASSOCIATION (EIMA).

B. SYSTEM MANUFACTURER FOR A MINIMUM OF TWENTY (20) YEARS.

C. MANUFACTURING FACILITIES ISO 9002 CERTIFIED.

D. MANUFACTURER'S WALL ASSEMBLY LISTED IN GYPSUM ASSOCIATION FIRE RESISTANCE DESIGN MANUAL.

B. CONTRACTOR REQUIREMENTS

A. ENGAGED IN APPLICATION OF EIFS FOR A MINIMUM OF THREE (3) YEARS.

B. KNOWLEDGEABLE IN THE PROPER USE AND HANDLING OF MATERIALS AND LISTED AS HAVING ATTENDED EIFS CONTINUING EDUCATION.

C. EMPLOY SKILLED MECHANICS THAT ARE EXPERIENCED AND KNOWLEDGEABLE IN EIFS APPLICATION, AND FAMILIAR WITH THE REQUIREMENTS OF THE SPECIFIED WORK.

D. SUCCESSFUL COMPLETION OF MINIMUM OF THREE (3) PROJECTS OF SIMILAR SIZE AND COMPLEXITY TO THE SPECIFIED PROJECT.

E. PROVIDE THE PROPER EQUIPMENT, MANPOWER AND SUPERVISION ON THE JOB SITE TO INSTALL THE SYSTEM IN COMPLIANCE WITH PUBLISHED SPECIFICATIONS AND DETAILS AND THE PROJECT PLANS AND SPECIFICATIONS.

C. INSULATION BOARD MANUFACTURER REQUIREMENTS

A. RECOGNIZED AS CAPABLE OF PRODUCING INSULATION BOARD TO MEET SYSTEM REQUIREMENTS, AND HOLD A VALID LICENSING AGREEMENT WITH MANUFACTURER.

B. LISTED BY AN APPROVED AGENCY.

C. LABEL INSULATION BOARD WITH INFORMATION REQUIRED BY THE APPROVED LISTING AGENCY AND THE APPLICABLE BUILDING CODE.

1.09 DELIVERY, STORAGE AND HANDLING

A. DELIVER MATERIALS TO THE PROJECT SITE IN MANUFACTURER'S ORIGINAL PACKAGING.

A. MATERIALS SHALL BEAR MANUFACTURER'S NAME, BRAND NAME, DESCRIPTION OF CONTENTS AND IDENTIFYING MARKINGS IN THE FORM REQUIRED BY THIS SPECIFICATION. MATERIALS NOT SO LABELED WILL BE REJECTED AND SHALL BE IMMEDIATELY REMOVED FROM THE SITE.

B. PACKAGES OF INSULATION BOARD SHALL BEAR IDENTIFYING MARKINGS OF AN INDEPENDENT TESTING AGENCY ACCEPTABLE TO THE AUTHORITIES HAVING JURISDICTION AND EITHER THE FLAME SPREAD AND SMOKEDEVELOPED INDEXES OF THE BOARD OR THE USE FOR WHICH THE BOARD HAS BEEN APPROVED.

C. FOAM PLASTIC INSTALLATION SHALL BE LISTED BY AN INDEPENDENT TESTING AGENCY ACCEPTABLE TO THE AUTHORITIES HAVING JURISDICTION.

B. STORE MATERIALS IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS.

A. STORAGE AREA: CLEAN, DRY, WELL-VENTILATED, PROTECTED FROM SUNLIGHT AND EXCESSIVE HEAT.

B. COATING MATERIALS SUSCEPTIBLE TO FROST DAMAGE: STORE ABOVE 40 DEGREES F.

C. INSULATION BOARD:

I. DO NOT EXPOSE TO FLAME OR OTHER IGNITION SOURCE.

II. COVER WITH OPAQUE, LIGHT-COLORED TARPS TO SHIELD FROM SUNLIGHT WHEN EXPOSED FOR EXTENDED PERIODS.

III. DO NOT EXPOSE TO SUNLIGHT FOR MORE THAN 5 DAYS BEFORE COVERING WITH BASE COAT.

IV. DO NOT EXPOSE TO TEMPERATURES EXCEEDING 165 DEGREES F.

V. STORE FLAT AND AT LEAST 8 INCHES OFF THE GROUND.

1.10 ENVIRONMENTAL CONDITIONS

A. MINIMUM TEMPERATURE OF AMBIENT AIR AND SUBSTRATES: 40 DEGREES F OR ABOVE AND STEADY OR RISING AT TIME OF INSTALLATION AND CURING OF COATING MATERIALS AND FOR AT LEAST 24 HOURS THEREAFTER.

B. HOT-WEATHER LIMITS: AS RECOMMENDED BY SYSTEM MANUFACTURER AND DEPENDING UPON AIR TEMPERATURE, RELATIVE HUMIDITY, WIND SPEED AND EXPOSURE TO SUN.

C. DO NOT INSTALL COATINGS WHEN CONDITIONS ARE OUTSIDE OF SPECIFIED LIMITS.

D. PARTIALLY COMPLETED WORK OR WORK NOT FULLY CURED THAT IS EXPOSED TO THE ELEMENTS IN EXCESS OF MANUFACTURER'S RECOMMENDATIONS MAY BE REJECTED.

1.11 WARRANTY

A. SYSTEM MANUFACTURER'S STANDARD MATERIAL REPLACEMENT WARRANTY.

B. THIS WARRANTY SHALL BE IN ADDITION TO, AND NOT A LIMITATION OF, OTHER RIGHTS THE OWNER MAY HAVE AGAINST THE CONTRACTOR UNDER THIS CONTRACT.

C. WARRANTY PERIOD: 15 FROM THE DATE OF SUBSTANTIAL COMPLETION.

PART 2 PRODUCTS

2

2.01 MANUFACTURERS

A. PRODUCTS OF THE MANUFACTURER LISTED BELOW FROM THE BASIS OF THE CONTRACT DOCUMENTS.

A. DRYVIT SYSTEMS, INC.: “OUTSULATION.”

B. PRODUCTS COMPLYING WITH REQUIREMENTS OF THE CONTRACT DOCUMENTS AND MADE ONLY BY ONE OF THE FOLLOWING WILL BE CONSIDERED ACCEPTABLE AS SUBSTITUTES:

A. SENERGY, INC.

B. STO INDUSTRIES DIVISION/STO CORPORATION.

C. ARCHITECT APPROVED SUBSTITUTE

C. SINGLE-SOURCE RESPONSIBILITY:

A. PROVIDE ONLY MATERIALS THAT ARE MANUFACTURED BY OR SPECIFICALLY APPROVED BY SYSTEM MANUFACTURER FOR USE IN SPECIFIED SYSTEM.

B. WHEN REQUIRED BY SYSTEM MANUFACTURER, INSULATION BOARD FABRICATED (BY OTHER THAN SYSTEM MANUFACTURER) FOR USE WITH THIS SYSTEM SHALL BE LABELED AS REQUIRED BY SYSTEM MANUFACTURER.

2.02 MATERIALS

SECTION 07 24 00

EIFS

A. AIR/MOISTURE BARRIER

A. “BACKSTOP NT - TEXTURE; FLUID APPLIED AIR/MOISTURE BARRIER FOR EXTERIOR WALL SHEATHING.

B. ADHESIVE:

A. “PRIMUS”; DRYVIT SYSTEMS, INC.

C. INSULATION BOARD:

A. EXPANDED POLYSTYRENE BOARD (EPS) COMPLYING WITH ASTM C 578, TYPE I AND WITH SYSTEM MANUFACTURER'S ADDITIONAL REQUIREMENTS.

B. THICKNESS: REFER TO DRAWINGS FOR REQUIRED THICKNESSES. R-VALUE TO BE 5 PER 1” OF THICKNESS.

C. SQUARE EDGES.

D. FIBERGLASS INSULATION:

A. GLASS FIBER INSULATION AT EXTERIOR PERIMETER WALLS WHERE INDICATED. UNFACED BLANKET/BATT: ASTM C655, TYPE I, NON COMBUSTIBLE AS TESTED IN ACCORDANCE WITH ASTM E136

B. THICKNESS: THICKNESS: 3 ½” (R-15.0)

C. PRODUCTS FROM THE FOLLOWING MANUFACTURERS, PROVIDED THEY COMPLY WITH THE REQUIREMENTS OF THE CONTRACT DOCUMENTS, WILL BE AMONG THOSE CONSIDERED ACCEPTABLE:

I. OWENS-CORNING FIBERGLASS CORP.

II. CERTAINTEED CORP.

III. KNAUF FIBER GLASS.

E. REINFORCING FABRIC:

A. “STANDARD”; DRYVIT SYSTEMS, INC.

B. ADD ALTERNATE “STANDARD PLUS”; DRYVIT SYSTEMS, INC. IN LIEU OF “STANDARD”; DRYVIT SYSTEMS, INC.

F. BASE COAT:

A. “PRIMUS”; DRYVIT SYSTEMS, INC.

G. FINISH COAT, COATING COLORS AND TEXTURE:

A. AS SELECTED BY THE ARCHITECT FROM MANUFACTURER'S FULL RANGE OF STANDARD COLORS & FINISHES.

2.03 MIXING

A. MIX MATERIALS IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS, USING ONLY

MANUFACTURER-APPROVED MATERIALS IN THE INSTRUCTED QUANTITIES. USE ONLY FRESHLY MIXED MATERIALS. APPLY MATERIALS WITHIN THE TIME PRESCRIBED BY THE MANUFACTURER AND WITHOUT RETEMPERING, UNLESS SPECIFICALLY APPROVED.

PART 3 EXECUTION

3

3.01 EXAMINATION

A. EXAMINE SUBSTRATES.

B. DETERMINE WHETHER OR NOT SUBSTRATE CONDITIONS ARE ACCEPTABLE.

A. ALL SUBSTRATES: CONFORM TO REQUIRED DIMENSIONAL TOLERANCES.

C. CORRECT UNSATISFACTORY CONDITIONS BEFORE PROCEEDING WITH INSTALLATION OF SYSTEM.

3.02 PREPARATION

A. GENERAL:

A. PROTECT ADJACENT SURFACES FROM CONTAMINATION DURING APPLICATION OF COATINGS.

B. SCHEDULE FLASHING AND SYSTEM INSTALLATION AS NECESSARY TO PRODUCE AN INTEGRATED, WATER-TIGHT ENVELOPE.

C. SUBSTRATES SHALL BE FREE OF WATER, MOISTURE, AND FROST.

D. PERFORMANCE SUBSTRATE SOUNDNESS TESTS RECOMMENDED BY SYSTEM MANUFACTURER.

B. SURFACE PREPARATION - ADHESIVE ATTACHMENT:

A. CLEAN SUBSTRATES, REMOVING CONTAMINATION SUCH AS OIL, FORM-RELEASE AGENTS, WAXES, PAINT, DUST AND DIRT. USE METHODS APPROPRIATE TO TYPE OF SUBSTRATE AND CONTAMINATION ENCOUNTERED, SUCH AS SCRUBBING WITH DETERGENTS, ACID ETCHING, SCARIFICATION, SANDBLASTING, ETC.

B. APPLY SURFACE SEALER OVER SUBSTRATES IF RECOMMENDED BY SYSTEM MANUFACTURER FOR IMPROVING ADHESION.

3.03 SURFACE LEVELING

A. WHERE REQUIRED IN ORDER TO PROVIDE UNIFORM PLANAR SUBSTRATE FOR APPLICATION OF INSULATION BOARD, APPLY ADHESIVE MIXTURE AS A LEVELING COAT TO TRUE THE SURFACE.

3.04 AIR / MOISTURE BARRIER

A. INSTALL AIR/MOISTURE BARRIER IN COMPLIANCE WITH MANUFACTURER'S PUBLISHED INSTRUCTIONS

A. PROTECT ADJACENT FINISHED SURFACES AND/OR MATERIALS FROM OVERSPRAY.

3.05 INSULATION BOARD

A. USE ADHESIVE ATTACHMENT OVER THE FOLLOWING SUBSTRATES:

A. NEW GLASS-FIBER-FACED GYPSUM SHEATHING.

B. ADHESIVE ATTACHMENT:

A. APPLY ADHESIVE IN ACCORDANCE WITH SYSTEM MANUFACTURER'S RECOMMENDATIONS. USE ONLY THE NOTCHED TROWEL METHOD, OTHER METHODS SHALL NOT BE USED WITHOUT APPROVAL OF THE ARCHITECT. ATTAIN AT LEAST THE REQUIRED MINIMUM CONTACT AREA BETWEEN INSULATION, ADHESIVE AND SUBSTRATE.

B. SEE SECTION 07 92 00 - JOINT SEALANTS FOR COMPLIANCE WITH LEED REQUIREMENTS.

C. DO NOT DISTURB ADHERED INSULATION FOR AT LEAST 24 HOURS AFTER INSTALLATION.

C. INSULATION BOARDS:

A. ARRANGE LAYOUT OF INSULATION JOINTS SUCH THAT JOINTS DO NOT COINCIDE WITH SHEATHING JOINTS.

B. FORM TIGHTLY BUTTED, FLUSH SURFACED JOINTS BETWEEN ADJACENT BOARDS AND ADJACENT COURSES. FILL ANY GAPS WITH PRECISELY FITTED INSULATION. DO NOT USE ADHESIVE TO SECURE FILLER PIECES.

C. RASP JOINTS WHERE NECESSARY TO PRODUCE A SMOOTH, EVEN, FLUSH SURFACE.

D. PRECISELY FIT INSULATION AT OPENINGS AND EDGES. ENSURE THAT EDGE OF INSULATION CONFORMS TO REQUIRED EDGE DETAILS.

E. INTERRUPT INSULATION AND FORM JOINTS WHERE INDICATED.

D. CONSTRUCT JOINTS AS REQUIRED FOR SEALANT APPLICATION.

A. WIDTH OF GAP AS NEEDED FOR APPLICATION OF SEALANT AFTER ENCAPSULATION OF BOARD EDGES WITH BASE COAT, REINFORCING FABRIC AND FINISH COAT.

B. APPLY BASE COAT, REINFORCING FABRIC AND FINISH COAT TO EXPOSED EDGES OF INSULATION BOARD INCLUDING THOSE FORMING SUBSTRATES OF SEALED JOINTS.

C. SEE SECTION 07 92 00 - JOINT SEALANTS FOR COMPLIANCE WITH LEED REQUIREMENTS.

3.06 COATINGS - GENERAL

A. COMPLETE EACH COATING IN SECTIONS BY WORKING FROM JOINT TO JOINT, FROM EDGE TO EDGE, FROM CORNER TO CORNER, OR ACCORDING TO OTHER SUCH DIVISIONS IN THE SURFACE.

B. WORK MATERIALS KEEPING A WET EDGE.

C. COMPLETE EACH APPLICATION BEFORE INITIAL SET OCCURS.

D. ALLOW EACH COATING TO CURE BEFORE PROCEEDING WITH SUBSEQUENT OPERATIONS.

E. PROTECT EACH COATING FROM DAMAGE AND EXCESSIVE HEAT, COLD, WATER AND

MOISTURE WHILE CURING.

3.07 TESTS AND ADJUSTMENTS

A. APPLY UNIFORM THICKNESS OF BASE COAT TO INSULATION.

A. THICKNESS WITHIN SYSTEM MANUFACTURER'S RECOMMENDED MINIMUM AND MAXIMUM.

B. REINFORCING FABRIC:

A. FULLY EMBED REINFORCING FABRICS IN BASE COAT WHILE STILL PLASTIC IN ORDER TO PRODUCE SMOOTH, EVENLY COATED INSTALLATION. AFTER EMBEDMENT, PATTERN OF FABRIC SHALL NOT BE VISIBLE.

B. COMPLY WITH SYSTEM MANUFACTURER'S REQUIREMENTS FOR LAPPING OR BUTTING FABRIC EDGES AND FOR REINFORCEMENT AT CORNERS, EDGES AND JOINTS.

I. INSTALL STANDARD DUTY FABRIC.

3.08 FINISH COAT

A. APPLY FINISH COAT, THICKNESS WITHIN MANUFACTURER'S RECOMMENDED MINIMUM AND MAXIMUM.

B. COLOR AND TEXTURE SHALL MATCH APPROVED SAMPLE.

3.09 TOLERANCES

A. SUBSTRATE - MAXIMUM VARIATION FROM PLANE:

A. 1/4 INCH IN 4 FEET.

B. MAJOR VERTICAL AND HORIZONTAL LINES (EXTERNAL CORNERS, CONTROL OR EXPANSION JOINTS, FREESTANDING ELEMENTS, OTHER CONSPICUOUS LINES) - MAXIMUM VARIATION FROM PLUMB:

A. 1/4 INCH IN 20 FEET.

B. 1/4 INCH IN ANY STORY.

C. MINOR VERTICAL AND HORIZONTAL LINES (ARISES AND OTHER INCONSPICUOUS LINES) - MAXIMUM VARIATION FROM PLUMB:

A. 1/4 INCH IN 8 FEET.

B. 3/8 INCH IN 20 FEET.

C. 3/8 INCH IN ANY STORY.

D. FINISHED SURFACES - MAXIMUM VARIATION FROM PLANE (EXCLUSIVE OF SPECIFIED TEXTURE):

A. 1/8 INCH IN 10 FEET.

E. COATING MATERIALS MINIMUM AND MAXIMUM THICKNESS (EXCLUSIVE OF SPECIFIED

TEXTURE):

A. AS RECOMMENDED BY SYSTEM MANUFACTURER.

B. IF A RANGE OF TOLERANCE IS NOT SPECIFIED BY SYSTEM MANUFACTURER, MINIMUM THICKNESS AT ANY POINT SHALL BE AS RECOMMENDED BY SYSTEM MANUFACTURER, AND MAXIMUM THICKNESS AT ANY POINT SHALL BE 150 PERCENT IF THE RECOMMENDED MINIMUM THICKNESS; AVERAGE THICKNESS OVERALL SHALL FALL WITHIN THE MIDDLE ONE-THIRD OF THE MINIMUM-TO-MAXIMUM RANGE.

3.10 CLEANING

A. CLEAN FINISHED SURFACE IN A TIMELY MANNER IF REQUIRED IN ORDER TO PREVENT PERMANENT DISCOLORATION.

B. REMOVE ACCUMULATED DIRT FROM FINISHED SURFACES PRIOR TO SUBSTANTIAL COMPLETION BUT AFTER COMPLETION OF ADJACENT ABUTTING HORIZONTAL SURFACE CONSTRUCTION (SUCH AS PAVEMENTS) AND AFTER ESTABLISHMENT OF ADJACENT TURF (IF ANY).

C. IF DISCOLORATION OR CONTAMINATION OCCURS AND CANNOT BE REMOVED, OR IF SYSTEM SUFFERS DAMAGE PRIOR TO SUBSTANTIAL COMPLETION, THEN RESTORE, OR REMOVE AND REPLACE, AFFECTED PORTIONS (REWORKING ENTIRE PLANAR SURFACES AS NECESSARY TO CONCEAL REWORK AREA), USING MANUFACTURER'S RECOMMENDED RESTORATION COATINGS OR NEW MATERIALS MEETING THE REQUIREMENTS OF THIS SPECIFICATION, AS ACCEPTABLE TO THE ARCHITECT.

3.11 PROTECTION

A. PROTECTION OF WORK IN PROGRESS:

A. PROVIDE TEMPORARY COVERING AND OTHER PROTECTION AS NECESSARY TO PREVENT SPATTERING OF MATERIALS O OTHER WORK.

B. PROVIDE TEMPORARY PROTECTION FOR TOPS OF WALLS AND OTHER EXPOSED LOCATIONS UNTIL PERMANENT CONSTRUCTION IS INSTALLED.

C. PROTECT SYSTEM AND SUBSTRATES FROM INCLEMENT WEATHER DURING INSTALLATION. PREVENT INFILTRATION OF MOISTURE BEHIND SYSTEM AND DETERIORATION OF SUBSTRATES.

D. PROVIDE TEMPORARY PROTECTION OF INCOMPLETE WORK AT THE END OF EACH WORKING DAY AND WHENEVER WORK IS NOT IN PROGRESS.

B. REMOVE TEMPORARY COVERINGS WHEN NO LONGER NEEDED.

C. PROVIDE FINAL PROTECTION AND MAINTAIN CONDITIONS UNTIL SUBSTANTIAL COMPLETION.

END OF SECTION

SECTION 07 42 00

INSULATED METAL PANELS

PART 1 GENERAL

1.01 SUMMARY AND SCOPE OF WORK

A. FURNISH AND INSTALL:

1. PRE-FORMED INSULATED METAL WALL AND CEILING PANEL SYSTEMS WITH RELATED FLASHINGS, SEALANTS, VAPOR BARRIERS, AND ACCESSORY COMPONENTS TO MAKE THE SYSTEM COMPLETE.

1.02 SYSTEM DESCRIPTION

A. SYSTEM: PREFORMED CONCEALED FASTENER INSULATED METAL PANELS, WITH THERMALLY BROKEN INTERLOCKING TABS AND USDA APPROVED SILICONE CAULKING AT ALL JOINTS TO PROVIDE A CONTINUOUS VAPOR BARRIER.

1.03 DESIGN AND PERFORMANCE REQUIREMENTS

A. COMPONENTS: SHALL MEET FACTORY MUTUAL REQUIREMENTS AND APPROVAL. DESIGN AND SIZE TO WITHSTAND DEAD AND LIVE LOADS CAUSED BY POSITIVE AND NEGATIVE WIND PRESSURE ACTING NORMAL TO PLANE OF PANEL AS CALCULATED IN ACCORDANCE WITH AND TO A DESIGN PRESSURE AS REQUIRED BY THE LOCAL BUILDING CODE AND MEASURED IN ACCORDANCE WITH ASTM E330.

1. MAXIMUM ALLOWABLE DEFLECTION OF PANELS:

A. L/180 AT EXTERIOR.

B. L/120 AT INTERIOR PARTITIONS.

C. L/240 AT CEILINGS.

B. MOVEMENT: ACCOMMODATE MOVEMENT WITHIN SYSTEM WITHOUT DAMAGE TO SYSTEM, COMPONENTS, OR DETERIORATION OF SEALS; MOVEMENT BETWEEN SYSTEM AND PERIMETER COMPONENTS WHEN SUBJECT TO SEASONAL TEMPERATURE CYCLING; DYNAMIC LOADING AND RELEASE OF LOADS; DEFLECTION OF STRUCTURAL SUPPORT FRAMING. ACCOMMODATE MOVEMENT BETWEEN PANELS OF DIFFEREING TEMPERATURE SPACES BY MEANS OF SLIP JOINT TRIMS WHERE REQUIRED.

C. TOLERANCES: ACCOMMODATE TOLERANCES OF BUILDING STRUCTURAL FRAMING.

D. PRODUCTS: PROVIDE CONTINUITY OF THERMAL BARRIER AT BUILDING ENCLOSURE ELEMENTS AND AT ADJACENT SPACES OF DIFFEREING TEMPERATURE.

PART 2 PRODUCTS

2.01 PRODUCTS AND MANUFACTURERS

E. THE FOLLOWING MANUFACTURER IS THE BASIS OF THE CONTRACT DOCUMENTS:

1. METL-SPAN METAL PANELS, COLD STORAGE PANELS, CF-MESA (EXTERIOR PANELS), TUFF-WALL (EXTERIOR PANELS), CF-LIGHT MESA (INTERIOR PARTITIONS & CEILINGS)

F. MANUFACTURERS' PRODUCT NAMES AND NUMBERS ARE GIVEN AS A STANDARD. PRODUCTS FROM OTHER MANUFACTURERS PROVIDED THEY COMPLY WITH THE REQUIREMENTS

OF THE CONTRACT DOCUMENTS WILL BE CONSIDERED, PENDING ARCHITECT APPROVAL.

2.02 PANEL SHEET MATERIALS

A. BASE MATERIAL

1. HOT DIPPED, COMMERCIAL QUALITY PRE-COATED 26-GAUGE GALVANIZED STEEL CONFORMING TO ASTM A755/A755M; ASTM A446/A446M, GRADE D, COATING DESIGNATION G-90.

B. PROFILES

1. EXTERIOR PANELS

A. METL-SPAN MESA

B. METL-SPAN TUFF-WALL

2. INTERIOR PANELS / PARTITIONS

A. BOTH SIDES = METL-SPAN CF-LIGHT MESA

C. FINISH

1. FACE OF WALL PANELS; SHOP PRE-COATED WITH FLUROPON HIGH PERFORMANCE FLUOROPOLYMER COATING, USDA ACCEPTED, WARRANTED FOR 20 YEARS IN AREAS REQUIRING HEAVY WASH DOWN. COLOR: AS INDICATED ON DRAWINGS.

2.03 INSULATION

A. INSULATION: POLYURETHANE, CONTINUOUSLY FOAMED IN PLACE WITH A NOMINAL DENSITY OF 2.4 LBS./CU.FT. AND A COMPRESSIVE STRENGTH OF 22 PSI; FLAME/SMOKE CLASSIFICATION OF 25/450 IN ACCORDANCE WITH ASTM E84, IN THICKNESS AS INDICATED (SEE DRAWINGS FOR SPECIFIC PANELS SIZES AND LOCATIONS):

1. 4 INCH THICK PANEL, MINIMUM R-VALUE OF 29.42 AT 75° F MEAN.

2. 6 INCH THICK PANEL, MINIMUM R-VALUE OF 43.71 AT 75° F MEAN.

2.04 ACCESSORIES

A. SEALANTS:

1. MANUFACTURER'S STANDARD TYPE SUITABLE FOR USE WITH INSTALLATION OF PANEL SYSTEM; NON-STAINING, NON-SKINNING, NON-SHRINKING AND NON-SAGGING; ULTRA-VIOLET AND OZONE RESISTANT COLOR AS SELECTED.

2. INTERIOR PANEL JOINTS FOR ALL FOOD PROCESSING AREAS SHALL BE USDA APPROVED WHITE SILICONE CAULK.

3. INTERIOR PANEL JOINTS AND ALL ASSOCIATED TRIM AT ALL INTERIOR WALLS AND CEILINGS NEED TO BE BACK SEALED WITH A USDA APPROVED WHITE SILICONE CAULK.

B. EXPOSED FASTENERS - SHOULD THESE BE REQUIRED IN ISOLATED CIRCUMSTANCES:

1. NON-FOOD AREAS - MANUFACTURER'S STANDARD TYPE TO SUIT APPLICATION; STEEL, HOT DIP GALVANIZED, COLOR TO MATCH PANEL.

2. FOOD PROCESSING AREAS - LOW PROFILE TYPE TO SUIT APPLICATION; STEEL, HOT DIP GALVANIZED, COLOR TO MATCH PANEL.

C. POWER ACTUATED FASTENERS: STEEL, HOT DIP GALVANIZED.

D. FIELD TOUCH-UP PAINT: AS RECOMMENDED BY PANEL MANUFACTURER.

2.05 COMPONENTS

A. EXTERIOR SHEET: MINIMUM 26 GAUGE THICK PRE-COATED GALVANIZED STEEL STOCK; PROFILE AS SELECTED; 42 INCHES WIDE PANEL; INTERLOCKING EDGES, JOINTS FILLED WITH BUTYL SEALANT.

B. INTERIOR SHEET: MINIMUM 26 GAUGE THICK PRE-COATED GALVANIZED STEEL STOCK; PROFILE AS SELECTED; 42 INCHES WIDE PANEL; INTERLOCKING EDGES, JOINTS FILLED WITH SILICONE SEALANT.

C. INTERNAL AND EXTERNAL CORNERS: SAME MATERIAL, THICKNESS, AND FINISH AS EXTERIOR SHEETS; PROFILE TO SUIT SYSTEM; SHOP CUT AND FACTORY MITERED AND OR BRAKE FORMED TO REQUIRED ANGLES. MITERED INTERNAL CORNERS TO BE BACK BRACED WITH 22 GAUGE PRE-COATED SHEET STOCK TO MAINTAIN CONTINUITY OF PROFILE.

D. EXPANSION JOINTS: SAME MATERIAL, THICKNESS AND FINISH AS EXTERIOR SHEETS; MANUFACTURER'S STANDARD BRAKE FORMED TYPE, OF PROFILE TO SUIT SYSTEM. EXPOSED FASTENERS SAME FINISH AS PANEL SYSTEM.

E. TRIM, CLOSURE PIECES, CAPS, FLASHINGS, AND FASCIA: SAME MATERIAL, THICKNESS AND FINISH AS EXTERIOR SHEETS; BRAKE FORMED TO REQUIRED PROFILES.

F. ANCHORS: GALVANIZED STEEL.

2.06 PERFORMANCE TESTING REQUIREMENTS

A. STRUCTURAL TESTS: THE DESIGN LOAD/DEFLECTION CRITERIA SHALL BE VERIFIED FROM TESTS PER ASTM E 72 "VACUUM CHAMBER METHOD" USING A 20 PSF SIMULATED WIND LOAD. A DEFLECTION LIMIT OF L/180 SHALL APPLY TO WALLS.

B. AIR INFILTRATION: AIR INFILTRATION SHALL NOT EXCEED .010 CFM PER SQUARE FOOT OF WALL AREA WHEN TESTED PER ASTM E 283 AT A PRESSURE DIFFERENTIAL OF 20.0 PSF.

C. STATIC WATER PENETRATION: THERE SHALL BE NO UNCONTROLLED WATER PENETRATION THROUGH THE PANEL JOINTS AT A PRESSURE DIFFERENTIAL OF 20.0 PSF WHEN TESTED PER ASTM E-331.

D. DYNAMIC WATER PENETRATION: THERE SHALL BE NO UNCONTROLLED WATER THROUGH THE PANEL JOINTS WHEN SUBJECTED TO A 95 MPH SLIPSTREAM AIR FLOW AND APPLICATION OF WATER FOR A 15-MINUTE PERIOD IN ACCORDANCE WITH AAMA 501.1.

E. THERMAL PROPERTIES: THERMAL VALUES OF INSULATION SHALL BE TESTED USING ASTM C-518 AT 75° F.

F. CONDENSATION: THE MINIMUM CONDENSATION RESISTANCE FACTOR OF THE PANEL SHALL BE 92 WHEN TESTED IN GENERAL ACCORDANCE WITH AAMA 1503.1.

G. FIRE TEST: PANELS SHALL HAVE BEEN TESTED BY FACTORY MUTUAL IN ACCORDANCE WITH FACTORY MUTUAL RESEARCH CORPORATION STANDARD 4880 BUILDING CORNER FIRE TEST PROCEDURE. CORE MATERIAL SHALL HAVE BEEN TESTED FOR "SURFACE BURNING

CHARACTERISTICS" IN ACCORDANCE WITH STANDARD ASTM E-84 TEST PROCEDURE. FLAME SPREAD 25 MAXIMUM AND SMOKE DEVELOPED 450 MAXIMUM.

H. BOND STRENGTH: THE PANEL SHALL EXHIBIT NO DELAMINATION, SURFACE BLISTERING OR PERMANENT BOWING WHEN SUBJECTED TO CYCLIC TEMPERATURE EXTREMES OF -20 DEG. F TO +180 DEG. F FOR TWENTY-ONE (21) EIGHT-HOUR TEMPERATURE CYCLES.

2.07 FABRICATION

A. FABRICATION OF PRIMARY COMPONENT PROFILES ON SITE IS NOT PERMITTED.

B. FORM SECTIONS TRUE TO SHAPE, ACCURATE IN SIZE, SQUARE, AND FREE FROM DISTORTION OR DEFECTS.

C. FORM PIECES IN LONGEST PRACTICABLE LENGTHS.

PART 3 EXECUTION

3.01 EXECUTION AND INSTALLATION

A. INSTALL INSULATED METAL BUILDING PANEL SYSTEM ON WALLS IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS.

B. PROTECT PANEL SURFACES IN CONTACT WITH CEMENTITIOUS MATERIALS AND DISSIMILAR METALS WITH BITUMINOUS PAINT. ALLOW TO DRY PRIOR TO INSTALLATION.

C. PERMANENTLY FASTEN PANEL SYSTEM TO STRUCTURAL SUPPORTS; ALIGNED, LEVEL, AND PLUMB, WITHIN SPECIFIED TOLERANCES.

D. PROVIDE EXPANSION CONTROL JOINTS WHERE INDICATED.

E. USE CONCEALED FASTENERS UNLESS OTHERWISE APPROVED BY ARCHITECT.

F. SEAL AND PLACE GASKETS TO PREVENT WEATHER PENETRATION. MAINTAIN NEAT APPEARANCE.

G. FILL ALL EXPOSED PANEL JOINTS SOLID WITH SPECIFIED SEALANT TO BE FLUSH WITH THE SURFACE FACE OF ADJOINING PANELS.

END OF SECTION

SECTION 07 54 23

TPO ROOFING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. FURNISH AND INSTALL ITEMS OF MEMBRANE ROOFING, ROOF INSULATION AND SHEET METAL WORK SHOWN ON PLANS AND DESCRIBED HEREIN, INCLUDING BUT NOT LIMITED TO THE FOLLOWING:

1. SUBSTRATE INSPECTION AND CLEANING.

2. MECHANICALLY FASTENED, THERMOPLASTIC POLYOLEFIN (TPO) SINGLE PLY MEMBRANE ROOFING SYSTEM

3. ROOF INSULATION INCLUDING TAPERED INSULATION.

4. FASTENERS.

5. MEMBRANE FLASHING.

6. FLASHING AT ALL PENETRATIONS THROUGH THE ROOFING SYSTEM AND AT ALL MATERIALS WHICH ABUT ROOFING SYSTEM.

7. EXPANSION JOINTS.

8. SEALANTS AND ADHESIVES.

9. SHEET METAL WORK, INCLUDING FLASHINGS, GRAVEL STOPS, COPINGS, CAP FLASHING, SCUPPERS AND MISCELLANEOUS FLASHING.

10. GUTTERS AND DOWN SPOUTS.

11. ROOF TRAFFIC WALKWAYS AND PADS

12. WOOD BLOCKING AND SHEATHING.

13. CONCRETE SPLASH BLOCKS.

1.2 RELATED SECTIONS

A. SECTION 06 10 00 - ROUGH CARPENTRY

B. SECTION 07 71 00 - MANUFACTURED ROOF SPECIALTIES

C. SECTION 07 92 10 - JOINT SEALANTS.

1.3 REFERENCES

A. COMPLY WITH APPLICABLE REQUIREMENTS OF THE FOLLOWING STANDARDS AND THOSE OTHERS REFERENCED IN THIS SECTION.

1. FM ROOF ASSEMBLY CLASSIFICATIONS AND LOSS PREVENTION REQUIREMENTS 1-28 AND 1-29S

2. UL FIRE RESISTANCE DIRECTORY.

3. ALL APPLICABLE FEDERAL, STATE AND MUNICIPAL CODES, LAWS AND REGULATIONS FOR FIRE-RESISTANCE ROOF RATINGS.

B. THE FOLLOWING REFERENCE MATERIALS ARE HEREBY MADE A PART OF THIS SECTION BY REFERENCE THERETO:

1. NRCA ROOFING AND WATERPROOFING MANUAL, LATEST PRINTING.

1.4 SYSTEM DESCRIPTION

A. MECHANICALLY FASTENED SINGLE-PLY TPO MEMBRANE ROOFING SYSTEM INCLUDING INSULATION.

1. ROOF ASSEMBLY SHALL MEET UNDERWRITERS LABORATORIES, INC. FIRE HAZARD CLASSIFICATION “CLASS A” ROOF.

2. FACTORY MUTUAL CLASSIFICATION: ROOF ASSEMBLY SHALL MEET THE REQUIREMENTS OF CLASS 1 AND WINDSTORM RESISTANCE OF 1-90, IN ACCORDANCE WITH FM DS 1-28.

1.5 SUBMITTALS

A. SUBMIT THE FOLLOWING UNDER PROVISIONS OF DIVISION 1:

1. LITERATURE: MANUFACTURER'S PRODUCT DATA SHEETS, SPECIFICATIONS, PERFORMANCE DATA, PHYSICAL PROPERTIES AND INSTALLATION INSTRUCTIONS FOR EACH ITEM FURNISHED HEREUNDER.

2. MANUFACTURER'S SPECIMEN WARRANTIES: PROVIDE SAMPLE COPIES OF MANUFACTURERS' ACTUAL WARRANTIES FOR ALL MATERIALS TO BE FURNISHED UNDER THIS SECTION, CLEARLY DEFINING ALL TERMS, CONDITIONS, AND TIME PERIODS FOR THE COVERAGE THEREOF.

3. SHOP DRAWINGS:

A. SETTING PLANS FOR ROOFING INSULATION, THICKNESSES AND DIRECTION OF SLOPES.

B. FULLY DIMENSIONED 1/4-INCH SCALE PLANS OF ROOF. PLANS SHALL SHOW CHANGES IN LEVEL, KEY LOCATIONS OF DETAILS, ALL ROOF PENETRATIONS, ROOF SLOPES AND DIRECTION OF SLOPE. INDICATE ON PLANS ANY AREAS OF PROPOSED STAGING AND MATERIAL STORAGE ON ROOF.

C. LARGE SCALE DESIGN DETAILS, MINIMUM OF 1-1/2 INCH PER FOOT SCALE, SHOWING PERIMETER FLASHING CONDITIONS AND PENETRATIONS. DETAILS SHALL SHOW DIMENSIONS OF ACTUAL MEASUREMENTS TAKEN AT THE PROJECT AND REFLECT ACTUAL CONDITIONS; MANUFACTURER'S STANDARD PREPRINTED DETAILS WILL NOT BE ACCEPTED AS SUBSTITUTE FOR SHOP DRAWINGS.

4. APPROVAL OF INSULATION MANUFACTURER FOR USE OF THE PRODUCT IN THE PROPOSED SYSTEM.

1.6 QUALIFICATIONS

A. ROOFING MANUFACTURER, WITH A MINIMUM OF 10 YEARS DOCUMENTED EXPERIENCE DEMONSTRATING PREVIOUSLY SUCCESSFUL WORK OF THE TYPE SPECIFIED HEREIN.

B. ROOFING APPLICATOR, WITH A MINIMUM OF 5 YEARS DOCUMENTED EXPERIENCE DEMONSTRATING PREVIOUSLY SUCCESSFUL WORK OF THE TYPE SPECIFIED HEREIN, AND APPROVED BY PRODUCT MANUFACTURER.

C. ROOFING APPLICATOR'S FOREMAN WITH A MINIMUM OF 5 YEARS DOCUMENTED EXPERIENCE OF THE TYPE SPECIFIED HEREIN, AND TRAINED BY PRODUCT MANUFACTURER.

1.7 QUALITY ASSURANCE

A. MATERIALS AND WORKMANSHIP TO BE PROVIDED IN STRICT CONFORMANCE WITH MANUFACTURER'S SPECIFICATIONS.

1. THE ROOFING MANUFACTURER SHALL HAVE A FIELD TECHNICIAN ON-SITE AT LEAST ONCE A WEEK DURING THE INSTALLATION OF THE MEMBRANE AND FLASHING TO ASSURE COMPLIANCE WITH MANUFACTURER'S SPECIFICATION AND FURNISH WRITTEN REPORTS - ABSOLUTELY NO EXCEPTION WILL BE MADE TO THIS REQUIREMENT. UPON COMPLETION OF THE INSTALLATION THE MANUFACTURER'S TECHNICIAN SHALL FURNISH THE ARCHITECT WITH A WRITTEN REPORT OF THESE OBSERVATIONS AND WRITTEN CONFIRMATION THAT THE INSTALLATION IS IN CONFORMANCE.

2. THE ENTIRE INSTALLATION SHALL HAVE NO WRINKLES OR LOOSE SPOTS.

B. THE MANUFACTURER'S AUTHORIZED REPRESENTATIVE SHALL PROVIDE A FINAL INSPECTION AT THE COMPLETION OF THE PROJECT TO ENSURE, THAT THE PROJECT HAS BEEN COMPLETED IN ACCORDANCE WITH THE MANUFACTURER'S REQUIREMENTS. UPON APPROVAL AND ACCEPTANCE OF THE PROJECT, THEN A MANUFACTURER'S WARRANTY CERTIFICATION SHALL BE WRITTEN, EXECUTED AND FURNISHED TO THE ARCHITECT.

C. SUBMIT MANUFACTURER'S FIELD QUALITY CONTROL REPORTS OF FIELD INSPECTIONS, INCLUDING, REVISED “AS-BUILT” SHOP DRAWINGS AND MANUFACTURER'S FINAL PUNCH LIST.

D. ALL ROOFING SHALL BE AS DESCRIBED IN THIS SECTION AND SHALL BE PROVIDED AND APPROVED BY THE ROOF SYSTEM MANUFACTURER. ANY MATERIALS NOT MANUFACTURER OR PROVIDED BY MANUFACTURER SHALL HAVE WRITTEN APPROVAL FROM THE MANUFACTURER STATING THE MATERIALS ARE ACCEPTABLE AND ARE COMPATIBLE WITH THE OTHER MATERIALS AND SYSTEMS REQUIRED.

E. UL LISTING: PROVIDE LABELED MATERIALS WHICH HAVE BEEN TESTED AND LISTED BY UL IN "BUILDING MATERIALS DIRECTORY" FOR APPLICATION INDICATED, WITH "CLASS A" RATED MATERIALS/SYSTEM FOR ROOF SLOPES SHOWN.

F. FIRE PERFORMANCE CHARACTERISTICS: PROVIDE INSULATION MATERIALS WHICH ARE IDENTICAL TO THOSE WHOSE FIRE PERFORMANCE CHARACTERISTICS, AS LISTED FOR EACH MATERIAL OR ASSEMBLY OF WHICH INSULATION IS A PART, HAVE BEEN DETERMINED BY TESTING, PER METHODS INDICATED BELOW, BY UL OR OTHER TESTING AND INSPECTING AGENCY ACCEPTABLE TO AUTHORITIES HAVING JURISDICTION:

G. THE ROOF SYSTEM MANUFACTURER'S TECHNICAL SPECIFICATIONS SHALL BE CONSIDERED A PART OF THIS SPECIFICATION AND SHOULD BE USED AS A REFERENCE FOR SPECIFIC APPLICATION PROCEDURES AND RECOMMENDATIONS. WHERE A CONFLICT DOES EXIST BETWEEN THE MANUFACTURER'S WRITTEN SPECIFICATIONS AND THOSE PROCEDURES SPECIFIED IN THIS SECTION, THE MORE STRINGENT REQUIREMENTS MEETING THE MANUFACTURER'S MINIMUM REQUIREMENTS FOR THE PROVIDED WARRANTY SHALL APPLY.

H. PRIOR TO AWARD OF THIS CONTRACT THE SUCCESSFUL BIDDER SHALL SUBMIT TO THE ARCHITECT IN WRITING FOR THEIR REVIEW THE FOLLOWING:

1. WRITTEN APPROVAL AND CERTIFICATION OF THE BIDDER BY THE ROOFING SYSTEM MANUFACTURER.

2. WRITTEN DOCUMENTATION FROM THE MEMBRANE MANUFACTURER THAT THE PROPOSED ROOFING SYSTEM MEETS THE APPLICABLE REQUIREMENTS AND CODE APPROVALS AS REFERENCED IN THIS SPECIFICATION.

1.8 REGULATORY REQUIREMENTS

A. CODE APPROVALS:

1. THE PROPOSED ROOFING SYSTEM SHALL MEET THE REQUIREMENT OF THE FOLLOWING RECOGNIZED CODE APPROVAL OR TESTING AGENCIES. NO ROOFING WORK SHALL COMMENCE WITHOUT WRITTEN DOCUMENTATION OF THE SYSTEMS COMPLIANCE

B. ROOFING SYSTEM, INCLUDING INSULATION AND SUBSTRATE, SHALL MEET UNDERWRITERS LABORATORIES, INC. FIRE HAZARD CLASSIFICATION “CLASS A” ROOF.

C. FACTORY MUTUAL CLASSIFICATION: CLASS I AND WINDSTORM RESISTANCE OF 1-90, IN ACCORDANCE WITH FM DS 1-28.

D. REFER TO APPLICABLE BUILDING CODES FOR ROOFING SYSTEM INSTALLATION REQUIREMENTS AND LIMITATIONS. WHEN A CONFLICT EXISTS, THE MORE RESTRICTIVE DOCUMENT WILL GOVERN.

E. ROOFING SYSTEM, INCLUDING INSULATION AND SUBSTRATE, SHALL MEET THE NEW YORK STATE BUILDING CODE, 2010 EDITION; AND ALL OTHER APPLICABLE FEDERAL, STATE AND MUNICIPAL CODES, LAWS AND REGULATIONS FOR FIRE-RESISTANCE ROOF RATINGS.

1.9 DELIVERY, STORAGE AND HANDLING

A. DELIVER MATERIALS IN MANUFACTURER'S ORIGINAL, UNOPENED CONTAINERS OR PACKAGES WITH LABELS AND PACKAGE SEALS INTACT AND LEGIBLE.

B. STORE ALL MATERIALS IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS. STORE ROLLED GOODS ON CLEAN, RAISED PLATFORMS. STORE OTHER MATERIALS IN DRY AREAS, PROTECTED FROM WATER AND DIRECT SUNLIGHT.

C. DO NOT EXPOSE STORED CURABLE ROOFING MATERIALS AND ACCESSORIES, INCLUDING UNCURED FLASHING, ADHESIVES, SEALANT AND POURABLE SEALER, TO A CONSTANT TEMPERATURE IN EXCESS OF 80 DEGREES FAHRENHEIT.

D. PROVIDE CONTINUOUS PROTECTION OF STORED MATERIALS AGAINST DETERIORATION FOR DURATION OF PROJECT.

E. STORE INSULATION ON DUNNAGE AND COMPLETELY COVER WITH A WATER-RESISTANT BREATHABLE MATERIAL. PROVIDE WEIGHTS TO PREVENT WIND DAMAGE TO INSULATION.

F. DISTRIBUTE ANY MATERIALS STORED ON ROOF LEVELS FOR IMMEDIATE USE TO PREVENT CONCENTRATED LOADS THAT WOULD IMPOSE EXCESSIVE STRAIN ON DECK OR STRUCTURAL MEMBERS. PROTECT STORED MATERIALS TO PREVENT DISPLACEMENT BY THE WIND AND PROTECT FROM EXPOSURE TO INCLEMENT WEATHER AND SUN.

G. DAMAGED MATERIAL: REMOVE ANY DAMAGED OR CONTAMINATED MATERIALS FROM JOB SITE IMMEDIATELY, INCLUDING MATERIALS IN BROKEN PACKAGES, OR SHOW OTHER EVIDENCE OF DAMAGE, UNLESS CONSTRUCTION MANAGER SPECIFICALLY AUTHORIZES USAGE ON PROJECT.

1.10 WARRANTY

A. MANUFACTURER'S 20 YEAR FULL SYSTEM WARRANTY.

B. UPON SUCCESSFUL COMPLETION OF THE WORK TO MANUFACTURER'S SATISFACTION AND RECEIPT OF FINAL PAYMENT, THE MANUFACTURER'S FULL SYSTEM WARRANTY SHALL BE ISSUED PROVIDING A 20-YEAR MATERIAL AND LABOR TOTAL SYSTEM WARRANTY TO COVER FAILURE AND PREVENT PENETRATION OF WATER.

C. APPLICATOR/ROOFING CONTRACTOR WARRANTY.

1. THE APPLICATOR SHALL SUPPLY THE OWNER WITH A SEPARATE WORKMANSHIP WARRANTY. IN THE EVENT ANY WORK RELATED TO ROOFING, FLASHING, OR METAL IS FOUND TO BE WITHIN THE APPLICATOR WARRANTY TERM, DEFECTIVE OR OTHERWISE NOT IN ACCORDANCE WITH THE CONTRACT DOCUMENTS, THE APPLICATOR SHALL REPAIR THAT DEFECT AT NO COST TO THE OWNER. THE APPLICATOR'S WARRANTY OBLIGATION SHALL RUN DIRECTLY TO THE OWNER AND SHALL COVER A PERIOD OF 5 YEARS FROM THE DATE OF COMPLETION. A COPY SHALL BE SENT TO MANUFACTURER.

2. ROOF SYSTEM SHALL MEET MANUFACTURES REQUIREMENTS FOR A 90 MPH MINIMUM WIND SPEED.

3. CORRECT ALL DEFECTIVE WORK WITHIN A TWO-YEAR PERIOD AFTER DATE OF SUBSTANTIAL COMPLETION.

4. ROOFING CONTRACTOR SHALL PROVIDE A WARRANTY OF WEATHER TIGHTNESS AND VAPOR SEAL FOR A TERM OF THREE YEARS FROM DATE OF OWNER'S FINAL ACCEPTANCE OF PROJECT.

5. ROOFING CONTRACTOR SHALL PROVIDE A CERTIFICATION OF PERFORMANCE OF PRESSURE TREATED WOOD WITH A TERM OF 20 YEARS FROM THE DATE OF OWNER'S FINAL ACCEPTANCE OF PROJECT.

6. ROOFING CONTRACTOR SHALL PROVIDE A GUARANTEE OF THERMAL PERFORMANCE OF ROOF INSULATION WITH A TERM OF 15 YEARS FROM DATE OF OWNER'S FINAL ACCEPTANCE OF PROJECT.

D. THE ABOVE WARRANTIES SHALL PROVIDE FOR THE REPAIR AND/OR REPLACEMENT OF MATERIALS AND LABOR FOR WORK WHICH IS FOUND TO BE FAULTY, SUBSTANDARD OR DEFECTIVE AS APPLICABLE WITHIN THE TERM OF THE WARRANTY.

E. OWNER RESPONSIBILITY

1. OWNER SHALL NOTIFY BOTH THE MANUFACTURER AND THE APPLICATOR OF ANY LEAKS AS THEY OCCUR DURING THE TIME PERIOD WHEN BOTH WARRANTIES ARE IN EFFECT.

1.11 ENVIRONMENTAL REQUIREMENTS

A. APPLY ROOFING IN DRY WEATHER; DO NOT INSTALL ROOFING IN INCLEMENT WEATHER OR WHEN PRECIPITATION IS PREDICTED WITH GREATER THAN 20 PERCENT POSSIBILITY.

B. DO NOT APPLY ROOFING MEMBRANE TO DAMP OR FROZEN DECK SURFACE OR WHEN PRECIPITATION IS EXPECTED OR OCCURRING.

C. APPLY ROOFING WHEN AMBIENT TEMPERATURE IS ABOVE 40 DEGREES FAHRENHEIT.

D. DO NOT EXPOSE MATERIALS VULNERABLE TO WATER OR SUN DAMAGE IN QUANTITIES

GREATER THAT CAN BE WEATHERPROOFED THE SAME DAY.

E. ALL SURFACES TO RECEIVE INSULATION, MEMBRANE OR FLASHINGS SHALL BE THOROUGHLY DRY. SHOULD EXCESSIVE SURFACE MOISTURE OCCUR, THE CONTRACTOR SHALL PROVIDE THE NECESSARY EQUIPMENT TO DRY THE SURFACE PRIOR TO APPLICATION.

F. ALL NEW AND TEMPORARY CONSTRUCTION, INCLUDING MATERIALS, EQUIPMENT AND ACCESSORIES, SHALL BE SECURED AGAINST WIND BLOW-OFF OR DAMAGE.

G. TEMPORARY WATER STOPS SHALL BE INSTALLED AT THE END OF EACH DAY'S WORK, AND SHALL BE REMOVED BEFORE PROCEEDING WITH THE NEXT DAY'S WORK. WATER STOPS SHALL BE COMPATIBLE WITH ALL MATERIALS AND SHALL NOT EMIT DANGEROUS OR INCOMPATIBLE FUMES.

H. PRIOR TO AND DURING APPLICATION, ALL DIRT, DEBRIS AND DUST SHALL BE REMOVED FROM SURFACES EITHER BY VACUUMING, SWEEPING, BLOWING WITH COMPRESSED AIR AND/OR SIMILAR METHODS.

I. THE CONTRACTOR SHALL FOLLOW ALL SAFETY REGULATIONS AS REQUIRED BY OSHA AND ANY OTHER APPLICABLE AUTHORITIES HAVING JURISDICTION.

J. THE CONTRACTOR SHALL TAKE PRECAUTIONS THAT STORAGE AND/OR APPLICATION OF MATERIALS AND/OR EQUIPMENT DOES NOT OVERLOAD THE ROOF DECK OR BUILDING STRUCTURE.

K. PRECAUTIONS SHALL BE TAKEN WHEN USING ADHESIVES AT OR NEAR ROOFTOP VENTS OR AIR INTAKES. ADHESIVE ODORS COULD ENTER THE BUILDING. COORDINATE THE OPERATION OF VENTS AND AIR INTAKES IN SUCH A MANNER AS TO AVOID THE INTAKE OF ADHESIVE ODOR WHILE VENTILATING THE BUILDING.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. MANUFACTURERS: SUBJECT TO COMPLIANCE WITH THE REQUIREMENTS SPECIFIED HEREIN, MANUFACTURERS OFFERING PRODUCTS WHICH MAY BE INCORPORATED IN THE WORK INCLUDE, ARE NOT LIMITED TO THE FOLLOWING:

1. MEMBRANE:

A. CARLISLE SYNTEC SYSTEMS, CARLISLE PA.

B. FIRESTONE BUILDING PRODUCTS CO., CARMEL IN

C. OR ARCHITECT APPROVED SUBSTITUTE.

2. INSULATION - SUBJECT TO ACCEPTANCE BY THE ROOFING MANUFACTURER:

A. SAME A MEMBRANE MANUFACTURER.

B. OR ARCHITECT APPROVED SUBSTITUTE.

2.2 ROOFING MATERIALS

A. FIRE RETARDANT, SINGLE-PLY THERMOPLASTIC POLYOLEFIN (TPO) MEMBRANE: ETHYLENE PROPYLENE THERMOPLASTIC POLYOLEFIN FORMED INTO UNIFORM, FLEXIBLE

SHEETS, COMPLYING WITH ASTM D 4637 AND ANSI/RAM IPR-1, WITH A NOMINAL THICKNESS OF 60 MILS. WHITE IN COLOR.

B. HOT AIR WELDED SEAMING SYSTEM: MANUFACTURER'S STANDARD MATERIALS AND EQUIPMENT FOR SEALING LAPPED JOINTS, INCLUDING EDGE SEALER TO COVER EXPOSED REINFORCEMENT AT CUT EDGES.

C. PREFABRICATED PIPE BOOTS, CORNERS, CANT STRIPS, TAPERED EDGE STRIPS AND FLASHING ACCESSORIES: TYPES RECOMMENDED BY MANUFACTURER OF TPO MATERIAL, PROVIDED AT LOCATIONS INDICATED AND AT LOCATIONS RECOMMENDED BY MANUFACTURER, INCLUDING ADHESIVE TAPES, FLASHING CEMENTS, AND SEALANTS.

D. FLASHING MATERIAL: MANUFACTURER'S STANDARD SYSTEM COMPATIBLE WITH FLEXIBLE SHEET MEMBRANE.

E. MEMBRANE FASTENING:

1. MECHANICAL FASTENERS: FASTENER TYPE, LENGTH, SPACING, AND PULL-OUT RESISTANCE SHALL BE AS RECOMMENDED AND APPROVED BY ROOFING MANUFACTURER FOR THE PARTICULAR SUBSTRATE AND AS REQUIRED TO WITHSTAND MIN. 90 PSF UPLIFT FORCE.

2.3 INSULATION MATERIALS

A. GENERAL: INSULATION SHALL BE APPROVED BY THE ROOF MANUFACTURER, AND SHALL BE UL LISTED AND FM APPROVED.

B. ACCEPTABLE MANUFACTURERS: SUBJECT TO ACCEPTANCE OF ROOFING MANUFACTURER AND THE FOLLOWING SPECIFICATION REQUIREMENTS:

1. REFER TO SECTION 2.1.2 FOR ACCEPTABLE MANUFACTURERS

C. CLOSED CELL POLYISOCYANURATE FOAM INSULATION MANUFACTURED WITH HCFC 14 POUND BLOWING AGENT AND BONDED TO GLASS FIBER REINFORCED FACERS ON TOP AND BOTTOM SURFACES DURING THE MANUFACTURING PROCESS. INSULATION SHALL CONFORM TO PROPERTY REQUIREMENTS OF FS HH-I-1972/GEN AND FS HH-I-1972/2.

1. MINIMUM THICKNESS: (SEE ROOF PLAN FOR ACTUAL INSULATION THICKNESS REQUIRED FOR EACH ROOF AREA).

2. MAXIMUM SHEET SIZE: 4'-0” X 8'-0”

A. MAXIMUM INSULATION THICKNESS (PER LAYER): 2”

3. DENSITY: 2.0 POUNDS PER CUBIC FOOT (ASTM D-1622).

4. COMPRESSIVE STRENGTH: 20 PSI (ASTM D1621).

5. MOISTURE VAPOR TRANSMISSION: LESS THAN 1 PERM (ASTM E-96).

6. WATER ABSORPTION: LESS THAN 1 PERCENT PER VOLUME (ASTM C209).

7. MINIMUM LTTR R-VALUE PER LAYER: 12.1

8. PROVIDE TAPERED INSULATION SYSTEM AS REQUIRED TO MEET ELEVATIONS AND SLOPES SHOWN ON DRAWINGS OR AS REQUIRED BY MEMBRANE MANUFACTURER, WHICH EVER IS MORE STRINGENT. PROVIDE CANTS AND CRICKETS AT DRAINS AS NECESSARY.

D. TAPERED ROOF INSULATION, JOHNS MANVILLE PRODIAMOND® CUSTOM CRICKETS AND DIAMONDBACK® PRE-CUT MITERS AND/OR COMPATIBLE WITH ROOF INSULATION SYSTEM. VERIFY DIMENSIONS IN FIELD AND PROVIDE SHOP DRAWINGS.

E. TAPERED EDGE AND CANT STRIPS: JOHNS MANVILLE AND/OR COMPATIBLE WITH ROOF INSULATION SYSTEM.

2.4 GUTTERS AND DOWNSPOUTS:

1. FABRICATE FROM PREFINISHED ALUMINUM SHEET: ASTM B 209, MANUFACTURER'S STANDARD ALLOY AND TEMPER FOR INDICATED APPLICATIONS.

A. MINIMUM THICKNESS: 16 B & S GAUGE (0.050 INCH), UNLESS INDICATED OTHERWISE.

B. FINISH: 70 PERCENT "KYNAR 500" OR "HYLAR 5000" RESIN FINISH OVER EPOXY PRIMER; MINIMUM SYSTEM THICKNESS 1.0 MIL. PROVIDE MANUFACTURER'S STANDARD PRIME COAT ON UNDERSIDE.

I. COLOR: SELECTED BY ARCHITECT, AFTER CONTRACT AWARD, FROM MANUFACTURER'S STANDARD COLOR SELECTION.

C. PROVIDE STRIPPABLE PLASTIC PROTECTIVE FILM ON PREFINISHED SURFACE.

2.5 ACCESSORIES

A. BONDING ADHESIVE SHALL BE AS RECOMMENDED BY MANUFACTURER. ADHESIVE SHALL BE COMPATIBLE WITH ALL MATERIALS TO WHICH THE ELASTOMERIC MEMBRANE AND INSULATION IS TO BE BONDED.

B. SPLICING CEMENT AND INSEAM SEALANT SHALL BE AS RECOMMENDED BY MEMBRANE MANUFACTURER.

C. LAP SEALANT FOR SEALING THE EXPOSED EDGE OF THE SPLICES SHALL BE TROWEL ON GUN CONSISTENCY AS RECOMMENDED BY MEMBRANE MANUFACTURER.

D. WATER CUTOFF MASTIC SHALL BE AS RECOMMENDED BY MEMBRANE MANUFACTURER.

E. POURABLE SEALER FOR PREPARATION OF DECKING SHALL BE AS RECOMMENDED BY MEMBRANE MANUFACTURER.

F. PREFABRICATED ELASTOMERIC ACCESSORIES (INSIDE AND OUTSIDE COMERS, ETC.) SHALL BE AS MANUFACTURED AND RECOMMENDED BY MEMBRANE MANUFACTURER.

G. NAILING STRIPS AND FASTENERS: NAILING STRIPS SHALL BE EXTRUDED RUBBER AND FASTENERS SHALL BE NON-CORRODIBLE.

H. FASTENERS: FASTENER TYPE, LENGTH AND PULL-OUT RESISTANCE SHALL BE AS APPROVED BY ROOFING MANUFACTURER AND AS REQUIRED TO MEET WIND UPLIFT RESISTANCE REQUIREMENTS.

1. SCREWS: STEEL FASTENER WITH FLUOROCARBON COATING. MINIMUM THREAD DIAMETER 0.22 INCHES AND MINIMUM SHANK DIAMETER OF 0.172 INCHES.

I. MISCELLANEOUS MATERIALS: BEST GRADE OR QUALITY APPROVED BY THE ROOFING MANUFACTURER FOR THE SPECIFIC APPLICATION.

J. STACK BOOTS: PREFABRICATED FLEXIBLE BOOT AND COLLAR FOR PIPE STACKS THROUGH MEMBRANE; SAME MATERIAL AS MEMBRANE.

K. WALKWAY PADS: 500 LF OF 120 MIL THICK X 30" WIDE ROLL WALKWAY PAD, LOCATION TO BE DETERMINED. WALKWAY TO BE SKID RESISTANT, AND OF A COLOR SHALL BE A CONTRASTING COLOR FROM ROOF MEMBRANE.

PART 3 - EXECUTION

3.1 EXAMINATION

A. INSPECT ALL SURFACES AND VERIFY THAT THEY ARE IN PROPER CONDITION TO RECEIVE THE WORK OF THIS SECTION.

B. VERIFY EDGE NAILERS, CURBS AND PENETRATIONS ARE IN PLACE PRIOR TO ROOFING, SO THAT THE ROOF SYSTEM CAN BE INSTALLED AS CONTINUOUSLY AS POSSIBLE.

C. VERIFY THE ROOF DECK, AND RELATED SURFACES ARE CLEAN, SMOOTH, FLAT, FREE OF DEPRESSIONS, WAVES, OR PROJECTIONS, PROPERLY SLOPED TO DRAINS, AND SUITABLE FOR INSTALLATION OF ROOF SYSTEM.

D. ANY CONDITION REQUIRING CORRECTION OR COMPLETION SHALL BE CORRECTED OR COMPLETED PRIOR TO THE INSTALLATION OF THE ROOFING SYSTEM NOTIFY CONSTRUCTION MANAGER OF UNACCEPTABLE CONDITIONS.

E. DO NOT PROCEED UNTIL DEFECTS ARE CORRECTED.

F. COMMENCEMENT OF INSTALLATION MEANS ACCEPTANCE OF EXISTING SUBSTRATE AND SITE CONDITIONS.

3.2 PREPARATION

A. DURING THE OPERATION OF WORK OF THIS SECTION, PROTECT THE WORK OF OTHER TRADES AGAINST UNDUE SOILAGE AND DAMAGE BY THE EXERCISE OF REASONABLE CARE AND PRECAUTIONS. REPAIR OR REPLACE ANY WORK SO DAMAGED AND SOILED.

B. CLEAN SUBSTRATE OF DUST, DEBRIS, MOISTURE, AND OTHER SUBSTANCES DETRIMENTAL TO ROOFING INSTALLATION ACCORDING TO ROOFING SYSTEM MANUFACTURER'S WRITTEN INSTRUCTIONS. REMOVE SHARP PROJECTIONS.

1. CAREFULLY BROOM CLEAN SUBSTRATE IMMEDIATELY PRIOR TO ROOFING APPLICATION.

C. WHERE SURFACE JOINTS AT ROOF AND WALL SUBSTRATES EXCEED 1/4-INCH WIDTH, FILL WITH POURABLE SEALER, FLUSH WITH ADJACENT SURFACES BEFORE PROCEEDING WITH THE INSTALLATION.

D. PREVENT MATERIALS FROM ENTERING AND CLOGGING ROOF DRAINS AND CONDUCTORS AND FROM SPILLING OR MIGRATING ONTO SURFACES OF OTHER CONSTRUCTION. REMOVE ROOF-DRAIN PLUGS WHEN NO WORK IS TAKING PLACE OR WHEN RAIN IS FORECAST.

1. THE ROOFING CONTRACTOR SHALL VERIFY THAT ALL ROOF DRAINS LINES ARE FUNCTIONING CORRECTLY (NOT CLOGGED OR BLOCKED) BEFORE STARTING WORK.

3.3 INSTALLATION - GENERAL

A. THE ENTIRE WORK OF THIS SECTION SHALL BE PERFORMED IN ACCORDANCE WITH THE BEST STANDARDS OF PRACTICE RELATING TO TRADES INVOLVED.

B. FOLLOW LOCAL, STATE AND FEDERAL REGULATIONS, SAFETY STANDARDS AND CODES. WHEN A CONFLICT EXISTS, THE MORE RESTRICTIVE DOCUMENT SHALL GOVERN.

C. FOLLOW INSURANCE UNDERWRITER'S REQUIREMENTS ACCEPTABLE FOR USE WITH SPECIFIED PRODUCTS OR SYSTEMS.

D. REVIEW ALL SPECIAL CONDITIONS, SUCH AS AT PROJECTIONS, AT CONNECTIONS TO SHEET METAL GRAVEL STOPS, FLASHINGS, ETC. WITH THE ROOFING MANUFACTURER, SUBMIT THE ROOFING MANUFACTURER'S RECOMMENDATIONS AND DETAILS TO THE ARCHITECT FOR APPROVAL.

E. SPECIAL CAUTIONS:

1. DO NOT USE OIL-BASED OR PLASTIC ROOF CEMENT.

2. DO NOT SUBJECT ELASTOMERIC MATERIALS TO CONTACT WITH PETROLEUM, GREASE, OIL, SOLVENTS, VEGETABLE OR MINERAL OIL, NOR ANIMAL FAT. PREVENT CONTACT WITH HOT PIPES, AND DUCTS.

3. CEMENTS AND BONDING ADHESIVE CONTAIN PETROLEUM DISTILLATES AND ARE EXTREMELY VOLATILE AND FLAMMABLE. AVOID BREATHING VAPORS AND DO NOT USE NEAR FIRE OR FLAME.

4. ENSURE THAT SPLICING AND BONDING SURFACES ARE DRY DURING INSTALLATION.

3.4 INSULATION INSTALLATION

A. PLACE THE CONSTANT THICKNESS INSULATION OF FIRST LAYER AND THE SUBSEQUENT TAPERED INSULATION TO THE REQUIRED SLOPE PATTERN IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS. NOTE: INSULATION SYSTEM SHALL BE ATTACHED PER DIRECTIONS OF MANUFACTURER FOR CONDITIONS CONDUCIVE TO FROZEN, COOLED OR REFRIGERATED SPACES AND LOCAL AREA STANDARDS.

1. STAGGER ALL INSULATION PANELS SUCH THAT NO JOINTS, VERTICALLY OR HORIZONTALLY ALIGN.

2. INSULATION BOARDS SHALL BE SECURED TO CONFORM TO THE SUBSTRATE SURFACE GEOMETRY.

3. ALL INSULATION TO BE CUT AND FIT TO WITHIN 1/4-INCH OF NAILERS, PROJECTIONS AND PENETRATIONS.

4. FILL GAPS EXCEEDING 1/4-INCH WITH COMPATIBLE SPRAY FOAM INSULATION.

B. INSULATION FASTENING

1. LOOSE LAY FIRST LAYER OF ROOF INSULATION ONTO ROOF DECK SUBSTRATE.

2. SECOND LAYER TO BE MECHANICALLY FASTENED TO METAL DECK SUBSTRATE WITH MECHANICAL ANCHORS OF TYPE AND SPACING INDICATED BY MEMBRANE MANUFACTURER; BUT IN NO CASE PROVIDE LESS THAN ONE ANCHOR PER 4 SQUARE FEET OF SURFACE AREA, OR LESS ANCHORAGE THAN REQUIRED BY FM "LOSS PREVENTION DATA SHEET 1-28."

3.5 MEMBRANE INSTALLATION

A. UNROLL AND POSITION MEMBRANE WITHOUT STRETCHING. ALLOW THE MEMBRANE TO RELAX FOR APPROXIMATELY 1/2 HOUR PRIOR TO ATTACHMENT. INSPECT SHEET FOR DEFECTS

AS IT IS BEING ROLLED OUT. PROVIDE AND SECURE BOTH PERIMETER AND FIELD MEMBRANE SHEETS IN ACCORDANCE WITH THE MANUFACTURER'S MOST CURRENT SPECIFICATIONS AND DETAILS.

B. ALIGN SHEET SO THAT IT OVERLAPS THE PREVIOUS SHEET BY THE LAP WIDTH RECOMMENDED BY THE MANUFACTURER, BUT NOT LESS THAN 3 INCHES.

C. SECURE THE MEMBRANE (APPROXIMATELY 3 INCHES FROM THE EDGE OF THE MEMBRANE SHEET) WITH THE REQUIRED FASTENER AND 2 INCH SEAM PLATE OR SEAM FASTENING PLATE SPACED A MAXIMUM OF 12 INCHES ON CENTER. THE MINIMUM DISTANCE BETWEEN THE EDGE OF THE FASTENING PLATE AND THE EDGE OF THE MEMBRANE MUST BE 2 INCHES.

AS AN ALTERNATE TO THE USE OF FASTENING PLATES, METAL FASTENING BARS MAY BE USED FOR MEMBRANE SECUREMENT.

D. INSTALL ADJOINING MEMBRANE SHEETS IN THE SAME MANNER IN ACCORDANCE WITH THE MANUFACTURER'S SPECIFICATIONS.

E. FASTEN SHEET TO SUBSTRATE EXCEPT THOSE AREAS DIRECTLY OVER OR WITHIN 3 INCHES OF A CONTROL OR EXPANSION JOINT.

F. PROVIDE ADDITIONAL MEMBRANE SECUREMENT AT THE PERIMETER OF ROOF.

1. INSTALL CONTINUOUS REINFORCEMENT STRIPS 3 INCHES TO 6 INCHES FROM INSIDE AND OUTSIDE CORNERS WHERE ADDITIONAL MEMBRANE SECUREMENT IS REQUIRED AND WHERE RECOMMENDED BY ROOFING MANUFACTURER. SECURE REINFORCEMENT STRIPS WITH 2 -INCH DIAMETER ALUMINUM OR STAINLESS STEEL SEAM FASTENING PLATES; SPACE FASTENING PLATES NOT GREATER THAN 12 INCHES ON CENTER.

2. INSTALL REINFORCEMENT STRIPS AS RECOMMENDED BY ROOFING MANUFACTURER.

3. CEMENT EPDM FLASHING OVER INSTALLED FASTENING PLATES AND REINFORCEMENT STRIPS AS RECOMMENDED BY ROOFING MANUFACTURER, AND IN NO CASE PROVIDE FLASHING OF LESS THAN 6 INCHES IN WIDTH, AND AT ENDS OF FLASHING, PROVIDE A MINIMUM 2 INCH SPLICE FROM EDGE OF PLATE/STRIP.

G. EXTEND MEMBRANE UP CANT STRIPS AND A MINIMUM OF 8 INCHES ONTO VERTICAL SURFACES.

H. SEAL MEMBRANE AROUND ROOF PENETRATIONS.

1. MIX SEALER COMPONENTS AS INSTRUCTED BY MANUFACTURER. APPLY AT RATE OF 1 GALLON/100 LINEAR FOOT, 12 INCH BACK FROM SHEET EDGES ON EXPOSED SUBSTRATE.

I. EMBED MEMBRANE IN SEALER AND APPLY CONTINUOUS PRESSURE WITH 2-1/2 INCH TUBING FILLED WITH SAND. PULL SHEET FREE BEFORE CONTINUING PERMANENT INSTALLATION.

3.6 INSTALLATION - ROOF WALKWAY

A. EXTENT OF WALKWAY TO BE DETERMINED.

1. INSURE THAT ALL AREAS TO RECEIVE WALKWAY ARE CLEAN, DRY, AND FREE OF DEBRIS.

2. INSTALL ROOF WALKWAYS FROM ROOF HATCH TO MECHANICAL UNITS, AND

SURROUNDING ROOF HATCH AND MECHANICAL UNITS AS SHOWN ON DRAWINGS.

3. WALKWAYS TO BE APPLIED TIGHT TO THE ACCESSIBLE PERIMETER OF MECHANICAL CURBS AND ROOF HATCHES AS SHOWN ON DRAWINGS. PATCH-IN WALKWAY AROUND PERIMETER OF CURBS AS REQUIRED. SEE DRAWINGS FOR OTHER APPROXIMATE LOCATIONS.

4. WALK SURFACE TO BE HEAT WELDED TO ROOF MEMBRANE IF POSSIBLE, OR BONDED TO ROOF MEMBRANE WITH AN ADHESIVE APPROVED BY ROOF MEMBRANE MANUFACTURER.

5. SECTIONS OF WALKWAY, OR PRE-CUT WALKWAY MATS OF SIMILAR TPO MATERIAL TO BE PLACED UNDER ALL PIPE RACKING SUPPORTS AS SHOWN ON DRAWINGS.

3.7 INSTALLATION - ELASTOMERIC FLASHINGS

A. ELASTOMERIC FLASHINGS. PROVIDE TPO SHEET FLASHINGS AT ELASTOMERIC SHEET ROOFING WORK, AS INDICATED.

1. USE LONGEST PRACTICAL LENGTHS AND WIDTHS OF ELASTOMERIC SHEET FLASHING MATERIAL TO ELIMINATE OR MINIMIZE JOINTS. COMPLETE WELDS BETWEEN FLASHINGS AND MAIN-ROOF SHEET BEFORE BONDING FLASHINGS TO VERTICAL SURFACES. WELDS SHALL BE SEALED 4.5 INCHES BEYOND FASTENERS THAT ATTACH MEMBRANE TO HORIZONTAL NAILER IN SAME MANNER AS WELDS WITHIN ROOFING MEMBRANE. FLASHINGS SHALL BE BONDED 100 PERCENT TO SUBSURFACE, EXCEPT AT COVES WHERE MOVEMENT IS ANTICIPATED.

2. APPLY BONDING ADHESIVE TO FLASHING AND SURFACE TO WHICH IT IS BEING BONDED. WHEN BONDING ADHESIVE HAS DRIED TO THE POINT WHERE IT DOES NOT STRING OR STICK TO A DRY FINGER TOUCH, ROLL FLASHING INTO ADHESIVE. DO NOT BRIDGE FLASHING AT CHANGES OF DIRECTION.

3.8 FIELD QUALITY CONTROL

A. SUBCONTRACTOR SHALL CORRECT ALL DEFICIENCIES IN ROOF AS DETERMINED BY ROOF SYSTEM MANUFACTURER.

3.9 TEMPORARY CUT-OFF

A. ALL FLASHINGS SHALL BE INSTALLED CONCURRENTLY WITH THE ROOF MEMBRANE IN ORDER TO MAINTAIN A WATERTIGHT CONDITION AS THE WORK PROGRESSES. WHEN A BREAK IN THE DAY'S WORK OCCURS IN THE CENTRAL AREA OF A ROOF, A TEMPORARY WATER STOP SHALL BE CONSTRUCTED TO PROVIDE 100% WATERTIGHT SEAL. WHEN WORK ON THE NEW SYSTEM IS SUSPENDED, THE STAGGER OF INSULATION JOINTS SHALL BE MAINTAINED BY INSTALLING PARTIAL FILLERS. THE NEW MEMBRANE SHALL BE CARRIED INTO TO THE WATER STOP. THE EDGE OF THE MEMBRANE SHALL BE SEALED IN A CONTINUOUS HEAVY APPLICATION OF ROOF CEMENT OF 6-INCH GIRTH. WHEN WORK RESUMES, THE CONTAMINATED EPDM MEMBRANE SHALL BE CUT OPEN. ALL SEALANT, CONTAMINATED MEMBRANE, INSULATION FILLERS, ETC. SHALL BE REMOVED FROM THE WORK AREA AND DISPOSED OF OFF SITE. NONE OF THESE MATERIALS SHALL BE REUSED IN THE NEW WORK.

B. IF INCLEMENT WEATHER OCCURS WHILE A TEMPORARY WATER STOP IS IN PLACE, THE CONTRACTOR SHALL PROVIDE THE LABOR NECESSARY TO MONITOR THE SITUATION TO MAINTAIN A WATERTIGHT CONDITION.

1. IF ANY WATER IS ALLOWED TO ENTER UNDER THE NEWLY COMPLETED ROOFING, THE AFFECTED AREA SHALL BE REMOVED AND REPLACED AT THE ROOFING CONTRACTOR'S EXPENSE.

3.10 PROTECTING AND CLEAN-UP

A. PROTECT MEMBRANE ROOFING SYSTEM FROM DAMAGE AND WEAR DURING THE REMAINDER OF THE CONSTRUCTION PERIOD.

B. REMOVE ELASTOMERIC ADHESIVE MARKINGS FROM FINISHED SURFACES.

C. IN AREAS WHERE FINISHED SURFACES ARE SOILED BY WORK OF THIS SECTION, CONSULT MANUFACTURER OF SURFACES FOR CLEANING ADVICE AND CONFORM TO THEIR INSTRUCTIONS.

D. REPAIR OR REPLACE DEFACED, OR DISFIGURED FINISHES CAUSED BY THE WORK OF THIS SECTION.

E. SITE CLEAN-UP INCLUDING BOTH INTERIOR AND EXTERIOR BUILDING AREAS BELOW OR ADJACENT TO, OR IN ANY WAY AFFECTED BY THE CONSTRUCTION SHALL BE COMPLETE TO THE OWNER'S AND CONSTRUCTION MANAGERS SATISFACTION.

F. ALL LANDSCAPED AREAS SHALL BE RAKED CLEAN AND RE-SEEDED, IF REQUIRED.

G. ALL PAVED AREAS SHALL BE SWEPT CLEAN.

H. ALL AREAS STAINED, DIRTIED AND DISCOLORED OR OTHERWISE DAMAGED DUE TO THE WORK SHALL BE CLEANED, RESTORED AND REPLACED AS REQUIRED.

I. ALL TRASH, DEBRIS AND EXISTING MATERIAL SHALL BE COMPLETELY REMOVED FROM THE PROJECT SITE PERIODICALLY DURING THE WORK AND AT COMPLETION OF THE WORK. ALL DEBRIS SHALL BE LEGALLY DISPOSED OF OFF-SITE BY THE CONTRACTOR FOR THIS SECTION.

3.11 COMPLETION

A. PRIOR TO DEMOBILIZATION FROM THE SITE, THE WORK SHALL BE REVIEWED BY THE OWNER, CONSTRUCTION MANAGER, CONTRACTOR AND MANUFACTURER. ALL DEFECTS NOTED, NON-COMPLIANCES WITH THESE SPECIFICATIONS OR THE RECOMMENDATIONS OF THE MEMBRANE MANUFACTURER SHALL BE ITEMIZED IN A PUNCH LIST. THOSE ITEMS MUST BE CORRECTED IMMEDIATELY BY THE ROOFING CONTRACTOR PRIOR TO DEMOBILIZATION TO THE SATISFACTION OF THE OWNER, CONSTRUCTION MANAGER AND THE MEMBRANE MANUFACTURER.

B. ALL WARRANTIES SHALL BE SUBMITTED FOR APPROVAL PRIOR TO FINAL PAYMENT.

END OF SECTION

SECTION 07 61 00

METAL ROOFING

PART 1 - GENERAL

1.01 RELATED SECTIONS

A. SECTION 06 10 00 - ROUGH CARPENTRY

B. SECTION 07 21 10 - BUILDING INSULATION

C. SECTION 07 71 00 - MANUFACTURED ROOF SPECIALTIES

D. SECTION 07 92 00 - JOINT SEALANTS

1.02 REFERENCES - QUALITY CRITERIA

A. ASTM B 209: ALUMINUM AND ALUMINUM ALLOY SHEET AND PLATE

B. ASTM E 283: STATIC AIR INFILTRATION

C. ASTM E 331: STATIC WATER INFILTRATION

D. FACTORY MUTUAL: DATA SHEET 1-28 -WIND DESIGN

E. FACTORY MUTUAL: DATA SHEET 1-29 - ROOF DECK SECUREMENT AND ABOVE-DECK ROOF COMPONENTS

F. FACTORY MUTUAL: DATA SHEET 1-31 - METAL ROOF SYSTEMS

G. FACTORY MUTUAL: DATA SHEET 1-54 - ROOF LOADS FOR NEW CONSTRUCTION

H. HERR VOSS: TENSION LEVELING

I. UL 90 RATING: WIND UPLIFT APPROVAL CONFORMING TO UNDERWRITER'S LABORATORIES (UL) SECTION 580 SPECIFICATIONS

J. UL 263: FIRE TESTS OF BUILDING CONSTRUCTION AND MATERIALS

K. UL 790: TEST FOR FIRE RESISTANCE OF ROOF COVERING MATERIALS

L. UL 2218: IMPACT RESISTANCE TEST

M. SMACNA: ARCHITECTURAL SHEET METAL MANUAL

1.03 SYSTEM DESCRIPTION

A. PERFORMANCE REQUIREMENTS: PROVIDE SHEET METAL ROOFING, WHICH HAS BEEN MANUFACTURED, FABRICATED, AND INSTALLED TO WITHSTAND STRUCTURAL AND THERMAL MOVEMENT, WIND LOADING AND WEATHER EXPOSURE TO MAINTAIN MANUFACTURER'S PERFORMANCE CRITERIA WITHOUT DEFECTS, DAMAGE, AND FAILURE OF INFILTRATION OF WATER.

1. WIND UPLIFT: ROOF PANEL ASSEMBLY SHALL COMPLY WITH FM GLOBAL 1-31 AND UL 580 FOR 1-90 RATED ASSEMBLIES.

2. STATIC AIR INFILTRATION: COMPLETED ROOF SYSTEM SHALL HAVE A MAXIMUM OF .06 CFM/SF WITH 6.24KPA AIR PRESSURE DIFFERENTIAL AS PER ASTM E 283.

3. WATER INFILTRATION: NO EVIDENCE OF WATER PENETRATION AT AN INWARD STATIC AIR PRESSURE DIFFERENTIAL OF NOT LESS THAN 6.24 PSF (43 KPA) AND NOT MORE THAN 12.0 PSF (83 KPA) AS PER ASTM E 331.

1.04 SUBMITTALS

A. SUBMIT THE FOLLOWING UNDER THE PROVISIONS OF DIVISION 1:

1. LITERATURE: MANUFACTURER'S PRODUCT DATA SHEETS, SPECIFICATIONS, PERFORMANCE DATA, PHYSICAL PROPERTIES AND INSTALLATION INSTRUCTIONS FOR EACH ITEM FURNISHED HEREUNDER.

2. MANUFACTURER'S SPECIMEN WARRANTIES: PROVIDE SAMPLE COPIES OF MANUFACTURERS' ACTUAL WARRANTIES FOR ALL MATERIALS TO BE FURNISHED UNDER THIS SECTION, CLEARLY DEFINING ALL TERMS, CONDITIONS, AND TIME PERIODS FOR THE COVERAGE THEREOF.

3. SHOP DRAWINGS: SUBMIT SIX (6) SETS TO ARCHITECT FOR REVIEW.

A. SHOW ALL ITEMS INCLUDING FACTORY AND CUSTOM-BUILT ITEMS ASSEMBLED AT A LEGIBLE SCALE WITH COLOR AND PART/MODEL NUMBERS IDENTIFIED.

B. SUBMIT COMPLETE ERECTION DRAWINGS AND DETAILS OF THE INSTALLATION BASED UPON THE ARCHITECT'S DRAWINGS AND SITE CONDITIONS. DRAWINGS TO INDICATE COMPLIANCE WITH SPECIFIED PERFORMANCE CRITERIA INCLUDING THERMAL MOVEMENT AND FASTENER PULLOUT. INDICATE FASTENER TYPES AND SPACING.

C. SHOW ALL FLASHING, EXPOSED AND CONCEALED FASTENERS.

B. SAMPLES

1. SUBMIT SELECTION AND VERIFICATION SAMPLES FOR FINISHES, COLORS, PROFILE, GAUGE AND WIDTH DIMENSION.

2. SUBMIT PAIR OF 2' LONG METAL PANELS SPECIFIED TO BE INSTALLED FOR APPROVAL BY THE ARCHITECT BEFORE PROCEEDING WITH THE WORK. SUBMIT SAMPLES OF ALL COMPONENTS INCLUDING BUT NOT LIMITED TO: SOFFITS, FASCIAS, GUTTERS, AND DOWNSPOUTS, PANEL CLIPS, CLOSURES AND ACCESSORY ITEMS.

1.05 QUALITY ASSURANCE

A. MATERIALS AND WORKMANSHIP TO BE PROVIDED IN STRICT CONFORMANCE WITH MANUFACTURER'S SPECIFICATIONS.

B. PRODUCT CERTIFICATES SIGNED BY MANUFACTURER CERTIFYING MATERIALS COMPLY WITH SPECIFIED PERFORMANCE CHARACTERISTICS AND PHYSICAL REQUIREMENTS.

C. PROVIDE LETTER FROM MANUFACTURER CERTIFYING THAT STANDING SEAM OR CORRUGATED METAL ROOFING PANELS ARE FACTORY ROLL-FORMED AND TENSION LEVELED PRIOR TO FABRICATION.

D. INSTALLER QUALIFICATIONS: INSTALLER EXPERIENCED IN PERFORMING WORK OF THIS SECTION WHO HAS SPECIALIZED IN THE INSTALLATION OF WORK SIMILAR TO THAT REQUIRED FOR THIS PROJECT.

E. MANUFACTURER AND ERECTOR SHALL DEMONSTRATE EXPERIENCE OF A MINIMUM OF FIVE (5) YEARS IN THIS TYPE OF PROJECT.

F. FACTORY MUTUAL APPROVAL: INSTALLED ROOFING SYSTEM SHALL BE TESTED AND APPROVED BY FACTORY MUTUAL FOR COMPLIANCE WITH FM REQUIREMENTS.

1.06 DELIVERY, STORAGE AND HANDLING

A. GENERAL: COMPLY WITH DIVISION 1 PRODUCT REQUIREMENTS SECTIONS.

1. ORDERING: COMPLY WITH MANUFACTURER'S ORDERING INSTRUCTIONS AND LEAD-TIME REQUIREMENTS TO AVOID CONSTRUCTION DELAYS.

2. DELIVERY: DELIVER MATERIALS IN MANUFACTURER'S ORIGINAL, UNOPENED, UNDAMAGED CONTAINERS WITH IDENTIFICATION LABELS INTACT. IDENTIFY FABRICATED COMPONENTS WITH 1-90 LABEL WHERE APPROPRIATE.

3. STORAGE AND PROTECTION: STORE MATERIALS PROTECTED FROM EXPOSURE TO HARMFUL CONDITIONS. STORE MATERIAL IN DRY, ABOVE GROUND LOCATION.

A. STACK PREFINISHED MATERIAL TO PREVENT TWISTING, BENDING, ABRASION, SCRATCHING AND DENTING. ELEVATE ONE END OF EACH SKID TO ALLOW FOR MOISTURE RUN OFF.

B. PREVENT CONTACT WITH MATERIAL THAT MAY CAUSE CORROSION, DISCOLORATION OR STAINING.

C. DO NOT EXPOSE TO DIRECT SUNLIGHT OR EXTREME HEAT TRIM MATERIAL WITH FACTORY APPLIED STRIPPABLE FILM.

1.07 PROJECT CONDITIONS

A. FIELD MEASUREMENTS: VERIFY ACTUAL MEASUREMENTS/OPENINGS BY FIELD MEASUREMENTS BEFORE FABRICATION. COORDINATE FIELD MEASUREMENTS, FABRICATION SCHEDULE WITH CONSTRUCTION MANAGER FOR CONSTRUCTION PROGRESS AND TO AVOID CONSTRUCTION DELAYS.

B. PROVIDE PROTECTION OR AVOID TRAFFIC ON COMPLETED ROOF SURFACES.

C. DO NOT OVERLOAD ROOF WITH STORED MATERIALS.

D. SUPPORT NO ROOF-MOUNTED EQUIPMENT DIRECTLY ON ROOFING SYSTEM.

1.08 WARRANTY

A. PROJECT WARRANTY: REFER TO CONDITIONS OF THE CONTRACT FOR PROJECT WARRANTY PROVISIONS.

B. MANUFACTURER'S WARRANTY: SUBMIT, FOR OWNER'S ACCEPTANCE, MANUFACTURER'S STANDARD WARRANTY DOCUMENT EXECUTED BY AUTHORIZED COMPANY OFFICIAL. MANUFACTURER'S WARRANTY IS IN ADDITION TO AND NOT A LIMITATION OF, OTHER RIGHTS OWNER MAY HAVE UNDER THE CONTRACT DOCUMENTS.

1. PROVIDE 20 YEAR, NON-PRORATED FINISH WARRANTY COVERING FADING, PEELING, CHALKING, ADHESION, BLISTERING, AND CRACKING.

2. PROVIDE 20-YEAR WEATHER TIGHTNESS WARRANTY INCLUDING FLASHINGS.

PART 2 - PRODUCTS

SECTION 07 61 00

METAL ROOFING

2.01 MANUFACTURES

A. MANUFACTURERS: SUBJECT TO COMPLIANCE WITH THE REQUIREMENTS SPECIFIED HEREIN, MANUFACTURERS OFFERING PRODUCTS WHICH MAY BE INCORPORATED IN THE WORK INCLUDE, BUT ARE NOT LIMITED TO THE FOLLOWING:

1. FABRAL

2. PAC-CLAD

3. FIRESTONE OMEGA

4. ENGLERT, INC.

5. OR ARCHITECT APPROVED SUBSTITUTE.

2.02 SHEET METAL ROOFING

A. PROFILE: AS SELECTED BY THE ARCHITECT FROM MANUFACTURER'S STAND PROFILES.

B. MATERIAL: 22 GA. MIN., G-90 HOT-DIPPED GALVANIZED STEEL PANELS.

C. COLOR: AS SELECTED BY THE ARCHITECT FROM MANUFACTURER'S STANDARD COLORS.

D. RATING: UL 90 RATING (WIND UPLIFT) PANEL ASSEMBLY.

E. FLASHING AND TRIM: STEEL 24 GA.

F. FASTENERS: HIGH PERFORMANCE ANCHORS RECOMMENDED BY MANUFACTURER FOR ROOFING APPLICATION AND UL 90 RATED (WIND UPLIFT) ASSEMBLIES.

G. FACTORY MUTUAL APPROVAL: ALL MATERIALS, FASTENERS, ETC., SHALL BE FACTORY MUTUAL APPROVED.

2.03 MATERIALS

A. ALUMINUM SHEET: ASTM B209, ALUMINUM AND ALUMINUM ALLOY 3105 WITH H14 TEMPER IN ACCORD WITH MANUFACTURER'S STANDARD TO SUIT FORMING OPERATION AND FINISH SPECIFIED.

1. THICKNESS: .032” MIN.

2.04 RELATED MATERIALS

A. GENERAL: COORDINATE USE OF RELATED MATERIALS:

1. UNDERLAYMENT WHERE REQUIRED:

A. ASTM D226 TYPE II NO. 30 ASPHALT SATURATED ORGANIC ROOFING FELT.

B. ICE & WATER SHIELD (RUBBERIZED ASPHALT AND POLYETHYLENE) SELF-ADHERING AND SELF-CURING MEMBRANE

2. SEALANTS: ELASTOMERIC JOINT SEALANTS. REFER TO DIVISION 7 JOINT SEALERS SECTION.

3. BITUMINOUS COATING: COLD APPLIED ASPHALTIC MASTIC. PROVIDE COMPOUND FREE OF ASBESTOS FIBERS AND OTHER HARMFUL IMPURITIES. REFER TO DIVISION 7 DAMP PROOFING SECTION.

2.05 FABRICATION

A. GENERAL

1. CONTINUOUS LENGTH: FABRICATE PANELS 50' AND LESS IN ONE CONTINUOUS LENGTH. CONSULT FACTORY FOR LONGER LENGTHS.

2. PANELS TO BE FACTORY ROLL FORMED WITH CORRECTIVE LEVELING OF METAL DURING THE ROLL FORMING PROCESS.

3. TRIM AND FLASHINGS: FABRICATE TRIM AND FLASHINGS FROM SAME MATERIAL AS ROOF SYSTEM MATERIAL.

4. PORTABLE ROLL FORMER: PANELS FABRICATED BY PORTABLE ROLL FORMERS SHALL NOT BE APPROVED. USE OF PORTABLE ROLL FORMER IS NOT ACCEPTABLE.

5. BRAKE-FORM ALL FLASHING AND TRIM TRUE AND ACCURATE IN BOTH SIZE AND CONFIGURATION BASED UPON FIELD DIMENSIONS.

6. HEM ALL EXPOSED EDGES.

2.06 FINISHES

A. FACTORY APPLIED FINISH

1. TOPSIDE: FULL-STRENGTH FLUROPOLYMER (70% KYNAR 500 OR HYLAR 5000 RESIN) SYSTEM OF 1.0MIL (.025 MM) TOTAL DRY FILM THICKNESS. MEETING AAMA 620-96 FOR ALUMINUM COIL

2. UNDERSIDE: WASH COAT OF .3 - .4 MIL DRY FILM THICKNESS.

3. TEXTURE: SMOOTH TEXTURE.

4. PROTECTIVE FILM: STRIPPABLE VINYL FILM APPLIED DURING PANEL FABRICATION AND FINISHING.

2.07 SOURCE QUALITY

A. SOURCE QUALITY: OBTAIN SHEET METAL ROOFING FROM A SINGLE MANUFACTURER.

PART 3 - EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS

A. COMPLIANCE: COMPLY WITH MANUFACTURER'S PRODUCT DATA, RECOMMENDATIONS AND INSTALLATIONS INSTRUCTIONS FOR SUBSTRATE VERIFICATION, PREPARATION REQUIREMENTS AND INSTALLATION.

1. STRIPPABLE FILM: REMOVE MANUFACTURER'S PROTECTIVE FILM, IF ANY, FROM SURFACES OF ROOFING PANELS.

3.02 EXAMINATION

A. SITE VERIFICATION OF CONDITIONS: VERIFY SUBSTRATE CONDITIONS, WHICH HAVE BEEN PREVIOUSLY INSTALLED UNDER OTHER SECTIONS, ARE ACCEPTABLE FOR PROJECT INSTALLATION IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS. MANUFACTURE TO MAKE JOBSITE INSPECTIONS.

B. CONTRACTOR IS RESPONSIBLE FOR ANY AND ALL ADDITIONAL SUPPORT OR FRAMING MEMBERS REQUIRED BY THE METAL ROOF PANEL MANUFACTURER, OR REQUIRED FOR A COMPLETE INSTALLATION, BEYOND WHAT IS INDICATED ON THE DRAWINGS.

3.03 PREPARATION

A. COORDINATION: COORDINATE METAL ROOFING WITH OTHER WORK (DRAINAGE, FLASHING AND TRIM, DECK SUBSTRATES, PARAPETS, COPINGS, WALLS) AND OTHER ADJOINING WORK TO PROVIDE A NON-CORROSIVE AND LEAK-PROOF INSTALLATION.

B. DISSIMILAR METALS: PREVENT GALVANIC ACTION OF DISSIMILAR METALS.

3.04 INSTALLATION

A. GENERAL: INSTALL METAL ROOFING PANELS TO PROFILES, PATTERNS AND DRAINAGE INDICATED AND REQUIRED FOR LEAK-PROOF INSTALLATION. PROVIDE FOR STRUCTURAL AND THERMAL MOVEMENT AT WORK. SEAL JOINTS FOR LEAK PROOF INSTALLATION.

1. SEAMS: PROVIDE UNIFORM, NEAT SEAMS.

2. FASTENERS: CONCEAL FASTENERS WHERE POSSIBLE IN EXPOSED WORK. COVER AND SEAL FASTENERS AND ANCHORS FOR WATERTIGHT AND LEAK-PROOF INSTALLATION.

3. SEALANT-TYPE JOINTS: PROVIDE SEALANT-TYPE JOINTS WHERE INDICATED. FORM JOINTS TO CONCEAL SEALANT. COMPLY WITH DIVISION 7 JOINT SEALANTS SECTION FOR SEALANT INSTALLATION.

3.05 FIELD QUALITY REQUIREMENTS

A. SITE TESTS: (POST INSTALLATION TESTING): OWNER RESERVES RIGHT TO PERFORM POST INSTALLATION TESTING OF INSTALLED SHEET METAL ROOFING.

B. MANUFACTURER'S FIELD SERVICES: UPON OWNER'S REQUEST, PROVIDE MANUFACTURER'S FIELD SERVICE CONSISTING OF PRODUCT USE RECOMMENDATIONS AND PERIODIC SITE VISIT FOR INSPECTION OF PRODUCT INSTALLATION IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS.

C. FACTORY MUTUAL APPROVAL: INSTALLED SHEET METAL ROOFING SYSTEM WILL BE INSPECTED BY FACTORY MUTUAL FOR COMPLIANCE WITH INSTALLATION REQUIREMENTS.

3.06 CLEANING

A. CLEANING: REMOVE TEMPORARY COVERINGS AND PROTECTION OF ADJACENT WORK AREAS. REPAIR OR REPLACE DAMAGED INSTALLED PRODUCTS. CLEAN INSTALLED PRODUCTS IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS PRIOR TO OWNER'S ACCEPTANCE. REMOVE CONSTRUCTION DEBRIS FROM PROJECT SITE AND LEGALLY DISPOSE OF DEBRIS.

3.07 PROTECTION

A. PROTECTION: PROTECT INSTALLED PRODUCT FROM DAMAGE DURING CONSTRUCTION.

END OF SECTION

SECTION 07 71 00

MANUFACTURED ROOF SPECIALTIES

PART 1 - GENERAL

1.01 DESIGN REQUIREMENTS

A. SHOULD A DISCREPANCY BE FOUND BETWEEN APPLICABLE CODES AND DRAWINGS, NOTIFY THE ARCHITECT IN WRITING PRIOR TO FABRICATION OF COMPONENTS.

1.02 SECTION INCLUDES

A. FURNISH AND INSTALL THE FOLLOWING:

1. FACTORY FABRICATED AND FINISHED FORMED ALUMINUM ROOF EDGING.

2. GUTTERS, DRAIN BOXES (SCUPPERS) AND DOWNSPOUTS; WHERE APPLICABLE.

3. ROOF, WALL AND COUNTER FLASHINGS.

4. ROOF ACCESS HATCHES

5. AUTOMATIC SMOKE VENT

6. SEALANT IN CONJUNCTION WITH SHEET METAL WORK SPECIFIED HEREIN.

1.03 RELATED SECTIONS

A. SECTION 06 10 00 - ROUGH CARPENTRY

B. SECTION 07 54 23 - TPO MEMBRANE ROOFING

C. SECTION 07 61 00 - METAL ROOFING

1.04 REFERENCES

A. COMPLY WITH APPLICABLE REQUIREMENTS OF THE FOLLOWING STANDARDS AND THOSE OTHERS REFERENCED IN THIS SECTION.

1. ASTM B 209 - SPECIFICATION FOR ALUMINUM ALLOY, SHEET AND PLATE.

2. ASTM A 167 - STAINLESS AND HEAT RESISTING CHROMIUM-NICKEL STEEL PLATE, SHEET AND STRIP.

3. ASTM A 480 - GENERAL REQUIREMENTS FLAT-ROLLED STAINLESS AND HEAT-RESISTING STEEL PLATE, SHEET AND STRIP.

4. ASTM D 4586 - ASPHALT ROOF CEMENT, ASBESTOS-FREE.

5. MANUFACTURER SHALL CERTIFY REGLET AND COUNTER FLASHING SYSTEM TO RESIST 120 MPH WIND LOAD WHEN TESTED IN ACCORDANCE WITH ASTM D3161-95A FOR A MINIMUM OF TWO CONTINUOUS HOURS AS VERIFIED BY INDEPENDENT TEST RESULTS.

B. THE FOLLOWING REFERENCE MATERIALS ARE HEREBY MADE A PART OF THIS SECTION BY REFERENCE THERETO:

1. SMACNA - ARCHITECTURAL SHEET METAL MANUAL, REFERRED TO HEREIN AS “SHEET METAL MANUAL”.

2. NRCA - ROOFING AND WATERPROOFING MANUAL.

1.05 SUBMITTALS

A. REFER TO SECTION 01300 - ADMINISTRATIVE REQUIREMENTS, FOR SUBMITTAL PROCEDURES.

1. LITERATURE: MANUFACTURER'S DATA SHEETS FOR EACH METAL TYPE AND ACCESSORIES FURNISHED HEREUNDER, INCLUDE MATERIAL SPECIFICATIONS, PERFORMANCE DATA, PHYSICAL PROPERTIES AND FINISHES.

2. CERTIFICATION: PROVIDE CERTIFICATIONS THAT MATERIALS AND SYSTEMS COMPLY WITH THE SPECIFIED REQUIREMENTS FOR THE USE INDICATED.

3. SHOP DRAWINGS:

A. FULLY DIMENSIONED LARGE-SCALE DESIGN DETAILS SHOWING MATERIAL PROFILES, SPLICES, FLASHING TERMINATIONS AND OTHER JOINTING DETAILS, FASTENING METHODS AND INSTALLATION DETAILS. INDICATE MATERIAL TYPE, SIZES, AND WEIGHTS OR GAGES. INDICATE EXTENT OF ADJACENT WORK SPECIFIED UNDER OTHER SECTIONS OF THE SPECIFICATIONS.

B. FULLY DETAIL METHODS OF RELIEVING STRESSES DUE TO THERMAL MOVEMENT, INCLUDING SEALING OF EXPANSION SEAMS.

C. ALL DETAILS BEARING DIMENSIONS OF ACTUAL MEASUREMENTS TAKEN AT THE PROJECT.

4. SELECTION SAMPLES:

A. METAL SAMPLE CHIPS, INDICATING MANUFACTURER'S FULL RANGE OF FINISH COLORS FOR FACTORY FINISHES AVAILABLE FOR SELECTION BY ARCHITECT.

B. MANUFACTURER'S CURED SEALANT SAMPLES FOR SEALANT COLOR SELECTION.

5. DESCRIBE MATERIAL PROFILE, JOINTING PATTERN, JOINTING DETAILS, FASTENING METHODS, AND INSTALLATION DETAILS.

6. PROVIDE 12" SIZED SAMPLE OF METAL FLASHING ILLUSTRATING TYPICAL SEAM, EXTERNAL CORNER, INTERNAL CORNER, VALLEY, RIDGE JUNCTION TO VERTICAL DISSIMILAR SURFACE, MATERIAL, AND FINISH.

1.06 QUALITY ASSURANCE

A. COMPANY SPECIALIZING IN FABRICATION AND INSTALLATION OF SHEET METAL WORK WITH MINIMUM 5 YEARS DOCUMENTED EXPERIENCE.

B. FLASHING AND SHEET METAL APPLICATOR, WITH A MINIMUM OF 5 YEARS DOCUMENTED EXPERIENCE DEMONSTRATING PREVIOUSLY SUCCESSFUL WORK OF THE TYPE SPECIFIED HEREIN, AND APPROVED BY PRODUCT MANUFACTURER.

C. FACTORY FABRICATED ROOF EDGE SHALL BE CERTIFIED BY ROOF EDGE MANUFACTURER TO MEET THE FOLLOWING DESIGN CRITERIA:

1. SPRI TEST METHOD RE-1 TEST FOR ROOF EDGE TERMINATION OF SINGLE-PLY ROOFING MEMBRANES: THE FASCIA SYSTEM SHALL BE TESTED TO SECURE THE MEMBRANE TO MINIMUM 100 LBS./FT IN ACCORD WITH SPRI TEST METHOD RE-1. USE CURRENT EDITION OF 'WIND RESISTANCE GUIDE FOR EDGE SYSTEMS USED WITH LOW SLOPE ROOFING SYSTEMS'.

2. SPRI TEST METHOD RE-2 PULL-OFF TEST FOR FASCIA: THE FASCIA SYSTEM SHALL BE TESTED IN ACCORD WITH SPRI TEST METHOD RE-2. USE CURRENT EDITION OF 'WIND RESISTANCE GUIDE FOR EDGE SYSTEMS USED WITH LOW SLOPE ROOFING SYSTEMS'.

3. FMRC LOSS PREVENTION DATA SHEET 1-49 'PERIMETER FLASHING.' THE FASCIA PRODUCT SHALL BE LISTED IN CURRENT FACTORY MUTUAL RESEARCH CORPORATION 'APPROVAL GUIDE FOR ZONE 2 90 PSF UPLIFT.'

1.10 DELIVERY, STORAGE AND HANDLING

A. STORE PREFORMED AND PRE-FINISHED MATERIAL TO PREVENT TWISTING, BENDING, OR ABRASION, AND TO PROVIDE VENTILATION. SLOPE METAL SHEETS TO ENSURE DRAINAGE.

B. PREVENT CONTACT WITH MATERIALS DURING STORAGE WHICH MAY CAUSE DISCOLORATION, STAINING, OR DAMAGE.

PART 2 - PRODUCTS

2.01 GUTTERS, DRAIN BOXES (SCUPPERS) AND DOWNSPOUTS

A. ALUMINUM SHEETS: ASTM B 209 (ASTM B 209M); .05 INCH THICK.

1. FINISH: CLASS I COLOR ANODIZED FINISH AAMA 606.1; INTEGRALLY COLORED ANODIC COATING NOT LESS THAN 0.7 MILS THICK.

2. COLOR: AS SELECTED BY ARCHITECT FROM MANUFACTURER'S STANDARD COLORS.

B. SHOP FABRICATE TO THE PROFILES AND SHAPES INDICATED ON DRAWINGS AND DETAILS.

1. FORM AND FABRICATE IN MAXIMUM LENGTHS POSSIBLE.

2. FABRICATE WITH REQUIRED CONNECTION PIECES.

3. SEAL WATERTIGHT

C. WELD AND FORM EDGES, ENDS, AND JOINTS, BY ELECTRIC PROCESS, WITH ALL WELDED JOINTS GROUND AND POLISHED SMOOTH. PERFORM ALL WELDING SO THAT NO MARK OF ANY KIND SHALL BE NOTICED ON THE FINISHED SURFACES. WELDS AND ADJOINING COMPONENTS SHALL BE HOMOGENOUS, NON-POROUS, AND FREE FROM PITS, CRACKS, IMPERFECTIONS OR DISCOLORATION.

1. HAMMER AND PEEN FLUSH WITH ADJOINING SURFACE WHEREVER MATERIALS HAVE BEEN DEPRESSED OR SUNKEN BY A WELDING OPERATION, AND, IF NECESSARY RE-WELD AND GRIND TO ELIMINATE LOW SPOTS.

2. EXCESSIVE DISTORTIONS CAUSED BY WELDING WILL NOT BE ACCEPTABLE AND SHALL BE CAUSE FOR REJECTION AND REMOVAL FROM PROJECT SITE.

D. PROVIDE A FINISH CONSISTENT THROUGHOUT THE WORK OF THIS SECTION.

1. BRAKE ENDS FREE OF OPEN TEXTURE OR ORANGE PEEL APPEARANCE. WHERE BRAKE WORK MARS THE FINISH OF THE MATERIALS, REMOVE MARKS BY GRINDING, POLISHING AND FINISHING.

2. SHEAR EDGES FREE OF BURRS, PROJECTION OR FINS TO ELIMINATE ALL DANGER OF LACERATION.

3. NEATLY FINISH MITER JOINTS AND BULL NOSED CORNERS WITH UNDER EDGE OF THE MATERIAL NEATLY GROUND TO A UNIFORM CONDITION AND IN NO CASE WILL OVERLAPPING MATERIALS BE ACCEPTABLE.

4. HEM EXPOSED EDGES OF METAL

E. ANCHORS AND SUPPORTS: PROFILED TO SUIT GUTTERS AND DOWNSPOUTS.

1. ANCHORING DEVICES: IN ACCORDANCE WITH SMACNA REQUIREMENTS.

2. GUTTER SUPPORTS: BRACKETS.

3. DOWNSPOUT SUPPORTS: BRACKETS.

2.02 FACTORY FABRICATED FASCIA TRIM/ROOF EDGE

A. MANUFACTURERS AND PRODUCTS: SUBJECT TO COMPLIANCE WITH THE REQUIREMENTS SPECIFIED HEREIN, PRODUCTS WHICH MAY BE INCORPORATED IN THE WORK ARE LIMITED TO THE FOLLOWING:

1. SAME MANUFACTURER OF ROOF MATERIALS.

2. OR ARCHITECT / MANUFACTURER APPROVED EQUIVALENT.

B. FASCIA TRIM/ ROOF EDGE: MULTI-COMPONENT ALUMINUM CANT DAM SYSTEM, FACTORY MUTUAL INC. CERTIFIED CLASS I-90, AND SHALL CONFORM TO THE FOLLOWING ADDITIONAL REQUIREMENTS:

1. PERFORMANCE CHARACTERISTICS:

A. EDGING SHALL LOCK MEMBRANE, PREVENTING WIND PULLBACK.

B. FASCIA SHALL FREELY THERMAL CYCLE ON SPRING CANT SUBSTRATE.

C. FASCIA MAY BE FACTORY MODIFIED FOR TRUE RADIUS APPLICATION.

D. FABRICATE ASSEMBLY SUCH THAT THE FASCIA MAY BE FIELD INSTALLED WITHOUT FASTENER PENETRATION OF EITHER THE ROOFING MEMBRANE OR THE CANT WATERDAM.

E. FACTORY FABRICATE ALL PIER MITERS, FASCIA SUMPS AND SPILLOUTS.

2. FASCIA TRIM, NOMINAL 6 INCH HEIGHT (OR AS INDICATED ON DRAWINGS AND DETAILS), FORMED ALUMINUM ALLOY 6063, TEMPER T5 0.050 INCH THICK.

3. FASCIA CORNERS: FACTORY FABRICATED, WELDED FASCIA, SHOP FINISHED TO EXACTLY MATCH RUNNING FASCIA. MINIMUM LEG LENGTH 12 INCHES.

4. CANT WATERDAM: G90 GALVANIZED STEEL, MINIMUM 24 GAGE, 10'-0" LENGTHS.

A. PROVIDE GALVANIZED FASTENERS SECURING CANT DAM IN PLACE, SPACED NOT GREATER THAN 24 INCHES ON CENTER ON BACK EDGE, AND 12 INCHES ON CENTER ON ROOFING SIDE.

C. FASTENERS: AS RECOMMENDED BY FASCIA MANUFACTURER FOR PARTICULAR SUBSTRATE ENCOUNTERED. NO EXPOSED FASTENERS PERMITTED.

D. FINISH, EXPOSED ALUMINUM:

1. POLYVINYLIDENE FLOURIDE (PVDF), KYNAR 500 COIL COATED RESIN BASED, HIGH PERFORMANCE THERMOPLASTIC ORGANIC COATING IN COLOR SELECTED BY ARCHITECT, FROM MANUFACTURER'S STANDARD COLOR CHART.

A. RESIN BASE OF 70 PERCENT PVDF BY WEIGHT, ATOCHEM NORTH AMERICA, INC., PRODUCT “KYNAR 500” OR AUSIMONT USA. PRODUCT “HYLAR 5000 “.

B. FINISH COATING SHALL BE MANUFACTURED AS ONE OF THE FOLLOWING PRODUCTS:

1) AKZO CHEMICAL; PRODUCT “TRINAR”.

2) GLIDDEN COMPANY; PRODUCT “NUBELAR.”

3) MORTON INTERNATIONAL; PRODUCT “FLUOROCERAM.”

4) P.P.G. INDUSTRIES INC.; PRODUCT “DURANAR.”

5) VALSPAR CORP., PRODUCT: “FLUROPON.”

C. SURFACE PREPARATION: PROPERLY CLEAN ALUMINUM WITH INHIBITED CHEMICAL CLEANER AND PRETREAT WITH ACID CHROMATE-FLUORIDE-PHOSPHATE CONVERSION COATING, IN ACCORDANCE WITH ALUMINUM ASSOCIATION METHOD AA-C12C42.

D. SHOP-PRIME ALL SURFACES WITH A CORROSION RESISTANT, EPOXY-BASED PRIMER COMPATIBLE WITH FINISH COATING, AVERAGING 0.2 TO 0.3 MILS DRY FILM THICKNESS, FULLY OVEN-CURED.

E. SHOP FINISH WITH ONE COLOR COAT, OF POLYVINYLIDENE FLOURIDE ENAMEL AVERAGING 0.70 TO 0.80 MIL DRY FILM THICKNESS ON ALL EXPOSED SURFACES, INCLUDING ALL EXPOSED SCREWS, FASTENINGS, ETC.

2.03 ROOF HATCHES

A. FABRICATE UNITS TO WITHSTAND 40-LBF PER SQ. FT. EXTERNAL LOADING AND 20-LBF PER SQ. FT. INTERNAL LOADING PRESSURE. FRAME WITH 9-INCH-HIGH INTEGRAL-CURB DOUBLE-WALL CONSTRUCTION WITH 1-1/2-INCH INSULATION, CANT STRIPS AND CAP FLASHING (ROOFING COUNTER FLASHING) WITH WELDED OR SEALED MECHANICAL CORNER JOINTS. PROVIDE DOUBLE-WALL COVER (LID) CONSTRUCTION WITH 1-INCH INSULATION CORE. PROVIDE GASKETING AND EQUIP CORROSION-RESISTANT OR HOT-DIP GALVANIZED HARDWARE INCLUDING PINTLE HINGES, HOLD-OPEN DEVICES, INTERIOR PADLOCK HASPS, AND BOTH INTERIOR AND EXTERIOR LATCH HANDLES.

B. SINGLE-LEAF TYPE: FOR PERSONNEL ACCESS.

1. FOR STAIR ACCESS: 2 FEET 6 INCHES BY 8 FEET 0 INCHES.

2. FOR LADDER ACCESS: 3 FEET 0 INCHES BY 3 FEET 0 INCHES.

C. MATERIAL: ALUMINUM, SHEETS AND EXTRUSIONS.

D. MANUFACTURERS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE PRODUCTS BY ONE OF THE FOLLOWING:

1. BILCO CO.

2. BABCOCK-DAVIS HATCHWAYS, INC.

3. OR APPROVED EQUIVALENT.

2.04 POLYURETHANE SPRAY FOAM

A. LOW EXPANSION POLYURETHANE SEALANT:

B. MANUFACTURERS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE PRODUCTS BY ONE OF THE FOLLOWING:

1. DOW FROTH-PAK

2. FLEXIBLE PRODUCTS COMPANY INSTA-SEAL

3. ARCHITECT APPROVED SUBSTITUTE

C. FURNISH AND INSTALL A TWO-COMPONENT, QUICK-CURE, SLOW RISE POLYURETHANE FOAM THAT FILLS CAVITIES, PENETRATIONS, CRACKS, AND EXPANSION JOINTS. PRODUCT TO BE OF THE CHEMICALLY CURED TYPE.

1. APPLICABLE STANDARDS:

A. C518 - STANDARD TEST METHOD FOR STEADY-STATE THERMAL TRANSMISSION PROPERTIES BY MEANS OF THE HEAT FLOW METER APPARATUS.

B. D1621 - STANDARD TEST METHOD FOR COMPRESSIVE PROPERTIES OF RIGID CELLULAR PLASTICS.

C. D2842 - STANDARD TEST METHOD FOR WATER ABSORPTION OF RIGID CELLULAR PLASTICS.

D. E96 - STANDARD TEST METHOD FOR WATER VAPOR TRANSMISSION OF MATERIALS.

2. INSTALLATION PER MANUFACTURER'S RECOMMENDATIONS FOR APPLICATION.

2.05 ACCESSORIES

A. UNDERLAYMENT: ASPHALT SATURATED BUILDING FELT, NON-PERFORATED, 15 POUNDS PER SQUARE AS RECOMMENDED FOR USE IN WATERPROOFING AND IN CONSTRUCTION OF BUILT-UP ROOFS. UNDERLAYMENT TO BE COMPATIBLE WITH ROOF NAV ASSEMBLY NUMBER 127787-0-0(ROOF NAV ASSEMBLY NUMBER 113406-0-0 AT BLENDING ANNEX ROOF.)

B. FLASHING CEMENT: TROWEL GRADE, COMPOSED OF SELECTED ASPHALT, SOLVENTS, AND NON-ASBESTOS FILLERS, CONFORMING TO FS SS-C-153 TYPE 1, ASTM D 2822, TYPE 1 AND ASTM D 4586, TYPE 1 (NON-ASBESTOS) AS MANUFACTURED BY KARNAK CHEMICAL CORPORATION, PRODUCT Nº. 19 “FLASHING CEMENT”, OR EQUAL AS MANUFACTURED BY KOCH MATERIALS COMPANY, J & P PETROLEUM PRODUCTS COMPANY OR OTHER APPROVED MANUFACTURER. FLASHING CEMENT TO BE COMPATIBLE WITH ROOF NAV. ASSEMBLY NUMBER 127787-0-0 (ROOF NAV. ASSEMBLY NUMBER 113406-0-0 AT BLENDING ANNEX ROOF.)

C. SEALANT: SEALANT IN CONJUNCTION WITH METAL WORK: ONE-PART ACRYLIC TERPOLYMER SEALANT, TREMCO MONO, PECORA UNICRYLIC, SONNEBORN SONAC, OR EQUIVALENT, IN COLOR TO MATCH THE COLOR OF THE METAL. SEALANT TO BE COMPATIBLE WITH ROOF NAV. ASSEMBLY NUMBER 127787-0-0 (ROOF NAV. ASSEMBLY NUMBER 113406-0-0 AT BLENDING ANNEX ROOF.)

D. SPLASH PADS: PRE-CAST CONCRETE TYPE, SIZE AND PROFILES INDICATED; MINIMUM 3000 PSI AT 28 DAYS, WITH MINIMUM 5 PERCENT AIR ENTRAINMENT.

E. GALVANIZED METAL FLASHING: COMMERCIAL GRADE GALVANIZED STEEL MEETING ASTM A653-95, COATING DESIGNATION G-90, MINIMUM.

1. COUNTER FLASHING: 26 GAGE

2. CONCRETE REGLET: 26 GAGE

3. SURFACE MOUNTED REGLET: 24 GAGE

4. MASONRY REGLET: 24 GAGE

5. ST STUCCO REGLET: 24 GAGE

6. STX REGLET: 24 GAGE

PART 3 - EXECUTION

3.01 EXAMINATION

A. VERIFY ROOF NAILING STRIPS AND WOOD BLOCKING IS SOLIDLY SET.

B. VERIFY THAT THE SUBSTRATE IS DRY, CLEAN, AND FREE OF FOREIGN MATTER. CORRECT DEFECTS PRIOR TO ANY INSTALLATION.

C. COMMENCING OF WORK SHALL CONSTITUTE ACCEPTANCE OF THE CONDITIONS OF THE SURFACES TO WHICH THIS WORK IS TO BE APPLIED.

3.02 PREPARATION

A. FIELD MEASURE AND VERIFY SITE CONDITIONS PRIOR TO FABRICATION.

B. VERIFY THAT SURFACES ARE READY TO RECEIVE WORK OF THIS SECTION.

C. INSTALL STARTER AND EDGE STRIPS, AND CLEATS BEFORE STARTING INSTALLATION.

D. DURING THE INSTALLATION OF WORK OF THIS SECTION, PROTECT THE WORK OF OTHER TRADES AGAINST UNDUE SOILAGE AND DAMAGE BY THE EXERCISE OF REASONABLE CARE AND PRECAUTIONS. REPAIR OR REPLACE ANY WORK SO DAMAGED AND SOILED.

E. INSTALL SURFACE MOUNTED REGLETS TRUE TO LINES AND LEVELS. SEAL TOP OF REGLETS WITH SEALANT.

F. SECURE FLASHINGS IN PLACE USING CONCEALED CONTINUOUS CLEATS, CLIPS AND FASTENERS IN ACCORDANCE WITH PRODUCT DATA AS INDICATED. USE EXPOSED FASTENERS ONLY IN LOCATIONS APPROVED BY ARCHITECT.

G. APPLY PLASTIC CEMENT COMPOUND BETWEEN METAL FLASHINGS AND FELT FLASHINGS.

H. LAP AND SEAL ALL JOINTS.

I. SLOPE GUTTERS 1/8 INCH PER FOOT MINIMUM.

J. SET SPLASH PADS UNDER DOWNSPOUTS, (AS INDICATED ON DRAWINGS).

K. FIT FLASHINGS TIGHT IN PLACE. MAKE CORNERS SQUARE, SURFACES TRUE AND STRAIGHT IN PLANES, AND LINES ACCURATE TO PROFILES.

L. SOLDER METAL JOINTS WATERTIGHT FOR FULL METAL SURFACE CONTACT. AFTER SOLDERING, WASH METAL CLEAN WITH NEUTRALIZING SOLUTION AND RINSE WITH WATER. SEAL METAL JOINTS WATERTIGHT.

M. COORDINATE COUNTER FLASHING AT ROOF SURFACES WITH ROOFING WORK TO PROVIDE WEATHER TIGHT CONDITION AT ROOF TERMINATIONS.

N. ISOLATE DISSIMILAR MATERIALS TO PREVENT ELECTROLYSIS. SEPARATE USING BITUMINOUS COATING.

O. INSTALL REGLETS AS WALLS ARE BUILT BY VARIOUS TRADES, ROOFING CONTRACTOR TO PROVIDE PRODUCTS TO TRADE INSTALLING WITH INSTALLATION INSTRUCTIONS. ROOFING CONTRACTOR TO VERIFY THAT RELETS HAVE BEEN PROPERLY INSTALLED AND CORRECT AS REQUIRED.

3.03 INSTALLATION - ROOF EDGE / FASCIA

A. COORDINATE WITH ROOFING INSTALLER PRIOR TO INSTALLATION. VERIFY SITE CONDITIONS AND MANUFACTURERS ROOF EDGING DETAILS. COMPLY WITH ROOF EDGING MANUFACTURER'S INSTALLATION INSTRUCTIONS AND RECOMMENDATIONS.

B. AFFIX GALVANIZED SPRING CLIP IN CONTINUOUS MANNER TO VERTICAL FACE OF WOOD NAILERS. LOCATE FASTENERS 3/4 INCH BELOW ROOF EDGE AND 12 INCHES ON CENTER USING A MINIMUM 1-1/2 INCH GALVANIZED ROOFING NAIL. ALLOW 1/4-INCH GAP BETWEEN SECTIONS OF SPRING CLIP.

C. LAY ROOFING MEMBRANE OVER THE SPRING CLIP ALLOWING IT TO EXTEND DOWN THE FACE TO THE DRIP EDGE. LOCATE AND HANG JOINT COVERS AT ALL JOINTS BETWEEN CORNERS AND STRAIGHT SECTIONS

D. HOOK EACH FASCIA SECTION OVER THE TOP OF THE SPRING CLIP AND MEMBRANE. PRESS DOWN ON THE FASCIA UNTIL THE DRIP EDGE IS ENGAGE. ALLOWED 1/8 TO 1/4-INCH GAP FOR EXPANSION (AS RECOMMENDED BY MANUFACTURER).

3.04 CLEANING

A. DAILY CLEAN WORK AREAS BY SWEEPING AND DISPOSING OF DEBRIS.

B. UPON COMPLETION OF THE WORK OF THIS SECTION OR IN ANY GIVEN AREA, REMOVE TOOLS, EQUIPMENT AND ALL RUBBISH AND DEBRIS FROM THE WORK AREA; LEAVE AREA IN BROOM-CLEAN CONDITION.

END OF SECTION

SECTION 07 84 10

THRU-PENETRATION FIRESTOP SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. CONSTRUCTION DRAWINGS, SPECIFICATIONS AND PROVISIONS OF THE CONTRACT INCLUDING GENERAL AND SUPPLEMENTAL CONDITIONS AND OTHER DIVISION 1 SPECIFICATION SECTIONS, ARE HEREBY MADE A PART OF THIS SECTION AS FULLY AND COMPLETELY AS IF REPEATED HEREIN.

1.02 ITEMS REQUIRED BUT NOT SPECIFIED

A. IF AN ITEM OR MATERIAL OF THIS TRADE IS INDICATED ON THE DRAWINGS BUT NOT SPECIFICALLY LISTED IN THIS SECTION, PROVIDE SUCH ITEM OR MATERIAL AT A STANDARD OF QUALITY EQUAL TO THE STANDARD ESTABLISHED FOR THE BALANCE OF THE WORK SPECIFIED, IN ACCORDANCE WITH THE ARCHITECT'S INTERPRETATION.

1.03 EXECUTION, CORRELATION AND INTENT

A. IN CASE OF AN INCONSISTENCY BETWEEN DRAWINGS AND SPECIFICATIONS OR WITHIN EITHER DOCUMENT NOT CLARIFIED BY ADDENDUM, THE BETTER QUALITY OR GREATER QUANTITY OF WORK IS TO BE PROVIDED, IN ACCORDANCE WITH THE ARCHITECT'S INTERPRETATION.

1.04 DEFINITIONS

A. FIRESTOPPING: MATERIAL OR COMBINATION OF MATERIALS USED TO RETAIN INTEGRITY OF FIRE-RATED CONSTRUCTION BY MAINTAINING AN EFFECTIVE BARRIER AGAINST THE SPREAD OF FLAME, SMOKE, AND HOT GASES THROUGH PENETRATIONS IN FIRE RATED WALL AND FLOOR ASSEMBLIES.

1.05 GENERAL DESCRIPTION OF THE WORK OF THIS SECTION

A. ONLY TESTED FIRESTOP SYSTEMS SHALL BE USED IN SPECIFIC LOCATIONS AS FOLLOWS:

1. PENETRATIONS FOR THE PASSAGE OF DUCT, CABLE, CABLE TRAY, CONDUIT, PIPING, ELECTRICAL BUSWAYS AND RACEWAYS THROUGH FIRE-RATED VERTICAL BARRIERS (WALLS AND PARTITIONS), HORIZONTAL BARRIERS (FLOOR/CEILING ASSEMBLIES), AND VERTICAL SERVICE SHAFT WALLS AND PARTITIONS.

2. BLANK OPENINGS THROUGH FIRE-RATED VERTICAL BARRIERS (WALLS AND PARTITIONS), HORIZONTAL BARRIERS (FLOOR/CEILING ASSEMBLIES), AND VERTICAL SERVICE SHAFT WALLS AND PARTITIONS.

3. OPENINGS AND PENETRATIONS IN FIRE-RATED PARTITIONS OR WALLS CONTAINING FIRE DOORS.

4. OPENINGS AROUND STRUCTURAL MEMBERS WHICH PENETRATE FLOORS OR WALLS.

1.06 RELATED WORK OF OTHER SECTIONS

A. COORDINATE WORK OF THIS SECTION WITH WORK OF OTHER SECTIONS AS REQUIRED TO PROPERLY EXECUTE THE WORK AND AS NECESSARY TO MAINTAIN SATISFACTORY PROGRESS OF THE WORK OF OTHER SECTIONS, INCLUDING:

1. SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

2. SECTION 03 40 00 - PRECAST CONCRETE

3. SECTION 04 00 00 - MASONRY WORK

4. SECTION 07842 - FIRE-RESISTIVE JOINT SYSTEMS

5. SECTION 07 90 00 - JOINT SEALERS

6. SECTION 09 20 00 - GYPSUM BOARD ASSEMBLIES

7. SECTION 21 00 00 - FIRE-SUPPRESSION SYSTEMS

9. DIVISION 15 - MECHANICAL SYSTEMS

10. DIVISION 16 - ELECTRICAL SYSTEMS

1.07 REFERENCES

A. TEST REQUIREMENTS: ASTM E 814, "STANDARD METHOD OF FIRE TESTS OF THROUGH PENETRATION FIRE STOPS"

B. TEST REQUIREMENTS: UL 1479, “FIRE TESTS OF THROUGH-PENETRATION FIRESTOPS”

C. UNDERWRITERS LABORATORIES (UL) OF NORTHBROOK, IL PUBLISHES TESTED SYSTEMS IN THEIR "FIRE RESISTANCE DIRECTORY" THAT IS UPDATED ANNUALLY.

1. UL FIRE RESISTANCE DIRECTORY:

A. FIRESTOP DEVICES (XHJI)

B. FIRE RESISTANCE RATINGS (BXRH)

C. THROUGH-PENETRATION FIRESTOP SYSTEMS (XHEZ)

D. FILL, VOIDS, OR CAVITY MATERIAL (XHHW)

A. FORMING MATERIALS (XHKU)

D. INTERNATIONAL FIRESTOP COUNCIL GUIDELINES FOR EVALUATING FIRESTOP SYSTEMS ENGINEERING JUDGMENTS

E. ASTM E 84, STANDARD TEST METHOD FOR SURFACE BURNING CHARACTERISTICS OF BUILDING MATERIALS.

F. INSPECTION REQUIREMENTS: ASTM E 2174, “STANDARD PRACTICE FOR ON-SITE INSPECTION OF INSTALLED FIRE STOPS.”

G. STATE BUILDING CODE, AS AMMENDED BY AUTHORITY HAVING JURISDICTION.

H. NFPA 101 - LIFE SAFETY CODE

I. NFPA 70 - NATIONAL ELECTRIC CODE

1.08 QUALITY ASSURANCE

A. A MANUFACTURER'S DIRECT REPRESENTATIVE (NOT DISTRIBUTOR OR AGENT) TO BE ON-

SITE DURING INITIAL INSTALLATION OF FIRESTOP SYSTEMS TO TRAIN APPROPRIATE CONTRACTOR PERSONNEL IN PROPER SELECTION AND INSTALLATION PROCEDURES. THIS WILL BE DONE PER MANUFACTURER'S WRITTEN RECOMMENDATIONS PUBLISHED IN THEIR LITERATURE AND DRAWING DETAILS.

B. FIRESTOP SYSTEM INSTALLATION MUST MEET REQUIREMENTS OF ASTM E 814 OR UL 1479 TESTED ASSEMBLIES THAT PROVIDE A FIRE RATING EQUAL TO THAT OF CONSTRUCTION BEING PENETRATED.

C. PROPOSED FIRESTOP MATERIALS AND METHODS SHALL CONFORM TO APPLICABLE GOVERNING CODES HAVING LOCAL JURISDICTION.

D. FIRESTOP SYSTEMS DO NOT REESTABLISH THE STRUCTURAL INTEGRITY OF LOAD BEARING PARTITIONS/ASSEMBLIES, OR SUPPORT LIVE LOADS AND TRAFFIC. INSTALLER SHALL CONSULT THE STRUCTURAL ENGINEER PRIOR TO PENETRATING ANY LOAD BEARING ASSEMBLY.

E. FOR THOSE FIRESTOP APPLICATIONS THAT EXIST FOR WHICH NO UL TESTED SYSTEM IS AVAILABLE THROUGH A MANUFACTURER, AN ENGINEERING JUDGMENT DERIVED FROM SIMILAR UL SYSTEM DESIGNS OR OTHER TESTS WILL BE SUBMITTED TO LOCAL AUTHORITIES HAVING JURISDICTION FOR THEIR REVIEW AND APPROVAL PRIOR TO INSTALLATION. ENGINEERING JUDGMENT DRAWINGS MUST FOLLOW REQUIREMENTS SET FORTH BY THE INTERNATIONAL FIRESTOP COUNCIL.

1.09 SUBMITTALS

A. SUBMIT PRODUCT DATA: MANUFACTURER'S SPECIFICATIONS AND TECHNICAL DATA FOR EACH MATERIAL INCLUDING THE COMPOSITION AND LIMITATIONS, DOCUMENTATION OF UL FIRESTOP SYSTEMS TO BE USED AND MANUFACTURER'S INSTALLATION INSTRUCTIONS.

B. MANUFACTURER'S ENGINEERING JUDGMENT IDENTIFICATION NUMBER AND DRAWING DETAILS WHEN NO UL SYSTEM IS AVAILABLE FOR AN APPLICATION. ENGINEERING JUDGMENT MUST INCLUDE BOTH PROJECT NAME AND CONTRACTOR'S NAME WHO WILL INSTALL FIRESTOP SYSTEM AS DESCRIBED IN DRAWING.

C. SUBMIT MATERIAL SAFETY DATA SHEETS PROVIDED WITH PRODUCT DELIVERED TO JOB-SITE.

1.10 INSTALLER QUALIFICATIONS

A. ENGAGE AN EXPERIENCED INSTALLER WHO IS CERTIFIED, LICENSED, OR OTHERWISE QUALIFIED BY THE FIRESTOPPING MANUFACTURER AS HAVING BEEN PROVIDED THE NECESSARY TRAINING TO INSTALL MANUFACTURER'S PRODUCTS PER SPECIFIED REQUIREMENTS. A MANUFACTURER'S WILLINGNESS TO SELL ITS FIRESTOPPING PRODUCTS TO THE CONTRACTOR OR TO AN INSTALLER ENGAGED BY THE CONTRACTOR DOES NOT IN ITSELF CONFER QUALIFICATION ON THE BUYER.

1.11 DELIVERY, STORAGE, AND HANDLING

A. DELIVER MATERIALS UNDAMAGED IN MANUFACTURER'S CLEARLY LABELED, UNOPENED CONTAINERS, IDENTIFIED WITH BRAND, TYPE, AND UL LABEL WHERE APPLICABLE.

B. COORDINATE DELIVERY OF MATERIALS WITH SCHEDULED INSTALLATION DATE TO ALLOW MINIMUM STORAGE TIME AT JOB-SITE.

C. STORE MATERIALS UNDER COVER AND PROTECT FROM WEATHER AND DAMAGE IN COMPLIANCE WITH MANUFACTURER'S REQUIREMENTS, INCLUDING TEMPERATURE RESTRICTIONS.

D. COMPLY WITH RECOMMENDED PROCEDURES, PRECAUTIONS OR REMEDIES DESCRIBED IN MATERIAL SAFETY DATA SHEETS AS APPLICABLE.

E. DO NOT USE DAMAGED OR EXPIRED MATERIALS.

1.12 PROJECT CONDITIONS

A. DO NOT USE MATERIALS THAT CONTAIN FLAMMABLE SOLVENTS.

B. SCHEDULE INSTALLATION OF FIRESTOPPING AFTER COMPLETION OF PENETRATING ITEM INSTALLATION BUT PRIOR TO COVERING OR CONCEALING OF OPENINGS.

C. VERIFY EXISTING CONDITIONS AND SUBSTRATES BEFORE STARTING WORK. CORRECT UNSATISFACTORY CONDITIONS BEFORE PROCEEDING.

D. WEATHER CONDITIONS: DO NOT PROCEED WITH INSTALLATION OF FIRESTOP MATERIALS WHEN TEMPERATURES EXCEED THE MANUFACTURER'S RECOMMENDED LIMITATIONS FOR INSTALLATION PRINTED ON PRODUCT LABEL AND PRODUCT DATA SHEET.

E. DURING INSTALLATION, PROVIDE MASKING AND DROP CLOTHS TO PREVENT FIRESTOPPING MATERIALS FROM CONTAMINATING ANY ADJACENT SURFACES.

PART 2 - PRODUCTS

2.01 FIRESTOPPING, GENERAL

A. PROVIDE FIRESTOPPING COMPOSED OF COMPONENTS THAT ARE COMPATIBLE WITH EACH OTHER, THE SUBSTRATES FORMING OPENINGS, AND THE ITEMS, IF ANY, PENETRATING THE FIRESTOPPING UNDER CONDITIONS OF SERVICE AND APPLICATION, AS DEMONSTRATED BY THE FIRESTOPPING MANUFACTURER BASED ON TESTING AND FIELD EXPERIENCE.

B. PROVIDE COMPONENTS FOR EACH FIRESTOPPING SYSTEM THAT ARE NEEDED TO INSTALL FILL MATERIAL. USE ONLY COMPONENTS SPECIFIED BY THE FIRESTOPPING MANUFACTURER AND APPROVED BY THE QUALIFIED TESTING AGENCY FOR THE DESIGNATED FIRE-RESISTANCE-RATED SYSTEMS.

C. FIRESTOPPING MATERIALS ARE EITHER “CAST-IN-PLACE” (INTEGRAL WITH CONCRETE PLACEMENT) OR “POST INSTALLED.” PROVIDE CAST-IN-PLACE FIRESTOP DEVICES PRIOR TO CONCRETE PLACEMENT.

2.02 ACCEPTABLE MANUFACTURERS

A. SUBJECT TO COMPLIANCE WITH THROUGH PENETRATION FIRESTOP SYSTEMS (XHEZ) LISTED IN VOLUME II OF THE UL FIRE RESISTANCE DIRECTORY, PROVIDE PRODUCTS OF THE FOLLOWING MANUFACTURERS AS IDENTIFIED BELOW:

1. HILTI, INC., TULSA, OKLAHOMA. (800) 879-8000 / WWW.US.HILTI.COM

2. SUBJECT TO COMPLIANCE WITH THE SPECIFICATIONS, PRODUCTS OF OTHER MANUFACTURERS WILL BE CONSIDERED BY THE ARCHITECT. ALTERNATE MANUFACTURERS AND PRODUCTS MUST BE SUBMITTED PRIOR TO SUBMISSION OF BID IN ORDER TO BE CONSIDERED.

2.03 MATERIALS

A. USE ONLY FIRESTOP PRODUCTS THAT HAVE BEEN UL 1479 OR ASTM E 814 TESTED FOR SPECIFIC FIRE-RATED CONSTRUCTION CONDITIONS CONFORMING TO CONSTRUCTION

ASSEMBLY TYPE, PENETRATING ITEM TYPE, ANNULAR SPACE REQUIREMENTS, AND FIRE-RATING INVOLVED FOR EACH SEPARATE INSTANCE.

B. CAST-IN PLACE FIRESTOP DEVICES FOR USE WITH COMBUSTIBLE AND NON-COMBUSTIBLE PIPES (CLOSED AND OPEN PIPING SYSTEMS) AND CABLE BUNDLES PENETRATING CONCRETE FLOORS, THE FOLLOWING PRODUCTS ARE ACCEPTABLE:

1. HILTI CP 680 CAST-IN PLACE FIRESTOP DEVICE

A. ADD AERATOR ADAPTOR WHEN USED IN CONJUNCTION WITH AERATOR (“SOVENT”) SYSTEM.

2. HILTI CP 681 TUB BOX KIT FOR USE WITH TUB INSTALLATIONS.

3. HILTI CP 682 CAST-IN PLACE FIRESTOP DEVICE FOR USE WITH NONCOMBUSTIBLE PENETRANTS

C. SEALANTS, CAULKING MATERIALS, OR FOAMS FOR USE WITH NON-COMBUSTIBLE ITEMS INCLUDING STEEL PIPE, COPPER PIPE, RIGID STEEL CONDUIT AND ELECTRICAL METALLIC TUBING (EMT), THE FOLLOWING PRODUCTS ARE ACCEPTABLE:

1. HILTI FS-ONE INTUMESCENT FIRESTOP SEALANT

2. HILTI CP 604 SELF-LEVELING FIRESTOP SEALANT

3. HILTI CP 620 FIRE FOAM

4. HILTI CP606 FLEXIBLE FIRESTOP SEALANT

5. HILTI CP 601S ELASTOMERIC FIRESTOP SEALANT

D. SEALANTS OR CAULKING MATERIALS FOR USE WITH SHEET METAL DUCTS, THE FOLLOWING PRODUCTS ARE ACCEPTABLE:

1. HILTI CP 601S ELASTOMERIC FIRESTOP SEALANT

2. HILTI CP 606 FLEXIBLE FIRESTOP SEALANT

3. HILTI FS-ONE INTUMESCENT FIRESTOP SEALANT

E. INTUMESCENT SEALANTS, CAULKING MATERIALS FOR USE WITH COMBUSTIBLE ITEMS (PENETRANTS CONSUMED BY HIGH HEAT AND FLAME) INCLUDING INSULATED METAL PIPE, PVC JACKETED, FLEXIBLE CABLE OR CABLE BUNDLES AND PLASTIC PIPE, THE FOLLOWING PRODUCTS ARE ACCEPTABLE:

1. HILTI FS-ONE INTUMESCENT FIRESTOP SEALANT

F. FOAMS, INTUMESCENT SEALANTS, OR CAULKING MATERIALS FOR USE WITH FLEXIBLE CABLE OR CABLE BUNDLES, THE FOLLOWING PRODUCTS ARE ACCEPTABLE:

1. HILTI FS-ONE INTUMESCENT FIRESTOP SEALANT

2. HILTI CP 620 FIRE FOAM

3. HILTI CP 601S ELASTOMERIC FIRESTOP SEALANT

4. HILTI CP 606 FLEXIBLE FIRESTOP SEALANT

G. NON-CURING, RE-PENETRABLE, INTUMESCENT PUTTY OR FOAM MATERIALS FOR USE WITH FLEXIBLE CABLE OR CABLE BUNDLES, THE FOLLOWING PRODUCTS ARE ACCEPTABLE:

1. HILTI CP 618 FIRESTOP PUTTY STICK

2. HILTI CP 658T FIRESTOP PLUG

H. WALL OPENING PROTECTIVE MATERIALS FOR USE WITH U.L. LISTED METALLIC AND SPECIFIED NONMETALLIC OUTLET BOXES, THE FOLLOWING PRODUCTS ARE ACCEPTABLE:

1. HILTI CP 617 FIRESTOP PUTTY PAD

I. FIRESTOP COLLAR OR WRAP DEVICES ATTACHED TO ASSEMBLY AROUND COMBUSTIBLE PLASTIC PIPE (CLOSED AND OPEN PIPING SYSTEMS), THE FOLLOWING PRODUCTS ARE ACCEPTABLE:

1. HILTI CP 643N FIRESTOP COLLAR

2. HILTI CP 644 FIRESTOP COLLAR

3. HILTI CP 645/648 WRAP STRIPS

J. MATERIALS USED FOR LARGE OPENINGS AND COMPLEX PENETRATIONS MADE TO ACCOMMODATE CABLE TRAYS AND BUNDLES, MULTIPLE STEEL AND COPPER PIPES, ELECTRICAL BUSWAYS IN RACEWAYS, THE FOLLOWING PRODUCTS ARE ACCEPTABLE:

1. HILTI CP 637 FIRESTOP MORTAR

2. HILTI FS 657 FIRE BLOCK

3. HILTI CP 620 FIRE FOAM

4. HILTI CP 675T FIRESTOP BOARD

K. NON-CURING, RE-PENETRABLE MATERIALS USED FOR LARGE OPENINGS AND COMPLEX PENETRATIONS MADE TO ACCOMMODATE CABLE TRAYS AND BUNDLES, MULTIPLE STEEL AND COPPER PIPES, ELECTRICAL BUSWAYS IN RACEWAYS, THE FOLLOWING PRODUCTS ARE ACCEPTABLE:

1. HILTI FS 657 FIRE BLOCK

2. HILTI CP 675T FIRESTOP BOARD

L. FOR BLANK OPENINGS MADE IN FIRE-RATED WALL OR FLOOR ASSEMBLIES, WHERE FUTURE PENETRATION OF PIPES, CONDUITS, OR CABLES IS EXPECTED, THE FOLLOWING PRODUCTS ARE ACCEPTABLE:

1. HILTI FS 657 FIRE BLOCK

2. HILTI CP 658T FIRESTOP PLUG

M. PROVIDE A FIRESTOP SYSTEM WITH A "F" RATING AS DETERMINED BY UL 1479 OR ASTM E 814 WHICH IS EQUAL TO THE TIME RATING OF CONSTRUCTION BEING PENETRATED.

PART 3 - EXECUTION

3.01 PREPARATION

A. VERIFICATION OF CONDITIONS: EXAMINE AREAS AND CONDITIONS UNDER WHICH WORK IS TO BE PERFORMED AND IDENTIFY CONDITIONS DETRIMENTAL TO PROPER OR TIMELY COMPLETION.

1. VERIFY PENETRATIONS ARE PROPERLY SIZED AND IN SUITABLE CONDITION FOR APPLICATION OF MATERIALS.

2. SURFACES TO WHICH FIRESTOP MATERIALS WILL BE APPLIED SHALL BE FREE OF DIRT, GREASE, OIL, RUST, LAITANCE, RELEASE AGENTS, WATER REPELLENTS, AND ANY OTHER SUBSTANCES THAT MAY AFFECT PROPER ADHESION.

3. PROVIDE MASKING AND TEMPORARY COVERING TO PREVENT SOILING OF ADJACENT SURFACES BY FIRESTOPPING MATERIALS.

4. COMPLY WITH MANUFACTURER'S RECOMMENDATIONS FOR TEMPERATURE AND HUMIDITY CONDITIONS BEFORE, DURING AND AFTER INSTALLATION OF FIRESTOPPING.

5. DO NOT PROCEED UNTIL UNSATISFACTORY CONDITIONS HAVE BEEN CORRECTED.

3.02 COORDINATION

A. COORDINATE LOCATION AND PROPER SELECTION OF CAST-IN-PLACE FIRESTOP DEVICES WITH TRADE RESPONSIBLE FOR THE WORK. ENSURE DEVICE IS INSTALLED BEFORE PLACEMENT OF CONCRETE.

B. RESPONSIBLE TRADES TO PROVIDE ADEQUATE SPACING OF FIELD RUN PIPES TO ALLOW FOR INSTALLATION OF CAST-IN-PLACE FIRESTOP DEVICES WITHOUT INTERFERENCES.

3.03 INSTALLATION

A. REGULATORY REQUIREMENTS: INSTALL FIRESTOP MATERIALS IN ACCORDANCE WITH UL FIRE RESISTANCE DIRECTORY.

B. MANUFACTURER'S INSTRUCTIONS: COMPLY WITH MANUFACTURER'S INSTRUCTIONS FOR INSTALLATION OF THROUGH-PENETRATION MATERIALS.

1. SEAL ALL HOLES OR VOIDS MADE BY PENETRATIONS TO ENSURE AN AIR AND WATER RESISTANT SEAL.

2. CONSULT WITH MECHANICAL ENGINEER, PROJECT MANAGER, AND DAMPER MANUFACTURER PRIOR TO INSTALLATION OF UL FIRESTOP SYSTEMS THAT MIGHT HAMPER THE PERFORMANCE OF FIRE DAMPERS AS IT PERTAINS TO DUCT WORK.

3. PROTECT MATERIALS FROM DAMAGE ON SURFACES SUBJECTED TO TRAFFIC.

3.04 FIELD QUALITY CONTROL

A. EXAMINE SEALED PENETRATION AREAS TO ENSURE PROPER INSTALLATION BEFORE CONCEALING OR ENCLOSING AREAS.

B. KEEP AREAS OF WORK ACCESSIBLE UNTIL INSPECTION BY APPLICABLE CODE AUTHORITIES.

C. INSPECTION OF THROUGH-PENETRATION FIRESTOPPING SHALL BE PERFORMED IN ACCORDANCE WITH ASTM E 2174, “STANDARD PRACTICE FOR ON-SITE INSPECTION OF INSTALLED FIRE STOPS” OR OTHER RECOGNIZED STANDARD.

D. PERFORM UNDER THIS SECTION PATCHING AND REPAIRING OF FIRESTOPPING CAUSED BY CUTTING OR PENETRATING OF EXISTING FIRESTOP SYSTEMS ALREADY INSTALLED BY OTHER TRADES.

3.05 ADJUSTING AND CLEANING

A. REMOVE EQUIPMENT, MATERIALS AND DEBRIS, LEAVING AREA IN UNDAMAGED, CLEAN CONDITION.

B. CLEAN ALL SURFACES ADJACENT TO SEALED HOLES AND JOINTS TO BE FREE OF EXCESS FIRESTOP MATERIALS AND SOILING AS WORK PROGRESSES.

END OF SECTION

SECTION 07 84 20

FIRE RESISTIVE JOINT SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. CONSTRUCTION DRAWINGS, SPECIFICATIONS AND PROVISIONS OF THE CONTRACT INCLUDING GENERAL AND SUPPLEMENTAL CONDITIONS AND OTHER DIVISION 1 SPECIFICATION SECTIONS, ARE HEREBY MADE A PART OF THIS SECTION AS FULLY AND COMPLETELY AS IF REPEATED HEREIN.

1.02 ITEMS REQUIRED BUT NOT SPECIFIED

A. IF AN ITEM OR MATERIAL OF THIS TRADE IS INDICATED ON THE DRAWINGS BUT NOT SPECIFICALLY LISTED IN THIS SECTION, PROVIDE SUCH ITEM OR MATERIAL AT A STANDARD OF QUALITY EQUAL TO THE STANDARD ESTABLISHED FOR THE BALANCE OF THE WORK SPECIFIED, IN ACCORDANCE WITH THE ARCHITECT'S INTERPRETATION.

1.03 EXECUTION, CORRELATION AND INTENT

A. IN CASE OF AN INCONSISTENCY BETWEEN DRAWINGS AND SPECIFICATIONS OR WITHIN EITHER DOCUMENT NOT CLARIFIED BY ADDENDUM, THE BETTER QUALITY OR GREATER QUANTITY OF WORK IS TO BE PROVIDED, IN ACCORDANCE WITH THE ARCHITECT'S INTERPRETATION.

1.04 DEFINITIONS

A. FIRESTOPPING: MATERIAL OR COMBINATION OF MATERIALS USED TO RETAIN INTEGRITY OF FIRE-RATED CONSTRUCTION BY MAINTAINING AN EFFECTIVE BARRIER AGAINST THE SPREAD OF FLAME, SMOKE, AND HOT GASES THROUGH PENETRATIONS IN FIRE RATED WALL AND FLOOR ASSEMBLIES.

1.05 GENERAL DESCRIPTION OF THE WORK OF THIS SECTION

A. ONLY TESTED AND LISTED FIRESTOP SYSTEMS SHALL BE USED IN SPECIFIC LOCATIONS AS FOLLOWS:

1. SAFING SLOT GAPS BETWEEN EDGE OF FLOOR SLABS AND PERIMETER CURTAIN WALLS.

2. OPENINGS BETWEEN STRUCTURALLY SEPARATE SECTIONS OF WALL OR FLOORS.

3. GAPS BETWEEN THE TOP OF WALLS AND CEILINGS OR ROOF ASSEMBLIES.

4. EXPANSION JOINTS IN WALLS AND FLOORS.

1.06 RELATED WORK OF OTHER SECTIONS

A. COORDINATE WORK OF THIS SECTION WITH WORK OF OTHER SECTIONS AS REQUIRED TO PROPERLY EXECUTE THE WORK AND AS NECESSARY TO MAINTAIN SATISFACTORY PROGRESS OF THE WORK OF OTHER SECTIONS, INCLUDING:

1. SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

2. SECTION 03 40 0 - PRECAST CONCRETE

3. SECTION 04 00 00 - MASONRY WORK

4. SECTION 07 84 10 - THROUGH-PENETRATION FIRESTOP SYSTEMS

5. SECTION 07 90 00 - JOINT SEALERS

6. SECTION 09 20 00 - GYPSUM BOARD ASSEMBLIES

1.07 REFERENCES

A. UNDERWRITERS LABORATORIES, INC. (UL) FIRE RESISTANCE DIRECTORY, VOLUME II, UPDATED ANNUALLY:

1. JOINT SYSTEMS (XHBN)

2. PERIMETER FIRE CONTAINMENT SYSTEMS (XHDG)

3. FIRE RESISTANCE RATINGS (BXRH)

4. FILL, VOIDS, OR CAVITY MATERIAL (XHHW)

5. FORMING MATERIALS (XHKU)

B. OMEGA POINT LABORATORIES, INC. (OPL) LISTED PRODUCTS DIRECTORY, VOLUME II, UPDATED ANNUALLY:

1. FIRE RESISTANT JOINT SYSTEMS

C. ASTM E 1966, “STANDARD TEST METHOD FOR FIRE-RESISTIVE JOINT SYSTEMS”

D. ASTM E 1399, “TEST METHOD FOR CYCLIC MOVEMENT AND MEASURING THE MINIMUM AND MAXIMUM JOINT WIDTH OF ARCHITECTURAL JOINT SYSTEMS”

E. ASTM E 84, “STANDARD TEST METHOD FOR SURFACE BURNING CHARACTERISTICS OF BUILDING MATERIALS”

F. ASTM E 2174, “STANDARD PRACTICE FOR ON-SITE INSPECTION OF INSTALLED FIRE STOPS”

G. ASTM E 2307, “STANDARD TEST METHOD FOR DETERMINING THE FIRE ENDURANCE OF PERIMETER FIRE BARRIER SYSTEMS USING INTERMEDIATE-SCALE, MULTI-STORY TEST APPARATUS”

H. ANSI/UL 2079, “TESTS FOR FIRE RESISTANCE OF BUILDING JOINT SYSTEMS”

I. INTERNATIONAL FIRESTOP COUNCIL RECOMMENDED (IFC) GUIDELINES FOR EVALUATING FIRESTOP SYSTEMS ENGINEERING JUDGMENTS

J. STATE BUILDING CODE, AS AMMENDED BY AUTHORITY HAVING JURISDICTION.

K. NFPA 101 - LIFE SAFETY CODE

1.08 QUALITY ASSURANCE

A. A MANUFACTURER'S DIRECT REPRESENTATIVE (NOT DISTRIBUTOR OR AGENT) TO BE ON-SITE DURING INITIAL INSTALLATION OF FIRESTOP SYSTEMS TO TRAIN APPROPRIATE CONTRACTOR PERSONNEL IN PROPER SELECTION AND INSTALLATION PROCEDURES. THIS WILL BE DONE PER MANUFACTURER'S WRITTEN RECOMMENDATIONS PUBLISHED IN THEIR LITERATURE AND DRAWING DETAILS.

B. FIRESTOP SYSTEM INSTALLATION SHALL MEET REQUIREMENTS OF ASTM E 1966 AND/OR

ANSI/UL 2079 TESTED AND LISTED ASSEMBLIES THAT PROVIDE FIRE-RESISTANCE RATINGS NOT LESS THAN THAT OF THE CONSTRUCTION IN WHICH THE JOINT OCCURS.

C. PROPOSED FIRESTOP MATERIALS AND METHODS SHALL CONFORM TO APPLICABLE GOVERNING CODES HAVING LOCAL JURISDICTION.

D. FIRESTOP SYSTEMS DO NOT REESTABLISH THE STRUCTURAL INTEGRITY OF LOAD BEARING PARTITIONS/ASSEMBLIES, OR SUPPORT LIVE LOADS AND TRAFFIC. INSTALLER SHALL CONSULT THE STRUCTURAL ENGINEER PRIOR TO PENETRATING ANY LOAD BEARING ASSEMBLY.

E. FOR THOSE FIRESTOP APPLICATIONS THAT EXIST FOR WHICH NO TESTED AND LISTED SYSTEM IS AVAILABLE THROUGH A MANUFACTURER, AN ENGINEERING JUDGMENT DERIVED FROM SIMILAR TESTED AND LISTED SYSTEM DESIGNS OR OTHER TESTS WILL BE SUBMITTED TO LOCAL AUTHORITIES HAVING JURISDICTION FOR THEIR REVIEW AND APPROVAL PRIOR TO INSTALLATION. ENGINEERING JUDGMENT DRAWINGS SHALL FOLLOW REQUIREMENTS SET FORTH BY THE INTERNATIONAL FIRESTOP COUNCIL.

1.09 SUBMITTALS

A. SUBMIT PRODUCT DATA: MANUFACTURER'S SPECIFICATIONS AND TECHNICAL DATA FOR EACH MATERIAL INCLUDING THE COMPOSITION AND LIMITATIONS, DOCUMENTATION OF TESTED AND LISTED FIRESTOP SYSTEMS TO BE USED AND MANUFACTURER'S INSTALLATION INSTRUCTIONS TO COMPLY WITH SECTION 01300.

B. MANUFACTURER'S ENGINEERING JUDGMENT IDENTIFICATION NUMBER AND DRAWING DETAILS WHEN NO TESTED AND LISTED SYSTEM IS AVAILABLE FOR AN APPLICATION. ENGINEERING JUDGMENT SHALL INCLUDE BOTH PROJECT NAME AND CONTRACTOR'S NAME WHO WILL INSTALL FIRESTOP SYSTEM AS DESCRIBED IN DRAWING.

C. SUBMIT MATERIAL SAFETY DATA SHEETS PROVIDED WITH PRODUCT DELIVERED TO JOB-SITE.

1.10 INSTALLER QUALIFICATIONS

A. ENGAGE AN EXPERIENCED INSTALLER WHO IS CERTIFIED, LICENSED, OR OTHERWISE QUALIFIED BY THE FIRESTOPPING MANUFACTURER AS HAVING BEEN PROVIDED THE NECESSARY TRAINING TO INSTALL MANUFACTURER'S PRODUCTS PER SPECIFIED REQUIREMENTS. A MANUFACTURER'S WILLINGNESS TO SELL ITS FIRESTOPPING PRODUCTS TO THE CONTRACTOR OR TO AN INSTALLER ENGAGED BY THE CONTRACTOR DOES NOT IN ITSELF CONFER QUALIFICATION ON THE BUYER.

1.11 DELIVERY, STORAGE, AND HANDLING

A. DELIVER MATERIALS UNDAMAGED IN MANUFACTURER'S CLEARLY LABELED, UNOPENED CONTAINERS, IDENTIFIED WITH BRAND, TYPE, AND UL OR OPL LABEL, WHERE APPLICABLE.

B. COORDINATE DELIVERY OF MATERIALS WITH SCHEDULED INSTALLATION DATE TO ALLOW MINIMUM STORAGE TIME AT JOB-SITE.

C. STORE MATERIALS UNDER COVER AND PROTECT FROM WEATHER AND DAMAGE IN COMPLIANCE WITH MANUFACTURER'S REQUIREMENTS, INCLUDING TEMPERATURE RESTRICTIONS.

D. COMPLY WITH RECOMMENDED PROCEDURES, PRECAUTIONS OR REMEDIES DESCRIBED IN MATERIAL SAFETY DATA SHEETS AS APPLICABLE.

E. DO NOT USE DAMAGED OR EXPIRED MATERIALS.

SECTION 07 84 20

FIRE RESISTIVE JOINT SYSTEMS

1.12 PROJECT CONDITIONS

A. DO NOT USE MATERIALS THAT CONTAIN FLAMMABLE SOLVENTS.

B. SCHEDULE INSTALLATION OF FIRESTOPPING AFTER COMPLETION OF PENETRATING ITEM INSTALLATION BUT PRIOR TO COVERING OR CONCEALING OF OPENINGS.

C. VERIFY EXISTING CONDITIONS AND SUBSTRATES BEFORE STARTING WORK. CORRECT UNSATISFACTORY CONDITIONS BEFORE PROCEEDING.

D. WEATHER CONDITIONS: DO NOT PROCEED WITH INSTALLATION OF FIRESTOP MATERIALS WHEN TEMPERATURES EXCEED THE MANUFACTURER'S RECOMMENDED LIMITATIONS FOR INSTALLATION PRINTED ON PRODUCT LABEL AND PRODUCT DATA SHEET.

E. DURING INSTALLATION, PROVIDE MASKING AND DROP CLOTHS TO PREVENT FIRESTOPPING MATERIALS FROM CONTAMINATING ANY ADJACENT SURFACES.

PART 2 - PRODUCTS

2.01 FIRESTOPPING, GENERAL

A. PROVIDE FIRESTOPPING COMPOSED OF COMPONENTS THAT ARE COMPATIBLE WITH EACH OTHER AND SUBSTRATES FORMING JOINTS UNDER CONDITIONS OF SERVICE AND APPLICATION, AS DEMONSTRATED BY THE FIRESTOPPING MANUFACTURER BASED ON TESTING AND FIELD EXPERIENCE.

B. PROVIDE COMPONENTS FOR EACH FIRE-RESISTIVE JOINT SYSTEM THAT ARE NEEDED TO INSTALL FILL MATERIAL. USE ONLY COMPONENTS SPECIFIED BY THE FIRESTOPPING MANUFACTURER AND APPROVED BY THE QUALIFIED TESTING AGENCY FOR THE DESIGNATED FIRE-RESISTANCE-RATED SYSTEMS.

2.02 ACCEPTABLE MANUFACTURERS

A. SUBJECT TO COMPLIANCE WITH JOINT SYSTEMS (XHBN) LISTED IN VOLUME II OF THE UL FIRE RESISTANCE DIRECTORY OR OPL LISTED PRODUCTS DIRECTORY; PROVIDE PRODUCTS OF THE FOLLOWING MANUFACTURERS AS IDENTIFIED BELOW:

1. HILTI, INC., TULSA, OKLAHOMA. (800) 879-8000 / WWW.US.HILTI.COM

2. SUBJECT TO COMPLIANCE WITH THE SPECIFICATIONS, PRODUCTS OF OTHER MANUFACTURERS WILL BE CONSIDERED BY THE ARCHITECT. ALTERNATE MANUFACTURERS AND PRODUCTS MUST BE SUBMITTED PRIOR TO SUBMISSION OF BID IN ORDER TO BE CONSIDERED.

2.03 MATERIALS

A. USE ONLY FIRESTOP PRODUCTS THAT HAVE BEEN TESTED IN ACCORDANCE WITH ASTM E 1966 AND/OR ANSI/UL 2079 FOR SPECIFIC RATED CONSTRUCTION CONDITIONS CONFORMING TO CONSTRUCTION ASSEMBLY TYPE, MOVEMENT CAPABILITY, SPACING REQUIREMENTS, AND FIRE-RESISTANCE-RATING INVOLVED FOR EACH SEPARATE INSTANCE.

B. SEALANTS FOR USE WITH FIRE-RESISTANCE-RATED CONSTRUCTION JOINTS, THE FOLLOWING PRODUCTS ARE ACCEPTABLE:

1. HILTI CP 672 SPEED SPRAY

2. HILTI CP 601S ELASTOMERIC FIRESTOP SEALANT

3. HILTI CP 606 FLEXIBLE FIRESTOP SEALANT

4. HILTI CP 604 SELF-LEVELING FIRESTOP SEALANT

C. SEALANTS FOR USE AS PART OF A PERIMETER FIRE BARRIER SYSTEM BETWEEN FIRE-RESISTANCE-RATED FLOORS AND EXTERIOR WALL ASSEMBLIES, THE FOLLOWING PRODUCTS ARE ACCEPTABLE:

1. HILTI CP 672 SPEED SPRAY

2. HILTI CP 604 SELF-LEVELING FIRESTOP SEALANT

D. PRE-FORMED MINERAL WOOL DESIGNED TO FIT FLUTES OF METAL PROFILE DECK AND GAP BETWEEN TOP OF WALL AND METAL DECK PROFILE; USE AS A BACKER FOR SPRAY MATERIAL.

1. HILTI CP 777 SPEED PLUGS

2. HILTI CP 767 SPEED STRIPS

E. PROVIDE A FIRESTOP SYSTEM WITH AN ASSEMBLY RATING AS DETERMINED BY ASTM E 1966 AND/OR ANSI/UL 2079 WHICH IS EQUAL TO THE FIRE-RESISTANCE RATINGS OF THE CONSTRUCTION IN WHICH THE JOINT OCCURS.

PART 3 - EXECUTION

3.01 PREPARATION

A. VERIFICATION OF CONDITIONS: EXAMINE AREAS AND CONDITIONS UNDER WHICH WORK IS TO BE PERFORMED AND IDENTIFY CONDITIONS DETRIMENTAL TO PROPER OR TIMELY COMPLETION.

1. SURFACES TO WHICH FIRESTOP MATERIALS WILL BE APPLIED SHALL BE FREE OF DIRT, GREASE, OIL, RUST, LAITANCE, RELEASE AGENTS, WATER REPELLENTS, AND ANY OTHER SUBSTANCES THAT MAY AFFECT PROPER ADHESION.

2. PROVIDE MASKING AND TEMPORARY COVERING TO PREVENT SOILING OF ADJACENT SURFACES BY FIRESTOPPING MATERIALS.

3. COMPLY WITH MANUFACTURER'S RECOMMENDATIONS FOR TEMPERATURE AND HUMIDITY CONDITIONS BEFORE, DURING AND AFTER INSTALLATION OF FIRESTOPPING.

4. DO NOT PROCEED UNTIL UNSATISFACTORY CONDITIONS HAVE BEEN CORRECTED.

3.02 INSTALLATION

A. REGULATORY REQUIREMENTS: INSTALL FIRESTOP MATERIALS IN ACCORDANCE WITH UL FIRE RESISTANCE DIRECTORY OR OMEGA POINT LABORATORIES LISTED PRODUCTS DIRECTORY.

B. MANUFACTURER'S INSTRUCTIONS: COMPLY WITH MANUFACTURER'S INSTRUCTIONS FOR INSTALLATION OF CONSTRUCTION JOINT MATERIALS.

1. PROTECT MATERIALS FROM DAMAGE ON SURFACES SUBJECTED TO TRAFFIC.

3.04 FIELD QUALITY CONTROL

A. EXAMINE SEALED JOINTS TO ENSURE PROPER INSTALLATION BEFORE CONCEALING OR ENCLOSING AREAS.

B. KEEP AREAS OF WORK ACCESSIBLE UNTIL INSPECTION BY APPLICABLE CODE AUTHORITIES AND/OR INDEPENDENT INSPECTION AGENCY.

C. PERFORM UNDER THIS SECTION PATCHING AND REPAIRING OF FIRESTOPPING CAUSED BY CUTTING OR PENETRATING OF EXISTING FIRESTOP SYSTEMS ALREADY INSTALLED BY OTHER TRADES.

3.05 ADJUSTING AND CLEANING

A. REMOVE EQUIPMENT, MATERIALS AND DEBRIS, LEAVING AREA IN UNDAMAGED, CLEAN CONDITION.

B. CLEAN ALL SURFACES ADJACENT TO SEALED HOLES AND JOINTS TO BE FREE OF EXCESS FIRESTOP MATERIALS AND SOILING AS WORK PROGRESSES.

END OF SECTION

SECTION 07 92 00

JOINT SEALANTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. PREPARE SEALANT SUBSTRATE SURFACES.

B. FURNISH AND INSTALL SEALANT AND BACKING.

1.02 REFERENCES

A. THE STANDARDS REFERENCED HEREIN ARE INCLUDED TO ESTABLISH RECOGNIZED QUALITY ONLY. EQUIVALENT QUALITY AND TESTING STANDARDS WILL BE ACCEPTABLE, SUBJECT TO THEIR TIMELY SUBMISSION, REVIEW AND ACCEPTANCE BY THE ARCHITECT.

B. COMPLY WITH APPLICABLE REQUIREMENTS OF THE FOLLOWING STANDARDS AND THOSE OTHERS REFERENCED IN THIS SECTION. WHERE THESE STANDARDS CONFLICT WITH OTHER SPECIFIED REQUIREMENTS, THE MOST RESTRICTIVE REQUIREMENTS SHALL GOVERN.

1. ASTM (AMERICAN SOCIETY OF TESTING AND MATERIALS):

A. ASTM C 717 - TERMS RELATING TO BUILDING SEALS AND SEALANTS.

B. ASTM C 790 - USE OF LATEX SEALING COMPOUNDS.

C. ASTM C 834 - LATEX SEALING COMPOUNDS.

D. ASTM C 920 - ELASTOMERIC JOINT SEALANTS.

E. ASTM C 962 - USE OF ELASTOMERIC JOINT SEALANTS.

F. ASTM C 1193 - GUIDE FOR USE OF JOINT SEALANTS.

G. ASTM D 1056 - FLEXIBLE CELLULAR MATERIALS - SPONGE OR EXPANDED RUBBER.

2. FS (FEDERAL SPECIFICATIONS, GENERAL SERVICES ADMINISTRATION):

A. FS TT-S-00227E - SEALING COMPOUND: ELASTOMERIC TYPE, MULTI-COMPONENT.

B. FS TT-S-001543A - SEALING COMPOUND, SILICONE RUBBER BASE.

C. FS TT-S-001657 - SEALING COMPOUND, SINGLE COMPONENT, BUTYL RUBBER BASED, SOLVENT RELEASE TYPE.

3. SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT (SCAQMD) RULE #1168 LIMITS FOR VOLATILE ORGANIC COMPOUNDS (VOC)

A. ARCHITECTURAL SEALANTS = 250 G/L LESS WATER

B. ROADWAY SEALANTS = 250 G/L LESS WATER

C. ALL OTHER SEALANTS = 420 G/L LESS WATER

D. ARCHITECTURAL (NON-POROUS) SEALANT PRIMER = 250 G/L LESS WATER

E. ARCHITECTURAL (POROUS) SEALANT PRIMER = 775 G/L LESS WATER

F. ALL OTHER SEALANT PRIMERS = 750 G/L LESS WATER

C. THE FOLLOWING REFERENCE MATERIALS ARE HEREBY MADE A PART OF THIS SECTION BY REFERENCE THERETO:

1. SWRI (SEALANT, WATERPROOFING & RESTORATION INSTITUTE) - SEALANT AND CAULKING GUIDE SPECIFICATION.

1.03 SUBMITTALS

A. SUBMIT THE FOLLOWING UNDER PROVISIONS OF DIVISION 1:

1. LITERATURE: MANUFACTURER'S PRODUCT DATA SHEETS, SPECIFICATIONS, PERFORMANCE DATA, CHEMICAL AND PHYSICAL PROPERTIES AND INSTALLATION INSTRUCTIONS FOR EACH ITEM FURNISHED HEREUNDER.

2. MANUFACTURER'S CERTIFICATION THAT THE PRODUCTS SUPPLIED MEET OR EXCEED SPECIFIED REQUIREMENTS.

3. COMPATIBILITY AND ADHESION TEST REPORTS: TEST REPORTS FROM SEALANT MANUFACTURER INDICATING THAT SEALANT PROPOSED FOR USE HAVE BEEN TESTED FOR COMPATIBILITY AND ADHESION WITH ACTUAL SAMPLES OF SUBSTRATES TO BE USED ON THIS PROJECT. INCLUDE SEALANT MANUFACTURER'S INTERPRETATION OF TEST RESULTS, AND RECOMMENDATIONS FOR PRIMERS AND SUBSTRATE PREPARATION SPECIFIC TO THIS PROJECT

4. SELECTION SAMPLES: SAMPLE CARD INDICATING MANUFACTURER'S FULL RANGE OF COLORS AVAILABLE FOR SELECTION BY ARCHITECT.

B. SUBMIT THE FOLLOWING UNDER PROVISIONS OF SECION 01 33 26:

1. VOC

1.04 QUALITY ASSURANCE

A. APPLICATOR SPECIALIZING IN APPLYING THE WORK OF THIS SECTION WITH A MINIMUM OF 3 YEARS DOCUMENTED EXPERIENCE APPROVED BY SEALANT MANUFACTURER.

B. OBTAIN JOINT SEALERS FROM A SINGLE MANUFACTURER FOR EACH TYPE SPECIFIED.CONFORM TO SWRI REQUIREMENTS FOR INSTALLATION.

1.05 DELIVERY, STORAGE AND HANDLING

A. EACH CONTAINER AND PACKAGE MUST BEAR AN UNBROKEN SEAL, TEST NUMBER AND LABEL OF THE MANUFACTURER UPON DELIVERY TO THE SITE. FAILURE TO COMPLY WITH THESE REQUIREMENTS SHALL BE SUFFICIENT CAUSE FOR REJECTION OF THE MATERIAL IN QUESTION, BY THE CONSTRUCTION MANAGER AND HIS REQUIRING ITS REMOVAL FROM THE SITE. NEW MATERIAL CONFORMING TO SAID REQUIREMENTS, SHALL BE PROMPTLY FURNISHED AT NO ADDITIONAL COST TO THE CONTRACT.

1.06 PROJECT CONDITIONS

A. DO NOT INSTALL SINGLE COMPONENT SOLVENT CURING SEALANT IN ENCLOSED BUILDING SPACES.

B. ENVIRONMENTAL REQUIREMENTS: MAINTAIN TEMPERATURE AND HUMIDITY RECOMMENDED BY THE SEALANT MANUFACTURER DURING AND 24 HOURS AFTER INSTALLATION. DO NOT PROCEED WITH INSTALLATION OF JOINT SEALERS UNDER THE

FOLLOWING CONDITIONS:

1. WHEN AMBIENT AND SUBSTRATE TEMPERATURE CONDITIONS ARE BELOW 40 DEGREES F.

2. WHEN JOINT SUBSTRATES ARE WET DUE TO RAIN, FROST, CONDENSATION, OR OTHER CAUSES.

C. DO NOT PROCEED WITH INSTALLATION OF JOINT SEALERS UNTIL CONTAMINATES CAPABLE OF INTERFERING WITH THEIR ADHESION ARE REMOVED FROM SUBSTRATES.

PART 2 - PRODUCTS

2.01 SEALANT MATERIALS

A. JOINT SEALER TYPE AA (ACRYLIC ACOUSTICAL): ONE COMPONENT ACRYLIC LATEX, PERMANENTLY ELASTIC, NON-STAINING, NON-SHRINKING, NON-MIGRATING AND PAINTABLE.

1. TREMCO INC., BEACHWOOD OH.; PRODUCT, “ACOUSTICAL SEALANT”.

2. UNITED STATES GYPSUM COMPANY, CHICAGO IL.; PRODUCT “USG ACOUSTICAL SEALANT”.

B. JOINT SEALER TYPE AP (ACRYLIC PAINTERS CAULK): ONE COMPONENT ACRYLIC LATEX CAULKING COMPOUND, CONFORMING TO FS 19-TP-21M AND ASTM C 834, PAINTABLE WITHIN 24 HOURS AFTER APPLICATION, WITH A MINIMUM MOVEMENT CAPABILITY OF ±12.5 PERCENT, EQUAL TO ONE OF THE FOLLOWING:

1. TREMCO INC., BEACHWOOD OH.; PRODUCT, “TREMFLEX 834”.

2. SONNEBORN BUILDING PRODUCTS INC., MINNEAPOLIS MN.; PRODUCT, “SONOLAC”.

3. BOSTIK; PRODUCT, “CHEM-CALK 600”.

C. JOINT SEALER TYPE B (BUTYL): GUN-GRADE MODIFIED BUTYL AND POLYISOBUTYLENE SEALANT, CONFORMING TO FS TT-S-001657, TYPE I, AND ASTM C-834, WITH A MOVEMENT CAPABILITY OF ±10 PERCENT OR BETTER AND A SHORE A HARDNESS OF 24 TO 28, EQUAL TO ONE OF THE FOLLOWING:

1. TREMCO INC., BEACHWOOD OH.; PRODUCT, “BUTYL SEALANT”.

2. PECORA CORPORATION, HARLEYSVILLE PA.; PRODUCT “BC-158”.

D. JOINT SEALER TYPE BP2 (BITUMEN MODIFIED POLYURETHANE, MULTI-COMPONENT): POURING GRADE SELF-LEVELING BITUMEN MODIFIED TWO COMPONENT URETHANE SEALANT, CONFORMING TO ASTM C920, TYPE M, GRADE P, CLASS 25 AND FS SS-S-00227E, TYPE 1, CLASS A, WITH A MINIMUM MOVEMENT CAPABILITY OF +50/-25 PERCENT, EQUAL TO ONE OF THE FOLLOWING:

1. TREMCO INC., PRODUCT “VULKEM 202”.

2. SONNEBORN BUILDING PRODUCTS INC., MINNEAPOLIS MN.; PRODUCT, “SONOMERIC 2”.

3. PECORA CORPORATION, HARLEYSVILLE PA.; PRODUCT “UREXPAN NR-300”.

E. JOINT SEALER TYPE CP2 (POLYURETHANE, MULTI-COMPONENT, INSIDE OF INSULATED ROOMS): METZGER/MCGUIRE SPAL PRO 2000.

F. JOINT SEALER TYPE HL2 (HORIZONTAL-SELF-LEVELING, 2-COMPONENT): POURING GRADE SELF-LEVELING MULTI-COMPONENT URETHANE SEALANT, CONFORMING TO FS TT-S-000227E, TYPE I, CLASS A, AND ASTM C 920, WITH A MINIMUM MOVEMENT CAPABILITY OF ±25 PERCENT, EQUAL TO THE FOLLOWING:

1. TREMCO INC, BEACHWOOD OH.; PRODUCT, “THC-900/901”.

2. SIKA CORP, LYNDHURST NJ.; PRODUCT, “SIKAFLEX 2CSL”.

3. SONNEBORN BUILDING PRODUCTS INC., MINNEAPOLIS MN.; PRODUCT, “SL2”.

G. JOINT SEALER TYPE SC (SILICONE, GENERAL CONSTRUCTION): ONE-PART MEDIUM MODULUS, NATURAL CURE, SYNTHETIC SEALANT, HAVING A USEFUL LIFE EXPECTANCY OF AT LEAST 20 YEARS, CONFORMING TO ASTM C 920, TYPE S, NS, CLASS 25, USE NT, G, A, M, O WITH A MINIMUM MOVEMENT CAPABILITY OF ±50 PERCENT, EQUAL TO THE FOLLOWING:

1. TREMCO INC., BEACHWOOD OH.; PRODUCT, “SPECTREM 2”.

2. DOW CORNING CORPORATION, MIDLAND MI.; PRODUCT, “791”.

3. GENERAL ELECTRIC COMPANY (GE SILICONES) WATERFORD NY.; PRODUCT, “SILPRUF”.

4. SONNEBORN BUILDING PRODUCTS INC., MINNEAPOLIS MN.; PRODUCT, “SONOLASTIC - OMNISEAL”.

H. JOINT SEALER TYPE SF (SILICONE, FOOD CONTACT): ONE COMPONENT SILICONE RUBBER, ACCEPTABLE TO LOCAL HEALTH OFFICIALS, CONFORMING TO U.S. FOOD AND DRUG ADMINISTRATION REGULATION 21 CFR 175.105 AND 175.300, FS TT-S-001543A, TYPE NON-SAG, CLASS A, AND ASTM C 920, TYPE NS, CLASS 25, USE NT, G, O AND A WITH A MINIMUM MOVEMENT CAPABILITY OF ±25 PERCENT, AND A SHORE A MINIMUM HARDNESS OF 20, EQUAL TO THE FOLLOWING:

1. TREMCO INC., BEACHWOOD OH.: PRODUCT, “TREMSIL 200 SANITARY”.

2. DOW CORNING CORPORATION, MIDLAND MI.; PRODUCT, "732".

3. GENERAL ELECTRIC COMPANY, WATERFORD NY.; PRODUCT, "SERIES SCS1000".

I. JOINT SEALER TYPE SM (SILICONE, MILDEW-RESISTANT): ONE COMPONENT ACETOXY SILICONE RUBBER, MILDEW RESISTANT, ACCEPTABLE TO LOCAL HEALTH OFFICIALS, FS TT-S-001543A, TYPE NON-SAG, CLASS A, AND FS TT-S-00230C, TYPE II, CLASS A AND ASTM C 920, TYPE S, CLASS 25, GRADE NS, USE NT,G AND A WITH A MINIMUM MOVEMENT CAPABILITY OF ±25 PERCENT, AND A SHORE A HARDNESS OF 20, EQUAL TO THE FOLLOWING:

1. TREMCO INC., BEACHWOOD OH.; PRODUCT, " TREMSIL 200 SANITARY".

2. DOW CORNING CORPORATION, MIDLAND MI.; PRODUCT, "786".

3. GENERAL ELECTRIC COMPANY, WATERFORD NY.; PRODUCT, "SANITARY 1700".

4. SONNEBORN BUILDING PRODUCTS INC., MINNEAPOLIS MN.; PRODUCT, "SONOLASTIC - OMNIPLUS".

J. JOINT SEALER TYPE SP (SILICONE FOR PLASTIC FABRICATIONS): ONE-PART SILICONE SEALANT, HAVING A USEFUL LIFE EXPECTANCY OF AT LEAST 20 YEARS, CONFORMING TO ASTM C 920, TYPE S, NS, CLASS 25, WITH A MINIMUM MOVEMENT CAPABILITY OF ±50 PERCENT, HAVING A PSI STRESS AT 50% EXTENSION OF 35 PSI. PROVIDE IN MANUFACTURER'S STANDARD COLORS

AS SELECTED BY THE ARCHITECT. SEALANT SHALL BE DESIGNED FOR PRIMERLESS APPLICATION TO POLYCARBONATE, ACRYLICS, PVC AND CPVC MATERIALS EQUAL TO: GENERAL ELECTRIC COMPANY (GE SILICONES) WATERFORD NY.; PRODUCT, "LEXSIL".

2.02 ACCESSORIES

A. COMPRESSIBLE JOINT BEAD BACK-UP: COMPRESSIBLE CLOSED CELL POLYETHYLENE, EXTRUDED POLYOLEFIN FOAM OR POLYURETHANE FOAM ROD, 1/3 GREATER IN DIAMETER THAN WIDTH OF JOINT. SHAPE AND SIZE OF COMPRESSIBLE BACK-UP SHALL BE AS RECOMMENDED BY MANUFACTURER FOR THE SPECIFIC CONDITION USED. PROVIDE ONE OF THE FOLLOWING, OR EQUAL. (ONLY CLOSED CELL RODS WILL BE CONSIDERED)

1. APPLIED EXTRUSION TECHNOLOGIES, INC., MIDDLETOWN DE, PRODUCT "SOF ROD".

2. BACKER ROD MANUFACTURING, INC., DENVER, CO, PRODUCT "DENVER FOAM".

3. SONNEBORN BUILDING PRODUCTS INC., MINNEAPOLIS MN, PRODUCT "SONOFOAM".

B. PRIMERS: FURNISH AND INSTALL JOINT PRIMERS OF THE TYPES, AND TO THE EXTENT, RECOMMENDED BY THE RESPECTIVE SEALANT MANUFACTURERS FOR THE SPECIFIC JOINT MATERIALS AND JOINT FUNCTION.

C. BOND-BREAKER TAPE, AND TEMPORARY MASKING TAPE: OF TYPES AS RECOMMENDED BY THE MANUFACTURER OF THE SPECIFIC SEALANT AND CAULKING MATERIAL USED AT EACH APPLICATION, AND COMPLETELY FREE FROM CONTAMINANTS WHICH WOULD ADVERSELY AFFECT THE SEALANT AND CAULKING MATERIALS.

PART 3 - EXECUTION

3.01 EXAMINATION

A. VERIFY THAT SUBSTRATE SURFACES AND JOINT OPENINGS ARE READY TO RECEIVE WORK.

B. VERIFY THAT JOINT BACKING AND RELEASE TAPES ARE COMPATIBLE WITH SEALANT.

3.02 PREPARATION

A. WEATHER CONDITIONS MUST BE DRY AND OF THE TEMPERATURE, AS RECOMMENDED BY SEALANT MANUFACTURER, DURING APPLICATION OPERATIONS.

B. SURFACE RECEIVING WORK OF THIS SECTION MUST BE ABSOLUTELY DRY AND DUST FREE. ALL JOINTS RECEIVING SEALANT AND CAULKING MATERIALS AND BE SUBJECT TO THE APPROVAL OF THE MATERIAL MANUFACTURER FOR PROPER USE OF THE SPECIFIED MATERIALS.

C. THOROUGHLY CLEAN ALL JOINTS, REMOVING ALL LOOSE MORTAR, OIL, GREASE, DUST, FROST, AND OTHER FOREIGN MATERIALS THAT WILL PREVENT PROPER ADHESION OF PRIMERS AND SEALANT MATERIALS.

1. CLEAN FERROUS METALS OF ALL RUST AND COATINGS BY WIRE BRUSH, GRINDING OR SANDBLASTING. REMOVE OIL, GREASE AND PROTECTIVE COATINGS WITH CLEANERS RECOMMENDED BY SEALANT MANUFACTURER.

D. IF SO RECOMMENDED AND FURNISHED BY THE SPECIFIC SEALANT MANUFACTURER, APPLY PRIMER TO ALL JOINT SURFACES, TAKING CARE NOT TO STAIN ADJACENT SURFACES.

E. VERIFY THAT JOINT BACKING AND RELEASE TAPES ARE COMPATIBLE WITH SEALANT.

F. PERFORM PREPARATION IN ACCORDANCE WITH ASTM C 804 AND C 790 FOR SOLVENT AND LATEX BASE SOLVENTS, RESPECTIVELY.

3.03 INSTALLATION

A. INSTALL JOINT BEAD BACK-UP IN ALL JOINTS IN EXCESS OF 5/8-INCH DEPTH, AND JOINTS THAT HAVE NO BACK-UP THEREIN, PLACING THE JOINT BEAD IN THE JOINT IN A MANNER THAT WILL ASSURE A CONSTANT DEPTH 1/8 INCH GREATER THAN THE SEALANT AND CAULKING MATERIAL DEPTH TOLERANCES.

1. SET BEADS INTO JOINTS CONTINUOUSLY, BY SLIGHTLY STRETCHING DURING PLACEMENT, TO PERMIT COMPRESSION AGAINST SIDES OF JOINT, WITHOUT SURFACE WRINKLES OR BUCKLES.

2. DO NOT STRETCH BACK-UP MATERIAL INTO JOINTS.

B. INSTALL BOND BREAKER IN JOINTS WHERE SHOWN IN THE DRAWINGS AND WHEREVER RECOMMENDED BY THE SEALANT MANUFACTURER TO PREVENT BOND OF THE SEALANT TO SURFACES WHERE SUCH BOND MIGHT IMPAIR THE WORK.

C. APPLY MASKING TAPE OR OTHER PRECAUTIONS TO PREVENT MIGRATION OR SPILLAGE OF MATERIALS ONTO ADJOINING SURFACES.

D. APPLY URETHANE SEALANT AND LATEX CAULKING MATERIALS INTO JOINTS IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS, USING MECHANICAL OR POWER CAULKING GUN EQUIPPED WITH NOZZLE OF APPROPRIATE SIZE, WITH SUFFICIENT PRESSURE TO COMPLETELY FILL THE JOINTS.

1. THE DEPTH OF SEALANT AND CAULKING MATERIALS SHALL BE IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS FOR THE SPECIFIC JOINT FUNCTION, BUT IN NO CASE EXCEED 1/2-INCH IN DEPTH, NOR LESS THAN 1/4-INCH, REGARDLESS OF THE JOINT WIDTH.

2. MAINTAIN THE OUTER EDGE OF THE SEALANT AND CAULKING MATERIALS, WHERE SIDE FACES OF JOINTS ARE IN THE SAME PLANE, BACK 1/8-INCH FROM THE FACES.

3. APPLY SEALANT IN CONTINUOUS BEADS WITHOUT OPEN JOINTS, VOIDS OR AIR POCKETS SO AS TO PROVIDE A WATERTIGHT AND AIRTIGHT SEAL FOR THE ENTIRE JOINT LENGTH.

4. AFTER PLACEMENT OF THE SEALANT AND CAULKING MATERIALS, CONCAVE-TOOL THE SURFACES TO UNIFORM DENSITY, USING A WATER-WET TOOL. DO NOT USE DETERGENTS OR SOAPY WATER FOR THE TOOLING OPERATIONS.

5. REMOVE THE TEMPORARY MASKING TAPE IMMEDIATELY AFTER TOOLING, AND BEFORE THE SEALANT OR CAULKING MATERIAL HAS TAKEN INITIAL SET.

3.04 CLEANING

A. CLEAN ALL SURFACES OF ADJACENT SURFACES WHICH HAVE BEEN MARKED OR SOILED BY THE WORK OF THIS SECTION, REMOVING ALL EXCESS SEALANT AND CAULKING MATERIALS WITH SOLVENTS WHICH WILL NOT DAMAGE THE SURFACES IN ANY WAY.

3.05 PROTECTION

A. DURING THE OPERATION OF SEALANT WORK, PROTECT THE WORK OF OTHER TRADES AGAINST UNDUE SOILAGE AND DAMAGE BY THE EXERCISE OF REASONABLE CARE AND PRECAUTIONS. REPAIR OR REPLACE ANY WORK SO DAMAGED AND SOILED.

3.06 SCHEDULE

A. GENERAL: SEAL JOINTS INDICATED ON EXTERIOR JOINTS ALL INTERIOR JOINTS, SEAMS, AND INTERSECTIONS BETWEEN DISSIMILAR MATERIALS.

B. SEALANT COLORS:

1. COLORS FOR SEALANT TYPES “HL2”, “SC”, “SF”, “SP”, AND “SM”: AS SELECTED BY THE ARCHITECT FROM MANUFACTURER'S STANDARD COLORS.

2. COLOR FOR SEALANT TYPES “AA” AND “AP”: CLEAR

3. COLOR FOR SEALANT TYPE “B”: WHITE

4. IN CONCEALED INSTALLATION, AND IN PARTIALLY EXPOSED INSTALLATION WHERE SO APPROVED BY THE ARCHITECT, STANDARD GRAY OR BLACK SEALANT MAY BE USED.

C. INTERIOR JOINTS (LISTED BY PRIMARY BUILDING MATERIAL ABUTTING SEALANT JOINTS):

1. INTERIOR CONCRETE:

JOINT CONDITION

A. CONCRETE TO CONCRETE, VERTICAL JOINTS, OUTSIDE OF INSULATED ROOMS: SC

B. CONCRETE TO CONCRETE: HORIZONTAL WALKABLE SURFACES, OUTSIDE OF INSULATED ROOMS: HL2

C. CONCRETE TO CONCRETE HORIZONTAL VEHICULAR TRAFFIC SURFACES (INCLUDING FORKLIFT), OUTSIDE OF INSULATED ROOMS: BP2

D. CONCRETE TO CONCRETE INSIDE OF INSULATED ROOMS: CP2

2. INTERIOR JOINTS AT FOOD PROCESSING AREAS AND INSULATED FOOD STORAGE AREAS:

A. ALL JOINTS AT THESE LOCATIONS, INCLUDING BETWEEN INSULATED METAL PANELS, CONCRETE TO INSULATED METAL PANELS AND INSULATED METAL PANELS TO STAINLESS STEEL CURB: SF

3. GYPSUM BOARD (NOT IN FOOD AREAS)

A. GYPSUM BOARD TO METAL OR WOOD TRIM: AP

B. GYPSUM BOARD TO ABUTTING SURFACES AT EXPOSED TOPS AND BOTTOMS PARTITIONS AND WALLS: AA

C. GYPSUM BOARD TO INTERIOR DOOR AND WINDOW FRAMES, PENETRATING CONDUITS AND PIPING, LIGHTING-FIXTURES, ELECTRICAL COVER PLATES, BUILDING SPECIALTY ITEMS, DUCTWORK, GRILLES, SUPPLY DIFFUSERS, FACUCETS, PIPING, ESCUTHEON PLATES AND SIMILAR ITEMS: AP

D. GYPSUM BOARD TO PLUMBING FIXTURES: SM

4. ARCHITECTURAL MILLWORK AND CASEWORK (NOT IN FOOD AREAS):

A. CASEWORK AND COUNTERS TO ABUTTING MATERIALS, COFFEE ROOMS, LUNCH ROOMS, TOILET ROOMS AND SIMILAR “WET SPACES”: SM

B. CASEWORK TO ABUTTING SURFACES (EXCEPT IN “WET” SPACES): AP

C. COUNTERTOPS TO PLUMBING FIXTURES AND FITTINGS: SM

5. INTERIOR METAL (NOT IN FOOD AREAS):

A. METAL TO METAL: SC

B. BEDDING OF METAL THRESHOLDS: B

6. ACOUSTICAL CEILINGS (NOT IN FOOD AREAS):

A. ACOUSTICAL CEILING EDGE ANGLE TO IRREGULAR WALL SURFACE: AP

7. TILE (NOT IN FOOD AREAS):

A. TILE TO TILE VERTICAL, AND HORIZONTAL NON-TRAFFIC JOINTS: SM

B. TILE TO TILE, HORIZONTAL PEDESTRIAN TRAFFIC JOINTS: HL2

8. INTERIOR PLASTIC (NOT IN FOOD AREAS):

A. PLASTIC FABRICATIONS (POLYCARBONATES, LEXAN, PVC AND CPVC) TO ABUTTING MATERIALS: SP

9. EXTERIOR WINDOW FRAME

A. WALL CONSTRUCTION TO EXTERIOR ALUMINUM FRAMED STOREFRONT WINDOW AND DOOR FRAMES (COLOR TO MATCH WINDOW/DOOR FRAMES): SC

B. INTERIOR FACE OF EXTERIOR ALUMINUM FRAMED STOREFRONT WINDOW AND DOOR FRAMES (COLOR: CLEAR): SC

END OF SECTION

SECTION 08 11 00

HOLLOW METAL DOORS & FRAMES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. CONSTRUCTION DRAWINGS, SPECIFICATIONS AND PROVISIONS OF THE CONTRACT INCLUDING GENERAL AND SUPPLEMENTAL CONDITIONS AND OTHER DIVISION 1 SPECIFICATION SECTIONS, ARE HEREBY MADE A PART OF THIS SECTION AS FULLY AND COMPLETELY AS IF REPEATED HEREIN.

1.02 ITEMS REQUIRED BUT NOT SPECIFIED

A. IF AN ITEM OR MATERIAL OF THIS TRADE IS INDICATED ON THE DRAWINGS BUT NOT SPECIFICALLY LISTED IN THIS SECTION, PROVIDE SUCH ITEM OR MATERIAL AT A STANDARD OF QUALITY EQUAL TO THE STANDARD ESTABLISHED FOR THE BALANCE OF THE WORK SPECIFIED, IN ACCORDANCE WITH THE ARCHITECT'S INTERPRETATION.

1.03 EXECUTION, CORRELATION AND INTENT

A. IN CASE OF AN INCONSISTENCY BETWEEN DRAWINGS AND SPECIFICATIONS OR WITHIN EITHER DOCUMENT NOT CLARIFIED BY ADDENDUM, THE BETTER QUALITY OR GREATER QUANTITY OF WORK IS TO BE PROVIDED, IN ACCORDANCE WITH THE ARCHITECT'S INTERPRETATION.

1.04 SECTION INCLUDES

A. FURNISH THE FOLLOWING PRODUCTS TO BE INSTALLED UNDER THE DESIGNATED SECTIONS:

1. FLUSH UL-LABELED AND NON-LABELED STEEL DOORS, COMPLETE WITH INTERNAL REINFORCING, HARDWARE CUT-OUTS; AND PROVIDED WITH GLAZING OPENINGS, WHERE SO INDICATED.

2. HOLLOW METAL FRAMES FOR DOORS, UL-LABELED AND NON-LABELED, COMPLETE WITH INTERNAL REINFORCING; INSTALLED.

3. METAL GLAZING BEADS, LOOSELY ATTACHED TO HOLLOW METAL FRAMES AND DOORS, WHERE SO INDICATED, FOR REMOVAL AND PERMANENT INSTALLATION DURING GLAZING OPERATIONS; INSTALLED.

1.05 RELATED SECTIONS

A. 06 10 00 - ROUGH CARPENTRY

B. 08 71 00 - DOOR HARDWARE

C. 08 80 00 - GLASS AND GLAZING

D. 09 90 00 - PAINTING: FIELD PAINTING OF DOORS.

1.06 REFERENCES

A. COMPLY WITH APPLICABLE REQUIREMENTS OF THE FOLLOWING STANDARDS AND THOSE OTHERS REFERENCED IN THIS SECTION. WHERE THESE STANDARDS CONFLICT WITH OTHER SPECIFIED REQUIREMENTS, THE MOST RESTRICTIVE REQUIREMENTS SHALL GOVERN.

1. ANSI (AMERICAN NATIONAL STANDARDS INSTITUTE) AND SDI (STEEL DOOR INSTITUTE):

A. ANSI A 117.1 - SPECIFICATIONS FOR MAKING BUILDINGS AND FACILITIES ACCESSIBLE TO AND USABLE BY PHYSICALLY HANDICAPPED PEOPLE.

B. ANSI/SDI 100 - STANDARD STEEL DOORS AND FRAMES.

2. ASTM (AMERICAN SOCIETY OF TESTING AND MATERIALS):

A. ASTM E 152 - METHODS OF FIRE TESTS OF DOOR ASSEMBLIES.

B. ASTM A 366 - STEEL, CARBON, COLD ROLLED SHEET, COMMERCIAL QUALITY.

C. ASTM A 568 - STEEL, CARBON AND HIGH STRENGTH LOW ALLOY HOT ROLLED STRIP, AND COLD ROLLED SHEET.

D. ASTM A 525 - STEEL SHEET, ZINC-COATED BY THE HOT-DIP PROCESS.

E. ASTM A 526 - STEEL SHEET, ZINC COATED (GALVANIZED) BY THE HOT DIP PROCESS, COMMERCIAL QUALITY.

3. NFPA (NATIONAL FIRE PROTECTION ASSOCIATION):

A. NFPA PUBLICATION 80 - FIRE DOORS AND WINDOWS.

4. UL (UNDERWRITERS LABORATORY INC.):

A. UL PUBLICATION 10B - FIRE TESTS OF DOOR ASSEMBLIES.

5. ALL APPLICABLE FEDERAL, STATE AND MUNICIPAL CODES, LAWS AND REGULATIONS FOR EXITS.

1.07 SUBMITTALS

A. SUBMIT THE FOLLOWING UNDER PROVISIONS OF DIVISION 1:

1. LITERATURE: MANUFACTURER'S PRODUCT DATA SHEETS, SPECIFICATIONS, FOR DOORS, FRAMES AND SHOP APPLIED FINISHES.

2. CERTIFICATION: MANUFACTURER'S WRITTEN CERTIFICATION STATING THAT DOORS, FRAMES, AND ALL RELATED ITEMS TO BE FURNISHED HEREUNDER, MEET OR EXCEED THE REQUIREMENTS SPECIFIED UNDER THIS SECTION; THAT SPECIFIED GALVANIZED AND SHOP PRIMING HAS BEEN PERFORMED; AND THAT ALL U.L. FIRE-RESISTIVE REQUIREMENTS FOR THE INDICATED LABELS HAVE BEEN MET.

3. SHOP DRAWINGS: A COMPLETE SCHEDULE OF DOORS AND FRAMES, TO BE FURNISHED HEREUNDER, COORDINATED WITH THE DOOR AND FRAME SCHEDULE CONTAINED IN THE CONTRACT DRAWINGS. LARGE SCALE DETAILS OF EACH TYPE DOOR AND FRAME CONSTRUCTION, INDICATING ALL GAGES, CUT-OUTS FOR GLAZING IN DOORS, REINFORCING, AND ANCHORAGE.

1.08 REGULATORY REQUIREMENTS

A. FIRE RATED DOOR CONSTRUCTION SHALL CONFORM TO UL PUBLICATION 10B.

B. INSTALL FIRE RATED DOOR ASSEMBLIES IN COMPLIANCE WITH NFPA 80.

1.09 SEQUENCING AND SCHEDULING

SECTION 08 11 00

HOLLOW METAL DOORS & FRAMES

A. COORDINATE THE WORK OF THIS SECTION WITH THE RESPECTIVE TRADES RESPONSIBLE FOR FURNISHING HARDWARE AND INSTALLING DOORS AND FRAMES.

B. ENSURE THAT THE WORK PERFORMED HEREUNDER IS COORDINATED WITH ISSUED TEMPLATES AUTHORIZED BY THE HARDWARE SUPPLIER.

C. DO NOT FABRICATE DOORS OR FRAMES BEFORE RECEIVING A COPY OF THE APPROVED HARDWARE SCHEDULE, SUBMITTED BY THE HARDWARE SUPPLIER, REVIEWED BY THE SUBCONTRACTOR AND ACCEPTED BY THE CONTRACTOR AND THE ARCHITECT. VERIFY THAT ISSUED TEMPLATES ARE COORDINATED WITH THE APPROVED SCHEDULE; IMMEDIATELY NOTIFY THE ARCHITECT, IN WRITING, OF ANY CONFLICTS.

1.10 DELIVERY, STORAGE, AND HANDLING

A. PRIOR TO SHIPPING, IDENTIFY EACH FRAME AND DOOR WITH A REMOVABLE METAL OR PLASTIC LABEL WHICH CORRESPONDS WITH DOOR SCHEDULE IDENTIFYING OPENING NUMBER AND LOCATION.

B. DELIVER DOORS AND FRAMES BOXED OR CRATED TO PROVIDE PROTECTION DURING TRANSIT AND JOB STORAGE.

C. INSPECT DOORS AND FRAMES UPON DELIVERY FOR DAMAGE. MINOR DAMAGE MAY BE REPAIRED PROVIDED THE REFINISHED ITEMS ARE EQUAL IN RESPECTS TO NEW WORK AND ACCEPTABLE TO THE ARCHITECT; OTHERWISE REMOVE AND REPLACE DAMAGED ITEMS.

D. STORE DOORS AND FRAMES AT THE BUILDING SITE UPRIGHT AND UNDER COVER. PLACE THE UNITS ON WOOD DUNNAGE AND COVER IN A MANNER THAT WILL PREVENT RUST AND DAMAGE.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. SUBJECT TO COMPLIANCE WITH THE REQUIREMENTS SPECIFIED HEREIN, MANUFACTURERS OFFERING PRODUCTS WHICH MAY BE INCORPORATED IN THE WORK INCLUDE THE FOLLOWING:

1. AMWELD BUILDING PRODUCTS, INC., GARRETTSVILLE, OH.

2. CECO COMPANY, OAKBROOK TERRACE, IL.

3. CURRIES COMPANY / ESSEX INDUSTRIES, MASON CITY, IA.

4. PHILLIPP MANUFACTURING, HOLYOKE, MA.

5. REPUBLIC BUILDERS PRODUCTS CORPORATION, MCKENZIE, TN.

6. ARCHITECT APPROVED EQUAL.

B. UNLESS OTHERWISE SPECIFICALLY ACCEPTED BY ARCHITECT, ALL DOORS AND FRAMES SHALL BE OF ONE MANUFACTURER.

2.02 DOORS

SECTION 08 11 00

HOLLOW METAL DOORS & FRAMES

A. GENERAL: REFER TO THE DRAWINGS FOR DESIGN OF DOORS, SIZES, GLAZING CUT-OUTS IN DOORS, AND DETAILS.

B. CONSTRUCTION: FULL FLUSH COMMERCIAL TYPE, 1-3/4 INCHES THICK, UNLESS NOTED OTHERWISE, MEETING OR EXCEEDING THE MATERIALS, GAGES, CONSTRUCTION, AND TESTING REQUIREMENTS OF THE REFERENCED ANSI AND SDI PUBLICATIONS.

C. EXTERIOR DOORS: ANSI/SDI 100, GRADE II, EXTRA HEAVY-DUTY (LEVEL A), MODEL 1, 16-GAGE STEEL FACES, WITH A FOAMED-IN-PLACE POLYURETHANE CORE.

1. FIRE-RATED DOORS: MODIFY SPECIFIED CONSTRUCTION TO MEET ALL CONSTRUCTION REQUIREMENTS REQUIRED FOR FIRE-RESISTIVE RATING.

A. AFFIX APPROPRIATE UL, FM OR WARNOCK HERSEY LABELS TO EACH RATED DOOR, INDICATING APPLICABLE RATING.

D. INTERIOR DOORS: ANSI/SDI 100, GRADE II, HEAVY-DUTY (LEVEL B), MODEL 1, 18-GAGE STEEL FACES, WITH A MINIMUM STC RATING OF 32.

1. GALVANIZED DOORS AND FRAMES: WHERE INDICATED ON DRAWINGS AND DOOR SCHEDULE.

A. ASTM A653/A653M, HOT DIPPED, CLASS G90 GALVANIZED

2. FIRE-RATED DOORS: MODIFY SPECIFIED CONSTRUCTION TO MEET ALL CONSTRUCTION REQUIREMENTS REQUIRED FOR FIRE-RESISTIVE RATING.

A. AFFIX APPROPRIATE UL, FM OR WARNOCK HERSEY LABELS TO EACH RATED DOOR, INDICATING APPLICABLE RATING.

E. GLAZING STOPS: RECTANGULAR CHANNEL SECTIONS, NOT LESS THAN 20 GAGE; PRE-DRILLED AND LOOSELY ATTACHED WITHIN THE GLAZING CUT-OUTS WITH COUNTERSUNK TAMPER-RESISTANT STAINLESS STEEL SCREWS; SIZED TO PROPERLY ACCOMMODATE THE DESIGNATED THICKNESSES OF GLASS AND GLAZING MATERIALS; AND EXTERNAL EDGES SET FLUSH WITH, OR SLIGHTLY BEHIND, DOOR FACE. MODIFY GLAZING STOPS FOR UL LABEL DOORS TO CONFORM WITH UL FIRE RATING REQUIREMENTS.

F. LOUVERS, NON-RATED DOORS: SIGHT-PROOF TYPE FIXED LOUVER WITH INVERSE Y SHAPE BLADES HAVING AN APPROXIMATE FREE AIR AREA OF 43 PERCENT. FRAME AND CORE FABRICATED FROM 20 GAGE STEEL.

1. PROVIDE INSECT SCREEN OF 18 BY 16 ALUMINUM MESH, MOUNTED ON INSIDE FACE OF LOUVER IF IN EXTERIOR DOOR.

G. LOUVERS IN RATED DOORS: EXTRUDED ALUMINUM FUSIBLE LINK LOUVER, UL AND WARNOCK HERSEY INTERNATIONAL APPROVED, MAXIMUM SIZE 24 BY 24 INCHES EQUAL TO CONSTRUCTION SPECIALTIES INC., MODEL Nº. “FL_138” .

1. FABRICATED FROM 6063-T5 ALLOY ALUMINUM, 0.05 INCHES THICK, FURNISHED WITH ADJUSTABLE TRIM.

2. FASTENERS: HIGH STRENGTH ALUMINUM OR STAINLESS STEEL, COUNTERSUNK INTO TRIM.

3. FINISH: FACTORY PRIMED WITH BAKED ENAMEL READY RECEIVE FIELD APPLIED FINISH.

H. HARDWARE REINFORCING: WELDED IN PLACE STEEL REINFORCEMENT, HOT ROLLED

PICKLED AND OILED STEEL PER ASTM A569, WITH THE FOLLOWING MINIMUM GAGES:

1. HINGES, 8 GAGE.

2. KICK PLATES, 18 GAGE.

3. CLOSERS, LOCKS, AND ALL OTHER HARDWARE: 10 GAGE.

4. LOCATIONS FOR REINFORCING SHALL BE DETERMINED FROM INFORMATION AND TEMPLATES PROVIDED UNDER SECTION 08710 - HARDWARE.

I. PROVIDE UL APPROVED WELDED STEEL ASTRAGAL AT EACH UL PAIR OF FIRE DOORS.

J. FABRICATION

1. FABRICATE DOORS WITH HARDWARE REINFORCEMENT WELDED IN PLACE.

2. ATTACH FIRE RATED LABEL TO EACH DOOR UNIT.

2.03 HOLLOW METAL FRAMES

A. GENERAL: REFER TO THE DRAWINGS FOR VARIOUS TYPES OF FRAMES, SIZES, AND PROFILES, UL FIRE-RESISTIVE LABEL FRAMES, AND OTHER CHARACTERISTICS OF FRAMES AND RELATED ITEMS.

1. NON-RATED FRAMES AND FIRE-RESISTANCE RATED FRAMES (IN CONCRETE AND MASONRY CONSTRUCTION): SHOP WELDED FRAMES WITH MITERED JOINTS ARC-WELDED, REINFORCED AND GROUND SMOOTH.

2. NON-RATED FRAMES AND FIRE-RESISTANCE RATED FRAMES (IN DRYWALL CONSTRUCTION): KNOCK-DOWN TYPE FLUSH FRAMES WITH JOINTS DIE-MITERED AND HAVING INTEGRAL TABS FOR REINFORCEMENT AND INTERLOCKING OF JAMBS TO THE HEAD.

3. FRAMES WITH SIDE LITES AND TRANSOMS: SHOP WELDED FRAMES WITH MITERED JOINTS ARC-WELDED, REINFORCED AND GROUND SMOOTH.

B. MATERIALS FOR FRAMES, REINFORCEMENT, ANCHORS, ANCHOR CLIPS AND RELATED ITEMS: COMMERCIAL GRADE COLD-ROLLED STEEL CONFORMING TO ASTM A366 OR COMMERCIAL GRADE HOT-ROLLED AND PICKLED STEEL CONFORMING TO ASTM A569.

1. FRAME GAGE:

A. EXTERIOR FRAMES: 14 GAGE

B. INTERIOR FRAMES: 16 GAGE

C. EXCEPT AS OTHERWISE REQUIRED FOR SPECIFIC U.L. LABEL.

2. REINFORCING CHANNELS WITHIN FRAMES, EXCEPT WHERE STRUCTURAL STEEL CHANNELS ARE INDICATED, AND EXCEPT WHERE U.L. LABEL REQUIREMENTS PROHIBIT SAME: 12 GAGE.

3. HINGE, LOCK AND STRIKE REINFORCEMENT: 3/16 INCH THICK.

4. DOOR CLOSER REINFORCEMENT: 12 GAGE.

5. FLOOR CLIPS: 3/16 INCH THICK.

6. SPLICE PLATES OR CHANNELS: SAME GAGE AS DOOR FRAME.

7. GLAZING STOPS: 16 GAGE, EXCEPT AS OTHERWISE REQUIRED FOR SPECIFIC U.L. LABEL.

8. PLASTER GUARDS: 26 GAGE.

C. FRAME CONSTRUCTION:

1. FIRE-RATED FRAME ASSEMBLIES: MODIFY SPECIFIED CONSTRUCTION TO MEET ALL CONSTRUCTION REQUIREMENTS REQUIRED FOR FIRE-RESISTIVE RATING.

A. AFFIX APPROPRIATE UL, FM OR WARNOCK HERSEY LABELS TO EACH RATED FRAME ASSEMBLY, INDICATING APPLICABLE RATING.

2. SHOP-FABRICATE FRAMES AS WHOLE SINGLE UNITS PER DOOR OPENING, EXCEPT WHEN FRAME SIZE IS TOO LARGE TO SHIP AS A SINGLE UNIT. OVERSIZED FRAMES MAY BE SHIPPED IN LARGE SECTIONS AS PRACTICABLE FOR FIELD ASSEMBLY WITH CONCEALED SPLICE PLATES OR CHANNELS.

3. FRAME CORNER CONSTRUCTION: AS SPECIFIED IN PARAGRAPH A, ABOVE.

4. REINFORCEMENTS, STIFFENERS, AND BASE ANGLE CLIPS: WELDED TO INTERIOR SURFACES OF FRAMES TO PROVIDE A STABLE BASE AND SO AS TO NOT INTERFERE WITH INSTALLATION OF HARDWARE.

5. PROVIDE PLASTER GUARDS WELDED TO FRAME, AT BACK OF HARDWARE CUT-OUTS WHERE MORTAR OR OTHER MATERIALS MAY OBSTRUCT HARDWARE OPERATION.

6. APPEARANCE OF FINISHED FRAMES: STRONG, RIGID, COMPLETELY FREE FROM WARP AND BUCKLE, WITH MITERS WELL-FORMED AND IN TRUE ALIGNMENT, AND WITH SURFACES SMOOTH AND FREE FROM DEFECTS OF ANY KIND.

7. SILENCER HOLES:

A. SINGLE LEAF DOORS: PUNCH THREE HOLES IN STOP OF STRIKE JAMB OF DOOR FRAMES FOR APPLICATION OF SILENCERS.

B. DOUBLE LEAF DOORS: PUNCH TWO HOLES IN STOP OF HEAD OF DOOR FRAMES FOR APPLICATION OF SILENCERS

8. GLAZING BEADS: CAREFULLY PLACE TO PROPERLY ACCOMMODATE THE VARIOUS THICKNESSES OF GLASS AND GLAZING MATERIALS, AND LOOSELY-ATTACH TO FRAMES WITH FLATHEAD GALVANIZED STEEL SCREWS THROUGH PRE-DRILLED HOLES HAVING COUNTERSUNK DEPRESSIONS.

D. ANCHORAGE:

1. ANCHOR CLIPS FOR FRAMES IN METAL SCREW STUD PARTITIONS: 12-GAGE STEEL Z_SHAPED CLIPS, 1-1/2 INCH UPTURNED AND DOWNTURNED LEGS, OR EQUIVALENT TYPE STANDARD WITH THE MANUFACTURER, CONTAINED WITHIN THE FRAMES, FOR SCREW ATTACHMENT TO METAL STUDS UNDER SECTION 09250 - GYPSUM BOARD.

2. ANCHORS FOR FRAMES IN MASONRY WALLS: ADJUSTABLE, T-SHAPED, POSITIVELY ENGAGING THE RETAINERS ON BOTH FLANGES OF EACH JAMB MEMBER, WHEN PLACED. THE STEM OF THE ANCHORS SHALL BE 2 INCHES WIDE BY 12 GAGE, MINIMUM, CORRUGATED OR

PERFORATED FOR MORTAR BOND, AND EXTEND 10 INCHES INTO THE MASONRY, UNLESS OTHERWISE INDICATED.

3. ANCHORS FOR FIRE-RESISTIVE RATED FRAMES: CONFORM TO ALL UL REQUIREMENTS FOR THE SPECIFIC FIRE-RESISTIVE RATINGS.

4. PROVIDE NOT LESS THAN 3 ANCHORS, CLIPS, OR BOLTS, PER JAMB, AS APPLICABLE.

5. ANCHOR TO FLOOR WITH MINIMUM OF 1 ANCHOR PER JAMB.

2.04 FABRICATION TOLERANCES

A. MAXIMUM VARIATION FOR DOORS AND FRAMES: MAXIMUM DIAGONAL DISTORTION 1/16 INCH MEASURED WITH STRAIGHT EDGE, CORNER TO CORNER.

2.05 FACTORY FINISHING

A. PREPARATION: PRESSURE-SAND ALL SURFACES OF ALL DOORS, FRAMES, ACCESSORY ITEMS, ANCHORS, AND RELATED ITEMS, TO REMOVE BLEMISHES AND FOREIGN MATTER AND PROVIDE PAINT GRIP. SPOT-FILL IMPERFECTIONS WITH METALLIC FILLER, AND SAND SMOOTH. THOROUGHLY CLEAN THE SURFACES BY APPLYING HOT OR COLD PHOSPHATE TREATMENT STANDARD WITH THE MANUFACTURER.

B. FOLLOWING CLEANING, APPLY ONE DIP OR SPRAY COAT OF RUST-INHIBITIVE METALLIC OXIDE, ZINC CHROMATE, OR SYNTHETIC RESIN PRIMER TO ALL SURFACES, INCLUDING THOSE WHICH WILL BE CONCEALED AFTER ERECTION. BAKE, OR OVEN DRY, THE PRIMER AT TIME AND TEMPERATURE RECOMMENDED BY THE MANUFACTURER FOR DEVELOPING MAXIMUM HARDNESS AND RESISTANCE TO ABRASION.

PART 3 - EXECUTION

3.01 EXAMINATION

A. EXAMINE DOORS AND FRAMES BEFORE BEGINNING DOOR / FRAME INSTALLATIONS.

1. VERIFY THAT FRAMES COMPLY WITH INDICATED REQUIREMENTS FOR TYPE, SIZE, LOCATION AND SWING CHARACTERISTICS AND HAVE BEEN INSTALLED WITH LEVEL HEADS AND PLUMB JAMBS.

2. REJECT DOORS WITH DEFECTS.

B. PROCEED WITH INSTALLATION ONLY AFTER UNSATISFACTORY CONDITIONS HAVE BEEN CORRECTED.

3.02 INSTALLATION - DOORS, FRAMES AND HARDWARE

A. INSTALL DOORS AND FRAMES IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS, ANSI/SDI-100, SDI-105, AND THE DOOR HARDWARE INSTITUTE RECOMMENDATIONS.

B. INSTALL HARDWARE IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS AND REQUIREMENTS OF REFERENCED ORGANIZATIONS, AND THE REQUIREMENTS OF SECTION 08 71 00 - DOOR HARDWARE.

C. USE THE TEMPLATES PROVIDED BY HARDWARE ITEM MANUFACTURER.

D. CONFORM TO ANSI 117.1 FOR POSITIONING REQUIREMENTS FOR THE HANDICAPPED.

E. TOOLS FOR MAINTENANCE: ALL SPECIAL TOOLS PACKAGED WITH HARDWARE ITEMS SHALL BE SAVED, TAGGED/IDENTIFIED AS TO PRODUCT USE, AND TURNED OVER TO THE OWNER UPON COMPLETION OF THE WORK.

F. CLEAN ADJACENT SURFACES SOILED BY HARDWARE INSTALLATION.

G. PRIOR TO FINAL INSPECTION MAKE FINAL CHECK AND ADJUSTMENT OF ALL HARDWARE, CLEAN OPERATING ITEMS AS NECESSARY TO RESTORE PROPER FUNCTION AND FINISH OF HARDWARE.

3.02 TOLERANCES

A. MAXIMUM VARIATION FOR WOOD WORK FROM TRUE POSITION OF 1/8 INCH IN 8 FEET FOR PLUMB AND LEVEL AND WITH A MAXIMUM OF 1/16 INCH OFFSETS IN ADJOINING SURFACES INTENDED TO BE FLUSH.

B. MAXIMUM VARIATION FOR DOORS AND FRAMES: MAXIMUM DIAGONAL DISTORTION 1/16 INCH MEASURED WITH STRAIGHT EDGE, CORNER TO CORNER.

3.03 ADJUSTING

A. ADJUST DOORS AND FRAMES FOR SMOOTH AND BALANCED MOVEMENT.

3.04 CLEANING

A. CLEAN WORK AREAS DAILY BY SWEEPING AND DISPOSING OF SCRAPS AND SAWDUST.

B. UPON COMPLETION OF THE WORK OF THIS SECTION IN ANY GIVEN AREA, REMOVE TOOLS, EQUIPMENT AND ALL RUBBISH AND DEBRIS FROM THE WORK AREA; LEAVE AREA IN BROOM-CLEAN CONDITION.

C. REMOVE PROTECTIVE MATERIAL FROM PRE-FINISHED SURFACES.

3.05 PROTECTION

A. DURING THE OPERATION OF HOLLOW METAL DOORS AND FRAMES, PROTECT THE WORK OF OTHER TRADES AGAINST UNDUE SOILAGE AND DAMAGE BY THE EXERCISE OF REASONABLE CARE AND PRECAUTIONS. REPAIR OR REPLACE ANY WORK SO DAMAGED AND SOILED.

END OF SECTION

SECTION 08 30 00

SPECIALTY DOORS

PART 1 - GENERAL

1.01 ITEMS REQUIRED BUT NOT SPECIFIED

A. IF AN ITEM OR MATERIAL OF THIS TRADE IS INDICATED ON THE DRAWINGS BUT NOT SPECIFICALLY LISTED IN THIS SECTION, PROVIDE SUCH ITEM OR MATERIAL AT A STANDARD OF QUALITY EQUAL TO THE STANDARD ESTABLISHED FOR THE BALANCE OF THE WORK SPECIFIED, IN ACCORDANCE WITH THE ARCHITECT'S INTERPRETATION.

1.02 EXECUTION, CORRELATION AND INTENT

A. IN CASE OF AN INCONSISTENCY BETWEEN DRAWINGS AND SPECIFICATIONS, OR WITHIN EITHER DOCUMENT NOT CLARIFIED BY ADDENDUM, THE BETTER QUALITY OR GREATER QUANTITY OF WORK IS TO BE PROVIDED, IN ACCORDANCE WITH THE ARCHITECT'S INTERPRETATION.

1.03 SECTION INCLUDES

A. FURNISH THE FOLLOWING PRODUCTS TO BE INSTALLED UNDER THE DESIGNATED SECTIONS:

1. INSULATED TRAFFIC / IMPACT DOORS

2. HEAVY DUTY, POLYPROPYLENE CORE DOORS (FRP) AND FILLED FRAMES

3. INFITTING COOLER / FREEZER MAN DOORS

4. HORIZONTAL SLIDING COOLER / FREEZER DOORS

B. PROVIDE 12 MONTH MAINTENANCE AND CALL BACK SERVICE FOR SPECIALTY DOORS FURNISHED.

C. RELATED SECTIONS INCLUDE THE FOLLOWING:

1. SECTION 07 92 10 - JOINT SEALERS

2. SECTION 16010 - GENERAL ELECTRICAL

3. SECTION 16110 - RACEWAYS

4. SECTION 16120 - CONDUCTORS

5. SECTION 16130 - BOXES

6. SECTION 16190 - HANGERS AND SUPPORTS

7. SECTION 16195 - ELECTRICAL IDENTIFICATION

8. SECTION 16450 - GROUNDING

1.04 REFERENCES

A. COMPLY WITH APPLICABLE REQUIREMENTS OF THE FOLLOWING STANDARDS AND THOSE OTHERS REFERENCED IN THIS SECTION. WHERE THESE STANDARDS CONFLICT WITH OTHER SPECIFIED REQUIREMENTS, THE MOST RESTRICTIVE REQUIREMENTS SHALL GOVERN.

SECTION 08 30 00

SPECIALTY DOORS

1. 2012 INTERNATIONAL BUILDING CODE

2. 2011 NEC (NATIONAL ELECTRIC CODE)

3. UL (UNDERWRITERS LABORATORY):

A. UL: APPLICABLE REQUIREMENTS FOR MOTORS, SWITCHES AND OTHER ELECTRICAL COMPONENTS.

4. ALL APPLICABLE FEDERAL, STATE AND MUNICIPAL CODES, LAWS AND REGULATIONS FOR EQUIPMENT REQUIREMENTS.

5. ALL ELECTRICAL EQUIPMENT AND ASSEMBLIES; I.E. CONTROL PANELS, MOTORS, PUSH BUTTON CONTROLS, SENSORS, LIGHTS, ETC. SHALL BE UL LISTED AND LABELED.

1.05 SUBMITTALS

A. SUBMIT THE FOLLOWING UNDER PROVISIONS OF DIVISION 1:

1. LITERATURE: MANUFACTURER'S PRODUCT DATA SHEETS, SPECIFICATIONS, PERFORMANCE DATA, FOR SPECIALTY DOORS COMPONENTS FURNISHED.

2. MANUFACTURER'S WARRANTIES: MANUFACTURER'S WRITTEN WARRANTY, COUNTERSIGNED BY THE INSTALLER, CLEARLY STATING ALL TERMS AND CONDITIONS OF THE WARRANTY AND COVERING ALL MATERIALS AND WORKMANSHIP PROVIDED FOR A PERIOD OF NOT LESS THAN ONE YEAR FROM DATE OF SUBSTANTIAL COMPLETION OF THE GENERAL CONTRACT.

3. SHOP DRAWINGS: LARGE SCALE DRAWINGS OF EACH TYPE OF DOOR, FRAME AND ANY ASSOCIATED CONSTRUCTION, INDICATING ALL GAGES, REINFORCING, ANCHORAGE, AND CUT-OUTS FOR GLAZING IN DOORS

A. A COMPLETE SCHEDULE OF DOORS AND FRAMES, TO BE FURNISHED HEREUNDER, COORDINATED WITH THE DOOR AND FRAME SCHEDULE CONTAINED IN THE CONTRACT DRAWINGS.

B. SUBMIT ALL TECHNICAL DATA AND DRAWINGS INCLUDING MANUFACTURER'S MOUNTING INSTRUCTIONS AND INSTALLATION INFORMATION.

C. SUBMIT MANUFACTURER'S OWNER'S MANUAL, MAINTENANCE MANUAL AND MASTER SERVICE MANUAL TO THE A/E.

4. MANUFACTURER'S CERTIFICATION: MANUFACTURER'S LETTER, CERTIFIED BY A NOTARY PUBLIC, THAT NO PROPRIETARY EQUIPMENT AS SPECIFIED UNDER PART 2 - PRODUCTS WILL BE USED IN INSTALLATION.

B. SUBMIT THE FOLLOWING UNDER PROVISION DIVISION 1:

1. PARTS LIST AND WIRING DIAGRAM; UPON COMPLETION OF THE INSTALLATION, SUBMIT FOUR (4) COPIES OF A COMPLETE PARTS LIST AND AS-BUILT WIRING DIAGRAMS FOR CONTROLLER AND MAINTENANCE INSTRUCTIONAL MANUAL.

2. PROVIDE TECHNICAL INFORMATION FOR SERVICING OPERATING EQUIPMENT.

3. INCLUDE LEGIBLE WIRING DIAGRAM OF INSTALLED ELECTRICAL EQUIPMENT AND CHANGES MADE IN THE WORK. LIST SYMBOLS CORRESPONDING TO IDENTITY OF MARKINGS ON APPARATUS.

4. MANUFACTURER'S WRITTEN INSTALLATION WARRANTY AND MAINTENANCE CONTRACT AS SPECIFIED HEREIN BELOW.

PART 2 - PRODUCTS

2.01 MANUFACTURER AND TYPE

A. MANUFACTURER: TO ESTABLISH A STANDARD OF QUALITY, DESIGN AND FUNCTION DESIRED.

B. PROPRIETARY EQUIPMENT: NO PROPRIETARY EQUIPMENT SHALL BE USED IN THE INSTALLATION. ALL EQUIPMENT INCLUDED IN THE SPECIALTY DOOR INSTALLATION SHALL HAVE REPAIR OR REPLACEMENT PARTS READILY ACCESSIBLE TO THE GENERAL SPECIALTY DOOR TRADE. WITHOUT LIMITATION, THIS SHALL INCLUDE DIAGNOSTIC TOOLS AND CONTROLLER COMPONENTS REQUIRED FOR THE COMPLETE MAINTENANCE OF THE INSTALLED DOORS.

1. ANY COSTS INCURRED FOR CHANGES IN THE WORK FROM THAT SHOW ON THE DRAWINGS, INCLUDING WORK OF THIS AND OTHER SECTIONS, DUE TO THE REQUIREMENTS OF THE PARTICULAR SPECIALTY DOORS FURNISHED THERE UNDER ARE THE SOLE RESPONSIBILITY OF THE SPECIALTY DOOR MANUFACTURER.

2.02 INSULATED TRAFFIC / IMPACT DOORS

A. THE IMPACT TRAFFIC DOORS SHALL BE MANUFACTURED BY CHASE DOOR COMPANY, CINCINNATI, OH. OR CMI DOORS (A DIVISION OF CHAM MANUFACTURING, INC.), WINNIPEG, MANITOBA OR ARCHITECT APPROVED SUBSTITUTE.

1. THE DOORS SHALL BE A HIGH IMPACT, HEAVY DUTY TRAFFIC DOOR.

2. THE DOORS SHALL CONSIST OF A 1/4" POLYETHYLENE OUTER SKIN WITH A URETHANE FOAM CORE. DOOR PANELS SHALL BE 1-7/8" THICK.

3. STANDARD BLACK POLYETHYLENE TEARDROP BUMPERS SHALL BE 42” HIGH AND SHALL BE PROVIDED ON BOTH SIDES ON ALL DOUBLE DOORS.

4. STANDARD BLACK PROTECTIVE PANELS SHALL BE 42” HIGH AND SHALL BE PROVIDED ON BOTH SIDES OF ALL SINGLE DOORS.

5. ALL DOORS SHALL HAVE STAINLESS STEEL “V” CAM HINGES WITH A STAINLESS STEEL BEARING, CAST ALUMINUM HINGE ADAPTER AND LOWER HINGE GUARDS. HINGES SHALL BE 90D WHERE SHOWN ON THE DRAWINGS. HINGES AND GUARDS SHALL BE JAMB MOUNTED (FLOOR MOUNTING WILL NOT BE PERMITTED).

6. ALL DOORS SHALL BE FULLY GASKETED AND HAVE MANUFACTURES STANDARD, MAXIMUM SIZE, POLYCARBONATE VISION PANEL AND SHALL BE WASH DOWN PROOF.

7. ALL DOORS SHALL BE PROVIDED WITH ¼” THICK STAINLESS STEEL WELD PLATES (2 PER LEAF). ALL WELDS ARE TO BE CLEANED AND POLISHED TO MATCH SUB-FRAME.

8. COLOR TO BE SELECTED BY ARCHITECT FROM MANUFACTURER'S STANDARD COLORS. DOOR SIZES AND LOCATIONS ARE AS SHOWN ON THE DRAWINGS AND SCHEDULES. DOORS SHALL BE COMPLETE WITH ALL COMPONENTS REQUIRED FOR COMPLETE INSTALLATION AND OPERATION.

9. ALL FASTENERS USED SHALL BE STAINLESS STEEL. THERE SHALL BE NO EXPOSED FASTENERS OR RIVETS ON THE OUTER SURFACES OF THE DOOR BODY.

2.03 HEAVY DUTY, POLYPROPYLENE CORE DOORS (FRP)

A. THE CORROSION RESISTANT MAN DOORS SHALL BE MANUFACTURED BY OVERLY/TIGER DOOR, OR APPROVED SUBSTITUTE.

1. NON-RATED FIBERGLASS REINFORCED PLASTIC DOORS:

A. DESIGN: FRP DOORS SHALL BE OF SEAMLESS PRESS-MOLDED CONSTRUCTION. LAMINATED FRP FACE SHEETS SHALL BE APPLIED WHILE WET AND UNCURED TO AN INTERNAL DOOR STILE AND RAIL SUBFRAME/CORE ASSEMBLY AND THEN PRESS-MOLDED UNDER HEAT AND PRESSURE. THE COMPOSITE DOOR PANEL MUST BE INTEGRALLY FUSED OVER ITS ENTIRE SURFACE AREA, NOT JUST ADHESIVE-BONDED AT PERIMETER STILES AND RAILS. DOORS SHALL REMAIN UNDER PRESSURE DURING CURING FOR FLAT, WARP-FREE SURFACES.

B. STILES & RAILS: A HIGH-MODULUS PULTRUDED FRP SQUARE OR RECTANGULAR TUBE SUBFRAME IS TO BE PROVIDED WITHIN THE DOOR. TUBES ARE TO BE MITERED AND JOINED INTERNALLY AT THE CORNERS WITH SOLID POLYMER BLOCKS TO YIELD A ONE-PIECE UNIT THAT DOES NOT REQUIRE ANY SECONDARY EXTERNAL SEALING. PROVIDE A TUBULAR MIDRAIL ACROSS WIDTH OF DOOR AT LOCK HEIGHT, AND ADDITIONAL HORIZONTAL RAILS WHERE SPECIFIC DESIGN CONDITIONS DICTATE. DOORS SHALL INCORPORATE MOLDED-IN FRP EDGE STRIPS, CHEMICALLY BONDED TO THE SUBFRAME STILES, FOR MACHINING OF HARDWARE MORTISES SO AS NOT TO CUT OR OTHERWISE COMPROMISE THE INTEGRITY OF THE PULTRUDED STILES, NOR ALLOW MOISTURE TO PENETRATE INTO THE CORE OF THE DOOR. ALL CONNECTIONS SHALL BE CHEMICALLY WELDED. NO MECHANICAL FASTENERS WILL BE ALLOWED. THE USE OR INCLUSION OF ALUMINUM, STEEL, GYPSUM OR WOOD INTO STILE AND RAIL CONSTRUCTION IS NOT PERMITTED.

C. CORE: FOR MAXIMUM RIGIDITY AND COMPRESSIVE STRENGTH A POLYPROPYLENE HONEYCOMB WITH FACE SCRIM CORE SHALL BE USED. MOLDING PRESSURE AND RESIN GEL TIME SHALL BE SUFFICIENT TO ALLOW FOR PENETRATION OF RESIN INTO THE CELLULAR STRUCTURE OF THE CORE TO MAXIMIZE SHEAR AND PEEL STRENGTHS AT THE SKIN/CORE INTERFACE AND ELIMINATE THE POSSIBILITY OF DELAMINATION. THE POLYPROPYLENE HONEYCOMB IS TO BE COMPLETELY ENCLOSED WITHIN THE STILE AND RAIL SUBFRAME. USE OF FOAM, BALSA WOOD OR KRAFT HONEYCOMB PAPER IS NOT PERMITTED.

D. INTERNAL REINFORCEMENT: HIGH-MODULOUS PULTRUDED TUBULAR FRP, HIGH-DENSITY POLYMER COMPRESSION BLOCKS, OR PLASTIC COMPRESSION BLOCKING AT ALL HARDWARE LOCATIONS, AND CORNER LOCATIONS. NO WOOD BLOCKING, STEEL OR ALUMINUM REINFORCING PLATES, RIBS OR FITTINGS SHALL BE USED. A MINIMUM OF 900 LBS OF PULLOUT STRENGTH IS REQUIRED FOR EACH FACTORY SUPPLIED HINGE SCREW.

E. FACES: DOOR FACINGS SHALL UTILIZE A CHEMICAL RESISTANT THERMOSETTING POLYESTER RESIN SYSTEM WITH FIBER REINFORCING LAYERS. SUPPLIER SHALL FURNISH DOOR FACES AS SHOWN ON THE DRAWINGS AND IN THE DOOR ELEVATIONS. CHOPPED STRAND MAT LAYERS SHALL BE USED TO PROVIDE BOND INTEGRITY BETWEEN GELCOAT, LAMINATED FACINGS AND THE INTERNAL DOOR STRUCTURE. STRUCTURAL REINFORCEMENT SHALL BE IN THE FORM OF A KNITTED MULTI-LAYER MATERIAL WITH LAYERS OF UNI-DIRECTIONAL GLASS FIBER ORIENTED IN BOTH THE VERTICAL AND HORIZONTAL DIRECTIONS FOR HIGH STIFFNESS, IMPACT RESISTANCE AND RESISTANCE TO WARPING. GELCOAT SURFACE INTEGRALLY MOLDED TO BE 25/30 MILS THICK (WET) ULTRA-VIOLET LIGHT STABILIZED MARINE GRADE NPG-ISOPHTHALIC POLYESTER GELCOAT.

F. FINISH: THE EXPOSED FRP DOOR FACES SHALL HAVE A 3-4 MILS (WET) FACTORY APPLIED TWO-PART ALIPHATIC POLYURETHANE FULLY CURED COATING OF INDUSTRIAL URETHANE. COATING SHALL HAVE A MINIMUM HARDNESS OF H TO 2H. FINISH SHALL BE A SLIGHTLY TEXTURED SEMI-GLOSS TO MINIMIZE THE VISUAL EFFECTS OF WEAR AND TEAR.

G. COLOR: TO BE SELECTED BY ARCHITECT FROM MANUFACTURER'S STANDARD COLORS.

2. NON-RATED FIBERGLASS REINFORCED PLASTIC FRAMES:

A. DESIGN: FRP DOOR FRAMES FURNISHED UNDER THIS SPECIFICATION SHALL UTILIZE A HIGH-MODULUS PULTRUDED STRUCTURAL FRP SHAPE. THE FRAME SECTION SHALL BE STANDARD DOUBLE RABBETED 5-3/4 INCH DEEP X 2 INCH FACE, 3/16 INCH THICK, WITH INTEGRAL 5/8 INCH DOORSTOP WITH 1 15/16 INCH SOFFITS, TO MATCH TYPICAL HOLLOW METAL CONFIGURATIONS.

B. CORNER JOINTS: FRAME JAMBS AND HEADER SHALL BE JOINED AT CORNERS VIA MITER CONNECTIONS WITH HIDDEN FRP ANGLE CLIPS AND ASSOCIATED FASTENERS. FRAMES SHALL BE FACTORY SET-UP & ALL JOINTS CHEMICALLY WELDED SO ALL CONNECTIONS WILL BE SEALED. POST AND BEAM CORNERS WILL NOT BE ACCEPTABLE. EXPOSED FASTENERS FOR MITER CONNECTIONS WILL NOT BE ACCEPTABLE EXCEPT FOR WRAP WALL APPLICATIONS.

C. FRAME CAVITIES SHALL BE FILLED WITH A PROPRIETARY, NON-WICKING, MOLD RESISTANT, COMPOSITE FORMULATION WITH A MINIMUM DENSITY OF 25 LB/FT3. HOLLOW METAL OR STAINLESS STEEL FRAMES ARE NOT ACCEPTABLE

D. HARDWARE REINFORCEMENTS: FRP REINFORCING SHALL BE CHEMICALLY WELDED TO DOOR FRAME MATERIAL AT REQUIRED LOCATIONS. MINIMUM SCREW PULLOUT STRENGTH OF 1100 LB PER #12 X 1 INCH" SHEET METAL SCREW IS REQUIRED. MECHANICALLY FASTENED REINFORCEMENTS ARE NOT PERMITTED.

E. ANCHORS: PROVIDE MANUFACTURER'S REQUIRED NUMBER OF 3/8 INCH DIAMETER X 4 INCH LONG FLAT HEAD STAINLESS STEEL SLEEVE ANCHORS FOR MASONRY OPENINGS, 3/8 INCH DIAMETER X 4 INCH MACHINE SCREW WITH NUT AND WASHERS FOR STRUCTURAL STEEL OPENINGS, #14 X 4 INCH STAINLESS STEEL FLAT HEAD SHEET METAL SCREWS FOR WOOD OR STEEL STUD OPENINGS. INCLUDE EXTRA ANCHORS FOR ADDITIONAL FRAME HEIGHT IN TWO FOOT INCREMENTS ABOVE 8'-0 INCH. PROVIDE SINGLE BOLT ANCHOR AT CENTER OF ALL HEADERS OVER FOUR FEET IN NOMINAL WIDTH. STAINLESS STEEL FASTENERS SHALL BE FURNISHED BY THE FACTORY.

F. FINISH: FRAMES SHALL HAVE A 3-4 MILS (WET) FACTORY APPLIED TWO-PART ALIPHATIC POLYURETHANE FULLY CURED COATING OF INDUSTRIAL URETHANE. INDUSTRIAL URETHANE CHEMICAL COATING COLOR TOPCOAT, TO MATCH THE COLOR AND SHEEN OF THE DOORS, FOR SUPERIOR WEATHERABILITY. GELCOAT MAY NOT BE SPRAYED ONTO THE FRAME AS A SECONDARY COATING.

G. COLOR: TO BE SELECTED BY ARCHITECT FROM MANUFACTURER'S STANDARD COLORS.

3. ALL DOOR HARDWARE SHALL BE FURNISHED AND INSTALLED BY THE DOOR MANUFACTURER. ALL DOOR PANELS SHALL HAVE (3) THREE FULL MORTISE, HEAVY DUTY, STAINLESS STEEL, BALL BEARING HINGES.

4. ALL DOORS SHALL HAVE FULL, SHOP APPLIED, WEATHER-STRIPPING AND DOOR SWEEPS. WEATHER-STRIPPING AND DOOR SWEEPS SHALL BE MOLDED FIBERGLASS (COLOR MATCHED TO FRAME) WITH A NEOPRENE BULB SEAL AND INSTALLED TO THE STOP/DOOR WITH STAINLESS STEEL FASTENERS.

2.04 INFITTING COOLER MAN DOORS

A. MANUFACTURER: WHERE PRODUCT MANUFACTURERS OR BRAND NAMES ARE LISTED, IT IS DONE SO TO ESTABLISH A STANDARD OF QUALITY, DESIGN AND FUNCTION DESIRED.

1. PRODUCTS OF THE FOLLOWING MANUFACTURERS, PROVIDED THEY COMPLY WITH THE

REQUIREMENTS OF THE CONTRACT DOCUMENTS WILL BE AMONG THOSE CONSIDERED ACCEPTABLE.

A. JAMISON DOOR COMPANY

B. FRANK DOOR COMPANY

C. ARCHITECT APPROVED SUBSTITUTE.

2. ALL DOORS WILL HAVE A FOAMED-IN-PLACE POLYURETHANE CORE PANEL WITH FLUSH SILL, HAVE RETURN JAMBS AND INSIDE CASING WITH PRE-FINISHED CLADDING IN 26-GA STUCCO EMBOSSED G90 GALVANIZED STEEL AND ALL EXPOSED SEAMS SEALED.

A. DOOR THICKNESS TO CORRESPOND TO ADJACENT WALL PANEL THICKNESS AND /OR ROOM TEMPERATURE TO WHICH THE DOOR WILL BE LOCATED.

B. FURNISH HEAD, JAMB AND SILL DETAILS IN COMPLIANCE WITH CONTRACT DOCUMENTS.

C. PROVIDE MEAT TROLLEY RAIL OPENING WHERE INDICATED ON DOOR SCHEDULE.

D. DOORS INDICATED ON SCHEDULE AS HEAT TRACED SHALL BE SUPPLIED WITH 120V HEATER CABLES IN THE PERIMETER EXCEPT THE BOTTOM OF THE DOOR (UL APPROVED).

3. ALL HARDWARE SHALL BE STAINLESS STEEL AND ALL DOORS SHALL HAVE A SAFETY RELEASE ON A SINGLE POINT LATCH. SEE DOOR SCHEDULE FOR HARDWARE REQUIRED.

A. CAM LIFT HINGES.

B. ALL DOORS TO BE EQUIPPED WITH CLOSERS.

C. EGRESS DOORS TO BE EQUIPPED WITH APPROVED PANIC HARDWARE.

4. THE PERIMETER OF THE DOOR PANEL SHALL BE SEALED WITH REINFORCED NEOPRENE GASKETS AND A DOUBLE WIPER SEAL ON THE BOTTOM.

2.06 HORIZONTAL BI-PARTING / SLIDING FREEZER / COOLER DOORS

A. PROVIDE HORIZONTAL BI-PARTING SLIDING FREEZER / COOLER DOORS MANUFACTURED BY JAMISON DOOR COMPANY, FRANK DOOR COMPANY, HERCULES BY KINGSPAN, OR APPROVED EQUALS, AS INDICATED ON THE DRAWINGS.

1. DOORS PANEL - STRUCTURAL FRAME CONSISTING OF:

A. ALUMINUM EXTRUSION WITH STEEL REINFORCEMENTS.

B. CLAD WITH 26-GA STUCCO EMBOSSED G90 GALVANIZED STEEL WITH ALL EXPOSED SEAMS SEALED.

2. INSULATION - DOOR CORE INJECTED WITH MINIMUM 4” THICK FOAMED-IN-PLACE POLYURETHANE (CFC - FREE). MINIMUM R-VALUE 33. THICKNESS VARIES PER APPLICATION, USE APPROPRIATE THICKNESS FOR PROJECT TEMPERATURES.

3. DOORS SHALL BE EQUIPPED WITH A FLUSH SILL AND SHALL HAVE RETURN JAMBS AND INSIDE CASING CLADDED WITH 26-GA STUCCO EMBOSSED G90 GALVANIZED STEEL WITH ALL EXPOSED SEAMS SEALED.

4. DOOR FINISH - IMPERIAL WHITE PPG DURAFIN 2000 HIGH PERFORMANCE COATING, USDA ACCEPTED, WARRANTED FOR 20 YEARS IN AREAS REQUIRING HEAVY WASH DOWN.

5. ALL HARDWARE SHALL BE HEAVY DUTY AND STAINLESS STEEL AND ALL DOORS SHALL HAVE AN INSIDE SAFETY RELEASE.

6. THE PERIMETER OF THE DOOR PANEL SHALL BE SEALED WITH ADJUSTABLE REINFORCED NEOPRENE BULB-TYPE GASKETS AND A DOUBLE WIPER SEAL ON THE BOTTOM. BI-PARTING DOORS SHALL HAVE DOUBLE NEOPRENE BUMPER GASKETS ON THE JOINING EDGE OF THE DOOR PANELS.

7. DOORS INDICATED ON SCHEDULE AS HEAT TRACED SHALL BE SUPPLIED WITH 120V HEATER CABLES IN THE PERIMETER EXCEPT THE BOTTOM OF THE DOOR (UL APPROVED).

8. PROVIDE MEAT TROLLEY RAIL OPENING WHERE INDICATED ON SCHEDULE.

PART 3 - EXECUTION

3.01 EXAMINATION

A. INSPECT ALL SURFACES, AND REQUIRED EMBEDDED ANCHORAGE DEVICES, AND VERIFY THAT THEY ARE IN PROPER CONDITION TO RECEIVE THE WORK OF THIS SECTION. VERIFY THAT FIELD MEASUREMENTS ARE AS INDICATED ON APPROVED SHOP DRAWINGS.

3.02 INSTALLATION - GENERAL

A. DOORS SHALL BE INSTALLED IN ACCORDANCE WITH THE APPROVED SHOP DRAWINGS, DETAILS SHOWN ON THE DRAWINGS, AND IN ACCORDANCE WITH APPROVED MANUFACTURER'S RECOMMENDATIONS.

B. DOORS SHALL BE SET SQUARE AND PLUMB. ADJUSTMENTS SHALL BE MADE SO DOORS HAVE A TIGHT SEAL ON ALL FOUR EDGES WHEN CLOSED. SPRINGS OR COUNTERWEIGHTS SHALL BE ADJUSTED SO THAT DOOR OPERATION IS SMOOTH AND OPERATES WITH EASE.

C. DOORS SHALL BE INSTALLED BY FACTORY QUALIFIED AND AUTHORIZED PERSONNEL IN STRICT ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS. ALL WELDING REQUIRED SHALL BE TIG WELDED.

3.03 TOLERANCES, TESTS AND ADJUSTMENTS

A. IN CONFORMANCE WITH MANUFACTURER'S OPERATING PARAMETERS AND WARRANTY REQUIREMENTS.

B. UPON COMPLETION OF THE INSTALLATION, THE DOORS SHALL BE TESTED AND ADJUSTED AS NECESSARY TO ASSURE SMOOTH AND PROPER OPERATION INCLUDING THE PROPER SEALING PRIOR TO TURNOVER OF FACILITY TO OWNER.

3.04 CLEANING

A. AFTER ALL WORK UNDER THIS SECTION HAS BEEN COMPLETED AND SATISFACTORILY TESTED, REMOVE ALL APPLIED PACKING LABELS FROM THE VARIOUS SURFACES, THOROUGHLY CLEAN AND POLISH ALL PLASTIC LAMINATE, STAINLESS STEEL AND PREFINISHED SURFACES. TOUCH UP ALL SCRATCHES, ABRASIONS, AND OTHER SURFACE DEFECTS IN THE PREFINISHED SURFACES, USING THE SAME MATERIAL, COLOR AND GLOSS AS USED IN THE PREFINISHING SYSTEM

B. UPON COMPLETION OF THE WORK OF THIS SECTION, REMOVE TOOLS, AND ALL RUBBISH AND DEBRIS FROM THE WORK AREA; LEAVE AREA IN BROOM-CLEAN CONDITION.

END OF SECTION

SECTION 08 3113

ACCESS DOORS & FRAMES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. CONSTRUCTION DRAWINGS, SPECIFICATIONS AND PROVISIONS OF THE CONTRACT INCLUDING GENERAL AND SUPPLEMENTAL CONDITIONS AND OTHER DIVISION 01 SPECIFICATION SECTIONS, ARE HEREBY MADE A PART OF THIS SECTION AS FULLY AND COMPLETELY AS IF REPEATED HEREIN.

1.02 ITEMS REQUIRED BUT NOT SPECIFIED

A. IF AN ITEM OR MATERIAL OF THIS TRADE IS INDICATED ON THE DRAWINGS BUT NOT SPECIFICALLY LISTED IN THIS SECTION, PROVIDE SUCH ITEM OR MATERIAL AT A STANDARD OF QUALITY EQUAL TO THE STANDARD ESTABLISHED FOR THE BALANCE OF THE WORK SPECIFIED, IN ACCORDANCE WITH THE ARCHITECT'S INTERPRETATION.

1.03 EXECUTION, CORRELATION AND INTENT

A. IN CASE OF AN INCONSISTENCY BETWEEN DRAWINGS AND SPECIFICATIONS OR WITHIN EITHER DOCUMENT NOT CLARIFIED BY ADDENDUM, THE BETTER QUALITY OR GREATER QUANTITY OF WORK IS TO BE PROVIDED, IN ACCORDANCE WITH THE ARCHITECT'S INTERPRETATION

1.04 SUMMARY

A. THIS SECTION INCLUDES THE FOLLOWING: SEE SCOPE OF WORK FOR QUANTITIES

1. WALL ACCESS DOORS AND FRAMES.

2. FIRE-RATED WALL ACCESS DOORS AND FRAMES.

3. CEILING ACCESS DOORS AND FRAMES.

B. RELATED SECTIONS INCLUDE THE FOLLOWING:

1. DIVISION 04 SECTION "UNIT MASONRY ASSEMBLIES" FOR ANCHORING AND GROUTING ACCESS DOOR FRAMES SET IN MASONRY CONSTRUCTION.

2. DIVISION 15 SECTION "DUCT ACCESSORIES" FOR HEATING AND AIR-CONDITIONING DUCT ACCESS DOORS.

1.05 SUBMITTALS

A. PRODUCT DATA: FOR EACH TYPE OF DOOR AND FRAME INDICATED. INCLUDE CONSTRUCTION DETAILS RELATIVE TO MATERIALS, INDIVIDUAL COMPONENTS AND PROFILES, FINISHES, AND FIRE RATINGS (IF REQUIRED) FOR ACCESS DOORS AND FRAMES.

B. SHOP DRAWINGS: SHOW FABRICATION AND INSTALLATION DETAILS OF CUSTOMIZED DOORS AND FRAMES. INCLUDE PLANS, ELEVATIONS, SECTIONS, DETAILS, AND ATTACHMENTS TO OTHER WORK.

1.06 QUALITY ASSURANCE

A. SOURCE LIMITATIONS: OBTAIN DOORS AND FRAMES THROUGH ONE SOURCE FROM A

SINGLE MANUFACTURER.

B. FIRE-RATED ACCESS DOORS AND FRAMES: UNITS COMPLYING WITH NFPA 80 THAT ARE IDENTICAL TO ACCESS DOOR AND FRAME ASSEMBLIES TESTED FOR FIRE-TEST-RESPONSE CHARACTERISTICS PER THE FOLLOWING TEST METHOD AND THAT ARE LABELED AND LISTED BY UL, ITS, OR ANOTHER TESTING AND INSPECTING AGENCY ACCEPTABLE TO AUTHORITIES HAVING JURISDICTION:

C. SIZE VARIATIONS: OBTAIN MANUFACTURER'S STANDARD-SIZE UNITS FOR APPLICATION.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. MANUFACTURERS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS; PROVIDE PRODUCTS BY ONE OF THE FOLLOWING:

1. ACCESS DOORS:

A. ELMDOR/STONEMAN; DIV. OF ACORN ENGINEERING CO.

B. J. L. INDUSTRIES, INC.

C. KARP ASSOCIATES, INC.

D. LARSEN'S MANUFACTURING COMPANY.

E. NYSTROM BUILDING PRODUCTS CO.

F. WILLIAMS BROS. CORPORATION OF AMERICA (THE).

2.02 MATERIALS

A. STEEL PLATES, SHAPES, AND BARS: ASTM A 36/A 36M.

B. HOT-ROLLED STEEL SHEETS: ASTM A 569/A 569M, COMMERCIAL STEEL (CS), TYPE B; FREE OF SCALE, PITTING, AND SURFACE DEFECTS; PICKLED AND OILED; WITH MINIMUM THICKNESS INDICATED REPRESENTING SPECIFIED NOMINAL THICKNESS ACCORDING TO ASTM A 568/A 568M.

C. COLD-ROLLED STEEL SHEETS: ASTM A 366/A 366M, COMMERCIAL STEEL (CS), OR ASTM A 620/A 620M, DRAWING STEEL (DS), TYPE B; STRETCHER-LEVELED STANDARD OF FLATNESS; WITH MINIMUM THICKNESS INDICATED REPRESENTING SPECIFIED NOMINAL THICKNESS ACCORDING TO ASTM A 568/A 568M. ELECTROLYTIC ZINC-COATED STEEL SHEET, COMPLYING WITH ASTM A 591/A 591M, CLASS C COATING, MAY BE SUBSTITUTED AT FABRICATOR'S OPTION.

D. ELECTROLYTIC ZINC-COATED STEEL SHEET: ASTM A 591/A 591M, COMMERCIAL STEEL (CS), WITH CLASS C COATING AND PHOSPHATE TREATMENT TO PREPARE SURFACE FOR PAINTING; WITH MINIMUM THICKNESS INDICATED REPRESENTING SPECIFIED NOMINAL THICKNESS ACCORDING TO ASTM A 568/A 568M FOR UNCOATED BASE METAL.

E. STAINLESS-STEEL SHEET, STRIP, PLATE, AND FLAT BARS: (TOILET ROOMS / LOCKER ROOMS ONLY) ASTM A 666, TYPE 304; WITH MINIMUM SHEET THICKNESS INDICATED REPRESENTING SPECIFIED THICKNESS ACCORDING TO ASTM A 480/A 480M.

2.03 PAINT

A. SHOP PRIMER FOR FERROUS METAL: FAST-CURING, LEAD- AND CHROMATE-FREE, UNIVERSAL MODIFIED-ALKYD PRIMER COMPLYING WITH PERFORMANCE REQUIREMENTS IN FS TT-P-664; SELECTED FOR GOOD RESISTANCE TO NORMAL ATMOSPHERIC CORROSION, COMPATIBILITY WITH FINISH PAINT SYSTEMS INDICATED, AND CAPABILITY TO PROVIDE A SOUND FOUNDATION FOR FIELD-APPLIED TOPCOATS DESPITE PROLONGED EXPOSURE.

2.04 ACCESS DOORS AND FRAMES

A. FLUSH, INSULATED, FIRE-RATED ACCESS DOORS AND FRAMES WITH EXPOSED TRIM: FABRICATED FROM STEEL SHEET.

1. LOCATIONS: MASONRY WALL SURFACES.

2. FIRE-RESISTANCE RATING: AS REQUIRED FOR WALL TYPE.

3. TEMPERATURE RISE RATING: 139 DEG C (250 DEG F) AT THE END OF 30 MINUTES.

4. DOOR: FLUSH PANEL WITH A CORE OF MINERAL-FIBER INSULATION ENCLOSED IN SHEET METAL WITH A MINIMUM THICKNESS OF 0.9 MM (0.036 INCH).

5. FRAME: MINIMUM 1.5-MM- (0.060-INCH-) THICK SHEET METAL WITH 25-MM- (1-INCH-) WIDE, SURFACE-MOUNTED TRIM.

6. HINGES: CONTINUOUS PIANO HINGE.

7. AUTOMATIC CLOSER: SPRING TYPE.

8. LATCH: SELF-LATCHING BOLT OPERATED BY FLUSH SCREWDRIVER WITH INTERIOR RELEASE.

B. FLUSH ACCESS DOORS AND FRAMES WITH EXPOSED TRIM: FABRICATED FROM STEEL OR STAINLESS-STEEL SHEET.

1. LOCATIONS: STEEL ACCESS DOORS IN GYPSUM BOARD SURFACES WALL OR CEILING. STAINLESS-STEEL ACCESS DOORS IN CERAMIC-TILE WALL SURFACES.

2. DOOR: MINIMUM 1.5-MM- (0.060-INCH-) THICK SHEET METAL, SET FLUSH WITH EXPOSED FACE FLANGE OF FRAME.

3. FRAME: MINIMUM - (0.060-INCH -) THICK SHEET METAL WITH 25-MM- (1-INCH-) WIDE, SURFACE-MOUNTED TRIM.

4. HINGES: CONTINUOUS PIANO HINGE.

5. LATCH: SCREWDRIVER-OPERATED CAM LATCH.

2.05 FABRICATION

A. GENERAL: PROVIDE ACCESS DOOR ASSEMBLIES MANUFACTURED AS INTEGRAL UNITS READY FOR INSTALLATION.

B. METAL SURFACES: FOR METAL SURFACES EXPOSED TO VIEW IN THE COMPLETED WORK, PROVIDE MATERIALS WITH SMOOTH, FLAT SURFACES WITHOUT BLEMISHES. DO NOT USE MATERIALS WITH EXPOSED PITTING, SEAM MARKS, ROLLER MARKS, ROLLED TRADE NAMES, OR ROUGHNESS.

C. STEEL DOORS AND FRAMES: GRIND EXPOSED WELDS SMOOTH AND FLUSH WITH ADJACENT SURFACES. FURNISH ATTACHMENT DEVICES AND FASTENERS OF TYPE REQUIRED TO SECURE ACCESS PANELS TO TYPES OF SUPPORTS INDICATED.

1. EXPOSED FLANGES: NOMINAL 25 TO 38 MM (1 TO 1-1/2 INCHES) WIDE AROUND PERIMETER OF FRAME.

D. LATCHING MECHANISMS: FURNISH NUMBER REQUIRED TO HOLD DOORS IN FLUSH, SMOOTH PLANE WHEN CLOSED.

2.06 FINISHES, GENERAL

A. COMPLY WITH NAAMM'S "METAL FINISHES MANUAL FOR ARCHITECTURAL AND METAL PRODUCTS" FOR RECOMMENDATIONS FOR APPLYING AND DESIGNATING FINISHES.

B. FINISH METAL FABRICATIONS AFTER ASSEMBLY.

2.07 STEEL FINISHES

A. SURFACE PREPARATION: PREPARE UNCOATED FERROUS-METAL SURFACES TO COMPLY WITH MINIMUM REQUIREMENTS INDICATED BELOW FOR SSPC SURFACE-PREPARATION SPECIFICATIONS AND ENVIRONMENTAL EXPOSURE CONDITIONS OF INSTALLED METAL FABRICATIONS:

1. INTERIORS (SSPC ZONE 1A): SSPC-SP 3, "POWER TOOL CLEANING."

B. APPLY SHOP PRIMER TO UNCOATED SURFACES OF METAL FABRICATIONS. COMPLY WITH SSPC-PA 1, "PAINT APPLICATION SPECIFICATION NO. 1," FOR SHOP PAINTING.

2.08 STAINLESS-STEEL FINISHES

A. REMOVE TOOL AND DIE MARKS AND STRETCH LINES OR BLEND INTO FINISH.

B. GRIND AND POLISH SURFACES TO PRODUCE UNIFORM, DIRECTIONALLY TEXTURED, POLISHED FINISH INDICATED, FREE OF CROSS SCRATCHES. RUN GRAIN WITH LONG DIMENSION OF EACH PIECE.

C. BRIGHT, DIRECTIONAL POLISH: NO. 4 FINISH.

1. WHEN POLISHING IS COMPLETED, PASSIVATE AND RINSE SURFACES. REMOVE EMBEDDED FOREIGN MATTER AND LEAVE SURFACES CHEMICALLY CLEAN.

PART 3 - EXECUTION

3.01 PREPARATION

A. ADVISE INSTALLERS OF OTHER WORK ABOUT SPECIFIC REQUIREMENTS RELATING TO ACCESS DOOR AND FLOOR DOOR INSTALLATION, INCLUDING SIZES OF OPENINGS TO RECEIVE ACCESS DOOR AND FRAME, AS WELL AS LOCATIONS OF SUPPORTS, INSERTS, AND ANCHORING DEVICES.

3.02 INSTALLATION

A. COMPLY WITH MANUFACTURER'S WRITTEN INSTRUCTIONS FOR INSTALLING ACCESS DOORS AND FRAMES.

B. SET FRAMES ACCURATELY IN POSITION AND ATTACH SECURELY TO SUPPORTS WITH PLANE OF FACE PANELS ALIGNED WITH ADJACENT FINISH SURFACES.

3.03 ADJUSTING AND CLEANING

A. ADJUST DOORS AND HARDWARE AFTER INSTALLATION FOR PROPER OPERATION.

B. REMOVE AND REPLACE DOORS AND FRAMES THAT ARE WARPED, BOWED, OR OTHERWISE DAMAGED.

END OF SECTION

SECTION 08 33 00

OVERHEAD COILING DOORS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. CONSTRUCTION DRAWINGS, SPECIFICATIONS AND PROVISIONS OF THE CONTRACT INCLUDING GENERAL AND SUPPLEMENTAL CONDITIONS AND OTHER DIVISION 1 SPECIFICATION SECTIONS, ARE HEREBY MADE A PART OF THIS SECTION AS FULLY AND COMPLETELY AS IF REPEATED HEREIN.

1.02 ITEMS REQUIRED BUT NOT SPECIFIED

A. IF AN ITEM OR MATERIAL OF THIS TRADE IS INDICATED ON THE DRAWINGS BUT NOT SPECIFICALLY LISTED IN THIS SECTION, PROVIDE SUCH ITEM OR MATERIAL AT A STANDARD OF QUALITY EQUAL TO THE STANDARD ESTABLISHED FOR THE BALANCE OF THE WORK SPECIFIED, IN ACCORDANCE WITH THE ARCHITECT'S INTERPRETATION.

1.03 EXECUTION, CORRELATION AND INTENT

A. IN CASE OF AN INCONSISTENCY BETWEEN DRAWINGS AND SPECIFICATIONS OR WITHIN EITHER DOCUMENT NOT CLARIFIED BY ADDENDUM, THE BETTER QUALITY OR GREATER QUANTITY OF WORK IS TO BE PROVIDED, IN ACCORDANCE WITH THE ARCHITECT'S INTERPRETATION.

1.04 SECTION INCLUDES:

A. NON-RATED OVERHEAD COILING DOORS

B. OVERHEAD COILING FIRE DOORS

1.05 RELATED SECTIONS

A. SECTION 07 84 10 - THRU PENETRATION FIRE-STOP SYSTEMS

B. SECTION 07 84 20 - FIRE RESISTIVE JOINT SYSTEMS

1.06 SUBMITTALS

A. SUBMIT 5 COPIES OF THE FOLLOWING SHOP DRAWING FOR APPROVAL PRIOR TO FABRICATION UNDER PROVISIONS OF SECTION 01300, CLEARLY INDICATING:

1. DESIGN AND INSTALLATION DETAILS TO WITHSTAND LOCAL WIND LOADING STANDARDS, WHERE APPLICABLE.

A. DETAILED PLANS, INCLUDING DETAILS OF FRAMING MEMBERS, REQUIRED CLEARANCES, ANCHORS AND ACCESSORIES.

B. ELEVATIONS.

2. ALL DETAILS REQUIRED FOR COMPLETE OPERATION AND INSTALLATION.

3. HARDWARE LOCATION.

4. TYPE AND GAGE OF METAL AND FINISH FOR DOOR SECTION.

5. FINISH FOR MISCELLANEOUS COMPONENTS AND ACCESSORIES.

B. PRODUCT DATA: INDICATING MANUFACTURER'S PRODUCT DATA AND INSTALLATION INSTRUCTIONS. INCLUDE BOTH PUBLISHED DATA AND SPECIFIC DATA FOR THIS PROJECT.

C. PROVIDE 4 X 6 INCH PIECE OF BASE METAL WITH SPECIFIED FINISH.

1.07 QUALITY ASSURANCE

A. SINGLE-SOURCE RESPONSIBILITY: PROVIDE DOORS, TRACK, MOTORS AND ACCESSORIES FROM ONE MANUFACTURER. SECONDARY COMPONENTS MAY BE PROVIDED BY A SOURCE ACCEPTABLE TO THE COILING STEEL DOOR MANUFACTURER.

B. INSTALLER: INSTALLATION OF COILING STEEL DOORS SHALL BE PERFORMED BY AN AUTHORIZED REPRESENTATIVE OF THE MANUFACTURER.

1. INSTALLER TO HAVE MINIMUM 5 YEARS DOCUMENTED EXPERIENCE DEMONSTRATING PREVIOUSLY SUCCESSFUL WORK OF THE TYPE SPECIFIED HEREIN.

C. PRE-INSTALLATION CONFERENCE: SCHEDULE AND CONVENE A PRE-INSTALLATION CONFERENCE JUST PRIOR TO COMMENCEMENT OF FIELD OPERATIONS, TO ESTABLISH PROCEDURES TO MAINTAIN OPTIMUM WORKING CONDITIONS AND TO COORDINATE THIS WORK WITH RELATED AND ADJACENT WORK.

D. PROVIDE 12 MONTH MAINTENANCE AND CALL BACK SERVICE FOR SPECIALTY DOORS FURNISHED AND INSTALLED.

1.08 DELIVERY, STORAGE AND HANDLING

A. DELIVER MATERIALS AND PRODUCTS IN ORIGINAL LABELED PROTECTIVE PACKAGES WITH FACTORY SEALS INTACT. PRODUCT MUST BE DRY AND UNDAMAGED IN ORDER TO BE DELIVERED TO SITE. STORE AND HANDLE IN STRICT COMPLIANCE WITH MANUFACTURER'S INSTRUCTIONS AND RECOMMENDATIONS. PROTECT FROM DAMAGE FROM WEATHER, EXCESSIVE TEMPERATURES AND CONSTRUCTION OPERATIONS.

1.09 SEQUENCING AND SCHEDULING

A. COORDINATE THE WORK OF THIS SECTION WITH THE RESPECTIVE TRADES RESPONSIBLE FOR INSTALLING INTERFACING WORK, AND ENSURE THAT THE WORK PERFORMED HEREUNDER IS ACCEPTABLE TO SUCH TRADES FOR THE INSTALLATION OF THEIR WORK.

PART 2 - PRODUCTS

2.01 MANUFACTURER AND TYPE

A. COILING STEEL DOOR AS MANUFACTURED BY,

1. THE COOKSON COMPANY. TYPE FWMI

2. CORNELL IRON WORKS, INC. MODEL ESD20

3. OVERHEAD DOOR CORPORATION. STORMTITE 625 SERIES

4. ARCHITECT APPROVED SUBSTITUTE

2.02 MATERIALS

A. IRON CASTINGS: ASTM A 48.

B. STEEL: ASTM A 446, STRUCTURAL QUALITY, COLD ROLLED STEEL SHEETS, GRADE A.

1. GALVANIZED COATING: ASTM A 525, G90 COATING.

A. MINIMUM 22 GAGE GALVANIZED.

B. PROVIDE FIRE RATINGS AS SCHEDULED ON THE DRAWINGS.

2.03 MANUFACTURED UNITS

A. OVERHEAD COILING DOORS:

1. CURTAIN:

A. MATERIAL: GALVANIZED STEEL.

B. GAGE: AS REQUIRED TO COMPLY WITH UL REQUIREMENTS FOR DOOR CONSTRUCTION FOR FIRE RATING AND SIZE OF DOOR INDICATED.

C. SLAT PROFILE: MANUFACTURER'S STANDARD FLAT FACED.

D. FINISH: MANUFACTURER'S STANDARD POLYESTER TOP COAT.

2. GUIDES:

A. MATERIAL: GALVANIZED STEEL.

B. FINISH: MANUFACTURER'S STANDARD POLYESTER TOP COAT.

3. HOOD:

A. MATERIAL: GALVANIZED STEEL, MINIMUM 24 GAUGE.

B. FINISH: MATCH CURTAIN FINISH.

4. OPERATOR: MANUAL PUSH-UP WITH LIFT HANDLE.

2.04 COMPONENTS

A. MANUAL OPERATORS:

1. MANUAL PUSH OPERATION.

2. OVERHEAD CURTAIN, LIFT-UP OPERATION FORCE: 25 POUNDS MAXIMUM.

3. DESIGN OPERATING MECHANISM TO ALLOW CURTAIN OPERATION TO STOP AND START AT ANY POSITION.

2.05 FABRICATION

A. DOOR CURTAIN:

1. INTERLOCKING SLATS CONTINUOUS FOR ENTIRE DOOR WIDTH; DESIGNED TO RESIST INDICATED WIND LOADS.

B. SHOP/FACTORY FINISHING: POWDER COAT, COLOR SELECTION FROM MANUFACTURER'S STANDARD COLOR SELECTION. DO NOT PAINT/COAT SURFACES REQUIRING LUBRICATION.

PART 3 - EXECUTION

3.01 INSTALLATION - GENERAL

A. INSTALL DOORS IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTION AND STANDARDS.

B. COMMENCING WORK OF THIS SECTION IS ACCEPTANCE OF ALL MATERIALS AND CONDITIONS IN-PLACE AT COMMENCEMENT.

C. INSTALL DOOR COMPLETE WITH ALL SPECIFIED AND NECESSARY HARDWARE, JAMB AND HEAD MOLD STRIPS, ANCHORS, INSERTS, HANGERS, AND EQUIPMENT SUPPORTS IN ACCORDANCE WITH FINAL SHOP DRAWINGS AND MANUFACTURER'S INSTRUCTIONS.

D. FIT AND ALIGN COILING STEEL DOOR TO BE LEVEL AND PLUMB FOR SMOOTH OPERATION.

E. COORDINATE INSTALLATION WITH ADJACENT WORK TO ENSURE PROPER CLEARANCES AND ALLOW OF MAINTENANCE.

F. INSTRUCT OWNER'S PERSONNEL IN PROPER OPERATING PROCEDURES AND MAINTENANCE SCHEDULE.

3.02 ADJUSTING

A. TEST AND ADJUST DOORS TO OPERATE EASILY AND BE WEATHER SEALED WHEN CLOSED.

3.03 CLEANING

A. CLEAN DOOR ASSEMBLY SURFACES, REMOVING DUST, DIRT AND GREASE BEFORE ACCEPTANCE.

END OF SECTION

SECTION 08 36 13

OVERHEAD SECTIONAL DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES:

A. INSULATED SECTIONAL OVERHEAD DOORS, MOTOR OPERATED WITH ACCESSORIES AND COMPONENTS.

1.02 RELATED SECTIONS

A. SECTION 11 13 19 - DOCK LEVELERS

B. SECTION 11 13 20 - TRUCK RESTRAINING DEVICES

C. SECTION 11 13 26 - DOCK LIGHTS

D. SECTION 11 13 16 - DOCK SHELTERS AND SEALS

E. SECTION 16050 - PROCESS ELECTRICAL

F. SECTION 16110 - RACEWAYS NON-PROCESS

G. SECTION 16120 - CONDUCTORS (600 VOLT)

H. SECTION 16130 - BOXES NON-PROCESS

I. SECTION 16190 - HANGERS AND SUPPORTS

J. SECTION 16191 - VIBRATION ISOLATION & SEISMIC RESTRAINTS

K. SECTION 16195 - ELECTRICAL IDENTIFICATION

L. SECTION 16450 - GROUNDING

1.03 REFERENCES

A. COMPLY WITH APPLICABLE REQUIREMENTS OF THE FOLLOWING STANDARDS AND THOSE OTHERS REFERENCED IN THIS SECTION. WHERE THESE STANDARDS CONFLICT WITH OTHER SPECIFIED REQUIREMENTS, THE MOST RESTRICTIVE REQUIREMENTS SHALL GOVERN.

1. 2012 INTERNATIONAL BUILDING CODE

2. 2012 NEC (NATIONAL ELECTRIC CODE).

3. ANSI/DASMA 102 - AMERICAN NATIONAL STANDARDS INSTITUTE (A216.1) SPECIFICATIONS FOR SECTIONAL OVERHEAD DOORS PUBLISHED BY NATIONAL ASSOCIATION OF GARAGE DOOR MANUFACTURES IN BULLETIN 102-88.

4. ASTM A123 - ZINC (HOT-DIPPED GALVANIZED) COATINGS ON IRON AND STEEL PRODUCTS.

5. ASTM A216 - SPECIFICATIONS FOR SECTIONAL OVERHEAD TYPE DOORS.

6. ASTM A229 - STEEL WIRE, OIL-TEMPERED FOR MECHANICAL SPRINGS.

7. ASTM A526 - STEEL SHEET, ZINC COATED (GALVANIZED) BY THE HOT-DIP PROCESS, COMMERCIAL QUALITY.

8. ASTM E-283 - STANDARD METHOD OF TEST FOR RATIO OF AIR LEAKAGE THROUGH EXTERIOR WINDOWS, CURTAIN WALLS AND DOORS.

9. UL (UNDERWRITERS LABORATORY): APPLICABLE REQUIREMENTS FOR MOTORS, SWITCHES AND OTHER ELECTRICAL COMPONENTS.

10. ALL APPLICABLE FEDERAL, STATE AND MUNICIPAL CODES, LAWS AND REGULATIONS FOR DOCK EQUIPMENT REQUIREMENTS.

11. ALL ELECTRICAL EQUIPMENT AND ASSEMBLIES; I.E. CONTROL PANELS, MOTORS, PUSH BUTTON CONTROLS, SENSORS, LIGHTS, ETC. SHALL BE UL LISTED AND LABELED.

1.04 SUBMITTALS

A. SUBMIT 5 COPIES OF THE FOLLOWING SHOP DRAWING FOR APPROVAL PRIOR TO FABRICATION UNDER PROVISIONS OF SECTION 01300, CLEARLY INDICATING:

1. DESIGN AND INSTALLATION DETAILS TO WITHSTAND LOCAL WIND LOADING STANDARDS.

A. DETAILED PLANS, INCLUDING DETAILS OF FRAMING MEMBERS, REQUIRED CLEARANCES, ANCHORS AND ACCESSORIES.

B. ELEVATIONS.

2. ALL DETAILS REQUIRED FOR COMPLETE OPERATION AND INSTALLATION.

3. HARDWARE LOCATION.

4. TYPE AND GAGE OF METAL AND FINISH FOR DOOR SECTION.

5. FINISH FOR MISCELLANEOUS COMPONENTS AND ACCESSORIES.

B. PRODUCT DATA: INDICATING MANUFACTURER'S PRODUCT DATA AND INSTALLATION INSTRUCTIONS. INCLUDE BOTH PUBLISHED DATA AND SPECIFIC DATA FOR THIS PROJECT.

C. PROVIDE 12 X 12 INCH SAMPLE OF PANEL SECTIONS SHOWING CONSTRUCTION AND FINISHES.

D. PROVIDE 6” LENGTH OF EACH TYPE OF SEAL USED.

1.05 QUALITY ASSURANCE

A. SINGLE-SOURCE RESPONSIBILITY: PROVIDE DOORS, TRACK, MOTORS AND ACCESSORIES FROM ONE MANUFACTURER. SECONDARY COMPONENTS MAY BE PROVIDED BY A SOURCE ACCEPTABLE TO THE SECTIONAL OVERHEAD DOOR MANUFACTURER.

B. INSTALLER: INSTALLATION OF SECTIONAL DOORS SHALL BE PERFORMED BY AN AUTHORIZED REPRESENTATIVE OF THE MANUFACTURER.

C. PRE-INSTALLATION CONFERENCE: SCHEDULE AND CONVENE A PRE-INSTALLATION CONFERENCE JUST PRIOR TO COMMENCEMENT OF FIELD OPERATIONS, TO ESTABLISH PROCEDURES TO MAINTAIN OPTIMUM WORKING CONDITIONS AND TOP COORDINATE THIS WORK WITH RELATED AND ADJACENT WORK.

1.06 DELIVERY, STORAGE AND HANDLING

A. DELIVER MATERIALS AND PRODUCTS IN ORIGINAL LABELED PROTECTIVE PACKAGES WITH FACTORY SEALS INTACT. PRODUCT MUST BE DRY AND UNDAMAGED IN ORDER TO BE DELIVERED TO SITE. STORE AND HANDLE IN STRICT COMPLIANCE WITH MANUFACTURER'S INSTRUCTIONS AND RECOMMENDATIONS. PROTECT FROM DAMAGE FROM WEATHER, EXCESSIVE TEMPERATURES AND CONSTRUCTION OPERATIONS.

1.07 WARRANTY

A. PROVIDE 12 MONTH MAINTENANCE AND CALL BACK SERVICE FOR DOORS FURNISHED AND INSTALLED UNDER THIS SECTION.

B. PROVIDE MANUFACTURER'S STANDARD SEVEN-YEAR WARRANTY AGAINST DELAMINATION OF THE POLYURETHANE FOAM FROM THE STEEL SKIN OF THE PANEL UNDER PROVISIONS OF DIVISION 1. STANDARD MANUFACTURER'S TEN-YEAR WARRANTY AGAINST CRACKING, SPLITTING OR DETERIORATION DUE TO RUST. REMAINING COMPONENTS AND OPERATION; 5 YEARS PARTS AND LABOR.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. THE FOLLOWING MANUFACTURER IS THE BASIS OF THE CONTRACT DOCUMENTS.

1. OVERHEAD DOOR CORPORATION.

2. OR ARCHITECT APPROVED EQUAL.

2.02 INSULATED STEEL SECTIONAL DOOR

A. 592 SERIES THERMACORE® INSULATED STEEL DOOR.

B. SECTIONAL DOOR ASSEMBLY: METAL/FOAM/METAL SANDWICH PANEL CONSTRUCTION, WITH EPDM THERMAL BREAK AND SHIP-LAP DESIGN WITH ROUNDED WATER CHANNELS. UNITS TO HAVE THE FOLLOWING CHARACTERISTICS:

1. PANEL THICKNESS: 2-INCHES.

2. EXTERIOR SURFACE: RIBBED, TEXTURED, EMBOSSING, NON-REPEATING RANDOM STUCCO TEXTURE

3. EXTERIOR STEEL; 0.016", HOT-DIPPED G-60 GALVANIZED STEEL.

4. END STILES: 16 GAUGE WITH THERMAL BREAK.

5. SPRINGS:

A. SPRINGS SHALL BE HEAVY-DUTY TORSION TYPE, LOW-STRESS, HELICAL WOUND, OIL-TEMPERED SPRING WIRE TO PROVIDE MINIMUM STANDARD 50,000 CYCLES OF USE, ON CONTINUOUS STEEL SHAFT; TUBULAR STEEL.

B. SPRING FITTINGS AND DRUMS MADE OF DIE CAST, HIGH-STRENGTH ALUMINUM.

C. PRE-FORMED GALVANIZED STEEL AIRCRAFT CABLE SHALL PROVIDE A MINIMUM OF A 5:1 SAFETY FACTOR.

6. INSULATION: CFC-FREE AND HCFC-FREE POLYURETHANE, FULLY ENCAPSULATED.

7. THERMAL VALUES: R-17.50.

8. AIR INFILTRATION: 0.08 CFM AT 15 MPH; 0.13 CFM AT 25 MPH.

9. PASS-DOOR: NOT REQUIRED.

10. HIGH-USAGE PACKAGE: REQUIRED.

11. PARTIAL GLAZING OF STEEL PANELS: INSULATED, DOUBLE STRENGTH GLASS OF SIZE INDICATED ON DRAWINGS.

C. FINISH AND COLOR: FACTORY APPLIED CONSISTING OF A BAKED-ON POLYESTER PRIMER AND BAKED-ON WHITE POLYESTER FINISH COAT AT EXTERIOR AND INTERIOR.

D. WINDLOAD DESIGN: ANSI/NAGDM 102 STANDARDS AND AS REQUIRED BY LOCAL CODES AND ORDINANCES.

E. HARDWARE: HINGE AND ROLLER ASSEMBLY.

1. HINGES AND BRACKETS SHALL BE MADE FROM HOT-DIPPED, GALVANIZED STEEL.

2. BALL BEARING TRACK ROLLERS SHALL BE CAST-HARDENED INNER STEEL RACES, WITH 10-BALL 3” ROLLERS.

3. ALL FACTORY-AUTHORIZED ATTACHMENTS SHALL BE MADE AT LOCATION INDICATED AND REINFORCED WITH BACKUP PLATES.

F. LOCK: INTERIOR MOUNTED SLIDE LOCK.

G. WEATHER-STRIPPING: EPDM RUBBER TUBE SEALS FITTED INSIDE JOINTS BETWEEN SECTIONS. EPDM RUBBER BULB-TYPE STRIP AT BOTTOM. HEAD AND JAMB WEATHER-STRIPPING.

H. TRACK: PROVIDE FULL VERTICAL TRACK AS RECOMMENDED BY MANUFACTURER TO SUIT LOADING REQUIRED.

1. MINIMUM TRACK DESIGN: VERTICAL MOUNTING ANGLES AND BRACKETS SHALL BE ASTM A-526 COMMERCIAL QUALITY STEEL, 16 GAUGE MINIMUM THICKNESS, G-40 HOT-DIPPED GALVANIZED. TRACK SIZE SHALL BE 3”. VERTICAL TRACK SHALL BE GRADUATED TO PROVIDE WEDGE TYPE WEATHERTIGHT CLOSING WITH CONTINUOUS TAPERED ANGLE MOUNTING FOR STEEL JAMB, AND SHALL BE FULLY ADJUSTABLE TO SEAL DOOR AT JAMBS.

PART 3 EXECUTION

3.01 PREPARATION

A. TAKE FIELD DIMENSIONS AND EXAMINE CONDITIONS OF SUBSTRATES, SUPPORTS AND OTHER CONDITIONS UNDER WHICH THIS WORK IS TO BE PERFORMED. DO NOT PROCEED WITH WORK UNTIL UNSATISFACTORY CONDITIONS ARE CORRECTED.

3.02 INSTALLATION

A. GENERAL:

1. INSTALL DOORS IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTION AND STANDARDS.

2. COMMENCING WORK OF THIS SECTION IS ACCEPTANCE OF ALL MATERIALS AND CONDITIONS IN-PLACE AT COMMENCEMENT.

B. INSTALL DOOR COMPLETE WITH ALL SPECIFIED AND NECESSARY HARDWARE, JAMB AND HEAD MOLD STRIPS, ANCHORS, INSERTS, HANGERS, AND EQUIPMENT SUPPORTS IN ACCORDANCE WITH FINAL SHOP DRAWINGS AND MANUFACTURER'S INSTRUCTIONS.

C. FIT AND ALIGN SECTIONAL OVERHEAD DOOR ASSEMBLIES LEVEL AND PLUMB FOR SMOOTH OPERATION.

D. COORDINATE INSTALLATION WITH ADJACENT WORK TO ENSURE PROPER CLEARANCES AND ALLOW OF MAINTENANCE.

E. INSTRUCT OWNER'S PERSONNEL IN PROPER OPERATING PROCEDURES AND MAINTENANCE SCHEDULE.

F. INSTALL DOORS FOLLOWING APPLICABLE UNDERWRITERS LABORATORIES REQUIREMENTS AND IN ACCORDANCE WITH THE ELECTRICAL SPECIFICATIONS.

3.03 ADJUSTING AND CLEANING

B. UPON COMPLETION OF INSTALLATION, TEST SECTIONAL DOORS AND CONTROLS FOR PROPER OPERATION. ADJUST AND LUBRICATE AS NECESSARY TO PROVIDE OPERATION WITHOUT BINDING OR DISTORTION. ENSURE PROPER SEAL AT ENTIRE PERIMETER OF INSTALLATION.

C. TOUCH-UP DAMAGED COATINGS AND FINISHES AND REPAIR MINOR DAMAGE. CLEAN EXPOSED SURFACES USING NON-ABRASIVE MATERIALS AND METHODS RECOMMENDED BY MANUFACTURER OF MATERIAL OR PRODUCT BEING CLEANED.

END OF SECTION

SECTION 08 43 13

ALUMINUM FRAMED STOREFRONTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. ENTRANCE AND STOREFRONT SYSTEMS, COMPLETE WITH REINFORCING, FASTENERS, ANCHORS AND ATTACHMENT DEVICES.

B. ACCESSORIES NECESSARY TO COMPLETE WORK.

1.02 RELATED SECTIONS

B. SECTION 07 92 00 - JOINT SEALANTS.

C. SECTION 08 81 00 - GLASS AND GLAZING.

1.03 REFERENCES

A. THE STANDARDS REFERENCED HEREIN ARE INCLUDED TO ESTABLISH RECOGNIZED QUALITY ONLY. EQUIVALENT QUALITY AND TESTING STANDARDS WILL BE ACCEPTABLE, SUBJECT TO THEIR TIMELY SUBMISSION, REVIEW AND ACCEPTANCE BY THE ARCHITECT.

B. COMPLY WITH APPLICABLE REQUIREMENTS OF THE FOLLOWING STANDARDS AND THOSE OTHERS REFERENCED IN THIS SECTION. WHERE THESE STANDARDS CONFLICT WITH OTHER SPECIFIED REQUIREMENTS, THE MOST RESTRICTIVE REQUIREMENTS SHALL GOVERN.

1. ALUMINUM ASSOCIATION (AA):

A. DAF-45 DESIGNATION SYSTEM FOR ALUMINUM FINISHES.

2. AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA):

A. 503.1 TEST METHOD FOR CONDENSATION RESISTANCE OF WINDOWS, DOORS AND GLAZED WALL SYSTEMS.

B. 608.1 SPECIFICATION AND INSPECTION METHODS FOR ELECTROLYTICALLY DEPOSITED COLOR ANODIC FINISHES FOR ARCHITECTURAL ALUMINUM.

C. MANUAL #10 CARE AND HANDLING OF ARCHITECTURAL ALUMINUM

FROM SHOP TO SITE.

D. SFM_1 ALUMINUM STOREFRONT AND ENTRANCE MANUAL.

3. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM):

A. A36 STRUCTURAL STEEL.

B. B209 ALUMINUM AND ALUMINUM - ALLOY SHEET AND PLATE.

C. B221 ALUMINUM-ALLOY EXTRUDED BARS, RODS, WIRE, SHAPES

AND TUBES.

D. B308 ALUMINUM-ALLOY 6061-T6 STANDARD STRUCTURAL SHAPES, ROLLED OR EXTRUDED.

A. C509 CELLULAR ELASTOMERIC PRE-FORMED GASKET AND

SEALING MATERIAL SEALING MATERIAL.

E. C864 DENSE ELASTOMERIC COMPRESSION SEAL GASKETS, SETTING BLOCKS AND SPACERS.

F. E283 TEST METHOD FOR RATE OF AIR LEAKAGE THROUGH EXTERIOR WINDOWS, CURTAIN WALLS AND DOORS.

G. E330 TEST METHOD FOR STRUCTURAL PERFORMANCE OF EXTERIOR WINDOWS, CURTAIN WALLS AND DOORS BY UNIFORM STATIC AIR PRESSURE DIFFERENCE.

B. E331 TEST METHOD FOR WATER PENETRATION OF EXTERIOR WINDOWS, CURTAIN WALLS AND DOORS BY UNIFORM STATIC AIR PRESSURE DIFFERENCE.

4. FEDERAL SPECIFICATIONS (FS):

A. TT-P-645A PRIMER, PAINT, ZINC CHROMATE, ALKYD TYPE.

5. STEEL STRUCTURES PAINTING COUNCIL (SSPC):

A. PAINT 12 COLD-APPLIED ASPHALT MASTIC (EXTRA THICK FILM).

1.04 SYSTEM REQUIREMENTS

A. DESIGN REQUIREMENTS:

1. DRAWINGS ARE DIAGRAMMATIC AND DO NOT PURPORT TO IDENTIFY NOR SOLVE PROBLEMS OF THERMAL OR STRUCTURAL MOVEMENT, GLAZING, ANCHORAGE OR MOISTURE DISPOSAL.

2. REQUIREMENTS SHOWN BY DETAILS ARE INTENDED TO ESTABLISH BASIC DIMENSION OF UNITS, SIGHT LINES AND PROFILES OF MEMBERS.

3. PROVIDE CONCEALED FASTENING.

4. PROVIDE ENTRANCE AND STOREFRONT SYSTEMS, INCLUDING NECESSARY MODIFICATIONS, TO MEET SPECIFIED REQUIREMENTS AND MAINTAINING VISUAL DESIGN CONCEPTS.

5. ATTACHMENT CONSIDERATIONS ARE TO TAKE INTO ACCOUNT SITE PECULIARITIES AND EXPANSION AND CONTRACTION MOVEMENTS SO THERE IS NO POSSIBILITY OF LOOSENING, WEAKENING OR FRACTURING CONNECTION BETWEEN UNITS AND BUILDING STRUCTURE OR BETWEEN UNITS THEMSELVES.

6. ANCHORS, FASTENERS AND BRACES SHALL BE STRUCTURALLY STRESSED NOT MORE THAN 50% OF ALLOWABLE STRESS WHEN MAXIMUM LOADS ARE APPLIED.

7. PROVIDE FOR EXPANSION AND CONTRACTION WITHOUT DETRIMENT TO APPEARANCE OR PERFORMANCE.

8. ASSEMBLIES SHALL BE FREE FROM RATTLES, WIND WHISTLES AND NOISE DUE TO THERMAL AND STRUCTURAL MOVEMENT AND WIND PRESSURE.

9. NOT PERMITTED: VIBRATION HARMONICS, WIND WHISTLES, NOISES CAUSED BY

THERMAL MOVEMENT, THERMAL MOVEMENT TRANSMITTED TO OTHER BUILDING ELEMENTS, LOOSENING, WEAKENING, OR FRACTURING OF ATTACHMENTS OR COMPONENTS OF SYSTEM.

B. PERFORMANCE REQUIREMENTS:

1. AIR INFILTRATION: AIR LEAKAGE THROUGH FIXED LIGHT AREAS OF STOREFRONT SHALL NOT EXCEED 0.06 CFM PER SQUARE FOOT (0.0003 M3/SM2) OF SURFACE AREA WHEN TESTED IN ACCORDANCE WITH ASTM E283 AT DIFFERENTIAL STATIC PRESSURE OF 6.24 PSF (300 PA).

2. WATER INFILTRATION: NO UNCONTROLLED WATER PENETRATION WHEN TESTED IN ACCORDANCE WITH ASTM E331 AT TEST PRESSURE OF 10.0 PSF (480 PA).

C. THERMAL REQUIREMENTS:

1. FRAMING SYSTEMS SHALL ACCOMMODATE EXPANSION AND CONTRACTION MOVEMENT DUE TO SURFACE TEMPERATURE DIFFERENTIALS OF 180 DEGREES FAHRENHEIT (82 DEGREES CELSIUS) WITHOUT CAUSING BUCKLING, STRESS ON GLASS, FAILURE OF JOINT SEALS, EXCESSIVE STRESS ON STRUCTURAL ELEMENTS, REDUCTION OF PERFORMANCE, OR OTHER DETRIMENTAL EFFECTS.

2. U-VALUE: 0.30 MAXIMUM FOR ASSEMBLY

3. SOLAR HEAT GAIN COEFFICIENT: 0.35 MAXIMUM FOR ASSEMBLY

D. STRUCTURAL REQUIREMENTS, AS MEASURED IN ACCORDANCE WITH ANSI/ASTM E330:

1. WIND LOADS FOR EXTERIOR ASSEMBLIES:

A. BASIC LOADING:

1) 38 PSF (1,200 PA) ACTING INWARD.

2) 48 PSF (1,580 PA) ACTING OUTWARD.

2. DEFLECTION: MAXIMUM CALCULATED DEFLECTION OF ANY FRAMING MEMBER IN DIRECTION NORMAL TO PLANE OF WALL WHEN SUBJECTED TO SPECIFIED DESIGN PRESSURES SHALL NOT EXCEED 1/175 OF ITS CLEAR SPAN.

3. STOREFRONT FRAMING MEMBERS ARE TO BE REINFORCED, AS REQUIRED, TO MEET REQUIRED WIND LOADINGS.

E. TESTING REQUIREMENTS: PROVIDE COMPONENTS THAT HAVE BEEN PREVIOUSLY TESTED BY AN INDEPENDENT TESTING LABORATORY.

1.05 SUBMITTALS

A. GENERAL: SUBMIT IN ACCORDANCE WITH SECTION 01300.

B. PRODUCT DATA:

1. SUBMIT MANUFACTURER'S DESCRIPTIVE LITERATURE AND PRODUCT SPECIFICATIONS.

2. INCLUDE INFORMATION FOR FACTORY FINISHES, HARDWARE, ACCESSORIES AND OTHER REQUIRED COMPONENTS.

3. INCLUDE COLOR SAMPLES OF CLEAR ANODIZED ALUMINUM FOR FINISH INDICATING

MANUFACTURER'S STANDARD COLORS AVAILABLE FOR SELECTION.

C. SHOP DRAWINGS:

1. SUBMIT SHOP DRAWINGS COVERING FABRICATION, INSTALLATION AND FINISH OF SPECIFIED SYSTEMS.

2. INCLUDE FOLLOWING:

A. FULLY DIMENSIONED PLANS AND ELEVATIONS WITH DETAIL COORDINATION KEYS.

B. LOCATIONS OF EXPOSED FASTENERS AND JOINTS.

3. PROVIDE DETAILED DRAWINGS OF:

A. COMPOSITE MEMBERS.

B. JOINT CONNECTIONS FOR FRAMING SYSTEMS.

C. ANCHORAGE.

D. SYSTEM REINFORCEMENTS.

E. EXPANSION AND CONTRACTION PROVISIONS.

F. HARDWARE, INCLUDING LOCATIONS, MOUNTING HEIGHTS, REINFORCEMENTS AND SPECIAL INSTALLATION PROVISIONS.

G. GLAZING METHODS AND ACCESSORIES.

H. INTERNAL SEALANT REQUIREMENTS AS RECOMMENDED BY SEALANT MANUFACTURER.

4. SCHEDULE OF FINISHES.

D. SAMPLES:

1. SUBMIT SAMPLES INDICATING QUALITY OF FINISH, IN REQUIRED COLORS, ON ALLOYS USED FOR WORK, IN SIZES AS STANDARD WITH MANUFACTURER.

F. CERTIFICATES:

1. SUBMIT MANUFACTURER'S CERTIFICATION STATING THAT SYSTEMS ARE IN COMPLIANCE WITH SPECIFIED REQUIREMENTS.

G. QUALIFICATION DATA:

1. SUBMIT INSTALLER QUALIFICATIONS VERIFYING FIVE (5) YEARS OF EXPERIENCE.

2. INCLUDE LIST OF PROJECTS HAVING SIMILAR SCOPE OF WORK IDENTIFIED BY NAME, LOCATION, DATE, REFERENCE NAME AND PHONE NUMBER.

1.06 QUALITY ASSURANCE

A. SINGLE SOURCE RESPONSIBILITY:

1. TO ENSURE QUALITY OF APPEARANCE AND PERFORMANCE, OBTAIN MATERIALS FOR

EACH SYSTEM FROM EITHER A SINGLE MANUFACTURER OR FROM MANUFACTURER APPROVED BY EACH SYSTEM MANUFACTURER.

B. INSTALLER QUALIFICATIONS: CERTIFIED IN WRITING BY CONTRACTOR AS QUALIFIED FOR INSTALLATION OF SPECIFIED SYSTEMS.

C. PERFORM WORK IN ACCORDANCE WITH AAMA SFM_1 AND MANUFACTURER'S WRITTEN INSTRUCTIONS.

1.07 DELIVERY, STORAGE AND HANDLING

A. COMPLY WITH REQUIREMENTS OF SECTION 01600.

B. PROTECT FINISHED SURFACES AS NECESSARY TO PREVENT DAMAGE.

C. DO NOT USE ADHESIVE PAPERS OR SPRAYED COATINGS WHICH BECOME FIRMLY BONDED WHEN EXPOSED TO SUN.

D. DO NOT LEAVE COATING RESIDUE ON ANY SURFACES.

E. REPLACE DAMAGED UNITS.

1.08 WARRANTY

A. PROVIDE WARRANTIES IN ACCORDANCE WITH SECTION 01780.

B. PROVIDE WRITTEN MANUFACTURER'S WARRANTY, EXECUTED BY COMPANY OFFICIAL, WARRANTING AGAINST DEFECTS IN MATERIALS AND PRODUCTS FOR 2 YEARS FROM DATE OF SUBSTANTIAL COMPLETION.

C. PROVIDE WRITTEN INSTALLER'S WARRANTY, WARRANTING WORK TO BE WATERTIGHT, FREE FROM DEFECTIVE MATERIALS, DEFECTIVE WORKMANSHIP, GLASS BREAKAGE DUE TO DEFECTIVE DESIGN, AND AGREEING TO REPLACE COMPONENTS WHICH FAIL WITHIN 2 YEARS FROM DATE OF SUBSTANTIAL COMPLETION.

1. WARRANTY SHALL COVER FOLLOWING:

A. COMPLETE WATERTIGHT AND AIRTIGHT SYSTEM INSTALLATION WITHIN SPECIFIED TOLERANCES.

B. COMPLETED INSTALLATION WILL REMAIN FREE FROM RATTLES, WIND WHISTLES AND NOISE DUE TO THERMAL AND STRUCTURAL MOVEMENT AND WIND PRESSURE.

C. SYSTEM IS STRUCTURALLY SOUND AND FREE FROM DISTORTION.

D. GLASS AND GLAZING GASKETS WILL NOT BREAK OR "POP" FROM FRAMES DUE TO DESIGN WIND, EXPANSION OR CONTRACTION MOVEMENT.

E. GLAZING SEALANTS AND GASKETS WILL REMAIN FREE FROM ABNORMAL DETERIORATION OR DISLOCATION DUE TO SUNLIGHT, WEATHER OR OXIDATION.

D. PROVIDE A WRITTEN THERMAL INTEGRITY WARRANTY FOR 10 YEARS FROM DATE OF SUBSTANTIAL COMPLETION AGAINST THERMAL BARRIER SYSTEM FAILURE RESULTING FROM THE FOLLOWING:

1. LONGITUDINAL AND TRANSVERSE THERMAL BARRIER SHRINKAGE.

2. THERMAL BARRIER CRACKING.

3. STRUCTURAL FAILURE OF THE THERMAL BARRIER MATERIAL.

4. LOSS OF ADHESION OR LOSS OF PRESCRIBED EDGE PRESSURE ON GLAZING MATERIAL RESULTING IN EXCESSIVE AIR AND WATER INFILTRATION.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

5. BASIS-OF-DESIGN PRODUCT: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, ALLOWABLE MANUFACTURERS INCLUDE:

6. EFCO CORPORATION.

7. KAWNEER COMPANY, INC.

8. YKK AP.

9. TUBELITE.

10. ARCHITECT APPROVED EQUAL

2.02 MATERIALS

A. ALUMINUM: ALLOY AND TEMPER RECOMMENDED BY MANUFACTURER FOR TYPE OF USE AND FINISH INDICATED.

1. SHEET AND PLATE: ASTM B 209.

2. EXTRUDED BARS, RODS, PROFILES, AND TUBES: ASTM B 221.

3. EXTRUDED STRUCTURAL PIPE AND TUBES: ASTM B 429.

4. STRUCTURAL PROFILES: ASTM B 308/B 308M.

B. STEEL REINFORCEMENT: MANUFACTURER'S STANDARD ZINC-RICH, CORROSION-RESISTANT PRIMER COMPLYING WITH SSPC-PS GUIDE NO. 12.00; APPLIED IMMEDIATELY AFTER SURFACE PREPARATION AND PRETREATMENT. SELECT SURFACE PREPARATION METHODS ACCORDING TO RECOMMENDATIONS IN SSPC-SP COM AND PREPARE SURFACES ACCORDING TO APPLICABLE SSPC STANDARD.

1. STRUCTURAL SHAPES, PLATES, AND BARS: ASTM A 36/A 36M.

2. COLD-ROLLED SHEET AND STRIP: ASTM A 1008/A 1008M.

3. HOT-ROLLED SHEET AND STRIP: ASTM A 1011/A 1011M.

2.03 FRAMING

A. FRAMING MEMBERS: MANUFACTURER'S STANDARD EXTRUDED- OR FORMED-ALUMINUM FRAMING MEMBERS OF THICKNESS REQUIRED AND REINFORCED AS REQUIRED TO SUPPORT IMPOSED LOADS.

SECTION 08 43 13

ALUMINUM FRAMED STOREFRONTS

1. CONSTRUCTION: THERMALLY BROKEN.

2. GLAZING PLANE: FRONT.

B. BRACKETS AND REINFORCEMENTS: MANUFACTURER'S STANDARD HIGH-STRENGTH ALUMINUM WITH NONSTAINING, NONFERROUS SHIMS FOR ALIGNING SYSTEM COMPONENTS.

C. FASTENERS AND ACCESSORIES: MANUFACTURER'S STANDARD CORROSION-RESISTANT, NONSTAINING, NONBLEEDING FASTENERS AND ACCESSORIES COMPATIBLE WITH ADJACENT MATERIALS.

1. USE SELF-LOCKING DEVICES WHERE FASTENERS ARE SUBJECT TO LOOSENING OR TURNING OUT FROM THERMAL AND STRUCTURAL MOVEMENTS, WIND LOADS, OR VIBRATION.

2. REINFORCE MEMBERS AS REQUIRED TO RECEIVE FASTENER THREADS.

3. USE EXPOSED FASTENERS WITH COUNTERSUNK PHILLIPS SCREW HEADS, FINISHED TO MATCH FRAMING SYSTEM.

D. ANCHORS: THREE-WAY ADJUSTABLE ANCHORS WITH MINIMUM ADJUSTMENT OF 1 INCH THAT ACCOMMODATE FABRICATION AND INSTALLATION TOLERANCES IN MATERIAL AND FINISH COMPATIBLE WITH ADJOINING MATERIALS AND RECOMMENDED BY MANUFACTURER.

E. CONCEALED FLASHING: MANUFACTURER'S STANDARD CORROSION-RESISTANT, NONSTAINING, NONBLEEDING FLASHING COMPATIBLE WITH ADJACENT MATERIALS.

F. FRAMING SEALANTS: MANUFACTURER'S STANDARD SEALANTS.

2.04 GLAZING

A. GLAZING: COMPLY WITH DIVISION 08 SECTION "GLAZING."

B. GLAZING GASKETS: MANUFACTURER'S STANDARD SEALED-CORNER PRESSURE-GLAZING SYSTEM OF BLACK, RESILIENT ELASTOMERIC GLAZING GASKETS, SETTING BLOCKS, AND SHIMS OR SPACERS.

C. GLAZING SEALANTS: AS RECOMMENDED BY MANUFACTURER.

4. PROVIDE SEALANTS FOR USE INSIDE OF THE WEATHERPROOFING SYSTEM THAT HAVE A VOC CONTENT OF 250 G/L OR LESS WHEN CALCULATED ACCORDING TO 40 CFR 59, SUBPART D (EPA METHOD 24).

2.05 ENTRANCE DOOR SYSTEMS

A. ENTRANCE DOORS: MANUFACTURER'S STANDARD GLAZED ENTRANCE DOORS FOR MANUAL-SWING OPERATION.

1. DOOR CONSTRUCTION: 1-3/4-INCH OVERALL THICKNESS, WITH MINIMUM 0.125-INCH-THICK, EXTRUDED-ALUMINUM TUBULAR RAIL AND STILE MEMBERS. MECHANICALLY FASTEN CORNERS WITH REINFORCING BRACKETS THAT ARE DEEPLY PENETRATED AND FILLET WELDED OR THAT INCORPORATE CONCEALED TIE RODS.

2. DOOR DESIGN: MEDIUM STILE; 3-1/2-INCH NOMINAL WIDTH.

C. ACCESSIBLE DOORS: SMOOTH SURFACED FOR WIDTH OF DOOR IN AREA WITHIN 10 INCHES ABOVE FLOOR OR GROUND PLANE.

3. GLAZING STOPS AND GASKETS: BEVELED, SNAP-ON, EXTRUDED-ALUMINUM STOPS AND PREFORMED GASKETS.

A. PROVIDE NONREMOVABLE GLAZING STOPS ON OUTSIDE OF DOOR.

2.06 ENTRANCE DOOR HARDWARE

A. RETAIN THIS ARTICLE IF ENTRANCE DOOR HARDWARE IS SPECIFIED IN THIS SECTION. BEFORE SELECTING HARDWARE, VERIFY ACCESSIBLE ENTRANCE, MEANS-OF-EGRESS DOORWAY, AND OTHER REQUIREMENTS OF AUTHORITIES HAVING JURISDICTION.

B. GENERAL: PROVIDE ENTRANCE DOOR HARDWARE AND ENTRANCE DOOR HARDWARE SETS INDICATED IN "ENTRANCE DOOR HARDWARE SETS" ARTICLE FOR EACH ENTRANCE DOOR TO COMPLY WITH REQUIREMENTS IN THIS SECTION.

4. ENTRANCE DOOR HARDWARE SETS: PROVIDE QUANTITY, ITEM, SIZE, FINISH OR COLOR INDICATED, AND PRODUCTS EQUIVALENT IN FUNCTION AND COMPARABLE IN QUALITY TO NAMED PRODUCTS.

5. OPENING-FORCE REQUIREMENTS:

B. EGRESS DOORS: NOT MORE THAN 15 LBF TO RELEASE THE LATCH AND NOT MORE THAN 30 LBF TO SET THE DOOR IN MOTION AND NOT MORE THAN 15 LBF TO OPEN THE DOOR TO ITS MINIMUM REQUIRED WIDTH.

C. ACCESSIBLE INTERIOR DOORS: NOT MORE THAN 5 LBF TO FULLY OPEN DOOR.

C. OPENING-FORCE REQUIREMENTS:

1. LATCHES AND EXIT DEVICES: NOT MORE THAN 15 LBF REQUIRED TO RELEASE LATCH.

D. PIVOT HINGES: BHMA A156.4, GRADE 1.

2. OFFSET-PIVOT HINGES: PROVIDE TOP, BOTTOM, AND INTERMEDIATE OFFSET PIVOTS AT EACH DOOR LEAF.

E. PANIC EXIT DEVICES: BHMA A156.3, GRADE 1, LISTED AND LABELED BY A TESTING AND INSPECTING AGENCY ACCEPTABLE TO AUTHORITIES HAVING JURISDICTION, FOR PANIC PROTECTION, BASED ON TESTING ACCORDING TO UL 305.

F. OPERATING TRIM: BHMA A156.6.

G. CLOSERS: BHMA A156.4, GRADE 1, WITH ACCESSORIES REQUIRED FOR A COMPLETE INSTALLATION, SIZED AS REQUIRED BY DOOR SIZE, EXPOSURE TO WEATHER, AND ANTICIPATED FREQUENCY OF USE; ADJUSTABLE TO MEET FIELD CONDITIONS AND REQUIREMENTS FOR OPENING FORCE.

H. WEATHER STRIPPING: MANUFACTURER'S STANDARD REPLACEABLE COMPONENTS.

1. COMPRESSION TYPE: MADE OF ASTM D 2000, MOLDED NEOPRENE, OR ASTM D 2287, MOLDED PVC.

2. SLIDING TYPE: AAMA 701, MADE OF WOOL, POLYPROPYLENE, OR NYLON WOVEN PILE WITH NYLON-FABRIC OR ALUMINUM-STRIP BACKING.

I. WEATHER SWEEPS: MANUFACTURER'S STANDARD EXTERIOR-DOOR BOTTOM SWEEP

WITH CONCEALED FASTENERS ON MOUNTING STRIP.

J. THRESHOLDS: BHMA A156.21, RAISED THRESHOLDS BEVELED WITH A SLOPE OF NOT MORE THAN 1:2, WITH MAXIMUM HEIGHT OF 1/2 INCH.

2.07 ACCESSORY MATERIALS

A. BITUMINOUS PAINT: COLD-APPLIED ASPHALT-MASTIC PAINT COMPLYING WITH SSPC-PAINT 12 REQUIREMENTS EXCEPT CONTAINING NO ASBESTOS, FORMULATED FOR 30-MIL THICKNESS PER COAT.

2.08 FABRICATION

A. FORM OR EXTRUDE ALUMINUM SHAPES BEFORE FINISHING.

B. FABRICATE COMPONENTS THAT, WHEN ASSEMBLED, HAVE THE FOLLOWING CHARACTERISTICS:

1. PROFILES THAT ARE SHARP, STRAIGHT, AND FREE OF DEFECTS OR DEFORMATIONS.

2. ACCURATELY FITTED JOINTS WITH ENDS COPED OR MITERED.

3. PHYSICAL AND THERMAL ISOLATION OF GLAZING FROM FRAMING MEMBERS.

4. ACCOMMODATIONS FOR THERMAL AND MECHANICAL MOVEMENTS OF GLAZING AND FRAMING TO MAINTAIN REQUIRED GLAZING EDGE CLEARANCES.

5. PROVISIONS FOR FIELD REPLACEMENT OF GLAZING FROM EXTERIOR.

6. FASTENERS, ANCHORS, AND CONNECTION DEVICES THAT ARE CONCEALED FROM VIEW TO GREATEST EXTENT POSSIBLE.

C. FABRICATE COMPONENTS THAT, WHEN ASSEMBLED, HAVE THE FOLLOWING CHARACTERISTICS:

7. INTERNAL GUTTERING SYSTEM OR OTHER MEANS TO DRAIN WATER PASSING JOINTS, CONDENSATION OCCURRING WITHIN FRAMING MEMBERS, AND MOISTURE MIGRATING WITHIN GLAZED ALUMINUM CURTAIN WALL TO EXTERIOR.

D. ENTRANCE DOOR FRAMES: REINFORCE AS REQUIRED TO SUPPORT LOADS IMPOSED BY DOOR OPERATION AND FOR INSTALLING ENTRANCE DOOR HARDWARE.

1. AT EXTERIOR DOORS, PROVIDE COMPRESSION WEATHER STRIPPING AT FIXED STOPS.

E. ENTRANCE DOORS: REINFORCE DOORS AS REQUIRED FOR INSTALLING ENTRANCE DOOR HARDWARE.

1. AT EXTERIOR DOORS, PROVIDE WEATHER SWEEPS APPLIED TO DOOR BOTTOMS.

F. ENTRANCE DOOR HARDWARE INSTALLATION: FACTORY INSTALL ENTRANCE DOOR HARDWARE TO THE GREATEST EXTENT POSSIBLE. CUT, DRILL, AND TAP FOR FACTORY-INSTALLED ENTRANCE DOOR HARDWARE BEFORE APPLYING FINISHES.

2.08 ALUMINUM FINISHES

A. ANODIZED FINISH: CLASS I, 0.018 MM OR THICKER.

1. EXTERIOR AND INTERIOR SURFACES

2. COLOR AS CHOSEN BY ARCHITECT.

PART 3 - EXECUTION

3.01 EXAMINATION

A. EXAMINE CONDITIONS AND PROCEED WITH WORK IN ACCORDANCE WITH SECTION 01 40 00.

B. VERIFY DIMENSIONS, TOLERANCES AND METHOD OF ATTACHMENT WITH OTHER WORK.

3.02 INSTALLATION

A. ERECTION TOLERANCES:

1. LIMIT VARIATIONS FROM PLUMB AND LEVEL:

A. 1/8 INCH (3 MM) IN 10 FEET (3 M) VERTICALLY.

B. 1/8 INCH (3 MM) IN 20 FEET (6 M) HORIZONTALLY.

2. LIMIT VARIATIONS FROM THEORETICAL LOCATIONS: 1/4 INCH (6 MM) FOR ANY MEMBER AT ANY LOCATION.

3. LIMIT OFFSETS IN THEORETICAL END-TO-END AND EDGE-TO-EDGE ALIGNMENT: 1/16 INCH (2 MM) FROM FLUSH SURFACES NOT MORE THAN 2 INCHES (51 MM) APART OR OUT-OF-FLUSH BY MORE THAN 1/4 INCH (6 MM).

B. SET UNITS PLUMB, LEVEL AND TRUE TO LINE, WITHOUT WARP OR RACK OF FRAME.

C. ANCHOR SECURELY IN PLACE, ALLOWING FOR REQUIRED MOVEMENT, INCLUDING EXPANSION AND CONTRACTION.

D. SEPARATE DISSIMILAR MATERIALS AT CONTACT POINTS, INCLUDING METAL IN CONTACT WITH MASONRY OR CONCRETE SURFACES, WITH BITUMINOUS PAINT OR PRE-FORMED SEPARATORS TO PREVENT CONTACT AND CORROSION.

E. SEAL PERIMETER MEMBERS AS SHOWN ON MANUFACTURER'S INSTALLATION INSTRUCTIONS OR AS REQUIRED FOR UNIQUE JOB CONDITIONS. SET OTHER MEMBERS WITH INTERNAL SEALANTS AND BAFFLES AS CALLED FOR IN MANUFACTURER'S INSTALLATION INSTRUCTIONS. USE SEALANTS AS RECOMMENDED BY SEALANT MANUFACTURER.

F. COORDINATE INSTALLATION OF PERIMETER SEALANT AND BACKING MATERIALS BETWEEN ASSEMBLIES AND ADJACENT CONSTRUCTION IN ACCORDANCE WITH REQUIREMENTS OF SECTION 07 92 00.

G. GLAZING: REFER TO REQUIREMENTS OF SECTION 08 81 00. UTILIZE "ANTI-WALK" EDGE BLOCKING ON ALL VERTICAL EDGES OF GLAZING.

3.03 CLEANING

A. CLEAN SURFACES IN COMPLIANCE WITH MANUFACTURER'S RECOMMENDATIONS;

REMOVE EXCESS MASTIC, MASTIC SMEARS, FOREIGN MATERIALS AND OTHER UNSIGHTLY MARKS.

B. CLEAN METAL SURFACES EXERCISING CARE TO AVOID DAMAGE.

END OF SECTION

SECTION 08 71 00

DOOR HARDWARE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. CONSTRUCTION DRAWINGS, SPECIFICATIONS AND PROVISIONS OF THE CONTRACT INCLUDING GENERAL AND SUPPLEMENTAL CONDITIONS AND OTHER DIVISION 1 SPECIFICATION SECTIONS, ARE HEREBY MADE A PART OF THIS SECTION AS FULLY AND COMPLETELY AS IF REPEATED HEREIN.

1.02 ITEMS REQUIRED BUT NOT SPECIFIED

A. IF AN ITEM OR MATERIAL OF THIS TRADE IS INDICATED ON THE DRAWINGS BUT NOT SPECIFICALLY LISTED IN THIS SECTION, PROVIDE SUCH ITEM OR MATERIAL AT A STANDARD OF QUALITY EQUAL TO THE STANDARD ESTABLISHED FOR THE BALANCE OF THE WORK SPECIFIED, IN ACCORDANCE WITH THE ARCHITECT'S INTERPRETATION.

1.03 EXECUTION, CORRELATION AND INTENT

A. IN CASE OF AN INCONSISTENCY BETWEEN DRAWINGS AND SPECIFICATIONS, OR WITHIN EITHER DOCUMENT NOT CLARIFIED BY ADDENDUM, THE BETTER QUALITY OR GREATER QUANTITY OF WORK IS TO BE PROVIDED, IN ACCORDANCE WITH THE ARCHITECT'S INTERPRETATION.

1.04 SUMMARY

A. THIS SECTION INCLUDES THE FOLLOWING:

1. COMMERCIAL DOOR HARDWARE FOR THE FOLLOWING:

A. SWINGING DOORS.

B. OTHER DOORS TO THE EXTENT INDICATED.

2. CYLINDERS AND CORES FOR DOORS SPECIFIED IN OTHER SECTIONS.

B. RELATED SECTIONS INCLUDE THE FOLLOWING:

1. DIVISION 8 SECTION "STEEL DOORS AND FRAMES" FOR ASTRAGALS PROVIDED AS PART OF A FIRE-RATED LABELED ASSEMBLY AND FOR DOOR SILENCERS PROVIDED AS PART OF THE FRAME.

1.05 SUBMITTALS

A. PRODUCT DATA: INCLUDE INSTALLATION DETAILS, MATERIAL DESCRIPTIONS, DIMENSIONS OF INDIVIDUAL COMPONENTS AND PROFILES, AND FINISHES.

C. SAMPLES: FOR EXPOSED DOOR HARDWARE OF EACH TYPE INDICATED BELOW, IN SPECIFIED FINISH, FULL SIZE. TAG WITH FULL DESCRIPTION FOR COORDINATION WITH THE DOOR HARDWARE SCHEDULE. SUBMIT SAMPLES BEFORE, OR CONCURRENT WITH, SUBMISSION OF THE FINAL DOOR HARDWARE SCHEDULE.

1. DOOR HARDWARE: AS FOLLOWS:

A. HINGES.

B. LOCKS AND LATCHES.

C. BOLTS.

D. EXIT DEVICES.

E. CYLINDERS AND KEYS.

F. OPERATING TRIM.

G. CLOSERS.

H. STOPS AND HOLDERS.

I. PROTECTIVE TRIM.

J. DOOR GASKETING.*

K. THRESHOLDS.*

*AS REQUESTED BY ARCHITECT.

2. SAMPLES WILL BE RETURNED TO CONTRACTOR. UNITS THAT ARE ACCEPTABLE AND REMAIN UNDAMAGED THROUGH SUBMITTAL, REVIEW, AND FIELD COMPARISON PROCESS MAY, AFTER FINAL CHECK OF OPERATION, BE INCORPORATED INTO THE WORK, WITHIN LIMITATIONS OF KEYING REQUIREMENTS.

D. DOOR HARDWARE SCHEDULE: PREPARED BY OR UNDER THE SUPERVISION OF SUPPLIER, DETAILING FABRICATION AND ASSEMBLY OF DOOR HARDWARE, AS WELL AS PROCEDURES AND DIAGRAMS. COORDINATE THE FINAL DOOR HARDWARE SCHEDULE WITH DOORS, FRAMES, AND RELATED WORK TO ENSURE PROPER SIZE, THICKNESS, HAND, FUNCTION, AND FINISH OF DOOR HARDWARE.

1. FORMAT: COMPLY WITH SCHEDULING SEQUENCE AND VERTICAL FORMAT IN DHI'S "SEQUENCE AND FORMAT FOR THE HARDWARE SCHEDULE."

2. ORGANIZATION: ORGANIZE THE DOOR HARDWARE SCHEDULE INTO DOOR HARDWARE SETS INDICATING COMPLETE DESIGNATIONS OF EVERY ITEM REQUIRED FOR EACH DOOR OR OPENING.

A. ORGANIZE DOOR HARDWARE SETS IN SAME ORDER AS IN THE DOOR SCHEDULE DRAWING SHEET.

3. CONTENT: INCLUDE THE FOLLOWING INFORMATION:

A. TYPE, STYLE, FUNCTION, SIZE, LABEL, HAND, AND FINISH OF EACH DOOR HARDWARE ITEM.

B. MANUFACTURER OF EACH ITEM.

C. FASTENINGS AND OTHER PERTINENT INFORMATION.

D. LOCATION OF EACH DOOR HARDWARE SET, CROSS-REFERENCED TO DRAWINGS, BOTH ON FLOOR PLANS AND IN DOOR AND FRAME SCHEDULE.

E. EXPLANATION OF ABBREVIATIONS, SYMBOLS, AND CODES CONTAINED IN SCHEDULE.

F. MOUNTING LOCATIONS FOR DOOR HARDWARE.

G. DOOR AND FRAME SIZES AND MATERIALS.

H. DESCRIPTION OF EACH ELECTRIFIED DOOR HARDWARE FUNCTION, INCLUDING LOCATION, SEQUENCE OF OPERATION, AND INTERFACE WITH OTHER BUILDING CONTROL SYSTEMS.

1) SEQUENCE OF OPERATION: INCLUDE DESCRIPTION OF COMPONENT FUNCTIONS THAT OCCUR IN THE FOLLOWING SITUATIONS: AUTHORIZED PERSON WANTS TO ENTER; AUTHORIZED PERSON WANTS TO EXIT; UNAUTHORIZED PERSON WANTS TO ENTER; UNAUTHORIZED PERSON WANTS TO EXIT.

4. SUBMITTAL SEQUENCE: SUBMIT THE FINAL DOOR HARDWARE SCHEDULE AT EARLIEST POSSIBLE DATE, PARTICULARLY WHERE APPROVAL OF THE DOOR HARDWARE SCHEDULE MUST PRECEDE FABRICATION OF OTHER WORK THAT IS CRITICAL IN THE PROJECT CONSTRUCTION SCHEDULE. INCLUDE PRODUCT DATA, SAMPLES, SHOP DRAWINGS OF OTHER WORK AFFECTED BY DOOR HARDWARE, AND OTHER INFORMATION ESSENTIAL TO THE COORDINATED REVIEW OF THE DOOR HARDWARE SCHEDULE.

I. KEYING SCHEDULE: PREPARED BY OR UNDER THE SUPERVISION OF SUPPLIER, DETAILING OWNER'S FINAL KEYING INSTRUCTIONS FOR LOCKS. INCLUDE SCHEMATIC KEYING DIAGRAM AND INDEX EACH KEY SET TO UNIQUE DOOR DESIGNATIONS.

J. PRODUCT CERTIFICATES: SIGNED BY MANUFACTURERS OF ELECTRIFIED DOOR HARDWARE CERTIFYING THAT PRODUCTS FURNISHED COMPLY WITH REQUIREMENTS.

1. CERTIFY THAT DOOR HARDWARE APPROVED FOR USE ON TYPES AND SIZES OF LABELED FIRE DOORS COMPLIES WITH LISTED FIRE DOOR ASSEMBLIES.

G. QUALIFICATION DATA: FOR FIRMS AND PERSONS SPECIFIED IN "QUALITY ASSURANCE" ARTICLE.

1. INCLUDE LISTS OF COMPLETED PROJECTS WITH PROJECT NAMES AND ADDRESSES OF ARCHITECTS AND OWNERS, AND OTHER INFORMATION SPECIFIED.

H. PRODUCT TEST REPORTS: BASED ON EVALUATION OF COMPREHENSIVE TESTS PERFORMED BY MANUFACTURER AND WITNESSED BY A QUALIFIED TESTING AGENCY, INDICATING CURRENT PRODUCTS COMPLY WITH REQUIREMENTS.

I. MAINTENANCE DATA: FOR EACH TYPE OF DOOR HARDWARE TO INCLUDE IN MAINTENANCE MANUALS SPECIFIED IN DIVISION 1.

J. WARRANTIES: SPECIAL WARRANTIES SPECIFIED IN THIS SECTION.

1.06 QUALITY ASSURANCE

A. INSTALLER QUALIFICATIONS: AN EXPERIENCED INSTALLER WHO HAS COMPLETED DOOR HARDWARE SIMILAR IN MATERIAL, DESIGN, AND EXTENT TO THAT INDICATED FOR THIS PROJECT AND WHOSE WORK HAS RESULTED IN CONSTRUCTION WITH A RECORD OF SUCCESSFUL IN-SERVICE PERFORMANCE.

B. SUPPLIER QUALIFICATIONS: DOOR HARDWARE SUPPLIER WITH WAREHOUSING FACILITIES IN PROJECT'S VICINITY AND WHO IS OR EMPLOYS A QUALIFIED ARCHITECTURAL HARDWARE CONSULTANT, AVAILABLE DURING THE COURSE OF THE WORK TO CONSULT WITH CONTRACTOR, ARCHITECT, AND OWNER ABOUT DOOR HARDWARE AND KEYING.

2. SCHEDULING RESPONSIBILITY: PREPARATION OF DOOR HARDWARE AND KEYING SCHEDULES.

C. ARCHITECTURAL HARDWARE CONSULTANT QUALIFICATIONS: A PERSON WHO IS CURRENTLY CERTIFIED BY THE DOOR AND HARDWARE INSTITUTE AS AN ARCHITECTURAL HARDWARE CONSULTANT AND WHO IS EXPERIENCED IN PROVIDING CONSULTING SERVICES FOR DOOR HARDWARE INSTALLATIONS THAT ARE COMPARABLE IN MATERIAL, DESIGN, AND EXTENT TO THAT INDICATED FOR THIS PROJECT.

D. SOURCE LIMITATIONS: OBTAIN EACH TYPE AND VARIETY OF DOOR HARDWARE FROM A SINGLE MANUFACTURER, UNLESS OTHERWISE INDICATED.

E. REGULATORY REQUIREMENTS: COMPLY WITH PROVISIONS OF THE FOLLOWING:

1. WHERE INDICATED TO COMPLY WITH ACCESSIBILITY REQUIREMENTS, COMPLY WITH STATE AND LOCAL ACCESSIBILITY GUIDELINES AS FOLLOWS:

A. HANDLES, PULLS, LATCHES, LOCKS, AND OTHER OPERATING DEVICES: SHAPE THAT IS EASY TO GRASP WITH ONE HAND AND DOES NOT REQUIRE TIGHT GRASPING, TIGHT PINCHING, OR TWISTING OF THE WRIST.

B. DOOR CLOSERS: COMPLY WITH THE FOLLOWING MAXIMUM OPENING-FORCE REQUIREMENTS INDICATED:

1) INTERIOR HINGED DOORS: 5 LBF (22.2 N) APPLIED PERPENDICULAR TO DOOR.

2) SLIDING OR FOLDING DOORS: 5 LBF (22.2 N) APPLIED PARALLEL TO DOOR AT LATCH.

3) FIRE DOORS: MINIMUM OPENING FORCE ALLOWABLE BY AUTHORITIES HAVING JURISDICTION.

C. THRESHOLDS: NOT MORE THAN 1/2 INCH (13 MM) HIGH. BEVEL RAISED THRESHOLDS WITH A SLOPE OF NOT MORE THAN 1:2.

2. NFPA 101: COMPLY WITH THE FOLLOWING FOR MEANS OF EGRESS DOORS:

A. LATCHES, LOCKS, AND EXIT DEVICES: NOT MORE THAN 15 LBF (67 N) TO RELEASE THE LATCH. LOCKS SHALL NOT REQUIRE THE USE OF A KEY, TOOL, OR SPECIAL KNOWLEDGE FOR OPERATION.

B. DELAYED-EGRESS LOCKS: LOCK RELEASES WITHIN 15 SECONDS AFTER APPLYING A FORCE NOT MORE THAN 15 LBF (67 N) FOR NOT MORE THAN 3 SECONDS.

C. DOOR CLOSERS: NOT MORE THAN 30 LBF (133 N) TO SET DOOR IN MOTION AND NOT MORE THAN 15 LBF (67 N) TO OPEN DOOR TO MINIMUM REQUIRED WIDTH.

D. THRESHOLDS: NOT MORE THAN 1/2 INCH (13 MM) HIGH.

F. FIRE-RATED DOOR ASSEMBLIES: PROVIDE DOOR HARDWARE FOR ASSEMBLIES COMPLYING WITH NFPA 80 THAT ARE LISTED AND LABELED BY A TESTING AND INSPECTING AGENCY ACCEPTABLE TO AUTHORITIES HAVING JURISDICTION, FOR FIRE RATINGS INDICATED, BASED ON TESTING ACCORDING TO NFPA 252.

1. TEST PRESSURE: TEST AT ATMOSPHERIC PRESSURE.

G. KEYING CONFERENCE: CONDUCT CONFERENCE AT PROJECT SITE TO COMPLY WITH REQUIREMENTS IN DIVISION 1 SECTION "PROJECT MEETINGS." INCORPORATE KEYING CONFERENCE DECISIONS INTO FINAL KEYING SCHEDULE AFTER REVIEWING DOOR HARDWARE KEYING SYSTEM INCLUDING, BUT NOT LIMITED TO, THE FOLLOWING:

1. FUNCTION OF BUILDING, FLOW OF TRAFFIC, PURPOSE OF EACH AREA, DEGREE OF SECURITY REQUIRED, AND PLANS FOR FUTURE EXPANSION.

2. PRELIMINARY KEY SYSTEM SCHEMATIC DIAGRAM.

3. REQUIREMENTS FOR KEY CONTROL SYSTEM.

4. ADDRESS FOR DELIVERY OF KEYS.

I. PREINSTALLATION CONFERENCE: CONDUCT CONFERENCE AT PROJECT SITE TO COMPLY WITH REQUIREMENTS IN DIVISION 1 SECTION "PROJECT MEETINGS." REVIEW METHODS AND PROCEDURES RELATED TO DOOR HARDWARE.

1.07 DELIVERY, STORAGE, AND HANDLING

A. INVENTORY DOOR HARDWARE ON RECEIPT AND PROVIDE SECURE LOCK-UP FOR DOOR HARDWARE DELIVERED TO PROJECT SITE.

B. TAG EACH ITEM OR PACKAGE SEPARATELY WITH IDENTIFICATION RELATED TO THE FINAL DOOR HARDWARE SCHEDULE, AND INCLUDE BASIC INSTALLATION INSTRUCTIONS WITH EACH ITEM OR PACKAGE.

C. DELIVER KEYS TO OWNER BY REGISTERED MAIL OR OVERNIGHT PACKAGE SERVICE.

1.08 COORDINATION

A. COORDINATE LAYOUT AND INSTALLATION OF RECESSED PIVOTS AND CLOSERS WITH FLOOR CONSTRUCTION. CAST ANCHORING INSERTS INTO CONCRETE. CONCRETE, REINFORCEMENT, AND FORMWORK REQUIREMENTS ARE SPECIFIED IN DIVISION 3 SECTION "CAST-IN-PLACE CONCRETE."

B. TEMPLATES: OBTAIN AND DISTRIBUTE TO THE PARTIES INVOLVED TEMPLATES FOR DOORS, FRAMES, AND OTHER WORK SPECIFIED TO BE FACTORY PREPARED FOR INSTALLING DOOR HARDWARE. CHECK SHOP DRAWINGS OF OTHER WORK TO CONFIRM THAT ADEQUATE PROVISIONS ARE MADE FOR LOCATING AND INSTALLING DOOR HARDWARE TO COMPLY WITH INDICATED REQUIREMENTS.

1.09 WARRANTY

A. GENERAL WARRANTY: SPECIAL WARRANTIES SPECIFIED IN THIS ARTICLE SHALL NOT DEPRIVE OWNER OF OTHER RIGHTS OWNER MAY HAVE UNDER OTHER PROVISIONS OF THE CONTRACT DOCUMENTS AND SHALL BE IN ADDITION TO, AND RUN CONCURRENT WITH, OTHER WARRANTIES MADE BY CONTRACTOR UNDER REQUIREMENTS OF THE CONTRACT DOCUMENTS.

B. SPECIAL WARRANTY: WRITTEN WARRANTY, EXECUTED BY MANUFACTURER AGREEING TO REPAIR OR REPLACE COMPONENTS OF DOOR HARDWARE THAT FAIL IN MATERIALS OR WORKMANSHIP WITHIN SPECIFIED WARRANTY PERIOD. FAILURES INCLUDE, BUT ARE NOT LIMITED TO, THE FOLLOWING:

1. STRUCTURAL FAILURES INCLUDING EXCESSIVE DEFLECTION, CRACKING, OR BREAKAGE.

2. FAULTY OPERATION OF OPERATORS AND DOOR HARDWARE.

3. DETERIORATION OF METALS, METAL FINISHES, AND OTHER MATERIALS BEYOND NORMAL WEATHERING.

C. WARRANTY PERIOD: THREE YEARS FROM DATE OF SUBSTANTIAL COMPLETION, UNLESS

OTHERWISE INDICATED.

E. WARRANTY PERIOD FOR MANUAL CLOSERS: 10 YEARS FROM DATE OF SUBSTANTIAL COMPLETION.

1.10 MAINTENANCE SERVICE

A. MAINTENANCE TOOLS AND INSTRUCTIONS: FURNISH A COMPLETE SET OF SPECIALIZED TOOLS AND MAINTENANCE INSTRUCTIONS AS NEEDED FOR OWNER'S CONTINUED ADJUSTMENT, MAINTENANCE, AND REMOVAL AND REPLACEMENT OF DOOR HARDWARE.

B. MAINTENANCE SERVICE: BEGINNING AT SUBSTANTIAL COMPLETION, PROVIDE SIX MONTHS' FULL MAINTENANCE BY SKILLED EMPLOYEES OF DOOR HARDWARE INSTALLER. INCLUDE QUARTERLY PREVENTIVE MAINTENANCE, REPAIR OR REPLACEMENT OF WORN OR DEFECTIVE COMPONENTS, LUBRICATION, CLEANING, AND ADJUSTING AS REQUIRED FOR PROPER DOOR HARDWARE OPERATION. PROVIDE PARTS AND SUPPLIES AS USED IN THE MANUFACTURE AND INSTALLATION OF ORIGINAL PRODUCTS.

PART 2 - PRODUCTS

2.01 SCHEDULED DOOR HARDWARE

A. GENERAL: PROVIDE DOOR HARDWARE FOR EACH DOOR TO COMPLY WITH REQUIREMENTS IN THIS SECTION. DOOR HARDWARE SETS INDICATED IN DOOR AND FRAME SCHEDULE.

B. DESIGNATIONS: REQUIREMENTS FOR DESIGN, GRADE, FUNCTION, FINISH, SIZE, AND OTHER DISTINCTIVE QUALITIES OF EACH TYPE OF DOOR HARDWARE ARE INDICATED IN THE DOOR HARDWARE SCHEDULE. PRODUCTS ARE IDENTIFIED BY USING DOOR HARDWARE DESIGNATIONS, AS FOLLOWS:

1. NAMED MANUFACTURER'S PRODUCTS: PRODUCT DESIGNATION AND MANUFACTURER ARE LISTED FOR EACH DOOR HARDWARE TYPE REQUIRED FOR THE PURPOSE OF ESTABLISHING MINIMUM REQUIREMENTS.

2. MANUFACTURERS' NAMES ARE ABBREVIATED IN THE DOOR HARDWARE SCHEDULE.

2.02 HINGES AND PIVOTS

A. MANUFACTURERS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE PRODUCTS BY ONE OF THE FOLLOWING:

1. HINGES:

A. IVES: H. B. IVES (IVS).

B. HAGER COMPANIES (HAG).

C. MCKINNEY PRODUCTS COMPANY; DIV. OF ESSEX INDUSTRIES, INC. (MCK).

2. PIVOTS AND PIVOT HINGES:

A. IVES: H. B. IVES (IVS).

B. HAGER COMPANIES (HAG).

3. CONTINUOUS GEARED HINGES

A. HAGER COMPANIES (HAG).

B. MARKAR PRODUCTS, INC. (MP).

B. QUANTITY: PROVIDE THE FOLLOWING, UNLESS OTHERWISE INDICATED:

1. TWO HINGES: FOR DOORS WITH HEIGHTS UP TO 60 INCHES (1524 MM).

2. THREE HINGES: FOR DOORS WITH HEIGHTS 61 TO 90 INCHES (1549 TO 2286 MM).

3. FOUR HINGES: FOR DOORS WITH HEIGHTS 91 TO 120 INCHES (2311 TO 3048 MM).

4. FOR DOORS WITH HEIGHTS MORE THAN 120 INCHES (3048 MM), PROVIDE 4 HINGES, PLUS 1 HINGE FOR EVERY 30 INCHES (750 MM) OF DOOR HEIGHT GREATER THAN 120 INCHES (3048 MM).

C. TEMPLATE REQUIREMENTS: EXCEPT FOR HINGES AND PIVOTS TO BE INSTALLED ENTIRELY (BOTH LEAVES) INTO WOOD DOORS AND FRAMES, PROVIDE ONLY TEMPLATE-PRODUCED UNITS.

F. CONTINUOUS-GEARED HINGES: MINIMUM 0.120-INCH- (3.0-MM-) THICK, HINGE LEAVES WITH MINIMUM OVERALL WIDTH OF 4 INCHES (100 MM); FABRICATED TO FULL HEIGHT OF DOOR AND FRAME. FINISH COMPONENTS AFTER MILLING AND DRILLING ARE COMPLETE. FABRICATE HINGES TO TEMPLATE SCREW LOCATIONS.

G. FASTENERS: COMPLY WITH THE FOLLOWING:

1. MACHINE SCREWS: FOR METAL DOORS AND FRAMES. INSTALL INTO DRILLED AND TAPPED HOLES.

2. WOOD SCREWS: FOR WOOD DOORS AND FRAMES.

3. THREADED-TO-THE-HEAD WOOD SCREWS: FOR FIRE-RATED WOOD DOORS.

4. SCREWS: PHILLIPS FLAT-HEAD SCREWS; MACHINE SCREWS (DRILLED AND TAPPED HOLES) FOR METAL DOORS. FINISH SCREW HEADS TO MATCH SURFACE OF HINGES.

2.03 LOCKS AND LATCHES

A. MANUFACTURERS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE PRODUCTS BY ONE OF THE FOLLOWING:

1. MECHANICAL LOCKS AND LATCHES:

A. SCHLAGE LOCK COMPANY; AN INGERSOLL-RAND COMPANY (SCH).

B. STANDARDS: COMPLY WITH THE FOLLOWING:

1. MORTISE LOCKS AND LATCHES: BHMA A156.13.

C. MORTISE LOCKS: STAMPED STEEL CASE WITH STEEL OR BRASS PARTS; BHMA [GRADE 1] ; SERIES 1000.

D. AUXILIARY LOCKS: BHMA [GRADE 1].

E. CERTIFIED PRODUCTS: PROVIDE DOOR HARDWARE LISTED IN THE FOLLOWING BHMA DIRECTORIES:

1. MECHANICAL LOCKS AND LATCHES: BHMA'S "DIRECTORY OF CERTIFIED LOCKS & LATCHES."

F. LOCK TRIM: COMPLY WITH THE FOLLOWING:

1. LEVER: AS SPECIFIED.

G. LOCK FUNCTIONS: FUNCTION NUMBERS AND DESCRIPTIONS INDICATED IN THE DOOR HARDWARE SCHEDULE COMPLY WITH THE FOLLOWING:

1. MORTISE LOCKS: BHMA A156.13.

H. LOCK THROW: COMPLY WITH TESTING REQUIREMENTS FOR LENGTH OF BOLTS TO COMPLY WITH LABELED FIRE DOOR REQUIREMENTS, AND AS FOLLOWS:

1. MORTISE LOCKS: MINIMUM 3/4-INCH (19-MM) LATCHBOLT THROW.

2. DEADBOLTS: MINIMUM 1-INCH (25-MM) BOLT THROW.

I. BACKSET: 2-3/4 INCHES (70 MM), UNLESS OTHERWISE INDICATED.

2.04 DOOR BOLTS

A. AVAILABLE MANUFACTURERS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, MANUFACTURERS OFFERING MANUFACTURERS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE PRODUCTS BY ONE OF THE FOLLOWING:

1. FLUSH BOLTS:

A. DOOR CONTROLS INTERNATIONAL (DCI).

B. IVES: H. B. IVES (IVS).

C. ROCKWOOD MANUFACTURING COMPANY (RM).

2.05 EXIT DEVICES

A. MANUFACTURERS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE PRODUCTS BY ONE OF THE FOLLOWING:

1. VON DUPRIN; AN INGERSOLL-RAND COMPANY (VD).

B. PANIC EXIT DEVICES: LISTED AND LABELED BY A TESTING AND INSPECTING AGENCY ACCEPTABLE TO AUTHORITIES HAVING JURISDICTION, FOR PANIC PROTECTION, BASED ON TESTING ACCORDING TO UL 305.

C. FIRE EXIT DEVICES: COMPLYING WITH NFPA 80 THAT ARE LISTED AND LABELED BY A TESTING AND INSPECTING AGENCY ACCEPTABLE TO AUTHORITIES HAVING JURISDICTION, FOR FIRE AND PANIC PROTECTION, BASED ON TESTING ACCORDING TO UL 305 AND NFPA 252.

D. DUMMY PUSH BAR: NONFUNCTIONING PUSH BAR MATCHING FUNCTIONAL PUSH BAR.

1. MATCH DESIGN FOR LOCKSETS AND LATCHSETS, UNLESS OTHERWISE INDICATED.

E. THROUGH BOLTS: FOR EXIT DEVICES AND TRIM ON METAL DOORS.

2.06 CYLINDERS AND KEYING

A. MANUFACTURERS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE PRODUCTS BY ONE OF THE FOLLOWING:

1. CYLINDERS NEW EVEREST PRIMUS SYSTEM.

2. CYLINDERS: AS SPECIFIED.

A. SCHLAGE LOCK COMPANY; AN INGERSOLL-RAND COMPANY (SCH).

3. KEY CONTROL SYSTEMS:

A. KEY CONTROL SYSTEMS, INC. (KCS).

B. MAJOR METALFAB CO. (MM).

C. SARGENT MANUFACTURING COMPANY; DIV. OF ESSEX INDUSTRIES, INC. (SGT).

D. SUNROC CORPORATION (SUN).

4. NUMBER OF PINS: SEVEN.

5. MORTISE TYPE: THREADED CYLINDERS WITH RINGS AND STRAIGHT- OR CLOVER-TYPE CAM.

6. RIM TYPE: CYLINDERS WITH BACK PLATE, FLAT-TYPE VERTICAL OR HORIZONTAL TAILPIECE, AND RAISED TRIM RING.

A. HIGH-SECURITY GRADE: BHMA GRADE 1A, LISTED AND LABELED AS COMPLYING WITH PICK- AND DRILL-RESISTANT TESTING REQUIREMENTS OF UL 437 (SUFFIX A).

B. PERMANENT CORES: MANUFACTURER'S STANDARD; FINISH FACE TO MATCH LOCKSET; COMPLYING WITH THE FOLLOWING:

1. REMOVABLE CORES: CORE INSERT, REMOVABLE BY USE OF A SPECIAL KEY, AND FOR USE WITH ONLY THE CORE MANUFACTURER'S CYLINDER AND DOOR HARDWARE SPECIFIED AS SCHLAGE EVEREST/PRIMUS.

C. CONSTRUCTION KEYING: COMPLY WITH THE FOLLOWING:

1. CONSTRUCTION CORES: PROVIDE CONSTRUCTION CORES THAT ARE REPLACEABLE BY PERMANENT CORES. PROVIDE 10 CONSTRUCTION MASTER KEYS.

A. REPLACE CONSTRUCTION CORES WITH PERMANENT CORES, AS DIRECTED BY OWNER.

B. FURNISH PERMANENT CORES TO OWNER FOR INSTALLATION.

D. KEYING SYSTEM: UNLESS OTHERWISE INDICATED, PROVIDE A FACTORY-REGISTERED KEYING SYSTEM COMPLYING WITH THE FOLLOWING REQUIREMENTS:

1. GRAND MASTER KEY SYSTEM: CYLINDERS ARE OPERATED BY A CHANGE KEY, A MASTER KEY, AND A GRAND MASTER KEY.

A. CYLINDERS SHALL BE MASTER KEYED.

E. KEYS: PROVIDE NICKEL-SILVER KEYS COMPLYING WITH THE FOLLOWING:

1. STAMPING: PERMANENTLY INSCRIBE EACH KEY WITH A VISUAL KEY CONTROL NUMBER AND INCLUDE THE FOLLOWING NOTATION:

A. NOTATION: "DO NOT DUPLICATE."

2.07 STRIKES

A. MANUFACTURERS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE PRODUCTS BY ONE OF THE FOLLOWING:

1. ELECTRIC STRIKES:

A. LOCKNETICS SECURITY ENGINEERING; A HARROW COMPANY (LSE).

B. VON DUPRIN, INC.; AN INGERSOLL-RAND COMPANY (VD).

B. STRIKES: PROVIDE MANUFACTURER'S STANDARD STRIKE WITH STRIKE BOX FOR EACH LATCH OR LOCK BOLT, WITH CURVED LIP EXTENDED TO PROTECT FRAME, FINISHED TO MATCH DOOR HARDWARE SET, UNLESS OTHERWISE INDICATED, AND AS FOLLOWS:

1. FLAT-LIP STRIKES: FOR LOCKS WITH THREE-PIECE ANTIFRICTION LATCHBOLTS, AS RECOMMENDED BY MANUFACTURER.

2. EXTRA-LONG-LIP STRIKES: FOR LOCKS USED ON FRAMES WITH APPLIED WOOD CASING TRIM.

3. ALUMINUM-FRAME STRIKE BOX: PROVIDE MANUFACTURER'S SPECIAL STRIKE BOX FABRICATED FOR ALUMINUM FRAMING.

C. DUSTPROOF STRIKES: BHMA GRADE 1.

2.08 OPERATING TRIM.

A. MANUFACTURERS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE PRODUCTS BY ONE OF THE FOLLOWING:

1. HAGER COMPANIES (HAG).

2. IVES: H. B. IVES (IVS).

3. NT QUALITY HARDWARE; AN INGERSOLL-RAND COMPANY (NTQ).

4. ROCKWOOD MANUFACTURING COMPANY (RM).

B. STANDARD: COMPLY WITH BHMA A156.6.

2.09 ACCESSORIES FOR PAIRS OF DOORS

A. MANUFACTURERS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE PRODUCTS BY ONE OF THE FOLLOWING:

1. COORDINATORS:

A. DOOR CONTROLS INTERNATIONAL (DCI).

B. GLYNN-JOHNSON; AN INGERSOLL-RAND COMPANY (GJ).

C. IVES: H. B. IVES (IVS).

2. REMOVABLE MULLIONS:

A. PRECISION HARDWARE, INC. (PH)

B. SARGENT MANUFACTURING COMPANY: DIV. OF ESSEX INDUSTRIES, INC. (SGT)

C. VON DUPRIN; AN INGERSOLL-RAND COMPANY (VD).

3. ASTRAGALS:

A. NATIONAL GUARD PRODUCTS, INC. (NGP).

B. PEMKO MANUFACTURING CO., INC. (PEM).

C. REESE ENTERPRISES, INC. (RE).

B. STANDARDS: COMPLY WITH THE FOLLOWING:

1. COORDINATORS: BHMA A156.3.

2. REMOVABLE MULLIONS: BHMA A156.3.

C. CARRY-OPEN BARS: PROVIDE CARRY-OPEN BARS FOR INACTIVE LEAVES OF PAIRS OF DOORS, UNLESS AUTOMATIC OR SELF-LATCHING BOLTS ARE USED.

D. FIRE-EXIT REMOVABLE MULLIONS: PROVIDE REMOVABLE MULLIONS FOR USE WITH FIRE EXIT DEVICES COMPLYING WITH NFPA 80 THAT ARE LISTED AND LABELED BY A TESTING AND INSPECTING AGENCY ACCEPTABLE TO AUTHORITIES HAVING JURISDICTION, FOR FIRE AND PANIC PROTECTION, BASED ON TESTING ACCORDING TO UL 305 AND NFPA 252. MULLIONS SHALL BE USED ONLY WITH EXIT DEVICES FOR WHICH THEY HAVE BEEN TESTED.

2.10 CLOSERS

A. MANUFACTURERS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE PRODUCTS BY ONE OF THE FOLLOWING:

1. SURFACE-MOUNTED CLOSERS:

A. LCN CLOSERS; AN INGERSOLL-RAND COMPANY (LCN).

2. CONCEALED CLOSERS:

A. LCN CLOSERS; AN INGERSOLL-RAND COMPANY (LCN).

B. HOLD-OPEN CLOSERS/DETECTORS: COORDINATE AND INTERFACE INTEGRAL SMOKE DETECTOR AND CLOSER DEVICE WITH FIRE ALARM SYSTEM.

C. CLOSERS SHALL BE CAST IRON.

D. SIZE OF UNITS: UNLESS OTHERWISE INDICATED, COMPLY WITH MANUFACTURER'S

WRITTEN RECOMMENDATIONS FOR SIZE OF DOOR CLOSERS DEPENDING ON SIZE OF DOOR, EXPOSURE TO WEATHER, AND ANTICIPATED FREQUENCY OF USE. PROVIDE FACTORY-SIZED CLOSERS, ADJUSTABLE TO MEET FIELD CONDITIONS AND REQUIREMENTS FOR OPENING FORCE.

2.11 PROTECTIVE TRIM UNITS

A. MANUFACTURERS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE PRODUCTS BY ONE OF THE FOLLOWING:

1. METAL PROTECTIVE TRIM UNITS:

A. IVES: H. B. IVES (IVS).

B. ROCKWOOD MANUFACTURING COMPANY (RM).

B. STANDARD: COMPLY WITH BHMA A156.6.

C. MATERIALS: FABRICATE PROTECTION PLATES FROM THE FOLLOWING:

1. STAINLESS STEEL: 0.050 INCH (1.3 MM) THICK; BEVELED TOP AND 2 SIDES.

D. FASTENERS: PROVIDE MANUFACTURER'S STANDARD EXPOSED FASTENERS FOR DOOR TRIM UNITS CONSISTING OF EITHER MACHINE OR SELF-TAPPING SCREWS.

E. FURNISH PROTECTION PLATES SIZED 2 INCHES (38 MM) LESS THAN DOOR WIDTH ON PUSH SIDE AND 1 INCH (13 MM) LESS THAN DOOR WIDTH ON PULL SIDE, BY HEIGHT SPECIFIED IN DOOR HARDWARE SCHEDULE.

2.12 STOPS AND HOLDERS

A. MANUFACTURERS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE PRODUCTS BY ONE OF THE FOLLOWING:

1. IVES: H. B. IVES (IVS).

2. LCN CLOSERS; AN INGERSOLL-RAND COMPANY (LCN).

3. ROCKWOOD MANUFACTURING COMPANY (RM).

B. STOPS AND BUMPERS: BHMA GRADE 1.

C. MECHANICAL DOOR HOLDERS: BHMA GRADE 1.

D. COMBINATION FLOOR AND WALL STOPS AND HOLDERS: BHMA GRADE 1.

E. COMBINATION OVERHEAD STOPS AND HOLDERS: BHMA GRADE 1.

F. FLOOR STOPS: FOR DOORS, UNLESS WALL OR OTHER TYPE STOPS ARE SCHEDULED OR INDICATED. DO NOT MOUNT FLOOR STOPS WHERE THEY WILL IMPEDE TRAFFIC.

1. WHERE FLOOR OR WALL STOPS ARE NOT APPROPRIATE, PROVIDE OVERHEAD HOLDERS.

G. SILENCERS FOR METAL DOOR FRAMES: BHMA GRADE 1; NEOPRENE OR RUBBER, MINIMUM DIAMETER 1/2 INCH (13 MM); FABRICATED FOR DRILLED-IN APPLICATION TO FRAME.

2.13 DOOR GASKETING

SECTION 08 71 00

DOOR HARDWARE

A. MANUFACTURERS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE PRODUCTS BY ONE OF THE FOLLOWING:

1. DOOR GASKETING:

A. NATIONAL GUARD PRODUCTS, INC. (NGP).

B. PEMKO MANUFACTURING CO., INC. (PEM).

C. REESE ENTERPRISES, INC. (RE).

2. DOOR BOTTOMS:

A. NATIONAL GUARD PRODUCTS, INC. (NGP).

B. PEMKO MANUFACTURING CO., INC. (PEM).

C. REESE ENTERPRISES, INC. (RE).

B. STANDARD: COMPLY WITH BHMA A156.22.

C. GENERAL: PROVIDE CONTINUOUS WEATHER-STRIP GASKETING ON EXTERIOR DOORS AND PROVIDE SMOKE, LIGHT, OR SOUND GASKETING ON INTERIOR DOORS WHERE INDICATED OR SCHEDULED. PROVIDE NONCORROSIVE FASTENERS FOR EXTERIOR APPLICATIONS AND ELSEWHERE AS INDICATED.

1. PERIMETER GASKETING: APPLY TO HEAD AND JAMB, FORMING SEAL BETWEEN DOOR AND FRAME.

2. MEETING STILE GASKETING: FASTEN TO MEETING STILES, FORMING SEAL WHEN DOORS ARE CLOSED.

3. DOOR BOTTOMS: APPLY TO BOTTOM OF DOOR, FORMING SEAL WITH THRESHOLD WHEN DOOR IS CLOSED.

D. AIR LEAKAGE: NOT TO EXCEED 0.50 CFM PER FOOT (0.000774 CU. M/S PER M) OF CRACK LENGTH FOR GASKETING OTHER THAN FOR SMOKE CONTROL, AS TESTED ACCORDING TO ASTM E 283.

E. SMOKE-LABELED GASKETING: ASSEMBLIES COMPLYING WITH NFPA 105 THAT ARE LISTED AND LABELED BY A TESTING AND INSPECTING AGENCY ACCEPTABLE TO AUTHORITIES HAVING JURISDICTION, FOR SMOKE-CONTROL RATINGS INDICATED, BASED ON TESTING ACCORDING TO UL 1784.

1. PROVIDE SMOKE-LABELED GASKETING ON 20-MINUTE-RATED DOORS AND ON SMOKE-LABELED DOORS.

F. FIRE-LABELED GASKETING: ASSEMBLIES COMPLYING WITH NFPA 80 THAT ARE LISTED AND LABELED BY A TESTING AND INSPECTING AGENCY ACCEPTABLE TO AUTHORITIES HAVING JURISDICTION, FOR FIRE RATINGS INDICATED, BASED ON TESTING ACCORDING TO UL 10B OR NFPA 252.

G. SOUND-RATED GASKETING: ASSEMBLIES THAT ARE LISTED AND LABELED BY A TESTING AND INSPECTING AGENCY, FOR SOUND RATINGS INDICATED, BASED ON TESTING ACCORDING TO ASTM E 1408.

H. REPLACEABLE SEAL STRIPS: PROVIDE ONLY THOSE UNITS WHERE RESILIENT OR FLEXIBLE SEAL STRIPS ARE EASILY REPLACEABLE AND READILY AVAILABLE FROM STOCKS MAINTAINED BY MANUFACTURER.

I. GASKETING MATERIALS: COMPLY WITH ASTM D 2000 AND AAMA 701/702.

J. GASKETING OF EXTERIOR DOORS SHALL BE INSTALLED AS TO NOT PERMIT ANY VISIBLE LIGHT PENETRATION AROUND PERIMETER OF DOORS.

2.14 THRESHOLDS

A. MANUFACTURERS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE PRODUCTS BY ONE OF THE FOLLOWING:

1. NATIONAL GUARD PRODUCTS, INC. (NGP).

2. PEMKO MANUFACTURING CO., INC. (PEM).

3. REESE ENTERPRISES, INC. (RE).

2.15 MISCELLANEOUS DOOR HARDWARE

A. MANUFACTURERS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE PRODUCTS BY ONE OF THE FOLLOWING:

1. IVES: H. B. IVES (IVS).

2. NT QUALITY HARDWARE; AN INGERSOLL-RAND COMPANY (NTQ).

3. ROCKWOOD MANUFACTURING COMPANY (RM).

B. AUXILIARY HARDWARE: BHMA GRADE 1, UNLESS OTHERWISE INDICATED.

2.16 FABRICATION

A. MANUFACTURER'S NAMEPLATE: DO NOT PROVIDE MANUFACTURERS' PRODUCTS THAT HAVE MANUFACTURER'S NAME OR TRADE NAME DISPLAYED IN A VISIBLE LOCATION (OMIT REMOVABLE NAMEPLATES) EXCEPT IN CONJUNCTION WITH REQUIRED FIRE-RATED LABELS AND AS OTHERWISE APPROVED BY ARCHITECT.

1. MANUFACTURER'S IDENTIFICATION WILL BE PERMITTED ON RIM OF LOCK CYLINDERS ONLY.

B. BASE METALS: PRODUCE DOOR HARDWARE UNITS OF BASE METAL, FABRICATED BY FORMING METHOD INDICATED, USING MANUFACTURER'S STANDARD METAL ALLOY, COMPOSITION, TEMPER, AND HARDNESS. FURNISH METALS OF A QUALITY EQUAL TO OR GREATER THAN THAT OF SPECIFIED DOOR HARDWARE UNITS AND BHMA A156.18 FOR FINISHES. DO NOT FURNISH MANUFACTURER'S STANDARD MATERIALS OR FORMING METHODS IF DIFFERENT FROM SPECIFIED STANDARD.

C. FASTENERS: PROVIDE DOOR HARDWARE MANUFACTURED TO COMPLY WITH PUBLISHED TEMPLATES GENERALLY PREPARED FOR MACHINE, WOOD, AND SHEET METAL SCREWS. PROVIDE SCREWS ACCORDING TO COMMERCIALLY RECOGNIZED INDUSTRY STANDARDS FOR APPLICATION INTENDED. PROVIDE PHILLIPS FLAT-HEAD SCREWS WITH FINISHED HEADS TO MATCH SURFACE OF DOOR HARDWARE, UNLESS OTHERWISE INDICATED.

1. CONCEALED FASTENERS: FOR DOOR HARDWARE UNITS THAT ARE EXPOSED WHEN DOOR IS CLOSED, EXCEPT FOR UNITS ALREADY SPECIFIED WITH CONCEALED FASTENERS. DO NOT USE THROUGH BOLTS FOR INSTALLATION WHERE BOLT HEAD OR NUT ON OPPOSITE FACE IS EXPOSED UNLESS IT IS THE ONLY MEANS OF SECURELY ATTACHING THE DOOR HARDWARE. WHERE THROUGH BOLTS ARE USED ON HOLLOW DOOR AND FRAME CONSTRUCTION, PROVIDE SLEEVES FOR EACH THROUGH BOLT.

2. STEEL MACHINE OR WOOD SCREWS: FOR THE FOLLOWING FIRE-RATED APPLICATIONS:

A. MORTISE HINGES TO DOORS.

B. STRIKE PLATES TO FRAMES.

C. CLOSERS TO DOORS AND FRAMES.

3. STEEL THROUGH BOLTS: FOR THE FOLLOWING FIRE-RATED APPLICATIONS, UNLESS DOOR BLOCKING IS PROVIDED:

A. SURFACE HINGES TO DOORS.

B. CLOSERS TO DOORS AND FRAMES.

C. SURFACE-MOUNTED EXIT DEVICES.

4. SPACERS OR SEX BOLTS: FOR THROUGH BOLTING OF HOLLOW METAL DOORS.

5. FASTENERS FOR WOOD DOORS: COMPLY WITH REQUIREMENTS OF DHI WDHS.2, "RECOMMENDED FASTENERS FOR WOOD DOORS."

2.17 FINISHES

A. STANDARD: COMPLY WITH BHMA A156.18.

B. PROTECT MECHANICAL FINISHES ON EXPOSED SURFACES FROM DAMAGE BY APPLYING A STRIPPABLE, TEMPORARY PROTECTIVE COVERING BEFORE SHIPPING.

C. APPEARANCE OF FINISHED WORK: VARIATIONS IN APPEARANCE OF ABUTTING OR ADJACENT PIECES ARE ACCEPTABLE IF THEY ARE WITHIN ONE-HALF OF THE RANGE OF APPROVED SAMPLES. NOTICEABLE VARIATIONS IN THE SAME PIECE ARE NOT ACCEPTABLE. VARIATIONS IN APPEARANCE OF OTHER COMPONENTS ARE ACCEPTABLE IF THEY ARE WITHIN THE RANGE OF APPROVED SAMPLES AND ARE ASSEMBLED OR INSTALLED TO MINIMIZE CONTRAST.

D. BHMA DESIGNATIONS: COMPLY WITH BASE MATERIAL AND FINISH REQUIREMENTS INDICATED BY THE FOLLOWING:

1. BHMA 626: SATIN CHROMIUM PLATED OVER NICKEL, OVER BRASS OR BRONZE BASE METAL.

2. BHMA 630: SATIN STAINLESS STEEL, OVER STAINLESS-STEEL BASE METAL.

3. BHMA 652: SATIN CHROMIUM PLATED OVER NICKEL, OVER STEEL BASE METAL.

4. BHMA 689: ALUMINUM PAINTED, OVER ANY BASE METAL.

PART 3 - EXECUTION

3.01 EXAMINATION

A. EXAMINE DOORS AND FRAMES, WITH INSTALLER PRESENT, FOR COMPLIANCE WITH REQUIREMENTS FOR INSTALLATION TOLERANCES, LABELED FIRE DOOR ASSEMBLY CONSTRUCTION, WALL AND FLOOR CONSTRUCTION, AND OTHER CONDITIONS AFFECTING PERFORMANCE.

B. PROCEED WITH INSTALLATION ONLY AFTER UNSATISFACTORY CONDITIONS HAVE BEEN CORRECTED.

3.02 PREPARATION

A. STEEL DOORS AND FRAMES: COMPLY WITH DHI A115 SERIES.

1. SURFACE-APPLIED DOOR HARDWARE: DRILL AND TAP DOORS AND FRAMES ACCORDING TO SDI 107.

3.03 INSTALLATION

A. MOUNTING HEIGHTS: MOUNT DOOR HARDWARE UNITS AT HEIGHTS INDICATED IN FOLLOWING APPLICABLE PUBLICATIONS, UNLESS SPECIFICALLY INDICATED OR REQUIRED TO COMPLY WITH GOVERNING REGULATIONS:

1. STANDARD STEEL DOORS AND FRAMES: DHI'S "RECOMMENDED LOCATIONS FOR ARCHITECTURAL HARDWARE FOR STANDARD STEEL DOORS AND FRAMES."

2. CUSTOM STEEL DOORS AND FRAMES: DHI'S "RECOMMENDED LOCATIONS FOR BUILDERS' HARDWARE FOR CUSTOM STEEL DOORS AND FRAMES."

B. INSTALL EACH DOOR HARDWARE ITEM TO COMPLY WITH MANUFACTURER'S WRITTEN INSTRUCTIONS. WHERE CUTTING AND FITTING ARE REQUIRED TO INSTALL DOOR HARDWARE ONTO OR INTO SURFACES THAT ARE LATER TO BE PAINTED OR FINISHED IN ANOTHER WAY, COORDINATE REMOVAL, STORAGE, AND REINSTALLATION OF SURFACE PROTECTIVE TRIM UNITS WITH FINISHING WORK SPECIFIED IN DIVISION 9 SECTIONS. DO NOT INSTALL SURFACE-MOUNTED ITEMS UNTIL FINISHES HAVE BEEN COMPLETED ON SUBSTRATES INVOLVED.

1. SET UNITS LEVEL, PLUMB, AND TRUE TO LINE AND LOCATION. ADJUST AND REINFORCE ATTACHMENT SUBSTRATES AS NECESSARY FOR PROPER INSTALLATION AND OPERATION.

2. DRILL AND COUNTERSINK UNITS THAT ARE NOT FACTORY PREPARED FOR ANCHORAGE FASTENERS. SPACE FASTENERS AND ANCHORS ACCORDING TO INDUSTRY STANDARDS.

D. THRESHOLDS: SET THRESHOLDS FOR EXTERIOR AND ACOUSTICAL DOORS IN FULL BED OF SEALANT COMPLYING WITH REQUIREMENTS SPECIFIED IN DIVISION 7 SECTION "JOINT SEALANTS."

3.04 FIELD QUALITY CONTROL

A. INDEPENDENT ARCHITECTURAL HARDWARE CONSULTANT: OWNER WILL ENGAGE A QUALIFIED INDEPENDENT ARCHITECTURAL HARDWARE CONSULTANT TO PERFORM INSPECTIONS AND TO PREPARE INSPECTION REPORTS.

1. INDEPENDENT ARCHITECTURAL HARDWARE CONSULTANT WILL INSPECT DOOR HARDWARE AND STATE IN EACH REPORT WHETHER INSTALLED WORK COMPLIES WITH OR DEVIATES FROM REQUIREMENTS, INCLUDING WHETHER DOOR HARDWARE IS PROPERLY

INSTALLED AND ADJUSTED.

3.05 ADJUSTING

A. INITIAL ADJUSTMENT: ADJUST AND CHECK EACH OPERATING ITEM OF DOOR HARDWARE AND EACH DOOR TO ENSURE PROPER OPERATION OR FUNCTION OF EVERY UNIT. REPLACE UNITS THAT CANNOT BE ADJUSTED TO OPERATE AS INTENDED. ADJUST DOOR CONTROL DEVICES TO COMPENSATE FOR FINAL OPERATION OF HEATING AND VENTILATING EQUIPMENT AND TO COMPLY WITH REFERENCED ACCESSIBILITY REQUIREMENTS.

1. SPRING HINGES: ADJUST TO ACHIEVE POSITIVE LATCHING WHEN DOOR IS ALLOWED TO CLOSE FREELY FROM AN OPEN POSITION OF 30 DEGREES.

2. ELECTRIC STRIKES: ADJUST HORIZONTAL AND VERTICAL ALIGNMENT OF KEEPER TO PROPERLY ENGAGE LOCK BOLT.

3. DOOR CLOSERS: ADJUST SWEEP PERIOD SO THAT, FROM AN OPEN POSITION OF 70 DEGREES, THE DOOR WILL TAKE AT LEAST 3 SECONDS TO MOVE TO A POINT 3 INCHES (75 MM) FROM THE LATCH, MEASURED TO THE LEADING EDGE OF THE DOOR.

B. SIX-MONTH ADJUSTMENT: APPROXIMATELY SIX MONTHS AFTER DATE OF SUBSTANTIAL COMPLETION, INSTALLER SHALL PERFORM THE FOLLOWING:

1. EXAMINE AND READJUST EACH ITEM OF DOOR HARDWARE AS NECESSARY TO ENSURE FUNCTION OF DOORS, DOOR HARDWARE, AND ELECTRIFIED DOOR HARDWARE.

2. CONSULT WITH AND INSTRUCT OWNER'S PERSONNEL ON RECOMMENDED MAINTENANCE PROCEDURES.

3. REPLACE DOOR HARDWARE ITEMS THAT HAVE DETERIORATED OR FAILED DUE TO FAULTY DESIGN, MATERIALS, OR INSTALLATION OF DOOR HARDWARE UNITS.

3.06 CLEANING AND PROTECTION

A. CLEAN ADJACENT SURFACES SOILED BY DOOR HARDWARE INSTALLATION.

B. CLEAN OPERATING ITEMS AS NECESSARY TO RESTORE PROPER FUNCTION AND FINISH.

C. PROVIDE FINAL PROTECTION AND MAINTAIN CONDITIONS THAT ENSURE DOOR HARDWARE IS WITHOUT DAMAGE OR DETERIORATION AT TIME OF SUBSTANTIAL COMPLETION.

3.07 DEMONSTRATION

A. ENGAGE A FACTORY-AUTHORIZED SERVICE REPRESENTATIVE TO TRAIN OWNER'S MAINTENANCE PERSONNEL TO ADJUST, OPERATE, AND MAINTAIN DOOR HARDWARE AND DOOR HARDWARE FINISHES.

3.08 HARDWARE SET SCHEDULE:

A. TO BE PREPARED FROM DOOR SCHEDULE BY HARDWARE VENDOR'S ARCHITECTURAL HARDWARE CONSULTANT AND SUBMITTED TO ARCHITECT FOR REVIEW AND APPROVAL.

END OF SECTION

SECTION 08 80 00

GLAZING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. CONSTRUCTION DRAWINGS, SPECIFICATIONS AND PROVISIONS OF THE CONTRACT INCLUDING GENERAL AND SUPPLEMENTAL CONDITIONS AND OTHER DIVISION 1 SPECIFICATION SECTIONS, ARE HEREBY MADE A PART OF THIS SECTION AS FULLY AND COMPLETELY AS IF REPEATED HEREIN.

1.02 ITEMS REQUIRED BUT NOT SPECIFIED

A. IF AN ITEM OR MATERIAL OF THIS TRADE IS INDICATED ON THE DRAWINGS BUT NOT SPECIFICALLY LISTED IN THIS SECTION, PROVIDE SUCH ITEM OR MATERIAL AT A STANDARD OF QUALITY EQUAL TO THE STANDARD ESTABLISHED FOR THE BALANCE OF THE WORK SPECIFIED, IN ACCORDANCE WITH THE ARCHITECT'S INTERPRETATION.

1.03 EXECUTION, CORRELATION AND INTENT

A. IN CASE OF AN INCONSISTENCY BETWEEN DRAWINGS AND SPECIFICATIONS OR WITHIN EITHER DOCUMENT NOT CLARIFIED BY ADDENDUM, THE BETTER QUALITY OR GREATER QUANTITY OF WORK IS TO BE PROVIDED, IN ACCORDANCE WITH THE ARCHITECT'S INTERPRETATION.

1.04 SECTION INCLUDES

A. FURNISH AND INSTALL:

1. INSULATING GLASS

2. IMPACT RESISTANT GLASS

3. FIRE-RATED, IMPACT SAFETY RATED GLASS CERAMIC

4. ¼”-THICK, LAMINATED SAFETY GLASS

5. GLAZING GASKETS

6. GLAZING SEALANTS

7. GLAZING ACCESSORIES

B. TYPES OF WORK IN THIS SECTION INCLUDE WORK FOR:

1. FIRE RATED, SAFETY RATED GLASS CERAMIC LITES FOR FIRE RATED DOORS.

2. ¼”-THICK LAMINATED SAFETY GLASS FOR DOOR LITES AND INTERIOR WINDOWS

3. INSULATED GLASS

1.05 RELATED SECTIONS

A. 06 10 00 - ROUGH CARPENTRY

B. 07 90 00 - JOINT SEALANTS

C. 08 11 00 - HOLLOW METAL DOORS AND FRAMES

SECTION 08 80 00

GLAZING

1.06 PERFORMANCE REQUIREMENTS

A. EXTERIOR GLAZING: PROVIDE GLAZING ASSEMBLIES WHICH WILL WITHSTAND NORMAL CONDITIONS WITHOUT FAILURE, LOSS OF WEATHER-TIGHTNESS OR DETERIORATION.

B. FIRE RATED, IMPACT SAFETY RATED GLASS CERAMIC: PROVIDE 3 HOUR FIRE RATED, IMPACT SAFETY RATED, LAMINATED GLASS CERAMIC LITES IN FIRE RATED DOORS AS INDICATED IN DOOR SCHEDULE. DESIGN IS BASED ON 5/16” PREMIUM GRADE FIRELITE PLUS BY TECHNICAL GLASS PRODUCTS.

C. DETERIORATION INCLUDES:

1. FOR INSULATING GLASS:

A. MOISTURE OR DIRT BETWEEN PANES

B. DEVELOPMENT OF CONDENSATION BETWEEN PANES

C. DAMAGE TO INTERNAL COATING, IF ANY

D. DEVELOPMENT OF OTHER VISIBLE INDICATION OF SEAL FAILURE

2. FOR COATED GLASS:

A. DEVELOPMENT OF VISIBLE DEFECTS IN COATING

1.07 SUBMITTALS

A. PRODUCT DATA: MANUFACTURER'S MATERIAL SPECIFICATIONS AND INSTALLATION RECOMMENDATIONS.

B. SAMPLES OF GLASS

C. SEALANT-SUBSTRATE TEST REPORTS: FOR EACH EXTERIOR SEALANT.

D. INSULATING WARRANTY

E. WEATHER-TIGHT WARRANTY

1.08 WARRANTY

A. SUBMIT A WRITTEN WARRANTY GUARANTEEING TO CORRECT FAILURES IN GLAZING WHICH OCCUR WITHIN THE PERIOD INDICATED AFTER SUBSTANTIAL COMPLETION, WITHOUT REDUCING OR OTHERWISE LIMITING ANY OTHER RIGHTS TO CORRECTION WHICH THE OWNER MAY HAVE UNDER THE CONTRACT DOCUMENTS.

1. WARRANTY ON INSULATING GLASS: FIVE (5) YEARS

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. MANUFACTURERS:

SECTION 08 80 00

GLAZING

1. PRODUCTS OF THE FOLLOWING MANUFACTURES, PROVIDED THEY COMPLY WITH THE REQUIREMENTS OF THE CONTRACT DOCUMENTS, WILL BE AMONG THOSE CONSIDERED ACCEPTABLE:

A. VIRACON, INC., 800 PARK DRIVE, OWATONNA, MN 55060

B. PPG INDUSTRIES, INC., ONE PPG PLACE PITTSBURGH, PA 15272

C. OLDCASTLE GLASS, 2425 OLYMPIC BOULEVARD, SUITE 525-E, SANTA MONICA, CALIFORNIA 90404

D. VERSALUX, A ZELEDYNE BRAND, 5555 SOUTH 129TH EAST AVE., TULSA, OK 74134

E. TECHNICAL GLASS PRODUCTS, 8107 BRAKEN PLACE, S.E., SNOQUALMIE,WA. 98065

F. SAFTIFIRST FIRE RATED GLAZING SOLUTIONS, 325 NEWHALL ST., SAN FRANCISCO, CA. 94124-1432

2.02 BASIC GLASS PRODUCTS

A. SEALED INSULATING UNITS: FACTORY-ASSEMBLED MULTIPLE PANES SEPARATED BY AND SEALED TO SPACERS FORMING AIR-TIGHT, DEHYDRATED AIR SPACE(S).

1. INSULATING GLASS UNITS ARE CERTIFIED THROUGH THE INSULATING GLASS CERTIFICATION COUNCIL (IGCC) TO EITHER ASTM E774, OR TO ASTM E2190, OR BOTH.

2. PROVIDE HERMETICALLY SEALED IG UNITS WITH DEHYDRATED AIRSPACE, DUAL SEALED WITH A PRIMARY SEAL OF POLY-ISOBUTYLENE (PIB), OR THERMO PLASTIC SPACER (TPS) AND A SECONDARY SEAL OF SILICONE OR AN ORGANIC SEALANT DEPENDING ON THE APPLICATION.

B. ANNEALED FLOAT GLASS SHALL COMPLY WITH ASTM C1036, TYPE I, CLASS 1 (CLEAR), CLASS 2 (TINTED), QUALITY Q3.

C. HEAT-STRENGTHENED FLOAT GLASS SHALL COMPLY WITH ASTM C1048, TYPE I, CLASS 1 (CLEAR), CLASS 2 (TINTED), QUALITY Q3, KIND HS.

D. TEMPERED FLOAT GLASS SHALL COMPLY WITH ASTM C1048, TYPE I, CLASS 1 (CLEAR), CLASS 2 (TINTED), QUALITY Q3, KIND FT

E. LAMINATED GLASS PRODUCTS TO BE FABRICATED IN AUTOCLAVE WITH HEAT, PLUS PRESSURE, FREE OF FOREIGN SUBSTANCES AND AIR POCKETS.

1. LAMINATED GLASS SHALL COMPLY WITH ASTM C1172 AND WITH OTHER REQUIREMENTS AS SPECIFIED.

F. FIRE-RATED GLASS CERAMIC PRODUCTS:

1. SUBJECT TO COMPLIANCE WITH REQUIREMENTS:

A. FIRELITE PLUS BY TECHNICAL GLASS PRODUCTS.

B. FIRELITE NT BY TECHNICAL GLASS PRODUCTS.

C. SUPERLITE C/SP SAFETY PREMIUM CERAMIC GLAZING SOLUTION BY SAFTIFIRST

D. APPROVED EQUAL

G. TONG MARKS ARE NOT PERMITTED ON ANY PIECE.

H. APPLICABLE STANDARDS:

1. ANSI Z97.1-1984 NATIONAL SAFETY GLAZING STANDARD

2. CPSC 16 CFR 1201 FEDERAL SAFETY GLAZING STANDARD

3. ASTN C 1036 STANDARD SPECIFICATION FOR FLAT GLASS

4. ASTM C 1048 STANDARD SPECIFICATION FOR HEAT TREATED GLASS

5. MIAMI-DADE COUNT PLASTIC CHECKLIST

2.03 GLASS TYPE

A. GLASS TYPES - GENERAL: PROVIDE GLASS TYPES FABRICATED OF THE GLASS PRODUCTS INDICATED.

1. EXTERIOR GLASS THICKNESS: 1/4 INCH (6 MM) NOMINAL, UNLESS OTHERWISE INDICATED.

2. INTERIOR GLASS THICKNESS: 1/4 INCH (6 MM) NOMINAL, UNLESS OTHERWISE INDICATED.

3. CUT TEMPERED GLASS TO SIZE AND SHAPE AND DRILL HOLES PRIOR TO TEMPERING.

B. GLASS TYPE - I-1: SEALED INSULATING GLASS (IG) UNITS WITH ARGON GAS.

1. TOTAL THICKNESS: 1-INCH (25 MM), NOMINAL.

2. INSULATING GLASS UNIT MAKEUP

A. OUTBOARD LITE

1) GLASS TINT: PROVIDE SAMPLES TO OWNER AND ARCHITECT FOR SELECTION

2) NOMINAL THICKNESS: 1/4-INCH (6 MM), NOMINAL

3) GLASS STRENGTH: HEAT-STRENGTHENED

4) COATING ORIENTATION: N/A

B. SPACER

1) NOMINAL THICKNESS: 1/2-INCH (13 MM), NOMINAL

2) GAS FILL: 90% ARGON

C. INBOARD LITE

1) GLASS TINT: CLEAR

2) NOMINAL THICKNESS: 1/4-INCH (6 MM), NOMINAL

3) GLASS STRENGTH: HEAT-STRENGTHENED

4) COATING ORIENTATION: N/A

3. PERFORMANCE CHARACTERISTICS (CENTER OF GLASS)

A. VISIBLE TRANSMITTANCE: 79%

B. VISIBLE REFLECTANCE: 15%

C. WINTER U-FACTOR (U-VALUE): 0.45

D. SUMMER U-FACTOR (U-VALUE): 0.48

E. SHADING COEFFICIENT (SC): 0.81

F. SOLAR HEAT GAIN COEFFICIENT (SHGC): 0.70

4. EDGE ENGAGEMENT: PER MANUFACTURER'S REQUIREMENTS.

5. BITE: PER MANUFACTURER'S REQUIREMENTS.

6. ACCEPTABLE GLAZING METHODS:

A. COMPRESSION GASKETS, BOTH SIDES.

B. SEALANT ONE SIDE, COMPRESSION GASKET OTHER SIDE.

C. GLASS TYPE - S-1: FLOAT GLASS. (THIS GLASS TYPE TO BE FURNISHED AND INSTALLED AT NON-FIRE RATED DOOR LOCATIONS.)

1. TOTAL THICKNESS: 1/4- INCH (6 MM), NOMINAL.

2. LAMINATED GLASS MAKEUP

A. OUTER PLY

1) GLASS TINT: CLEAR

2) NOMINAL THICKNESS: 1/8-INCH (3 MM), NOMINAL

3) GLASS STRENGTH: FULLY TEMPERED

4) COATING ORIENTATION: N/A

B. INTERLAYER

1) INTERLAYER TYPE: PVB

2) INTERLAYER TINT: CLEAR

3) NOMINAL THICKNESS: 0.060-INCH

C. INNER PLY

1) GLASS TINT: CLEAR

2) NOMINAL THICKNESS: 1/8-INCH (3 MM), NOMINAL

3) GLASS STRENGTH: FULLY TEMPERED

4) COATING ORIENTATION: N/A

3. PERFORMANCE CHARACTERISTICS (CENTER OF GLASS)

A. VISIBLE TRANSMITTANCE: 82%

B. VISIBLE REFLECTANCE: 8%

C. WINTER U-FACTOR (U-VALUE): 0.98

D. SUMMER U-FACTOR (U-VALUE): 0.89

E. SHADING COEFFICIENT (SC): 0.75

F. SOLAR HEAT GAIN COEFFICIENT (SHGC): 0.65

4. INTERLAYER MATERIAL: POLYVINYL BUTYRAL SHEETS.

5. EDGE ENGAGEMENT: PER MANUFACTURER'S REQUIREMENTS.

6. BITE: PER MANUFACTURER'S REQUIREMENTS.

7. ACCEPTABLE GLAZING METHODS:

A. SEALANT, BOTH SIDES.

B. SEALANT ONE SIDE, COMPRESSION GASKET OTHER SIDE.

D. GLASS TYPE - P-1: POLYCARBINATE GLAZING (THIS GLASS TYPE TO BE FURNISHED AND INSTALLED AT LOCATIONS NOTED ON DOOR SCHEDULE.)

1. TOTAL THICKNESS: 1/4”

2. COLOR: CLEAR

E. GLASS TYPE - FR-1: 3/4-HOUR FIRE RATED GLASS (THIS GLASS TYPE TO BE FURNISHED AND INSTALLED AT 3/4-HOUR FIRE RATED DOORS AS INDICATED IN DOOR SCHEDULE)

1. PROPERTIES

A. APPROXIMATE VISIBLE TRANSMITTANCE: 85%

B. APPROXIMATE VISIBLE REFLECTION: 9%

C. SURFACE FINISH: PREMIUM (POLISHED)

D. IMPACT SAFETY RESISTANCE:ANSI Z97.1 AND CPSC 16CFR1201 (CAT. I AND II)

E. POSITIVE PRESSURE TEST: UL 10C, UBC 7-2 AND 7-4: PASSES

F. STC RATING: APPROX. 35 DB.

2.04 INSTALLATION MATERIALS

A. GENERAL: SELECT PRODUCTS WHICH HAVE APPROPRIATE PERFORMANCE CHARACTERISTICS AS RECOMMENDED BY GLASS AND GLAZING MATERIALS MANUFACTURERS AND WHICH ARE COMPATIBLE WITH ALL MATERIALS WITH WHICH THEY WILL COME INTO CONTACT.

B. EXTERIOR GLAZING SEALANT: NON-CURING SILICONE COMPLYING WITH ASTM C920, GRADE NS, TYPE S OR M, CLASS 25, USES NT, A AND G.

1. DEMONSTRATE COMPATIBILITY AND ADHESION BY PRECONSTRUCTION TESTING.

2. COLORS: TO MATCH SUBSTRATE.

C. HEEL AND TOE BEAD SEALANT: NON-CURING, NON-SKINNING, MINIMUM 75 PERCENT SOLIDS, BUTYL OR POLYISOBUTYLENE RUBBER, COMPLYING WITH 802.3, TYPE II DUCTILE BACK BEDDING COMPOUND, AS DESCRIBED IN AAMA 800.

D. SEALANT TAPE: PRE-CURED, 100 PERCENT SOLIDS BUTYL POLYISOBUTYLENE RUBBER WITH INTERNAL SPACER ROD OR OF COMPOSITION LIMITING COMPRESSION TO A MAXIMUM OF 50 PERCENT, COMPLYING WITH 806.3 OR 807.3 TAPE, AS DESCRIBED IN AAMA 800.

1. SIZE TAPE SO THAT IT IS UNDER COMPRESSION WHEN GLAZING IS FULLY INSTALLED.

E. DENSE COMPRESSION GASKETS: PREFORMED NEOPRENE, EPDM OR THERMOPLASTIC POLYOLEFIN RUBBER, COMPLYING WITH ASTM C864.

1. SELECT STYLE AND SIZE SO THAT SOFT GASKET WILL BE COMPRESSED AT LEAST 25 PERCENT WHEN GLAZING IS FULLY INSTALLED.

F. SOFT COMPRESSION GASKETS: BLACK, PREFORMED CLOSED CELL NEOPRENE, COMPLYING WITH ASTM C509, TYPE II; SHAPED AND DENSITY TO MAINTAIN SEAL.

1. SEALANT TAPE MAY BE USED IN LIEU OF SOFT GASKETS, AT CONTRACTOR'S OPTION.

PART 3 - EXECUTION

3.01 EXAMINATION

A. SITE VERIFICATION AND CONDITIONS

1. VERIFY THAT SITE CONDITIONS ARE ACCEPTABLE FOR INSTALLATION OF THE GLASS.

2. VERIFY OPENINGS FOR GLAZING ARE CORRECTLY SIZED AND WITHIN TOLERANCE.

3. VERIFY THAT A FUNCTIONING WEEP SYSTEM IS PRESENT.

4. VERIFY THAT THE MINIMUM REQUIRED FACE AND EDGE CLEARANCES ARE BEING FOLLOWED.

5. DO NOT PROCEED WITH GLAZING UNTIL UNSATISFACTORY CONDITIONS HAVE BEEN CORRECTED.

3.02 PREPARATION

SECTION 08 80 00

GLAZING

A. PROTECTION

1. HANDLE AND STORE PRODUCT ACCORDING TO MANUFACTURERS' RECOMMENDATIONS.

B. SURFACE PREPARATION

1. CLEAN AND PREPARE GLAZING CHANNELS AND OTHER FRAMING MEMBERS TO RECEIVE GLASS.

2. REMOVE COATINGS AND OTHER HARMFUL MATERIALS THAT WILL PREVENT GLASS AND GLAZING INSTALLATION REQUIRED TO COMPLY WITH PERFORMANCE CRITERIA SPECIFIED.

3.03 INSTALLATION

A. INSTALL PRODUCTS USING THE RECOMMENDATIONS OF MANUFACTURERS OF GLASS, SEALANTS, GASKETS AND OTHER GLAZING MATERIALS, EXCEPT WHERE MORE STRINGENT REQUIREMENTS ARE INDICATED, INCLUDING THOSE IN THE “GANA GLAZING MANUAL”.

B. VERIFY THAT INSULATING GLASS (IG) UNIT SECONDARY SEAL IS COMPATIBLE WITH GLAZING SEALANTS.

C. INSTALL GLASS IN PREPARED GLAZING CHANNELS AND OTHER FRAMING MEMBERS.

D. INSTALL SETTING BLOCKS IN RABBETS AS RECOMMENDED BY REFERENCED GLAZING STANDARDS IN GANA GLAZING MANUAL AND IGMA GLAZING GUIDELINES.

E. PROVIDE BITE ON GLASS, MINIMUM EDGE AND FACE CLEARANCES AND GLAZING MATERIAL TOLERANCES RECOMMENDED BY GANA GLAZING MANUAL.

F. PROVIDE WEEP SYSTEM AS RECOMMENDED BY GANA GLAZING MANUAL. DO NOT BLOCK WEEP HOLES.

G. SET GLASS LITES IN EACH SERIES WITH UNIFORM PATTERN, DRAW, BOW AND SIMILAR CHARACTERISTICS.

H. DISTRIBUTE THE WEIGHT OF THE GLASS UNIT ALONG THE EDGE RATHER THAN AT THE CORNER.

I. COMPLY WITH MANUFACTURER'S AND REFERENCED INDUSTRY RECOMMENDATIONS ON EXPANSION JOINTS AND ANCHORS, ACCOMMODATING THERMAL MOVEMENT, GLASS OPENINGS, USE OF SETTING BLOCKS, EDGE, FACE AND BITE CLEARANCES, USE OF GLASS SPACERS, EDGE BLOCKS AND INSTALLATION OF WEEP SYSTEMS.

J. PROTECT GLASS FROM EDGE DAMAGE DURING HANDLING AND INSTALLATION. DO NOT INSTALL GLASS THAT HAS EDGE DAMAGE OR DEFECTS THAT REDUCE GLASS STRENGTH OR PERFORMANCE OR DIMINISH APPEARANCE.

K. PREVENT GLASS FROM CONTACT WITH CONTAMINATING SUBSTANCES THAT RESULT FROM CONSTRUCTION OPERATIONS, SUCH AS WELD SPATTER, FIREPROOFING OR PLASTER.

L. REMOVE AND REPLACE GLASS THAT IS BROKEN, CHIPPED, CRACKED OR DAMAGED IN ANY WAY.

3.04 GLAZING IN FRAMES

A. USE CONTINUOUS HEEL AND TOE BEAD AT ALL EXTERIOR GLAZING.

B. SEALANTS:

1. USE CONTINUOUS SPACERS.

A. EXCEPTION: FOR LITES OF LESS THAN 100 UNITED INCHES, NON-CONTINUOUS SPACERS MAY BE USED, WITH BACKER RODS TO FORM PROPER SEALANT SHAPE.

C. COMPRESSION GASKETS: SECURE GASKETS SO THEY WILL NOT WORK OUT UNDER NORMAL MOVEMENT.

1. INSTALL GASKETS SO THEY FIT TIGHTLY AT CORNERS, ALLOWING FOR STRETCH DURING INSTALLATION.

3.05 CLEANING AND PROTECTION

A. CLEANING:

1. REMOVE TEMPORARY COVERINGS AND PROTECTION OF ADJACENT WORK AREAS.

2. REPAIR OR REPLACE DAMAGED INSTALLED PRODUCTS.

3. CLEAN EXCESS SEALANT OR COMPOUND FROM GLASS AND FRAMING MEMBERS IMMEDIATELY AFTER APPLICATION USING SOLVENTS OR CLEANERS RECOMMENDED BY MANUFACTURERS.

4. GLASS TO BE CLEANED ACCORDING TO:

A. GANA GLASS INFORMATIONAL BULLETIN GANA 01-0300 - PROPER PROCEDURES FOR CLEANING ARCHITECTURAL GLASS PRODUCTS.

B. GANA GLASS INFORMATION BULLETIN GANA TD-02-0402 - HEAT-TREATED GLASS SURFACES ARE DIFFERENT.

5. DO NOT USE SCRAPERS OR OTHER METAL TOOLS TO CLEAN GLASS.

6. REMOVE CONSTRUCTION DEBRIS FROM PROJECT SITE AND LEGALLY DISPOSE OF DEBRIS.

B. PROTECTION: PROTECT INSTALLED PRODUCT'S FINISH SURFACES FROM DAMAGE DURING CONSTRUCTION.

END OF SECTION

SECTION 09 26 00

GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. CONSTRUCTION DRAWINGS, SPECIFICATIONS AND PROVISIONS OF THE CONTRACT INCLUDING GENERAL AND SUPPLEMENTAL CONDITIONS AND OTHER DIVISION 1 SPECIFICATION SECTIONS, ARE HEREBY MADE A PART OF THIS SECTION AS FULLY AND COMPLETELY AS IF REPEATED HEREIN.

1.02 ITEMS REQUIRED BUT NOT SPECIFIED

A. IF AN ITEM OR MATERIAL OF THIS TRADE IS INDICATED ON THE DRAWINGS BUT NOT SPECIFICALLY LISTED IN THIS SECTION, PROVIDE SUCH ITEM OR MATERIAL AT A STANDARD OF QUALITY EQUAL TO THE STANDARD ESTABLISHED FOR THE BALANCE OF THE WORK SPECIFIED, IN ACCORDANCE WITH THE ARCHITECT'S INTERPRETATION

1.03 EXECUTION, CORRELATION AND INTENT

A. IN CASE OF AN INCONSISTENCY BETWEEN DRAWINGS AND SPECIFICATIONS OR WITHIN EITHER DOCUMENT NOT CLARIFIED BY ADDENDUM, THE BETTER QUALITY OR GREATER QUANTITY OF WORK IS TO BE PROVIDED, IN ACCORDANCE WITH THE ARCHITECT'S INTERPRETATION

1.04 SUMMARY

A. THIS SECTION INCLUDES THE FOLLOWING:

1. NON-LOAD BEARING STEEL FRAMING.

2. SUSPENDED METAL FRAMING FOR GYPSUM SHEATHED CEILINGS

3. ACOUSTIC INSULATION.

4. INTERIOR GYPSUM WALLBOARD (WALLS AND CEILINGS).

5. GYPSUM WALLBOARD FINISHING.

6. FIRE SAFING.

7. MISCELLANEOUS WOOD BLOCKING AND OR METAL STRAPPING.

1.05 RELATED SECTIONS

A. 06 10 00 - ROUGH CARPENTRY

B. 07 84 10 - THROUGH-PENETRATION FIRESTOP SYSTEMS

C. 07 84 20 - FIRE RESISTIVE JOINT SYSTEMS

D. 07 90 00 - JOINT SEALERS

1.06 DEFINITIONS

A. GYPSUM BOARD TERMINOLOGY: REFER TO ASTM C11 FOR DEFINITIONS OF TERMS FOR GYPSUM BOARD ASSEMBLIES NOT DEFINED IN THIS SECTION OR IN OTHER REFERENCE STANDARDS.

1.07 SUBMITTALS

A. PRODUCT DATA: FOR EACH TYPE OF PRODUCT INDICATED.

1.08 QUALITY ASSURANCE

A. INSTALLER QUALIFICATIONS: PROVIDE INSTALLATION BY A COMPANY SPECIALIZING IN WORK SIMILAR TO THAT REQUIRED ON THIS PROJECT AND WITH NOT LESS THAN 5 YEARS OF DOCUMENTED EXPERIENCE.

B. REGULATORY REQUIREMENTS: AS INDICATED ON THE DRAWINGS PROVIDE FIRE-RATED ASSEMBLIES TESTED IN ACCORDANCE WITH ASTM E119 AND ACCEPTABLE TO AUTHORITIES FOR RATINGS REQUIRED. PROVIDE ASSEMBLIES AS LISTED IN ONE OF THE FOLLOWING:

1. GA-600, "FIRE RESISTANCE DESIGN MANUAL"

2. UNDERWRITERS LABORATORIES INC.'S (UL) "FIRE RESISTANCE DIRECTORY".

C. SOUND TRANSMISSION CHARACTERISTICS: FOR GYPSUM BOARD ASSEMBLIES WITH STC RATINGS, PROVIDE MATERIALS AND CONSTRUCTION IDENTICAL TO THOSE TESTED IN ASSEMBLY INDICATED ACCORDING TO ASTM E90 AND CLASSIFIED ACCORDING TO ASTM E413 BY A QUALIFIED INDEPENDENT TESTING AGENCY.

1. STC RATING: 50 (MIN.)

1.09 DELIVERY, STORAGE AND HANDLING

A. ALL MATERIALS FOR THE WORK OF THIS SECTION SHALL BE DELIVERED, STORED AND HANDLED SO AS TO PRECLUDE DAMAGE OF ANY NATURE. ALL PRODUCTS SHALL BE DELIVERED AND STORED IN THE MANUFACTURER'S ORIGINAL, UNOPENED CONTAINERS OR WRAPPINGS WITH SEALS AND LABELS INTACT.

B. STORE MATERIALS INSIDE UNDER COVER AND KEEP THEM DRY AND PROTECTED AGAINST DAMAGE FROM WEATHER, DIRECT SUNLIGHT, SURFACE CONTAMINATION, CORROSION, CONSTRUCTION TRAFFIC AND OTHER CAUSES. STACK GYPSUM BOARD PANELS FLAT TO PREVENT SAGGING.

C. ALL MATERIALS IN BROKEN CONTAINERS OR IN PACKAGES SHOWING WATERMARKS OR OTHER EVIDENCE OF DAMAGE AS DETERMINED BY THE OWNERS REPRESENTATIVE ARE TO BE REMOVED FROM THE JOB SITE AND REPLACED AT NO COST TO THE OWNER.

1.10 PROJECT CONDITIONS

A. ENVIRONMENTAL LIMITATIONS: COMPLY WITH ASTM C840 REQUIREMENTS OR GYPSUM BOARD MANUFACTURER'S WRITTEN RECOMMENDATIONS, WHICH EVER ARE MORE STRINGENT.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. AVAILABLE MANUFACTURERS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, MANUFACTURERS OFFERING PRODUCTS THAT MAY BE INCORPORATED INTO THE WORK INCLUDE, BUT ARE NOT LIMITED TO, THE FOLLOWING:

SECTION 09 26 00

GYPSUM BOARD ASSEMBLIES

1. STEEL FRAMING AND FURRING:

A. DIETRICH INDUSTRIES.

B. NATIONAL GYPSUM COMPANY.

C. UNIMAST, INC.

2. GYPSUM BOARD AND RELATED PRODUCTS:

A. G-P GPYSUM CORP.

B. NATIONAL GYPSUM COMPANY.

C. UNITED STATES GYPSUM CO.

2.02 STEEL PARTITION AND SOFFIT FRAMING

A. COMPONENTS, GENERAL : AS FOLLOWS:

1. COMPLY WITH ASTM C754 FOR CONDITIONS INDICATED.

2. STEEL SHEET COMPONENTS: COMPLYING WITH ASTM C645 REQUIREMENTS FOR METAL AND WITH ASTM A635/A653M, G40, HOT-DIP GALVANIZED ZINC COATING.

B. STEEL STUDS AND RUNNERS: ASTM C645

1. MINIMUM BASE METAL THICKNESS: 20 GAGE (0.0359 INCH).

2. DEPTH: AS INDICATED ON DRAWINGS.

C. DEEP-LEG DEFLECTION TRACK: ASTM C645 TOP RUNNER WITH 2-INCH DEEP FLANGES.

D. FLAT STRAP AND BACKING PLATE: STEEL SHEET FOR BLOCKING AND BRACING IN LENGTH AND WIDTH INDICATED.

1. MINIMUM BASE METAL THICKNESS: 20 GAGE (0.0359 INCH).

E. HAT-SHAPED, RIGID FURRING CHANNELS: ASTM C645.

1. MINIMUM BASE METAL THICKNESS: 20 GAGE (0.0359 INCH).

2. DEPTH: 7/8 INCH.

F. SINGLE-LEG, RESILIENT FURRING CHANNELS: ASTM C645.

1. MINIMUM BASE METAL THICKNESS: 20 GAGE (0.0359 INCH).

2. DEPTH: 1/2 INCH.

G. FASTENERS FOR METAL FRAMING: OF TYPE, MATERIAL, SIZE, CORROSION RESISTANCE, HOLDING POWER AND OTHER PROPERTIES REQUIRED TO FASTEN STEEL MEMBERS TO SUBSTRATES.

2.03 CEILING SUSPENSION SYSTEM FOR GYPSUM BOARD CEILING

SECTION 09 26 00

GYPSUM BOARD ASSEMBLIES

A. STEEL FRAMING MEMBERS:

1. MANUFACTURERS:

A. CHICAGO METALIC AND SPECIALTY PRODUCTS, (800) 323-7164. PRODUCT: 650-C HEAVY-DUTY SUSPENSION SYSTEM.

B. ARMSTRONG WORLD INDUSTRIES, (877) 276-7876. PRODUCT: DRYWALL GRID SYSTEM.

C. APPROVED EQUAL.

2. GENERAL: ASTM C 635 HEAVY-DUTY MAIN BEAM CLASSIFICATION, ASTM A 653 ZINC-COATED HOT DIPPED GALVANIZED STEEL. CONFORM TO ASTM C 645, STANDARD SPECIFICATOIN FOR RIGID FURRING CHANNELS FOR SCREW APPLICATIONS OF GYPSUM BOARD.

3. FURRING RUNNERS: 1-3/8" WIDE KNURLED FACE BY 1-1/2" HIGH BY 12'-0" LONG BY .020" THICK, WITH FACTORY PUNCHED CROSS TEE SLOTS, HANGER HOLES, AND NON-DIRECTIONAL BAYONET END TAB COUPLINGS.

4. FURRING TEES: 1-3/8" WIDE KNURLED FACE BY 1-1/2" HIGH BY 4'-0" LONG BY .020" THICK, WITH FACTORY PUNCHED CROSS TEE SLOTS, HANGER HOLES, AND HOOK TYPE END TAB COUPLINGS.

5. FURRING CROSS CHANNEL: 1-3/8" WIDE KNURLED FACE BY 7/8" HIGH BY 4'-0" LONG BY .020" THICK, WITH STRAIGHT LOCKING END TABS.

6. CROSS TEES: 15/16" WIDE BY 1-1/2" HIGH BY 4'-0" LONG BY .020" THICK, WITH FACTORY PUNCHED CROSS TEE SLOTS, HANGER HOLES, AND STAB-TYPE END TAB COUPLINGS. COATED WITH FACTORY APPLIED WHITE BAKED-ON ENAMEL PAINT FINISH.

7. WALL TRACK: 1-9/16" HIGH BY 10'-0" LONG BY .020" THICK WITH A 1" TOP AND BOTTOM FLANGE.

B. COLD ROLLED CHANNELS: 16 GA., 1-1/2" DEEP WITH 9/16" FLANGES

C. HANGER WIRE: NO. 12 SWG GALVANIZED STEEL WIRE

2.04 INTERIOR GYPSUM WALLBOARD

A. PANEL SIZE: PROVIDE MAXIMUM LENGTHS AND WIDTHS AVAILABLE THAT WILL MINIMIZE JOINTS IN EACH AREA AND CORRESPOND WITH SUPPORT INDICATED.

B. GYPSUM WALLBOARD: ASTM C36.

1. TYPE X:

A. THICKNESS: 1/2 INCH AND 5/8 INCH.

B. LONG EDGES: TAPERED

C. LOCATION: ALL INTERIOR GYPSUM WALLBOARD, EXCEPT WHERE OTHERWISE INDICATED.

2. TYPE SW:

A. THICKNESS: 1/2 INCH AND 5/8 INCH.

B. LONG EDGES: TAPERED

C. LOCATION: WHERE INDICATED ON DRAWINGS.

3. PROVIDE WATER-RESISTANT GYPSUM WALLBOARD WHERE INDICATED.

2.05 TRIM ACCESSORIES

A. INTERIOR TRIM: ASTM C1047.

1. MATERIAL: GALVANIZED COATED STEEL SHEET OR ROLLED ZINC.

2. SHAPES:

A. CORNER BEAD: USE AT OUTSIDE CORNERS, UNLESS OTHERWISE INDICATED.

B. BULL NOSE BEAD: USE WHERE INDICATED.

C. LC BEAD: J-SHAPED; EXPOSED LONG FLANGE RECEIVES JOINT COMPOUND; USE AS INDICATED.

D. U-BEAD: J-SHAPED; EXPOSED SHORT FLANGE DOES NOT RECEIVE JOINT COMPOUND; USE AT EXPOSED PANEL EDGES.

E. EXPANSION (CONTROL) JOINT: USE WHERE INDICATED.

F. CURVED-EDGED CORNER BEAD: WITH NOTCHED OR FLEXIBLE FLANGES; USE AT CURVED OPENINGS.

2.06 JOINT TREATMENT MATERIALS

A. GENERAL: COMPLY WITH ASTM C475.

B. JOINT TAPE:

1. INTERIOR GYPSUM WALLBOARD: PAPER.

C. JOINT COMPOUND FOR INTERIOR GYPSUM WALLBOARD: FOR EACH COAT USE FORMULATIONS THAT ARE COMPATIBLE WITH OTHER COMPOUNDS APPLIED ON PREVIOUSLY OR FOR SUCCESSIVE COATS.

1. PRE-FILLING: AT OPEN JOINTS AND DAMAGED SURFACE AREAS, USE SETTING-TYPE TAPING COMPOUND.

2. EMBEDDING AND FIRST COAT: FOR EMBEDDING TAPE AND FIRST COAT ON JOINTS, FASTENERS AND TRIM FLANGES, USE SETTING-TYPE TAPING COMPOUND.

3. FILL COAT: FOR SECOND COAT, USE SETTING TYPE, SANDABLE TOPPING COMPOUND.

4. FINISH COAT: FOR THIRD COAT, USE SETTING TYPE, SANDABLE TOPPING COMPOUND.

2.07 SOUND ATTENTUATION BATT INSULATION

A. PROVIDE MANUFACTURER'S STANDARD PREFORMED INSULATION UNITS, SIZED FOR PROPER FIT IN INDICATED APPLICATIONS.

B. SOUND ATTENUATION BATT INSULATION: ASTM C665, TYPE I, PASSING ASTM E136 COMBUSTION TEST REQUIREMENTS; UNFACED SEMI-RIGID MINERAL WOOL FIBER BATT; THICKNESS AS REQUIRED AND INDICATED FOR WALL CONSTRUCTION AND STC RATING.

1. TOTAL R-VALUE: 3.8 PER INCH, APPROX. R13.3.

2. PRODUCTS FROM THE FOLLOWING MANUFACTURERS, PROVIDED THEY COMPLY WITH THE REQUIREMENTS OF THE CONTRACT DOCUMENTS, WILL BE AMONG THOSE CONSIDERED ACCEPTABLE:

A. OWENS- CORNING FIBERGLASS CORP.

B. CERTAINTEED CORP.

C. KNAUF FIBER GLASS.

2.08 FIRE SAFING

A. MINERAL FIBER FIRE SAFING INSULATION: COMPOSED OF THERMOSETTING RESIN BINDERS AND SEMIREFRACTORY MINERAL FIBERS DERIVED FROM ROCK OR SLAG:

1. UNFACED BLANKET/BATT: ASTM C655, TYPE I, NONCOMBUSTIBLE AS TESTED IN ACCORDANCE WITH ASTM E136.

A. INSTALL IN ALL CONTINUOUS JOINTS IN FIRE RATED WALLS AND IN ALL LOCATIONS WHERE FIRE-STOP SEALANT IS INDICATED ON THE DRAWINGS.

2. THICKNESS: 4 INCH OR AS OTHERWISE REQUIRED.

3. INCLUDE GALVANIZED STEEL SAFING IMPALING CLIPS, UL LABELED.

4. PRODUCTS FROM THE FOLLOWING MANUFACTURERS, PROVIDED THEY COMPLY WITH THE REQUIREMENTS OF THE CONTRACT DOCUMENTS, WILL BE AMONG THOSE CONSIDERED ACCEPTABLE:

A. USG CORPORATION.

2.09 AUXILLARY MATERIALS

A. GENERAL: PROVIDE AUXILIARY MATERIALS THAT COMPLY WITH THE REFERENCED INSTALLATION STANDARDS AND MANUFACTURERS WRITTEN RECOMMENDATIONS.

B. STEEL DRILL SCREWS: ASTM C1002, UNLESS OTHERWISE INDICATED.

1. USE SCREWS COMPLYING WITH ASTM C954 FOR FASTENING TO STEEL MEMBERS FROM 0.033 TO 0.112 INCH THICK.

C. ISOLATION STRIP AT EXTERIOR WALLS.

1. ASPHALT-SATURATED ORGANIC FELT: ASTM D226, TYPE 1 (NO. 15 ASPHALT FELT), NON-PERFORATED.

PART 3 - EXECUTION

SECTION 09 26 00

GYPSUM BOARD ASSEMBLIES

3.01 EXAMINATION

A. INSPECTION: VERIFY THAT PROJECT CONDITIONS AND SUBSTRATES ARE APPROPRIATE TO BEGIN INSTALLATION OF WORK OF THIS SECTION.

3.02 INSTALLING STEEL FRAMING, GENERAL

A. INSTALLATION STANDARDS: ASTM C754 AND ASTM C840 REQUIREMENTS APPLY TO FRAMING INSTALLATION.

B. INSTALL SUPPLEMENTARY FRAMING, BLOCKING AND BRACING AT TERMINATIONS IN GYPSUM BOARD ASSEMBLIES TO SUPPORT FIXTURES, EQUIPMENT SERVICES, HEAVY TRIM, GRAB BARS, TOILET ACCESSORIES, FURNISHINGS OR SIMILAR CONSTRUCTION. COMPLY WITH DETAILS INDICATED AND WITH GYPSUM BOARD MANUFACTURER'S WRITTEN RECOMMENDATIONS OR IF NONE AVAILABLE, WITH UNITED STATES GYPSUM'S "GYPSUM CONSTRUCTION HANDBOOK".

C. ISOLATE STEEL FRAMING FROM BUILDING STRUCTURE TO PREVENT TRANSFER OF LOADING IMPOSED BY STRUCTURAL MOVEMENT.

1. ISOLATE CEILING ASSEMBLIES WHERE THEY ABUT OR ARE PENETRATED BY BUILDING STRUCTURE.

2. ISOLATE PARTITION FRAMING AND WALL FURRING WHERE IT ABUTS STRUCTURE, EXCEPT AT FLOOR. INSTALL SLIP-TYPE JOINTS AT HEAD OF ASSEMBLIES THAT AVOID AXIAL LOADING OF ASSEMBLY AND LATERALLY SUPPORT ASSEMBLY.

A. USE DEEP-LEG DEFLECTION TRACK WHERE INDICATED.

D. DO NOT BRIDGE BUILDING CONTROL JOINTS AND EXPANSION JOINTS WITH STEEL FRAMING OR FURRING MEMBERS. FRAME BOTH SIDES OF JOINT INDEPENDENTLY.

3.03 INSTALLING STEEL PARTITIONS AND SOFFIT FRAMING

A. INSTALL TRACKS (RUNNERS) AT FLOORS, CEILINGS, AND STRUCTURAL WALLS AND COLUMNS WHERE GYPSUM BOARD ASSEMBLIES ABUT OTHER CONSTRUCTION.

1. WHERE STUDS ARE INSTALLED DIRECTLY AGAINST EXTERIOR WALLS, INSTALL ASPHALT-FELT ISOLATION STRIP BETWEEN STUD AND WALL.

B. INSTALLATION TOLERANCE: INSTALL EACH STEEL FRAMING AND FURRING MEMBER SO FASTENING SURFACES VARY NOT MORE THAN 1/8 INCH FROM PLANE FORMED BY THE FACES OF ADJACENT FRAMING.

C. EXTEND ALL PARTITION FRAMING FULL HEIGHT TO UNDERSIDE OF STEEL FLOOR OR ROOF DECKING, STRUCTURAL SUPPORTS OR SUBSTRATES ABOVE SUSPENDED CEILINGS, EXCEPT WHERE PARTITIONS ARE INDICATED TO TERMINATE AT SUSPENDED CEILINGS. CONTINUE FRAMING OVER FRAMES FOR DOORS AND OPENINGS AND FRAME AROUND DUCTS PENETRATING PARTITIONS ABOVE CEILING TO PROVIDE SUPPORT FOR GYPSUM BOARD.

1. FOR FIRE-RESISTANT-RATED AND STC-RATED PARTITIONS THAT EXTEND TO THE UNDERSIDE OF ROOF/SLAB AND DECKS OR OTHER CONTINUOUS SOLID-STRUCTURE SURFACES. TO OBTAIN RATINGS, INSTALL FRAMING AROUND STRUCTURAL AND OTHER MEMBERS EXTENDING BELOW FLOOR/ROOF SLABS AND DECKS, AS NEEDED TO SUPPORT GYPSUM BOARD CLOSURES AND TO MAKE PARTITIONS CONTINUOUS FROM FLOOR TO UNDERSIDE OF SOLID STRUCTURE.

D. INSTALL STEEL STUDS AND FURRING AT THE FOLLOWING SPACING:

1. SINGLE-LAYER CONSTRUCTION: 16 INCHES O.C., UNLESS OTHERWISE INDICATED.

2. MULTI-LAYER CONSTRUCTION: 16 INCHES O.C., UNLESS OTHERWISE INDICATED.

E. INSTALL STEEL STUDS SO FLANGES POINT IN THE SAME DIRECTION AND LEADING EDGE OR END OF EACH PANEL CAN BE ATTACHED TO OPEN (UNSUPPORTED) EDGES OF STUD FLANGES FIRST.

F. FRAME DOOR OPENING TO COMPLY WITH GA-600 AND WITH GYPSUM BOARD MANUFACTURER'S APPLICABLE RECOMMENDATIONS, UNLESS OTHERWISE INDICATED. SCREW VERTICAL STUDS AT JAMBS TO JAMB ANCHOR CLIPS ON DOOR FRAMES; INSTALL RUNNER TRACK SECTION (FOR CRIPPLE STUDS) AT HEAD AND SECURE TO JAMB STUDS.

1. INSTALL TWO STUDS AT EACH JAMB, UNLESS OTHERWISE INDICATED.

2. INSTALL CRIPPLE STUDS AT HEAD ADJACENT TO EACH JAMB STUD, WITH A MINIMUM ½ INCH CLEARANCE FROM JAMB STUD TO ALLOW FOR INSTALLATION OF CONTROL JOINT.

3. EXTEND JAMB STUDS THROUGH SUSPENDED CEILINGS AND ATTACH TO UNDERSIDE OF FLOOR OR ROOF STRUCTURE ABOVE.

G. FRAME OPENINGS OTHER THAN DOOR OPENING THE SAME AS REQUIRED FOR DOOR OPENINGS, UNLESS OTHERWISE INDICATED. INSTALL FRAMING BELOW SILLS OF OPENINGS TO MATCH FRAMING REQUIRED ABOVE DOOR HEADS.

3.04 INSTALLATION - CEILING FRAMING

A. FURRING RUNNERS: INSTALLED 48 INCHES ON CENTER BY DIRECT SUSPENSION FROM STRUCTURE WITH NOT LESS THAN 12 GA. HANGER WIRES SPACED 48” ON CENTER ALONG MAIN RUNNER. WRAP HANGER WIRES TIGHTLY 3 FULL TURNS AT EACH END.

B. FURRING TEES: INSTALLED PERPENDICULAR TO FURRING RUNNERS 24” ON CENTER TO FORM 24” BY 48” MODULES.

C. CROSS TEES: INSTALLED ADJACENT TO EACH UNSUPPORTED SIDE OF RECESSED FIXTURES.

D. WALL TRACK: INSTALLED ON VERTICAL SURFACES, INTERSECTING SUSPENSION COMPONENTS.

E. ADDITIONAL HANGER WIRES: WRAPPED TIGHTLY 3 FULL TURNS TO STRUCTURE AND COMPONENT AT LOCATIONS WHERE LOADS COULD CAUSE DEFLECTION EXCEEDING 1/360 SPAN

F. INSTALLED IN ACCORDANCE WITH U.L. DESIGN NUMBER P514 GUIDELINES.

3.05 APPLYING AND FINISHING PANELS, GENERAL

A. GYPSUM BOARD APPLICATION AND FINISHING STANDARDS: ASTM C840, GA-214 AND GA-216.

B. INSTALL CEILING BOARD PANELS ACROSS FRAMING TO MINIMIZE THE NUMBER OF ABUTTING END JOINTS AND TO AVOID ABUTTING END JOINTS IN THE CENTRAL AREA OF EACH CEILING. STAGER ABUTTING END JOINTS OF ADJACENT PANELS NOT LESS THAN ONE FRAMING MEMBER.

C. INSTALL GYPSUM PANELS WITH FACE SIDE OUT. BUTT PANELS TOGETHER FOR A LIGHT CONTACT AT EDGES AND ENDS WITH NOT MORE THAN 1/16 INCH OF OPEN SPACE BETWEEN PANELS. DO NOT FORCE INTO PLACE.

D. LOCATE EDGE AND END JOINTS OVER SUPPORTS, EXCEPT IN CEILING APPLICATIONS WHERE INTERMEDIATE SUPPORTS OR GYPSUM BOARD BACK-BLOCKING IS PROVIDED BEHIND END JOINTS. DO NOT PLACE TAPERED EDGES AGAINST CUT EDGES OR ENDS. STAGGER VERTICAL JOINTS ON OPPOSITE SIDES OF PARTITIONS. DO NOT MAKE JOINTS OTHER THAN CONTROL JOINTS AT CORNERS OF FRAMED OPENINGS.

E. ATTACH GYPSUM PANELS TO STEEL STUDS SO LEADING EDGE OR END OF EACH PANEL IS ATTACHED TO OPEN (UNSUPPORTED) EDGES OF STUD FLANGES FIRST.

F. ATTACH GYPSUM PANELS TO FRAMING PROVIDED AT OPENINGS AND CUTOUTS.

G. FORM CONTROL AND EXPANSION JOINTS WITH SPACE BETWEEN EDGES OF ADJOINING GYPSUM PANELS.

H. COVER BOTH FACES OF STEEL STUD PARTITION FRAMING WITH GYPSUM PANELS IN CONCEALED SPACES (ABOVE CEILINGS, ETC.), EXCEPT IN CHASES BRACED INTERNALLY.

1. UNLESS CONCEALED APPLICATION IS INDICATED OR REQUIRED FOR SOUND, FIRE, AIR OR SMOKE RATINGS, COVERAGE MAY BE ACCOMPLISHED WITH SCRAPS OF NOT LESS THAN 8 SQ. FT. IN AREA.

2. FIT GYPSUM PANELS AROUND DUCTS, PIPES AND CONDUITS.

3. WHERE PARTITIONS INTERSECT OPEN CONCRETE COFFERS, CONCRETE JOIST AND OTHER STRUCTURAL MEMBERS PROJECTING BELOW UNDERSIDE OF FLOOR/ROOF SLABS AND DECKS, CUT GYPSUM PANELS TO FIT PROFILE FORMED BY COFFERS, JOISTS AND OTHER STRUCTURAL MEMBERS; ALLOW 1/4- TO 3/8-INCH WIDE JOINTS TO INSTALL SEALANT.

I. ISOLATE PERIMETER OF NON-LOAD BEARING GYPSUM BOARD PARTITIONS AT STRUCTURAL ABUTMENTS, EXCEPT FLOORS. PROVIDE ¼ TO ½ INCH WIDE SPACES AT THESE LOCATIONS AND TRIM EDGES WITH U-BEAD EDGE TRIM WHERE EDGES OF GYPSUM BOARD ARE EXPOSED. SEAL JOINTS BETWEEN EDGES AND ABUTTING STRUCTURAL SURFACES WITH ACOUSTICAL SEALANT.

J. STC-RATED ASSEMBLIES:

1. SEAL CONSTRUCTION AT PERIMETER, BEHIND CONTROL AND EXPANSION JOINTS AND AT OPENINGS AND PENETRATIONS WITH CONTINUOUS BEAD OF ACOUSTICAL SEALANT. INSTALL ACOUSTICAL SEALANT AT BOTH FACES OF PARTITIONS AT PERIMETERS AND THROUGH PENETRATIONS. COMPLY WITH ASTM C919 AND MANUFACTURER'S WRITTEN RECOMMENDATIONS FOR LOCATING EDGE TRIM AND CLOSING OFF SOUND-FLANKING PATHS AROUND OR THROUGH GYPSUM BOARD ASSEMBLIES, INCLUDING SEALING PARTITIONS ABOVE ACOUSTICAL CEILINGS.

2. AT PARTITIONS SHOWN OR WHERE REQUIRED FOR STC RATINGS INDICATED, INSTALL SOUND ATTENUATION BLANKETS AFTER GYPSUM BOARD HAS BEEN INSTALLED ON ONE SIDE.

K. SPACE FASTENERS IN GYPSUM PANELS ACCORDING TO REFERENCED GYPSUM BOARD APPLICATION AND FINISHING STANDARD AND MANUFACTURER'S RECOMMENDATIONS.

1. SPACE SCREWS A MAXIMUM OF 12 INCHES O.C. FOR VERTICAL APPLICATIONS.

3.06 PANEL APPLICATION METHODS

A. SINGLE-LAYER APPLICATION:

1. ON CEILINGS, APPLY GYPSUM PANELS BEFORE WALL/PARTITION BOARD APPLICATION TO THE GREATEST EXTENT POSSIBLE AND AT RIGHT ANGLES TO FRAMING, UNLESS OTHERWISE INDICATED.

2. ON PARTITIONS/WALLS, APPLY GYPSUM PANELS HORIZONTALLY (PERPENDICULAR TO FRAMING), UNLESS OTHERWISE INDICATED OR REQUIRED BY FIRE-RESISTANCE-RATED ASSEMBLY AND MINIMIZE END JOINTS.

A. STAGGER ABUTTING END JOINTS NOT LESS THAN ONE FRAMING MEMBER IN ALTERNATE COURSES OF BOARD.

B. AT HIGH WALLS, INSTALL PANELS HORIZONTALLY, UNLESS OTHERWISE INDICATED OR REQUIRED BY FIRE-RESISTANCE-RATED ASSEMBLY.

B. MULTI-LAYER APPLICATION ON PARTITIONS/WALLS: APPLY GYPSUM BOARD AS INDICATED FOR BASE LAYERS AND FACE LAYERS VERTICALLY (PARALLEL TO FRAMING) WITH JOINTS OF BASE LAYERS LOCATED OVER STUD OF FURRING MEMBER AND FACE-LAYER JOINTS OFFSET AT LEAST ONE STUD OR FURRING MEMBER WITH BASE LAYER JOINTS, UNLESS OTHERWISE INDICATED OR REQUIRED BY FIRE-RESISTANCE-RATED ASSEMBLY. STAGGER JOINTS ON OPPOSITE SIDE OF PARTITIONS.

C. SINGLE-LAYER FASTENING METHOD: APPLY GYPSUM PANELS TO SUPPORTS WITH STEEL DRILL SCREWS.

D. MULTI-LAYER FASTENING METHODS: FASTEN BASE LAYERS AND FACE LAYERS SEPARATELY TO SUPPORTS WITH STEEL DRILL SCREWS.

3.07 INSTALLING TRIM ACCESSORIES

A. GENERAL: FOR TRIM WITH BACK FLANGES INTENDED FOR FASTENERS, ATTACH TO FRAMING WITH SAME FASTENERS USED FOR PANELS. OTHERWISE, ATTACH TRIM ACCORDING TO MANUFACTURERS WRITTEN INSTRUCTIONS.

B. CONTROL JOINTS: INSTALL CONTROL JOINTS ACCORDING TO ASTM C840 AND IN SPECIFIC LOCATIONS APPROVED BY ARCHITECT FOR VISUAL EFFECT.

3.08 FIRE SAFING

A. INSTALL FIRE SAFING MATERIALS IN EXACT ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS AND THE CONDITIONS OF THE TESTING; PROVIDE ALL ACCESSORY MATERIALS REQUIRED.

1. PROVIDE SEALANT AT JOINT OVER INSULATION, IF REQUIRED BY THE MANUFACTURER FOR FIRE RATING OR OTHERWISE CALLED FOR ON THE DRAWINGS.

3.09 FINISHING GYPSUM BOARD ASSEMBLIES

A. GENERAL: TREAT GYPSUM BOARD JOINTS, INTERIOR ANGLES, EDGE TRIM, CONTROL JOINTS, PENETRATIONS, FASTENER HEADS, SURFACE DEFECTS AND ELSEWHERE AS REQUIRED TO PREPARE GYPSUM BOARD SURFACES FOR DECORATION.

B. PRE-FILL OPEN JOINTS AND DAMAGED SURFACE AREAS.

C. APPLY JOINT TAPE OVER GYPSUM BOARD JOINTS, EXCEPT TRIM HAVING FLANGES NOT INTENDED FOR TAPE.

D. GYPSUM BOARD FINISH LEVELS: FINISH PANELS TO LEVELS INDICATED BELOW, ACCORDING TO ASTM C840, GA 214 AND GA 216 FOR LOCATIONS INDICATED:

1. LEVEL 4: EMBED TAPE AND APPLY SEPARATE FIRST, FILL AND FINISH COATS OF JOINT COMPOUND TO TAPE, FASTENERS AND TRIM FLANGES AT PANEL SURFACES THAT WILL BE EXPOSED TO VIEW, UNLESS OTHERWISE INDICATED.

3.10 CLEANING

A. PROMPTLY REMOVE ANY RESIDUAL GYPSUM DRYWALL MATERIALS FROM ADJACENT OR ADJOINING SURFACES, LEAVING SPACES READY FOR SUBSEQUENT FINISHING OPERATIONS AND DECORATING.

END OF SECTION

SECTION 09 30 13

CERAMIC TILE

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. FURNISH AND INSTALL THE FOLLOWING:

1. FLOORING TILE.

2. INTERIOR WALL TILE.

3. TILE BASE AND ASSOCIATED TRIM.

4. INSTALLATION SYSTEMS, ADHESIVES, MORTARS AND GROUTS.

5. CONTROL JOINTS IN TILED FLOORS.

B. PERFORM DRILLING AND CUTTING IN TILE SURFACES, AS REQUIRED TO ACCOMMODATE PENETRATING ITEMS OF OTHER TRADES, FROM TEMPLATES AND INSTRUCTIONS FURNISHED BY THE RESPECTIVE TRADES.

1.02 REFERENCES

A. COMPLY WITH APPLICABLE REQUIREMENTS OF THE FOLLOWING STANDARDS AND THOSE OTHERS REFERENCED IN THIS SECTION. WHERE THESE STANDARDS CONFLICT WITH OTHER SPECIFIED REQUIREMENTS, THE MOST RESTRICTIVE REQUIREMENTS SHALL GOVERN.

1. ANSI (AMERICAN NATIONAL STANDARDS INSTITUTE):

A. ANSI A108.5 - INSTALLATION OF CERAMIC TILE WITH DRY-SET PORTLAND CEMENT MORTAR OR LATEX PORTLAND CEMENT MORTAR.

B. ANSI A108.10 - INSTALLATION OF GROUT IN TILEWORK.

C. ANSI A118.1 - DRY-SET PORTLAND CEMENT MORTAR.

D. ANSI A118.4 - LATEX-PORTLAND CEMENT MORTAR.

E. ANSI A118.6 - CERAMIC TILE GROUTS.

F. ANSI A137.1 - SPECIFICATIONS FOR CERAMIC TILE.

2. TCA HANDBOOK FOR CERAMIC TILE INSTALLATION, LATEST EDITION.

3. ASTM (AMERICAN SOCIETY OF TESTING AND MATERIALS):

A. ASTM C 144 - AGGREGATE FOR MASONRY MORTAR.

B. ASTM C 150 - PORTLAND CEMENT.

C. ASTM C 627 - EVALUATING CERAMIC FLOOR TILE INSTALLATION SYSTEMS.

D. ASTM C 1026 - MEASURING RESISTANCE OF CERAMIC TILE TO FREEZE THAW CYCLES

E. ASTM C 1027 - DETERMINING VISIBLE ABRASION RESISTANCE OF GLAZED CERAMIC TILE

1.03 SUBMITTALS

A. SUBMIT THE FOLLOWING UNDER PROVISIONS OF DIVISION 1:

1. LITERATURE: MANUFACTURER'S PRODUCT DATA SHEETS, SPECIFICATIONS, PERFORMANCE DATA, PHYSICAL PROPERTIES AND INSTALLATION INSTRUCTIONS FOR EACH ITEM FURNISHED HEREUNDER.

A. INCLUDE MAINTENANCE DATA AND RECOMMENDED CLEANING MATERIALS, AND CLEANING AND STAIN REMOVAL METHODS.

2. SELECTION SAMPLES:

A. REQUIRED ONLY IF CONTRACTOR IS PROPOSING A SUBSTITUTION.

1) MANUFACTURER'S SAMPLE BOARDS FOR EACH TYPE AND COLOR GROUP OF TILE SPECIFIED, AND GROUT COLORS, FOR SELECTIONS BY THE ARCHITECT.

3. VERIFICATION SAMPLES:

A. FULL SIZE SAMPLES OF EACH TILE TYPE REQUIRED.

B. TRIM SHAPES AND BASE, IN SELECTED COLORS IN TYPES AND SHAPES INDICATED FOR PROJECT CONDITIONS.

4. GRADE CERTIFICATES: MANUFACTURER'S MASTER GRADE CERTIFICATES SUBMITTED PRIOR TO SHIPMENT OF TILE TO PROJECT. COMPLY WITH ANSI A137.1 FOR SPECIAL PURPOSE TILES.

1.04 QUALITY ASSURANCE

A. CONFORM TO ANSI A 137.1 CERAMIC TILE STANDARD AND TCA HANDBOOK FOR CERAMIC TILE INSTALLATION F113.

B. INSTALLER, WITH A MINIMUM OF 3 YEARS DOCUMENTED EXPERIENCE DEMONSTRATING PREVIOUSLY SUCCESSFUL WORK OF THE TYPE SPECIFIED HEREIN.

C. TILES DELIVERED TO THE JOB OR INSTALLED IN THE WORK WHICH DO NOT FALL WITHIN THE ACCEPTED COLOR AND TEXTURE RANGE DEMONSTRATED BY THE SAMPLES SHALL BE REMOVED FROM THE SITE AND REPLACE WITH ACCEPTABLE MATERIALS.

1.05 DELIVERY, STORAGE AND HANDLING

A. DELIVER TILE IN MANUFACTURER'S SEALED CARTONS, GRADE-SEALED BY THE MANUFACTURER IN ACCORDANCE WITH ANSI A 137.1, WITH GRADE-SEALED UNBROKEN, AND CLEARLY MARKED AS TO CONTENTS, COLOR, AND QUANTITY.

B. STORE AND PROTECT CONTAINERS ABOVE FLOOR LEVEL, KEEP DRY UNTIL READY FOR USE.

C. PROTECT ADHESIVES FROM FREEZING OR OVERHEATING IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS. STORE EPOXY MORTAR AND EPOXY GROUTS AT 70 DEGREES FAHRENHEIT (21° C) TEMPERATURE FOR 24 HOURS PRIOR TO USE.

1.06 ENVIRONMENTAL CONDITIONS

A. DO NOT INSTALL SETTING OR GROUTING MATERIALS IN A CLOSED, UNVENTILATED ENVIRONMENT. VENTILATE PROPANE OR FOSSIL FUEL HEATERS TO PREVENT DAMAGE TO TILE WORK FROM CARBON-DIOXIDE BUILD UP.

B. MAINTAIN AMBIENT TEMPERATURES BETWEEN 50 (10º C) AND 80 (26º C) DEGREES FAHRENHEIT IN TILED AREAS, DURING INSTALLATION OF MORTAR MATERIALS AND FOR 7 DAYS AFTER COMPLETION.

1. WHEN TEMPERATURE OF SUBSTRATE EXCEEDS 90 (32º C) DEGREES FAHRENHEIT, CONTACT MANUFACTURER FOR INSTRUCTIONS.

1.07 SEQUENCING AND SCHEDULING

A. COORDINATE THE WORK OF THIS SECTION WITH THE RESPECTIVE TRADES RESPONSIBLE FOR INSTALLING INTERFACING WORK, AND ENSURE THAT THE WORK PERFORMED HEREUNDER IS ACCEPTABLE TO SUCH TRADES FOR THE INSTALLATION OF THEIR WORK.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. MANUFACTURE: TO ESTABLISH A STANDARD OF QUALITY, DESIGN AND FUNCTION DESIRED, DRAWINGS AND SPECIFICATIONS HAVE BEEN BASED ON THE TILE AND SETTING MATERIALS SPECIFIED IN THE FOLLOWING ARTICLES.

2.02 TILE

A. TILE AS SCHEDULED ON THE DRAWINGS AND ROOM FINISH SCHEDULE. PROVIDE TILE AS SELECTED BY THE OWNER AND APPROVED BY THE ARCHITECT.

B. ACCEPTABLE MANUFACTURERS:

C. FLOOR TILE: (CT-1)

1. DALTILE

2. CROSSVILLE

3. EMIL

4. ARCHITECT APPROVED EQUAL

5. PROVIDE MATCHING TRIM AND BULLNOSE SHAPES AT FREE EDGES.

6. PROVIDE MATCHING COVE BASE TRIM.

2.03 SETTING MATERIALS

A. WALLS AND FLOORS WITH AND WITHOUT OUT DRAINS: THIN-SET POLYMER-MODIFIED PORTLAND CEMENT DRY-SET MORTAR FOR TILE WALLS AND FLOORS: COMPLYING WITH THE BOND STRENGTH REQUIREMENTS OF ANSI A118.4.

1. ACCEPTABLE PRODUCTS ARE LIMITED TO:

A. MAPEI PRODUCT: “KERABOND” WITH “KERALASTIC” ADDITIVE.

B. LATICRETE PRODUCT NUMBER 211"CRETEFILLER" WITH NUMBER 4237 ADDITIVE.

B. FLOORS WITH DRAINS: MORTAR BED (FIELD MIX) FOR THICK-SET APPLICATIONS: (NOT USED)

1. PORTLAND CEMENT: CONFORMING TO ASTM C 150, TYPE 1.

2. SAND: DRY NATURAL SAND CONFORMING TO ASTM C 144, GRADED AS RECOMMENDED BY LATEX ADDITIVE MANUFACTURER FOR THICKNESS OF LEVELING BED.

3. LATEX ADDITIVE: EQUAL TO MAPEI: "PLANICRETE 50" OR LATICRETE "38," MEETING THE FOLLOWING ADDITIONAL REQUIREMENTS WHEN MIXED WITH MORTAR:

A. COMPRESSIVE STRENGTH PER ASTM C-109, 28 DAY STRENGTH: 4,000 POUNDS PER SQUARE INCH.

B. TENSIL STRENGTH PER ASTM C-109, 28 DAY STRENGTH: 630 POUNDS PER SQUARE INCH.

C. FLEXURAL STRENGTH PER ASTM C256, 28 DAY STRENGTH: 1,100 POUNDS PER SQUARE INCH.

2.04 GROUTING MATERIALS

A. GROUT FOR WALLS HAVING JOINTS LESS THAN 1/8 INCH WIDTH: ACRYLIC MODIFIED PORTLAND CEMENT (UNSANDED) GROUT CONFORMING TO ANSI 118.6. ACCEPTABLE PRODUCTS ARE LIMITED TO:

1. TILE GROUT: AS SELECTED BY ARCHITECT.

B. GROUT FOR FLOORS, AND WALLS HAVING JOINTS 1/8 INCH AND GREATER WIDTH: ACRYLIC MODIFIED PORTLAND CEMENT SANDED GROUT FOR FLOORS CONFORMING TO ANSI 118.6. ACCEPTABLE PRODUCTS ARE LIMITED TO:

1. TILE GROUT: AS SELECTED BY ARCHITECT.

2.05 ACCESSORIES

A. EDGE STRIPS: DESIGN AS REQUIRED FOR THE CONDITION OF USE, AND FABRICATE FROM EXTRUDED ALUMINUM, MILL FINISH.

1. SCHÜTER SYSTEMS L.P., PLATTSBURGH NY (800 361-3127).

PART 3 - EXECUTION

3.01 EXAMINATION

A. INSPECT ALL SURFACES AND VERIFY THAT THEY ARE IN PROPER CONDITION TO RECEIVE THE WORK OF THIS SECTION.

1. VERIFY THAT ALL CONCRETE SUBSTRATES ARE AT LEAST 28 CALENDAR DAYS OLD, COMPLETELY CURED AND FREE OF NEGATIVE HYDROSTATIC CONDITIONS OR MOISTURE PROBLEMS.

B. BEGINNING OF INSTALLATION MEANS ACCEPTANCE OF EXISTING SUBSTRATE AND SITE CONDITIONS.

3.02 PREPARATION

A. DURING THE OPERATION OF WORK OF THIS SECTION, PROTECT EXISTING FINISHES AGAINST UNDUE SOILAGE AND DAMAGE BY THE EXERCISE OF REASONABLE CARE AND PRECAUTIONS. CLEAN, OR REPAIR ALL EXISTING MATERIALS WHICH ARE SOILED OR OTHERWISE DAMAGED BY WORK OF THIS SECTION, TO MATCH ORIGINAL PROFILES AND FINISHES. EXISTING MATERIALS AND FINISHES WHICH CANNOT BE CLEANED, OR REPAIRED SHALL BE REMOVED AND REPLACED WITH NEW WORK TO MATCH EXISTING.

B. ENSURE THAT ALL ANCHORS, PLUGS, ELECTRICAL AND MECHANICAL WORK TO BE IN OR UNDERNEATH TILE HAVE BEEN INSTALLED.

C. VACUUM CLEAN EXISTING SUBSTRATE SURFACES.

D. SEAL CONCRETE SUBSTRATE CRACKS WITH FILLER; LEVEL CONCRETE SUBSTRATE TO ACCEPTABLE FLATNESS TOLERANCES.

1. THE USE OF PVA BONDING AGENTS OR GYPSUM BASED LEVELING MATERIALS IS PROHIBITED.

E. APPLY CONDITIONER OR PRIMER TO SURFACES AS RECOMMENDED BY ADHESIVE MANUFACTURER.

3.03 INSTALLATION - GENERAL REQUIREMENTS

A. INSTALLATION STANDARDS: THE AMERICAN NATIONAL STANDARD SPECIFICATIONS FOR THE INSTALLATION OF CERAMIC TILE, CURRENT EDITION (ANSI A108), IS HEREBY MADE A PART OF THIS SPECIFICATION. ALL WORK OF THIS SECTION SHALL BE INSTALLED IN ACCORDANCE WITH THE REQUIREMENTS CONTAINED IN REFERENCED ANSI A108 STANDARDS, AND AS ADDITIONALLY SPECIFIED BELOW, AND IN ACCORDANCE WITH THE MANUFACTURER'S SPECIFICATIONS OF THOSE PRODUCTS USED.

1. USE TROWEL SHAPES AND SIZES AS RECOMMENDED BY SETTING MATERIALS MANUFACTURER.

2. BACK-BUTTER TILES AS REQUIRED TO PROVIDE COVERAGE INDICATED.

B. TILE PATTERNS AND TYPES: TILE PATTERNS ARE SHOWN ON THE DRAWINGS, IF MORE INFORMATION IS REQUIRED; OBTAIN THE NECESSARY INFORMATION FROM THE ARCHITECT. DO NOT INTERRUPT TILE PATTERN AROUND OPENINGS.

C. TILE LAYOUT AND INSTALLATION

1. LAYOUT TILE ON ROOM AXIS, LEAVING EQUAL SIZED BORDER UNITS OF NOT LESS THAN ONE-HALF TILE WIDTH.

2. CUT AND FIT TILE TIGHT TO PENETRATIONS THROUGH TILE. FORM CORNERS AND BASES NEATLY. ALIGN BASE AND WALL JOINTS.

3. PLACE TILE JOINTS UNIFORM IN WIDTH, SUBJECT TO VARIANCE IN TOLERANCE ALLOWED IN TILE SIZE. MAKE JOINTS WATERTIGHT, FULL WITHOUT VOIDS, CRACKS, EXCESS MORTAR, OR EXCESS GROUT.

3.04 INSTALLATION OF CONTROL JOINTS

A. GENERAL: PROVIDE CONTROL JOINTS WHERE INDICATED ON THE DRAWINGS, AND AS DIRECTED BY THE CONSTRUCTION MANAGER. WHERE NOT INDICATED, PROVIDE JOINTS PER

THE FOLLOWING:

1. INTERIOR TILEWORK: 24 TO 36 FEET IN EACH DIRECTION, EXCEPT WHERE EXPOSED TO DIRECT SUNLIGHT OR MOISTURE.

2. INTERIOR TILEWORK EXPOSED TO DIRECT SUNLIGHT OR MOISTURE: 12 TO 16 FEET IN EACH DIRECTION.

3. WHERE TILE ABUTS RESTRAINING SURFACES SUCH AS PERIMETER WALLS, DISSIMILAR FLOORS, CURBS, COLUMNS, PIPES, AND WHERE CHANGES OCCUR IN SUBSTRATE MATERIALS.

4. AT PERIMETER WALLS IN ROOMS AND SPACES LARGER THAN 12 FEET ON ONE SIDE.

5. AS CONTINUATION OF EXPANSION JOINTS, CONTROL JOINTS, AND SEISMIC JOINTS IN THE BUILDING STRUCTURE WHICH OCCUR IN TILE AREAS.

B. LOCATIONS: VERIFY EXACT LOCATIONS OF JOINTS WITH CONSTRUCTION MANAGER PRIOR TO COMMENCING TILE INSTALLATION.

C. CONTROL JOINTS:

1. FORM CONTROL JOINTS NEAT, STRAIGHT, AND UNIFORMLY WIDE EQUAL TO WIDTH OF NORMAL TILE JOINT. CUT TILE NEATLY AND TO ACCURATE RADIUS AT EXPOSED JUNCTION WITH PIPES, ETC.

2. EXTEND CONTROL JOINTS FULL THICKNESS OF TILE, SETTING BED AND REINFORCING.

D. KEEP OPEN JOINTS FREE OF GROUT AND DEBRIS UNTIL FILLED WITH SEALANT. INSTALL NON-CONTAMINATING TEMPORARY JOINT FILLER TO MAINTAIN JOINTS IN CLEAN CONDITION UNTIL INSTALLATION OF JOINT BACKING AND SEALANT UNDER SECTION 07 92 10 - JOINT SEALERS.

3.05 FLOORING INSTALLATION - THIN-SET

A. GENERAL: INSTALL IN ACCORDANCE WITH ANSI A108.5, AND TCA INSTALLATION METHOD NUMBER F113, AND AS ADDITIONALLY SPECIFIED HEREIN BELOW. APPLY MATERIALS IN STRICT ACCORDANCE WITH THE WRITTEN INSTRUCTIONS AND RECOMMENDATIONS OF SETTING MATERIALS MANUFACTURER.

1. SETTING MATERIALS: LATEX MODIFIED PORTLAND CEMENT (ANSI A118.4).

2. GROUT MATERIALS: ACRYLIC MODIFIED PORTLAND CEMENT SANDED GROUT (ANSI A118.6).

B. INSTALL LATEX/PORTLAND CEMENT MORTAR BED OVER CURED ANTI-FRACTURE MEMBRANE TO A NOMINAL THICKNESS OF 3/32 INCH.

C. GROUTING:

1. ALLOW TILE TO FULLY SET PRIOR TO GROUTING; DO NOT GROUT IN LESS THAN 24 HOURS AFTER INSTALLATION OF TILE.

2. GROUT TILE JOINTS IN ACCORDANCE WITH ANSI A108.10 AND AS ADDITIONALLY SPECIFIED.

3.06 WALL TILE INSTALLATION - THIN-SET

A. GENERAL: INSTALL IN ACCORDANCE WITH ANSI A108.5, TCA INSTALLATION METHOD NUMBER W243, AND AS ADDITIONALLY SPECIFIED HEREIN BELOW. APPLY MATERIALS IN STRICT ACCORDANCE WITH THE WRITTEN INSTRUCTIONS AND RECOMMENDATIONS OF SETTING MATERIALS MANUFACTURER.

1. PRIMER: SYNTHETIC LATEX EMULSION AS RECOMMENDED BY MORTAR MANUFACTURER.

2. SETTING MATERIALS: DRY-SET MORTAR.

3. GROUT MATERIALS: ACRYLIC MODIFIED PORTLAND CEMENT (UNSANDED) GROUT (ANSI A118.6).

B. PRIME GYPSUM WALLBOARD SURFACES, IF RECOMMENDED BY MORTAR MANUFACTURER. INSTALL LATEX MODIFIED PORTLAND CEMENT MORTAR BED TO A THICKNESS RECOMMENDED BY MANUFACTURER.

C. GROUTING:

1. ALLOW TILE TO FULLY SET PRIOR TO GROUTING; DO NOT GROUT IN LESS THAN 24 HOURS AFTER INSTALLATION OF TILE.

2. GROUT TILE JOINTS IN ACCORDANCE WITH ANSI A108.10 AND AS ADDITIONALLY SPECIFIED.

3.07 INSTALLATION - GROUT

A. REMOVE SPACERS, ROPES, GLUE, AND SIMILAR FOREIGN MATTER PRIOR TO GROUTING.

B. FORCE THE MAXIMUM AMOUNT OF THE APPROVED GROUT INTO JOINTS IN ACCORDANCE WITH PERTINENT RECOMMENDATIONS CONTAINED IN ANSI A108.10 AND FOR EPOXY GROUTS, ANSI A108.6.

C. FILL IN JOINTS OF CUSHION-EDGE TILE TO DEPTH OF THE CUSHION; FILL JOINTS OF SQUARE-EDGE TILE FLUSH WITH THE SURFACE.

D. FILL ALL GAPS AND SKIPS. DO NOT PERMIT MORTAR OR MOUNTING MESH TO SHOW THROUGH GROUTED JOINTS.

E. PROVIDE HARD FINISHED GROUT WHICH IS UNIFORM IN COLOR, SMOOTH AND WITHOUT VOIDS, PIN HOLES, OR LOW SPOTS.

F. REMOVE ALL EXCESS GROUT IMMEDIATELY AFTER INSTALLATION THEREOF, WASH AND RINSE TILE FREE FROM GROUT FILM, AND TOOL GROUT TO A UNIFORM DENSITY THROUGHOUT.

3.08 REPAIR

A. REPLACE CRACKED CHIPPED, BROKEN, AND OTHERWISE DEFECTIVE TILES.

B. REMOVE WORK NOT COMPLYING WITH REQUIREMENTS OF THE CONTRACT DOCUMENTS OR THE REFERENCED STANDARDS, AND PROMPTLY REPLACE WITH WORK WHICH DOES COMPLY.

3.09 CLEANING

A. AFTER COMPLETION OF THE WORK OF THIS SECTION, REMOVE EQUIPMENT, AND CLEAN

ALL WALL, PARTITION, AND FLOOR AREAS FREE FROM DEPOSITS OF MORTAR, GROUT, AND OTHER MATERIALS INSTALLED UNDER THIS SECTION, AND WASH COMPLETED TILEWORK.

1. DO NOT USE ACID OR ACID CLEANERS TO CLEAN TILE.

2. WHEN TILE IS THOROUGHLY CLEAN AND DRY, POLISH GLAZED TILE WITH CLEAN DRY CLOTHS.

3.010 CURING

A. DAMP CURE ALL TILE INSTALLATIONS, INCLUDING PORTLAND CEMENT GROUTS, FOR 72 HOURS MINIMUM.

3.011 PROTECTION

A. DO NOT PERMIT TRAFFIC OVER FINISHED FLOOR SURFACE UNTIL GROUT AND TILE MATERIALS ARE FULLY SET FOR NOT LESS THAN 72 HOURS. PROTECT FLOOR SURFACES WITH RAM-BOARD FLOOR PROTECTION OR ARCHITECT APPROVED EQUAL.

END OF SECTION

SECTION 09 51 00

ACOUSTICAL LAY-IN CEILINGS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. CONSTRUCTION DRAWINGS, SPECIFICATIONS AND PROVISIONS OF THE CONTRACT INCLUDING GENERAL AND SUPPLEMENTAL CONDITIONS AND OTHER DIVISION 1 SPECIFICATION SECTIONS, ARE HEREBY MADE A PART OF THIS SECTION AS FULLY AND COMPLETELY AS IF REPEATED HEREIN.

1.02 ITEMS REQUIRED BUT NOT SPECIFIED

A. IF AN ITEM OR MATERIAL OF THIS TRADE IS INDICATED ON THE DRAWINGS BUT NOT SPECIFICALLY LISTED IN THIS SECTION, PROVIDE SUCH ITEM OR MATERIAL AT A STANDARD OF QUALITY EQUAL TO THE STANDARD ESTABLISHED FOR THE BALANCE OF THE WORK SPECIFIED, IN ACCORDANCE WITH THE ARCHITECT'S INTERPRETATION

1.03 EXECUTION, CORRELATION AND INTENT

A. IN CASE OF AN INCONSISTENCY BETWEEN DRAWINGS AND SPECIFICATIONS OR WITHIN EITHER DOCUMENT NOT CLARIFIED BY ADDENDUM, THE BETTER QUALITY OR GREATER QUANTITY OF WORK IS TO BE PROVIDED, IN ACCORDANCE WITH THE ARCHITECT'S INTERPRETATION

1.04 SUMMARY

A. THIS SECTION INCLUDES ACOUSTICAL PANELS AND EXPOSED SUSPENSION SYSTEMS FOR CEILINGS.

1. STANDARD ACOUSTIC PANELS.

2. VINYL-FACED ACOUSTIC PANELS FOR AREAS AS INDICATED IN DRAWINGS AND SCHEDULES.

1.05 DEFINITIONS

A. AC: ARTICULATION CLASS.

B. CAC: CEILING ATTENUATION CLASS.

C. LR: LIGHT REFLECTANCE COEFFICIENT.

D. NRC: NOISE REDUCTION COEFFICIENT.

1.06 SUBMITTALS

A. PRODUCT DATA: FOR EACH TYPE OF PRODUCT INDICATED.

B. SAMPLES FOR VERIFICATION: FOR EACH COMPONENT INDICATED AND FOR EACH EXPOSED FINISH REQUIRED, PREPARED ON SAMPLES OF SIZE INDICATED BELOW.

1. ACOUSTICAL PANEL: SET OF 150-MM- (6-INCH-) SQUARE SAMPLES OF EACH TYPE, COLOR, PATTERN, AND TEXTURE.

2. EXPOSED SUSPENSION SYSTEM MEMBERS, MOLDINGS, AND TRIM: SET OF 300-MM- (12-INCH-) LONG SAMPLES OF EACH TYPE, FINISH, AND COLOR.

C. MAINTENANCE DATA: FOR FINISHES TO INCLUDE IN MAINTENANCE MANUALS.

1.07 QUALITY ASSURANCE

A. SOURCE LIMITATIONS: OBTAIN EACH TYPE OF ACOUSTICAL CEILING PANEL AND SUPPORTING SUSPENSION SYSTEM THROUGH ONE SOURCE FROM A SINGLE MANUFACTURER.

B. FIRE-TEST-RESPONSE CHARACTERISTICS: PROVIDE ACOUSTICAL PANEL CEILINGS THAT COMPLY WITH THE FOLLOWING REQUIREMENTS:

1. SURFACE-BURNING CHARACTERISTICS: PROVIDE ACOUSTICAL PANELS WITH THE FOLLOWING SURFACE-BURNING CHARACTERISTICS COMPLYING WITH ASTM E 1264 FOR CLASS A MATERIALS AS DETERMINED BY TESTING IDENTICAL PRODUCTS PER ASTM E 84:

C. SEISMIC STANDARD: PROVIDE SUSPENDED ACOUSTICAL PANEL CEILINGS DESIGNED AND INSTALLED TO WITHSTAND THE EFFECTS OF EARTHQUAKE MOTIONS ACCORDING TO THE FOLLOWING:

1. STANDARD FOR CEILING SUSPENSION SYSTEMS REQUIRING SEISMIC RESTRAINT: COMPLY WITH ASTM E 580.

2. CISCA'S GUIDELINES FOR SYSTEMS REQUIRING SEISMIC RESTRAINT: COMPLY WITH CISCA'S "GUIDELINES FOR SEISMIC RESTRAINT OF DIRECT-HUNG SUSPENDED CEILING ASSEMBLIES--SEISMIC ZONES 0-2."

1.08 DELIVERY, STORAGE, AND HANDLING

A. DELIVER ACOUSTICAL PANELS, SUSPENSION SYSTEM COMPONENTS, AND ACCESSORIES TO PROJECT SITE IN ORIGINAL, UNOPENED PACKAGES AND STORE THEM IN A FULLY ENCLOSED, CONDITIONED SPACE WHERE THEY WILL BE PROTECTED AGAINST DAMAGE FROM MOISTURE, HUMIDITY, TEMPERATURE EXTREMES, DIRECT SUNLIGHT, SURFACE CONTAMINATION, AND OTHER CAUSES.

B. BEFORE INSTALLING ACOUSTICAL PANELS, PERMIT THEM TO REACH ROOM TEMPERATURE AND A STABILIZED MOISTURE CONTENT.

C. HANDLE ACOUSTICAL PANELS CAREFULLY TO AVOID CHIPPING EDGES OR DAMAGING UNITS IN ANY WAY.

1.09 PROJECT CONDITIONS

A. ENVIRONMENTAL LIMITATIONS: DO NOT INSTALL ACOUSTICAL PANEL CEILINGS UNTIL SPACES ARE ENCLOSED AND WEATHERPROOF, WET WORK IN SPACES IS COMPLETE AND DRY, WORK ABOVE CEILINGS IS COMPLETE, AND AMBIENT TEMPERATURE AND HUMIDITY CONDITIONS ARE MAINTAINED AT THE LEVELS INDICATED FOR PROJECT WHEN OCCUPIED FOR ITS INTENDED USE.

1.10 COORDINATION

A. COORDINATE LAYOUT AND INSTALLATION OF ACOUSTICAL PANELS AND SUSPENSION SYSTEM WITH OTHER CONSTRUCTION THAT PENETRATES CEILINGS OR IS SUPPORTED BY THEM, INCLUDING LIGHT FIXTURES, HVAC EQUIPMENT, FIRE-SUPPRESSION SYSTEM, AND PARTITION ASSEMBLIES.

PART 2 - PRODUCTS

SECTION 09 51 00

ACOUSTICAL LAY-IN CEILINGS

2.01 MANUFACTURERS

A. IN OTHER PART 2 ARTICLES WHERE TITLES BELOW INTRODUCE LISTS, THE FOLLOWING REQUIREMENTS APPLY FOR PRODUCT SELECTION:

1. AVAILABLE PRODUCTS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PRODUCTS THAT MAY BE INCORPORATED INTO THE WORK INCLUDE, BUT ARE NOT LIMITED TO, THE PRODUCTS SPECIFIED.

2.02 ACOUSTICAL PANELS, GENERAL

A. ACOUSTICAL PANEL STANDARD: PROVIDE MANUFACTURER'S STANDARD PANELS OF CONFIGURATION INDICATED THAT COMPLY WITH ASTM E 1264 CLASSIFICATIONS AS DESIGNATED BY TYPES, PATTERNS, ACOUSTICAL RATINGS, AND LIGHT REFLECTANCES, UNLESS OTHERWISE INDICATED.

B. ACOUSTICAL PANEL COLORS AND PATTERNS: MATCH APPEARANCE CHARACTERISTICS INDICATED FOR EACH PRODUCT TYPE.

1. WHERE APPEARANCE CHARACTERISTICS OF ACOUSTICAL PANELS ARE INDICATED BY REFERENCING PATTERN DESIGNATIONS IN ASTM E 1264 AND NOT MANUFACTURERS' PROPRIETARY PRODUCT DESIGNATIONS, PROVIDE PRODUCTS SELECTED BY ARCHITECT FROM EACH MANUFACTURER'S FULL RANGE THAT COMPLY WITH REQUIREMENTS INDICATED FOR TYPE, PATTERN, COLOR, LIGHT REFLECTANCE, ACOUSTICAL PERFORMANCE, EDGE DETAIL, AND SIZE.

C. COATING-BASED ANTIMICROBIAL TREATMENT: PROVIDE ACOUSTICAL PANELS WITH FACE AND BACK SURFACES COATED WITH ANTIMICROBIAL TREATMENT CONSISTING OF MANUFACTURER'S STANDARD FORMULATION WITH FUNGICIDE ADDED TO INHIBIT GROWTH OF MOLD AND MILDEW AND SHOWING NO MOLD OR MILDEW GROWTH WHEN TESTED ACCORDING TO ASTM D 3273.

2.03 ACOUSTICAL PANELS FOR SANITARY LAY-IN CEILINGS

A. CLEAN ROOM CLIMA PLUS, CLASS 10M-100M. MANUFACTURED BY USG CORPORATION.

1. VINYL FACED PERFORATED FACE PATTERN.

2. SIZE: 600 MM X 1200 MM X 15 MM (2' X 4' X 5/8”)

3. EDGE: SQUARE (SQ)

4. COLOR: WHITE

5. LIGHT REFLECTANCE: .79

6. NRC / CAC RANGE: .55-.65 / 35-39

7. RECYCLED CONTENT: 63%

2.04 MINERAL-BASE ACOUSTICAL PANELS

A. ASPEN, MANUFACTURED BY USG CORPORATION.

1. RANDOM FISSURED AND SCULPTED. TYPE III, FORM 2, PATTERN CDFI.

2. SIZE: 600 MM X 1200 MM X 19.5 MM (2' X 4' X 3/4")

3. EDGE: TEGULAR, SLOPED (SLT)

4. COLOR: WHITE

5. LIGHT REFLECTANCE: .87

6. NRC / CAC RANGE: .50-.60 / 35-39

7. RECYCLED CONTENT: 62%

2.05 METAL SUSPENSION SYSTEMS, GENERAL

A. METAL SUSPENSION SYSTEM STANDARD: PROVIDE MANUFACTURER'S STANDARD DIRECT-HUNG METAL SUSPENSION SYSTEMS OF TYPES, STRUCTURAL CLASSIFICATIONS, AND FINISHES INDICATED THAT COMPLY WITH APPLICABLE REQUIREMENTS IN ASTM C 635.

B. FINISHES AND COLORS, GENERAL: COMPLY WITH NAAMM'S "METAL FINISHES MANUAL FOR ARCHITECTURAL AND METAL PRODUCTS" FOR RECOMMENDATIONS FOR APPLYING AND DESIGNATING FINISHES. PROVIDE MANUFACTURER'S STANDARD FACTORY-APPLIED FINISH FOR TYPE OF SYSTEM INDICATED.

C. ATTACHMENT DEVICES: SIZE FOR FIVE TIMES THE DESIGN LOAD INDICATED IN ASTM C 635, TABLE 1, "DIRECT HUNG," UNLESS OTHERWISE INDICATED.

D. WIRE HANGERS, BRACES, AND TIES: PROVIDE WIRES COMPLYING WITH THE FOLLOWING REQUIREMENTS:

1. ZINC-COATED CARBON-STEEL WIRE: ASTM A 641/A 641M, CLASS 1 ZINC COATING, SOFT TEMPER.

2. SIZE: SELECT WIRE DIAMETER SO ITS STRESS AT THREE TIMES HANGER DESIGN LOAD (ASTM C 635, TABLE 1, "DIRECT HUNG") WILL BE LESS THAN YIELD STRESS OF WIRE, BUT PROVIDE NOT LESS THAN 3.5-MM- (0.135-INCH-) DIAMETER WIRE.

E. SEISMIC STRUTS: MANUFACTURER'S STANDARD COMPRESSION STRUTS DESIGNED TO ACCOMMODATE SEISMIC FORCES WHERE APPLICABLE.

F. SEISMIC CLIPS: MANUFACTURER'S STANDARD SEISMIC CLIPS DESIGNED AND SPACED TO SECURE ACOUSTICAL PANELS IN-PLACE WHERE APPLICABLE.

2.06 METAL SUSPENSION SYSTEM FOR ACOUSTICAL PANEL CEILINGS

A. DONN DX, MANUFACTURED BY USG: MAIN AND CROSS RUNNERS ROLL FORMED FROM COLD-ROLLED STEEL SHEET, PRE-PAINTED, ELECTROLYTICALLY ZINC COATED, OR HOT-DIP GALVANIZED ACCORDING TO ASTM A 653/A 653M, NOT LESS THAN Z90 (G30) COATING DESIGNATION, WITH PREFINISHED 24-MM- (15/16-INCH-) WIDE METAL CAPS ON FLANGES.

1. STRUCTURAL CLASSIFICATION: HEAVY-DUTY SYSTEM.

2. END CONDITION OF CROSS RUNNERS: OVERRIDE (STEPPED) OR BUTT-EDGE TYPE.

3. FACE DESIGN: FLAT, FLUSH.

4. CAP MATERIAL: STEEL OR ALUMINUM COLD-ROLLED SHEET.

5. CAP FINISH: PAINTED WHITE.

6. MOLDINGS AND TRIM: MATCH GRID SYSTEM.

2.07 ACOUSTICAL SEALANT

A. AVAILABLE PRODUCTS:

1. ACOUSTICAL SEALANT FOR EXPOSED AND CONCEALED JOINTS:

A. PECORA CORP; AC-20 FTR ACOUSTICAL AND INSULATION SEALANT.

B. UNITED STATES GYPSUM CO.; SHEETROCK ACOUSTICAL SEALANT.

2. ACOUSTICAL SEALANT FOR CONCEALED JOINTS:

A. PECORA CORP.; BA-98.

B. TREMCO, INC.; TREMCO ACOUSTICAL SEALANT.

B. ACOUSTICAL SEALANT FOR EXPOSED AND CONCEALED JOINTS: MANUFACTURER'S STANDARD NON-SAG, PAINTABLE, NON-STAINING LATEX SEALANT COMPLYING WITH ASTM C 834 AND EFFECTIVE IN REDUCING AIRBORNE SOUND TRANSMISSION THROUGH PERIMETER JOINTS AND OPENINGS IN BUILDING CONSTRUCTION AS DEMONSTRATED BY TESTING REPRESENTATIVE ASSEMBLIES ACCORDING TO ASTM E 90.

C. ACOUSTICAL SEALANT FOR CONCEALED JOINTS: MANUFACTURER'S STANDARD NONDRYING, NON-HARDENING, NON-SKINNING, NON-STAINING, GUNNABLE, SYNTHETIC-RUBBER SEALANT RECOMMENDED FOR SEALING INTERIOR CONCEALED JOINTS TO REDUCE AIRBORNE SOUND TRANSMISSION.

PART 3 - EXECUTION

3.01 EXAMINATION

A. EXAMINE SUBSTRATES, AREAS, AND CONDITIONS, INCLUDING STRUCTURAL FRAMING TO WHICH ACOUSTICAL PANEL CEILINGS ATTACH OR ABUT, WITH INSTALLER PRESENT, FOR COMPLIANCE WITH REQUIREMENTS SPECIFIED IN THIS AND OTHER SECTIONS THAT AFFECT CEILING INSTALLATION AND ANCHORAGE AND WITH REQUIREMENTS FOR INSTALLATION TOLERANCES AND OTHER CONDITIONS AFFECTING PERFORMANCE OF ACOUSTICAL PANEL CEILINGS.

B. PROCEED WITH INSTALLATION ONLY AFTER UNSATISFACTORY CONDITIONS HAVE BEEN CORRECTED.

3.02 PREPARATION

A. MEASURE EACH CEILING AREA AND ESTABLISH LAYOUT OF ACOUSTICAL PANELS TO BALANCE BORDER WIDTHS AT OPPOSITE EDGES OF EACH CEILING. AVOID USING LESS-THAN-HALF-WIDTH PANELS AT BORDERS, AND COMPLY WITH LAYOUT SHOWN ON REFLECTED CEILING PLANS. COORDINATE CEILING GRID WITH LIGHTING LAYOUT.

3.03 INSTALLATION, GENERAL

SECTION 09 51 00

ACOUSTICAL LAY-IN CEILINGS

A. GENERAL: INSTALL ACOUSTICAL PANEL CEILINGS TO COMPLY WITH ASTM C 636 SEISMIC REQUIREMENTS INDICATED, PER MANUFACTURER'S WRITTEN INSTRUCTIONS AND CISCA'S "CEILING SYSTEMS HANDBOOK."

B. SUSPEND CEILING HANGERS FROM BUILDING'S STRUCTURAL MEMBERS AND AS FOLLOWS:

1. INSTALL HANGERS PLUMB AND FREE FROM CONTACT WITH INSULATION OR OTHER OBJECTS WITHIN CEILING PLENUM THAT ARE NOT PART OF SUPPORTING STRUCTURE OR OF CEILING SUSPENSION SYSTEM.

2. SPLAY HANGERS ONLY WHERE REQUIRED TO MISS OBSTRUCTIONS; OFFSET RESULTING HORIZONTAL FORCES BY BRACING, COUNTER-SPLAYING, OR OTHER EQUALLY EFFECTIVE MEANS.

3. WHERE WIDTH OF DUCTS AND OTHER CONSTRUCTION WITHIN CEILING PLENUM PRODUCES HANGER SPACINGS THAT INTERFERE WITH LOCATION OF HANGERS AT SPACINGS REQUIRED TO SUPPORT STANDARD SUSPENSION SYSTEM MEMBERS, INSTALL SUPPLEMENTAL SUSPENSION MEMBERS AND HANGERS IN FORM OF TRAPEZES OR EQUIVALENT DEVICES. SIZE SUPPLEMENTAL SUSPENSION MEMBERS AND HANGERS TO SUPPORT CEILING LOADS WITHIN PERFORMANCE LIMITS ESTABLISHED BY REFERENCED STANDARDS AND PUBLICATIONS.

4. SECURE WIRE HANGERS TO CEILING SUSPENSION MEMBERS AND TO SUPPORTS ABOVE WITH A MINIMUM OF THREE TIGHT TURNS. CONNECT HANGERS DIRECTLY EITHER TO STRUCTURES OR TO INSERTS, EYE SCREWS, OR OTHER DEVICES THAT ARE SECURE AND APPROPRIATE FOR SUBSTRATE AND THAT WILL NOT DETERIORATE OR OTHERWISE FAIL DUE TO AGE, CORROSION, OR ELEVATED TEMPERATURES.

5. DO NOT SUPPORT CEILINGS DIRECTLY FROM PERMANENT METAL FORMS OR FLOOR DECK. FASTEN HANGERS TO CAST-IN-PLACE HANGER INSERTS, POSTINSTALLED MECHANICAL OR ADHESIVE ANCHORS, OR POWER-ACTUATED FASTENERS THAT EXTEND THROUGH FORMS INTO CONCRETE.

6. DO NOT ATTACH HANGERS TO STEEL DECK TABS.

7. SPACE HANGERS NOT MORE THAN 1200 MM (48 INCHES) O.C. ALONG EACH MEMBER SUPPORTED DIRECTLY FROM HANGERS, UNLESS OTHERWISE INDICATED; PROVIDE HANGERS NOT MORE THAN 200 MM (8 INCHES) FROM ENDS OF EACH MEMBER.

C. SECURE BRACING WIRES TO CEILING SUSPENSION MEMBERS AND TO SUPPORTS WITH A MINIMUM OF FOUR TIGHT TURNS. SUSPEND BRACING FROM BUILDING'S STRUCTURAL MEMBERS AS REQUIRED FOR HANGERS, WITHOUT ATTACHING TO PERMANENT METAL FORMS, STEEL DECK, OR STEEL DECK TABS. FASTEN BRACING WIRES INTO CONCRETE WITH CAST-IN-PLACE OR POSTINSTALLED ANCHORS.

D. INSTALL EDGE MOLDINGS AND TRIM OF TYPE INDICATED AT PERIMETER OF ACOUSTICAL CEILING AREA AND WHERE NECESSARY TO CONCEAL EDGES OF ACOUSTICAL PANELS.

1. APPLY ACOUSTICAL SEALANT IN A CONTINUOUS RIBBON CONCEALED ON BACK OF VERTICAL LEGS OF MOLDINGS BEFORE THEY ARE INSTALLED.

2. SCREW ATTACH MOLDINGS TO SUBSTRATE AT INTERVALS NOT MORE THAN 400 MM (16 INCHES) O.C. AND NOT MORE THAN 75 MM (3 INCHES) FROM ENDS, LEVELING WITH CEILING SUSPENSION SYSTEM TO A TOLERANCE OF 3.2 MM IN 3.66 M (1/8 INCH IN 12 FEET). MITER CORNERS ACCURATELY AND CONNECT SECURELY.

3. DO NOT USE EXPOSED FASTENERS, INCLUDING POP RIVETS, ON MOLDINGS AND TRIM.

E. INSTALL SUSPENSION SYSTEM RUNNERS SO THEY ARE SQUARE AND SECURELY INTERLOCKED WITH ONE ANOTHER. REMOVE AND REPLACE DENTED, BENT, OR KINKED MEMBERS.

F. INSTALL ACOUSTICAL PANELS WITH UNDAMAGED EDGES AND FIT ACCURATELY INTO SUSPENSION SYSTEM RUNNERS AND EDGE MOLDINGS. SCRIBE AND CUT PANELS AT BORDERS AND PENETRATIONS TO PROVIDE A NEAT, PRECISE FIT.

1. ARRANGE DIRECTIONALLY PATTERNED ACOUSTICAL PANELS AS FOLLOWS:

A. AS INDICATED ON REFLECTED CEILING PLANS.

2. FOR SQUARE-EDGED PANELS, INSTALL PANELS WITH EDGES FULLY HIDDEN FROM VIEW BY FLANGES OF SUSPENSION SYSTEM RUNNERS AND MOLDINGS.

3. FOR REVEAL-EDGED PANELS ON SUSPENSION SYSTEM RUNNERS, INSTALL PANELS WITH BOTTOM OF REVEAL IN FIRM CONTACT WITH TOP SURFACE OF RUNNER FLANGES.

4. PAINT CUT EDGES OF PANEL REMAINING EXPOSED AFTER INSTALLATION; MATCH COLOR OF EXPOSED PANEL SURFACES USING COATING RECOMMENDED IN WRITING FOR THIS PURPOSE BY ACOUSTICAL PANEL MANUFACTURER.

3.04 CLEANING

A. CLEAN EXPOSED SURFACES OF ACOUSTICAL PANEL CEILINGS, INCLUDING TRIM, EDGE MOLDINGS, AND SUSPENSION SYSTEM MEMBERS. COMPLY WITH MANUFACTURER'S WRITTEN INSTRUCTIONS FOR CLEANING AND TOUCHUP OF MINOR FINISH DAMAGE. REMOVE AND REPLACE CEILING COMPONENTS THAT CANNOT BE SUCCESSFULLY CLEANED AND REPAIRED TO PERMANENTLY ELIMINATE EVIDENCE OF DAMAGE.

END OF SECTION

SECTION 09 65 00

RESILIENT FLOORING

PART 1 GENERAL

1.01 ITEMS REQUIRED BUT NOT SPECIFIED

A. IF AN ITEM OR MATERIAL OF THIS TRADE IS INDICATED ON THE DRAWINGS BUT NOT SPECIFICALLY LISTED IN THIS SECTION, PROVIDE SUCH ITEM OR MATERIAL AT A STANDARD OF QUALITY EQUAL TO THE STANDARD ESTABLISHED FOR THE BALANCE OF THE WORK SPECIFIED, IN ACCORDANCE WITH THE ARCHITECT'S INTERPRETATION.

1.02 EXECUTION, CORRELATION AND INTENT

A. IN CASE OF AN INCONSISTENCY BETWEEN DRAWINGS AND SPECIFICATIONS, OR WITHIN EITHER DOCUMENT NOT CLARIFIED BY ADDENDUM, THE BETTER QUALITY OR GREATER QUANTITY OF WORK IS TO BE PROVIDED, IN ACCORDANCE WITH THE ARCHITECT'S INTERPRETATION.

1.03 SECTION INCLUDES

A. PREPARE SUBSTRATES TO AS REQUIRED TO ENSURE SPECIFIED TOLERANCE LEVEL FOR FINISH SURFACE OF RESILIENT FLOORING MATERIAL. PREPARATION WORK INCLUDES PATCHING, SMOOTHING AND LEVELING SUB-FLOORS AND UNDERLAYMENT, INCLUDING:

1. GRINDING DOWN HIGH SPOTS OF SUBSTRATE.

2. PROVIDING PORTLAND CEMENT-BASED LATEX UNDERLAYMENT (FILLER).

B. FURNISH AND INSTALL THE FOLLOWING:

1. VINYL COMPOSITION TILE FLOORING.

2. VINYL COVE BASE AT VCT FLOORING.

3. RESILIENT TRANSITION STRIPS AT OFFICE AREAS WHEREVER EDGES OF RESILIENT TILE FLOORING MATERIALS ABUT DISSIMILAR FLOORING, WHERE NO THRESHOLDS OCCUR.

4. ALUMINUM TRANSITION STRIPS WHERE TILE FLOORING ABUTS CONCRETE.

1.04 REFERENCES

A. COMPLY WITH APPLICABLE REQUIREMENTS OF THE FOLLOWING STANDARDS AND THOSE OTHERS REFERENCED IN THIS SECTION.

1. ASTM (AMERICAN SOCIETY OF TESTING AND MATERIALS):

A. ASTM E 84 - SURFACE BURNING CHARACTERISTICS OF BUILDING MATERIALS.

2. FS (FEDERAL SPECIFICATIONS, GENERAL SERVICES ADMINISTRATION):

A. FS SS-T-312 - TILE, FLOOR: ASPHALT, RUBBER, VINYL, VINYL COMPOSITION.

B. FS SS-W-40 - WALL BASE: RUBBER AND VINYL PLASTIC.

3. NFPA (NATIONAL FIRE PROTECTION ASSOCIATION): PUBLICATION 253 - TEST FOR CRITICAL RADIANT FLUX OF FLOOR COVERING SYSTEMS.

4. ALL APPLICABLE FEDERAL, STATE AND MUNICIPAL CODES, LAWS AND REGULATIONS

REGARDING FLAMMABILITY AND SMOKE GENERATION OF INTERIOR FINISHES.

1.05 PERFORMANCE CHARACTERISTICS

A. FIRE PERFORMANCE: PROVIDE MATERIALS AND ASSEMBLIES CONFORMING TO APPLICABLE BUILDING CODES AND REGULATORY AGENCIES AND COMPLYING WITH THE FOLLOWING REQUIREMENTS.

1. CRITICAL RADIANT FLUX (CRF): ASTM E 648 OR NFPA 253; MINIMUM VALUE AS FOLLOWS:

A. 0.45 WATTS PER SQ. CM. OR GREATER, CLASS 1.

2. FLAME SPREAD : ASTM E84; MAXIMUM 75.

3. SMOKE DEVELOPED: ASTM E84; MAXIMUM 450.

1.06 SUBMITTALS

A. SUBMIT THE FOLLOWING UNDER PROVISIONS OF DIVISION 1:

1. LITERATURE: MANUFACTURER'S TECHNICAL PRODUCT DATA SHEETS, SPECIFICATIONS, PERFORMANCE DATA AND PHYSICAL PROPERTIES FOR EACH ITEM FURNISHED HEREUNDER.

2. MANUFACTURER'S INSTALLATION INSTRUCTIONS: PROVIDE MANUFACTURER'S APPLICATION METHODS OR INSTALLATION INSTRUCTIONS FOR EACH ITEM FURNISHED HEREUNDER. INDICATE SPECIAL PROCEDURES, AND PERIMETER CONDITIONS REQUIRING SPECIAL ATTENTION.

3. MANUFACTURER'S SAMPLE WARRANTIES.

4. SUBMIT THE MANUFACTURER'S CERTIFICATION THAT THE RESILIENT FLOORING HAS BEEN TESTED BY AN INDEPENDENT LABORATORY AND COMPLIES WITH THE REQUIRED FIRE TESTS.

5. SAMPLES FOR SELECTION AND/OR VERIFICATION AS REQUESTED BY THE ARCHITECT.

A. VCT

B. RESILIENT BASE

6. MAINTENANCE PROCEDURES: SUBMIT MANUFACTURER'S PUBLISHED INSTRUCTIONS FOR CARE AND CLEANING OF RESILIENT FLOORING PRODUCTS SPECIFIED.

1.07 QUALITY ASSURANCE

A. MANUFACTURER: FOR EACH TYPE OF PRODUCT REQUIRED, INCLUDING ADHESIVES, CLEANING COMPOUNDS AND OTHER INSTALLATION ACCESSORIES, PROVIDE THE SAME PRODUCT BY ONE MANUFACTURER THROUGHOUT THE PROJECT.

B. APPLICATOR: COMPANY SPECIALIZING IN TILE INSTALLATION OF THE TYPE SPECIFIED HEREIN WITH A MINIMUM OF THREE YEARS DOCUMENTED EXPERIENCE, AND APPROVED BY TILE MANUFACTURER.

C. AVOID COLOR AND PATTERN DIFFERENTIAL; PROVIDE FLOORING FROM ONE PRODUCTION RUN IN ANY SINGLE ROOM OR CONTIGUOUS AREAS.

D. SUBSTRATE TESTING: DO NOT INSTALL RESILIENT FLOORING ON CONCRETE SUBSTRATES UNTIL TESTING HAS BEEN CONDUCTED TO ASSURE THAT MOISTURE LEVELS ARE ACCEPTABLE.

1.08 DELIVERY, STORAGE AND HANDLING

A. DELIVER RESILIENT FLOORING AND BASE MATERIALS IN ORIGINAL, UNOPENED PACKAGES AND STORE PROTECTED

B. STORE RESILIENT FLOORING MATERIALS AND ACCESSORIES IN THE SPACES WHERE THEY WILL BE INSTALLED FOR AT LEAST 72 HOURS BEFORE BEGINNING INSTALLATION TO ACHIEVE TEMPERATURE STABILITY.

C. STORE MATERIALS IN A CLEAN DRY, ENCLOSED SPACE OFF THE GROUND AND PROTECTED FROM THE WEATHER. PROTECT ADHESIVES FROM FREEZING.

1.09 ENVIRONMENTAL CONDITIONS

A. MAINTAIN UNIFORM TEMPERATURE OF MINIMUM OF 65 DEGREES FAHRENHEIT AND HUMIDITY OF 20 TO 40 PERCENT 72 HOURS PRIOR TO INSTALLATION, DURING INSTALL, AND 48 HOURS AFTER INSTALLATION.

B. THEREAFTER, MAINTAIN A MINIMUM TEMPERATURE OF 55 DEGREES FAHRENHEIT IN THE AREAS WHERE THE WORK IS COMPLETED.

C. VENTILATE SPACES WHERE WORK OF THIS SECTION OCCURS, DURING AND FOR A PERIOD OF 72 HOURS AFTER COMPLETION OF CURING. VENTILATE TO DISSIPATE HUMIDITY, AND TO PREVENT ACCUMULATION OF FUMES, VAPORS, AND GASES. PROVIDE TEMPORARY FAN UNITS AND DUCTING AS REQUIRED TO FOR VENTING OPERATIONS.

1.010 SEQUENCING AND SCHEDULING

A. COORDINATE THE WORK OF THIS SECTION WITH THE RESPECTIVE TRADES RESPONSIBLE FOR INSTALLING INTERFACING WORK.

B. SEQUENCE WORK TO ENSURE RESILIENT FLOORING IS NOT INSTALLED UNTIL BUILDING IS COMPLETELY ENCLOSED, SUFFICIENT HEAT IS PROVIDED, DUST GENERATING ACTIVITIES HAVE TERMINATED, WET WORK IS DRY AND CURED, AND WORK OVERHEAD IS COMPLETED.

C. ENSURE THAT INSTALLATION OF FLOORING AND ACCESSORIES OCCURS AFTER OTHER FINISHING OPERATIONS, INCLUDING PAINTING.

1.011 MAINTENANCE MATERIALS

A. EXTRA MATERIALS: AFTER RESILIENT INSTALLATION HAS BEEN COMPLETED, DELIVER TO THE OWNER/CONSTRUCTION MANAGER THE FOLLOWING:

1. RESILIENT TILE: 4 CASES OF EACH COLOR, PATTERN AND/OR STYLE.

2. RESILIENT BASE: 5 PERCENT OF EACH COLOR INSTALLED.

3. RESILIENT ACCESSORIES: 6 OF EACH COLOR AND TYPE.

B. EXTRA MATERIALS FURNISHED MUST PRECISELY MATCH MATERIALS INSTALLED, MUST BE WRAPPED IN SUITABLE PACKAGING AND MUST BE CLEARLY LABELED.

C. EXTRA MATERIAL WILL NOT BE USED UNDER ANY CIRCUMSTANCE FOR PUNCH LIST

WORK.

PART 2 PRODUCTS

2.01 VINYL COMPOSITION TILE FLOORING (VCT-1)

A. VINYL COMPOSITION TILE (STANDARD): 12 X 12 INCH BY 1/8 INCH THICK WITH SOLID COLOR EXTENDING THROUGH THICKNESS OF TILE; COMPOSED OF VINYL RESINS, NON-ASBESTOS INORGANIC MINERAL FILLERS, AND COLORFAST PIGMENTS COMPLYING WITH FS SS-T-312B(1), TYPE IV, COMPOSITION 1 AND ASTM F1066 COMPOSITION 1, CLASS 2.

1. MANUFACTURERS: PRODUCTS OF THE FOLLOWING MANUFACTURERS, PROVIDED THEY COMPLY WITH THE REQUIREMENTS OF THE CONTRACT DOCUMENTS, WILL BE AMONG THOSE CONSIDERED ACCEPTABLE.

A. ARMSTRONG WORLD INDUSTRIES, INC.

B. JOHNSONITE, INC.

C. ROPPE CORP.

B. COLOR: AS SELECTED BY OWNER FROM MANUFACTURER'S FULL RANGE OF NON-PREMIUM COLORS. UP TO 4 COLORS MAY BE SELECTED AT NO ADDITIONAL CHARGE.

1. REFER TO ROOM FINISH SCHEDULE.

2.02 VINYL COVE BASE

A. VINYL WALL BASE: FS SS-W-40 TYPE II AND AS FOLLOWS:

1. MANUFACTURERS: PRODUCTS OF THE FOLLOWING MANUFACTURERS, PROVIDED THEY COMPLY WITH THE REQUIREMENTS OF THE CONTRACT DOCUMENTS, WILL BE AMONG THOSE CONSIDERED ACCEPTABLE.

A. ARMSTRONG WORLD INDUSTRIES, INC.

B. JOHNSONITE, INC.

C. ROPPE CORP.

2. HEIGHT: 4 INCHES.

3. THICKNESS: 1/8 INCH.

4. STYLE: STANDARD TOE BASE.

5. CORNERS: SITE-FABRICATED USING HEAT FORMING TOOL ACCEPTABLE TO MANUFACTURER.

6. LENGTHS SHALL BE CUT FROM ROLL STOCK TO PROVIDE CONTINUOUS PIECES BETWEEN ROOM CORNERS.

A. 4 FOOT SECTIONS OF BASE WILL NOT BE ACCEPTED.

7. FINISH: DULL OR MATTE.

B. COLOR: AS SELECTED BY OWNER FROM MANUFACTURER'S FULL RANGE OF NON-PREMIUM COLORS.

1. REFER TO ROOM FINISH SCHEDULE.

2.03 ACCESSORIES

A. FILLER FOR PATCHING, SMOOTHING AND LEVELING SUBFLOORS AND UNDERLAYMENTS: PORTLAND CEMENT-BASED LATEX UNDERLAYMENT ACCEPTABLE TO FLOORING MANUFACTURER, EQUAL TO THE FOLLOWING:

1. ARDEX, INC., PRODUCTS “FEATHER FLASH” AND “ARDEX SD-P”.

2. QUIKRETE COMPANIES, PRODUCT “FAST-SET UNDERLAYMENT 1248”.

3. SILPRO MASONRY SYSTEMS INC., PRODUCT “ULTRA SKIM AND SPEEDTOP”

B. PRIMER: TYPE RECOMMENDED BY RESILIENT MANUFACTURER FOR APPLICATION TO CONCRETE SUBSTRATES.

1. ALL FLAT PRIMERS AND UNDERLAYMENTS MUST MEET THE REQUIREMENTS FOR LEED AS SET FORTH BY THE US GREEN BUILDING COUNCIL. THE LEED REQUIREMENT FOR FLAT PRIMERS AND UNDERLAYMENTS SETS THE LIMIT FOR VOLATILE ORGANIC COMPOUNDS (VOCS) AT 50 G/L. ALL FLAT PRIMERS AND UNDERLAYMENTS USED ON THE PROJECT MUST NOT EXCEED THIS LIMIT.

C. ADHESIVES

1. GENERAL: WATERPROOF, ACCEPTABLE TO THE RESILIENT FLOORING MANUFACTURER, FOR SUBSTRATE CONDITIONS.

2. ACCEPTABLE MANUFACTURERS:

A. SAME MANUFACTURER OF RESILIENT PRODUCT BEING ADHERED.

D. JOINT SEALER FOR BETWEEN THE TOP OF WALL BASE AND IRREGULAR WALL SURFACES: PLASTIC FILLER AS RECOMMENDED BY MANUFACTURER.

E. RESILIENT EDGE STRIPS: SOLID RUBBER OR VINYL IN TAPERED OR ROUNDED PROFILE, NOMINALLY 1 INCH IN WIDTH AND 1/8 INCH IN THICKNESS. TRANSITION STRIPS (DIFFERING FLOORING MATERIAL), CARPET REDUCERS, EDGINGS AND ACCESSORIES FOR OFFICE AREAS: COLORS AS SELECTED BY THE ARCHITECT.

1. ACCEPTABLE MANUFACTURERS:

A. ARMSTRONG WORLD INDUSTRIES, INC.

B. JOHNSONITE, INC.

C. ROPPE CORP.

F. METAL EDGE STRIPS WHERE TILE ABUTS CONCRETE: EXTRUDED ALUMINUM, MILL FINISH, OF WIDTH, THICKNESS, AND PROFILE TO PROTECT EXPOSED EDGES OF THE RESILIENT FLOORING. PROVIDE UNITS OF MAXIMUM AVAILABLE LENGTH TO MINIMIZE THE NUMBER OF

JOINTS.

G. CLEANING MATERIAL: DOMESTIC NEUTRAL FLOOR DETERGENT HAVING A PH 7 OR PH 8, AS RECOMMENDED BY THE FLOORING MANUFACTURER.

PART 3.EXECUTION

3.01 EXAMINATION

A. INSPECT SUBSTRATES AND CONDITIONS OF INSTALLATION TO VERIFY THAT THE WORK MAY PROPERLY COMMENCE. DO NOT PROCEED WITH THE WORK UNTIL UNSATISFACTORY CONDITIONS HAVE BEEN CORRECTED. START OF INSTALLATION WORK CONSTITUTES ACCEPTANCE OF SUBSTRATE CONDITIONS AND FULL RESPONSIBILITY FOR THE COMPLETED WORK.

B. ENSURE THAT NEWLY PLACED CONCRETE HAS CURED FOR A MINIMUM PERIOD OF 30 DAYS AND THAT MOISTURE CONTENT AND PH OF CONCRETE ARE WITHIN RANGE SPECIFIED BY ADHESIVE MANUFACTURER.

1. MOISTURE EMISSION FROM THE FLOOR CANNOT EXCEED 3.0 POUNDS PER 1,000 SQUARE FEET IN 24 HOURS.

2. ACCEPTABLE PH RANGE IS 7.0 TO 9.0.

C. VERIFY THAT SURFACES ARE SMOOTH AND FLAT AND ARE READY TO RECEIVE WORK.

D. REQUEST CORRECTION OF DEFECTS IN RECEIVING SURFACES WHICH ARE NOT CORRECTABLE BY THE METHODS SPECIFIED HEREIN. DO NOT COMMENCE WORK UNTIL SUCH DEFECTS ARE ENTIRELY CORRECTED.

3.02 PREPARATION

A. GENERAL: COMPLY WITH FLOORING MANUFACTURER'S REQUIREMENTS FOR PREPARATION OF SUBSTRATE TO RECEIVE RESILIENT FLOORING.

1. CLOSE SPACES TO TRAFFIC DURING THE INSTALLATION OF THE FLOORING.

B. REMOVE ALL PROTRUDING EDGES, HIGH SPOTS, SUB-FLOOR RIDGES AND BUMPS BY LIGHT SANDING AND GRINDING.

C. FILL LOW SPOTS, CRACKS, JOINTS, HOLES AND OTHER DEFECTS WITH SUB-FLOOR FILLER. APPLY, TROWEL, AND FLOAT FILLER TO LEAVE SMOOTH, LEVEL AND HARD SURFACE, AS REQUIRED TO ENSURE THAT RESILIENT SURFACES WILL BE LEVEL TO WITHIN 1/8 INCH TOLERANCE IN 10 FEET IN ANY DIRECTION.

D. PROHIBIT TRAFFIC UNTIL FILLER IS CURED.

E. APPLY PRIMER TO CONCRETE SUBSTRATES PRIOR TO APPLICATION OF ADHESIVE, FOLLOWING MANUFACTURER'S PRINTED INSTRUCTIONS.

F. THOROUGHLY SWEEP AND VACUUM SUBSTRATE AND REMOVE ALL FOREIGN MATTER.

G. ENSURE THAT SUBSTRATE IS DRY, CLEAN AND SMOOTH PRIOR TO APPLICATION OF FLOORING

H. MEASURE ALL AREAS TO RECEIVE MATERIALS TO BE FURNISHED AND INSTALLED HEREUNDER, AND VERIFY IN THE FIELD THEIR ACTUAL DIMENSIONS, INCLUDING WALL-TO-WALL DIMENSIONS, OFFSETS, DOOR LOCATIONS, AND DETAILS, FIXED EQUIPMENT, AND ALL OTHER INSTALLED ITEMS. EXTRA CHARGES WILL NOT BE ALLOWED BECAUSE OF LACK OF FAMILIARITY WITH ACTUAL PROJECT CONDITIONS.

3.03 INSTALLATION - GENERAL

A. INSTALL ALL PRODUCTS IN STRICT ACCORDANCE WITH EACH MANUFACTURER'S WRITTEN INSTALLATION PROCEDURES AND OTHER PROVISIONS SPECIFIED HEREIN.

B. SPREAD ONLY ENOUGH ADHESIVE TO PERMIT INSTALLATION OF MATERIALS BEFORE INITIAL SET.

C. TIGHTLY ADHERE RESILIENT FLOORING TO SUBSTRATE WITH NO OPEN JOINTS OR CRACKS AND WITHOUT RAISED OR BLISTERED AREAS. SPREAD ADHESIVE EVENLY WITH NOTCHED TROWEL, SO THAT FINAL INSTALLATION WILL BE WITHOUT TELEGRAPHING MARKINGS FROM ADHESIVE OR SUBSTRATE.

D. MIX TILE TO ENSURE THAT CONCENTRATION OF SURFACE PATTERNS IS UNIFORM THROUGHOUT. USE TILE FROM CARTONS IN SAME SEQUENCE AS MANUFACTURED AND PACKAGED, IF SO NUMBERED.

1. DISCARD BROKEN, CHIPPED AND/OR OTHERWISE DAMAGED TILES.

3.04 INSTALLATION - FLOOR TILE

A. LAY FLOORING IN A SQUARE GRID PATTERN, WITH JOINTS AND SEAMS PARALLEL TO BUILDING LINES. LAY TILE FLOORING IN PATTERN AS INDICATED ON THE DRAWINGS OR IF NOT INDICATED AS SUCH, LAY PATTERN-GRAIN IN 1/4 TURNS TO ADJACENT TILES. LAY TILE WITH JOINTS STRAIGHT AND CONTINUOUS IN BOTH DIRECTIONS AND WITH BORDER TILE NOT LESS THAN 1/2 THE WIDTH OF THE TILE.

B. NEATLY FIT RESILIENT MATERIALS TO ALL INTERSECTING SURFACES, AND MAKE JOINTS AS INCONSPICUOUS AS POSSIBLE.

C. TERMINATE FLOORING AT CENTERLINE OF DOOR IN CLOSED POSITION WHERE ADJACENT FLOOR FINISH IS OF DIFFERENT MATERIAL OR COLOR.

D. APPLY RESILIENT MATERIALS TO HAVE UNIFORM CONTACT WITH RECEIVING SURFACES THROUGHOUT, WITH TIGHT HAIRLINE JOINTS, AND WITH ALL FINISH SURFACES SMOOTH, IN TRUE PLANE, FREE FROM BUCKLES, WAVES, AND OTHER IMPERFECTIONS.

E. EXTEND RESILIENT FLOORING TO WALL LINES BENEATH ALL MOVABLE EQUIPMENT AND MOVABLE CASEWORK. FIT RESILIENT FLOORING ONTO BREAKS AND RECESSES, AGAINST NON-RESILIENT BASES, AROUND PIPES AND OTHER PROTRUSIONS, UNDER SADDLES, AND TO AND AROUND OTHER FIXED SURFACES, MAKING NEAT CUTS IN THE FLOORING AND MINIMIZING JOINTS.

F. ROLL EACH AREA OF INSTALLATION AT REGULAR INTERVALS, TO ASSURE FIRM BONDING OF TILES TO SUBSTRATE.

G. ACCESS COVERS: INSTALL RESILIENT FLOORING TIGHTLY TO REMOVABLE ACCESS COVERS IN FIELD OF FLOORING, TAKING CARE THAT PATTERN WILL MATCH WHEN COVERS ARE IN CLOSED POSITION.

H. PROHIBIT TRAFFIC ON FINISHED FLOOR AREAS UNTIL FLOORING ADHESIVE HAS FULLY SET.

3.05 INSTALLATION OF ACCESSORIES

A. RESILIENT COVE BASE: INSTALL BASE ON SOLID BACKING, ADHERE TO VERTICAL SUBSTRATE WITH FULL SPREAD OF ADHESIVE, ASSURING CONTINUOUS CONTACT WITH VERTICAL AND HORIZONTAL SURFACES. APPLY VCB TO WALLS, COLUMNS, CASEWORK AND OTHER PERMANENT FIXTURES IN AREAS WHERE BASE IS REQUIRED.

1. INSTALL IN LENGTHS AS LONG AS PRACTICAL.

2. SCRIBE TO FIT TO DOOR FRAMES AND OTHER INTERRUPTIONS.

3. FORM ALL EXTERNAL AND INTERNAL CORNERS IN ACCORDANCE WITH MANUFACTURER'S WRITTEN INSTRUCTIONS. COPE INSIDE CORNERS AND FIT NEATLY.

4. AT IRREGULAR VERTICAL SURFACES WHERE TOP EDGE OF RESILIENT BASE DOES NOT MAKE CONTINUOUS CONTACT, FILL VOIDS WITH MANUFACTURER'S RECOMMENDED ADHESIVE COMPOUND..

B. RESILIENT EDGE AND TRANSITION STRIPS:

1. INSTALL EDGE STRIPS AT ALL EDGES OF FLOORING WHICH WOULD OTHERWISE BE EXPOSED.

2. PLACE RESILIENT EDGE STRIPS TIGHTLY BUTTED TO FLOORING AND SECURE WITH ADHESIVE RECOMMENDED BY THE EDGE STRIP MANUFACTURER.

3. ALL EDGE AND TRANSITION STRIPS ARE TO BE SUBMITTED TO THE ARCHITECT FOR REVIEW AND APPROVAL PRIOR TO INSTALLATION.

3.06 POST-INSTALLATION CLEANING

A. REMOVE EXCESS AND WASTE MATERIALS PROMPTLY. SWEEP OR VACUUM CLEAN RESILIENT FLOORING AS SOON AS INSTALLATION HAS BEEN COMPLETED IN EACH AREA TO REMOVE ALL LOOSE DIRT AND DEBRIS.

B. AS INSTALLATION PROGRESSES AND ADHESIVE HAS HAD ADEQUATE TIME TO SET, MOP EACH AREA WITH DAMP MOP AND MILD DETERGENT

1. CONTINUALLY REMOVE EXCESS ADHESIVE FROM FLOOR, BASE AND WALL SURFACES WITHOUT DAMAGE.

C. AFTER MANUFACTURER SPECIFIED WAITING PERIOD OR 5 CALENDAR DAYS FROM VCT INSTALLATION, WHICH EVER IS LONGER, FINAL CLEAN ALL MATERIALS INSTALLED HEREUNDER.

1. PROHIBIT WASHING, SCRUBBING OR OTHER SIMILAR 'WET' OPERATIONS TO OCCUR ON FINISHED FLOOR AREAS FOR A MINIMUM PERIOD OF 5 CALENDAR DAYS AFTER INSTALLATION.

3.07 FINAL CLEANING

A. GENERAL: PERFORM FINAL CLEANING NO EARLIER THAN 4 DAYS PRIOR TO INTENDED OCCUPANCY DATE.

B. VINYL COMPOSITION TILE FLOORS:

1. REMOVE SCUFF MARKS, EXCESSIVE ADHESIVE AND OTHER FOREIGN SUBSTANCES WITH NON-ABRASIVE COMMERCIAL DETERGENT WITH FLOOR MACHINE EQUIPPED WITH GREEN OR BLUE PAD. THOROUGHLY RINSE WITH CLEAN WATER. APPLY MANUFACTURER'S RECOMMENDED STRIPPING SOLUTION WHEN FLOORS ARE BADLY SOILED.

A. USE ONLY CLEANING PRODUCTS AND TECHNIQUES RECOMMENDED BY THE MANUFACTURER OF THE RESILIENT PRODUCT.

2. APPLY A MINIMUM OF THREE COATS OF ACRYLIC FLOOR POLISH TO PROTECT PREVIOUSLY CLEANED RESILIENT FLOORING SURFACES UNTIL REGULAR MAINTENANCE PROCEDURES CAN BE STARTED.

3.08 PROTECTION

A. CONSTRUCTION PERIOD: COVER TRAFFIC ROUTES ACROSS COMPLETED RESILIENT FLOORING WITH PLYWOOD, HARDBOARD OR OTHER DURABLE MATERIAL TO PROTECT AGAINST DAMAGE FROM LOADED DOLLIES AND OTHER CONSTRUCTION TRAFFIC.

B. FINAL PROTECTION: COVER RESILIENT FLOOR SURFACE WITH NON-STAINING BUILDING/KRAFT PAPER ENSURE THAT POLISHED FLOORS ARE PROTECTED. TAPE THE EDGES TO MAINTAIN POSITION OF THE PROTECTION PAPER. REAPPLY PAPERS AS REQUIRED TO MAINTAIN FLOOR PROTECTION

END OF SECTION

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MONOLITHIC RESINOUS FLOORING

PART 1 GENERAL

1.01 ITEMS REQUIRED BUT NOT SPECIFIED

A. IF AN ITEM OR MATERIAL OF THIS TRADE IS INDICATED ON THE DRAWINGS BUT NOT SPECIFICALLY LISTED IN THIS SECTION, PROVIDE SUCH ITEM OR MATERIAL AT A STANDARD OF QUALITY EQUAL TO THE STANDARD ESTABLISHED FOR THE BALANCE OF THE WORK SPECIFIED, IN ACCORDANCE WITH THE ARCHITECT'S INTERPRETATION.

1.02 EXECUTION, CORRELATION AND INTENT

A. IN CASE OF AN INCONSISTENCY BETWEEN DRAWINGS AND SPECIFICATIONS, OR WITHIN EITHER DOCUMENT NOT CLARIFIED BY ADDENDUM, THE BETTER QUALITY OR GREATER QUANTITY OF WORK IS TO BE PROVIDED, IN ACCORDANCE WITH THE ARCHITECT'S INTERPRETATION.

1.03 SECTION INCLUDES

A. SPECIAL DECORATIVE MONOLITHIC RESINOUS FLOORING SYSTEM MATERIALS INCLUDING UNDERLAYMENT'S, WATERPROOFING MEMBRANES, PRIMERS, FILLERS, AND OTHER APPLIED MATERIALS USED AS PRIME, BODY COAT AND FINISH COATS AND THE APPLICATION OF THESE MATERIALS.

B. PROVISIONS ESTABLISHED WITHIN THE CONTRACT, DIVISION 1, GENERAL REQUIREMENTS, AND THE DRAWINGS ARE COLLECTIVELY APPLICABLE TO THIS SECTION.

1.04 REFERENCE STANDARDS

A. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

1.05 SUBMITTALS

A. PRODUCT DATA: PRIOR TO COMMENCING WORK, SUBMIT MANUFACTURER'S TECHNICAL INFORMATION, INSTALLATION INSTRUCTIONS AND DETAILS, AND GENERAL RECOMMENDATIONS FOR EACH RESINOUS FLOORING MATERIAL REQUIRED. INCLUDE CERTIFICATION INDICATING COMPLIANCE OF MATERIALS WITH REQUIREMENTS.

B. SAMPLES: SUBMIT, FOR VERIFICATION PURPOSES, 6-INCH SQUARE SAMPLES OF EACH TYPE OF RESINOUS FLOORING REQUIRED, APPLIED TO A RIGID BACKING, IN COLOR AND FINISH INDICATED.

1. FOR INITIAL SELECTION OF COLORS AND FINISHES, SUBMIT MANUFACTURER'S COLOR CHARTS SHOWING FULL RANGE OF COLORS AND FINISHES AVAILABLE.

1.06 QUALITY ASSURANCE

SECTION 09 67 23

MONOLITHIC RESINOUS FLOORING

A. CONTRACTOR SHALL BE AN ESTABLISHED FIRM REGULARLY ENGAGED IN SATISFACTORY INSTALLATION OF SIMILAR MATERIALS AND PROVIDE A LIST OF 3 PROJECTS OF SIMILAR NATURE AND COMPLEXITY COMPLETED IN THE LAST 5 YEARS. CONTRACTOR SHALL PROVIDE A LETTER OF CERTIFICATION BY MANUFACTURER THAT CONTRACTOR IS A CURRENT QUALIFIED INSTALLER.

B. SINGLE SOURCE RESPONSIBILITY: PROVIDE FILLERS, UNDERLAYMENT'S, WATERPROOF MEMBRANE, PRIMERS, BODY COATS AND TOP COATS PRODUCED BY THE SAME MANUFACTURER WITH NO LESS THAN 10 YEARS EXPERIENCE IN THE MANUFACTURE AND SUPPLY OF PRINCIPAL MATERIALS FOR WORK IN THIS SECTION.

C. PRIOR TO COMMENCING THE INSTALLATION, THE RESINOUS FLOORING CONTRACTOR SHALL INSTALL, WITH ARCHITECT'S APPROVAL, A MUTUALLY AGREED UPON SAMPLE (“MOCK-UP”) TO SHOW FINAL COLOR AND TEXTURE OF THE SYSTEM. THIS 8'X8' MOCK-UP AREA SHALL SERVE AS A JOB STANDARD FOR THE FINAL INSTALLATION.

D. ISO 9002: ALL MATERIALS, INCLUDING PRIMERS, RESINS, CURING AGENTS, FINISH COATS, AGGREGATES AND SEALANTS ARE MANUFACTURED AND TESTED UNDER AN ISO 9002 REGISTERED QUALITY SYSTEM.

1.07 DELIVERY, STORAGE AND HANDLING

A. MATERIAL SHALL BE DELIVERED TO PROJECT SITE IN MANUFACTURER'S ORIGINAL UNOPENED CONTAINERS BEARING MANUFACTURER'S NAME, PRODUCT AND COLOR. MATERIAL SHALL BE CHECKED BY THE SUBCONTRACTOR FOR COMPLETENESS AND DAMAGE UPON DELIVERY.

B. ALL MATERIALS USED SHALL BE FACTORY PRE-WEIGHED AND PRE-PACKAGED IN SINGLE, EASY TO MANAGE BATCHES TO ELIMINATE ON SITE MIXING ERRORS. NO ON-SITE WEIGHING OR VOLUMETRIC MEASUREMENTS ALLOWED.

C. MATERIALS SHALL BE STORED INDOORS, PROTECTED FROM DAMAGE, MOISTURE, DIRECT SUNLIGHT AND TEMPERATURES BELOW 50 DEGREES F OR ABOVE 80 DEGREES F.

1.08 WARRANTY

A. MANUFACTURER SHALL FURNISH A WRITTEN WARRANTY COVERING BOTH MATERIAL AND WORKMANSHIP FOR A PERIOD OF FIVE FULL YEARS FROM THE DATE OF INSTALLATION.

B. ITEMS COVERED UNDER WARRANTY WILL BE SINGLE SOURCE RESPONSIBILITY TO THE CONTACTOR FOR ALL PHASES OF THE WORK INCLUDING BUT NOT LIMITED TO THE FLOOR PREP, MATERIALS, INSTALLATION, ETC.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. BASF/UCRETE INDUSTRIAL FLOORING

B. FLOWCRETE

2.02 COLORS AND FINISHES

A. COLORS: AS SELECTED BY OWNER FROM MANUFACTURER'S STANDARD COLORS.

B. FINISHES: AS SELECTED BY OWNER FROM MANUFACTURER'S RANGE OF FINISHES.

2.03 RESINOUS FLOORING - ("MRF-1" PER ROOM FINISH SCHEDULE):

A. 1/4" HEAVY DUTY ANTI-MICROBIAL FLOORING SYSTEM WITH ANTI-SLIP TEXTURED SURFACE AND CANT BASE. (UCRETE HF & WR) (FLOWFRESH HF & CM)

1. FINISH SURFACE MUST HAVE HIGH RESISTANCE TO THERMAL SHOCK FROM HIGH PRESSURE WATER WASH DOWN AND LIQUIDS OF UP TO 250°F.

2. FINISHED SURFACE TO BE FAST CURING, CRACK FREE AFTER EXTENDED USAGE, EASILY CLEANABLE, ZERO POROSITY AND NON DUSTING.

B. PHYSICAL PROPERTIES: THE URETHANE COMPOSITE FLOORING SYSTEM SHALL COMPLY WITH THE FOLLOWING MINIMUM TEST STANDARDS:

COMPRESSIVE STRENGTH, ASTM - C 579 = 8,000 PSI

TENSILE STRENGTH, ASTM - C 307 = 1,450 PSI

FLEXURAL STRENGTH, ASTM - C 580 = 2,900 PSI

MODULUS OF ELASTICITY, ASTM - C 469 = 1.7 X 10^5 PSI

DENSITY, ASTM - C 905 = 2.5 LB/FT2

COEFFICIENT OF THERMAL EXPANSION, ASTM - C531 = 1.1 X 10-5 IN/IN/°F

WATER ABSORPTION, ASTM - C 413 = <0.1%

RESISTANCE TO FUNGI GROWTH, ASTM - G 21 = PASSES

ABRASION RESISTANCE, ASTM - D 4060 = 0.05 G LOSS

IMPACT RESISTANCE, ASTM - D 2794 = NO CRACKING OR DELAMINATION AT 160 IN-LBS.

C. MATERIALS MUST BE PHTHALATE FREE. PROVIDE VERIFICATION.

D. AN ANTI-MICROBIAL ADDITIVE SHALL BE USED. THE REQUIRED ANTI-MICROBIAL ADDITIVE CANNOT BE FIELD ADDED OR APPLIED.

E. THE FLOORING SYSTEM SHALL COMPLY WITH SCAQMD RULE #1113 LIMITS FOR

VOLATILE ORGANIC COMPOUNDS (VOC)

1. INDUSTRIAL MAINTENANCE COATING: 100 G / L (LESS WATER)

F. THE URETHANE COMPOSITE FLOORING SYSTEM SHALL SHOW NO CHEMICAL ATTACK WHEN TESTED IN ACCORDANCE WITH ASTM - D 1308 AT 72°F FOR 28 DAYS IMMERSION AGAINST THE FOLLOWING REAGENTS AND CONCENTRATIONS NOTED:

BORIC ACID 100%	ETHYLENE GLYCOL 100%
CITRIC ACID 40%	ACETIC ACID 20%
ETHYLENE DICHLORIDE	ALL DIESEL FUEL 100%
HYDROCHLORIC ACID 35%	MALEIC ANHYDRIDE 100%
STEARIC ACID ALL	SODIUM HYPOCHLORITE
AMONIUM AQUEOUS 30%.	AMYL ACETATE ALL
LACTIC ACID 85%	COPPER SULFATE IN SOLUT.
CHLOROBENZENE ALL	NITRIC ACID 30%
BENZENE 100%	FATTY ACID 100%
MURATIC ACID 35%	BENZOIC ACID 100%
GLYCOLIC 100%	SULFURIC ACID 30%
BUTYL ALCOHOL 100%	PICRIC 5%
PHOSPHORIC ACID 80%	

G. PROVIDE FULL CHEMICAL RESISTANCE AND STAIN RESISTANCE PRODUCT DATA FOR SUBMITTED PRODUCT.

2.04 CHEMICAL RESISTANT RESINOUS FLOORING - (“MRF-2” - PER ROOM FINISH SCHEDULE)

A. 1/4” HEAVY DUTY ANTI-MICROBIAL /CHEMICAL RESISTANT FLOORING SYSTEM WITH ANTI-SLIP TEXTURED SURFACE WITH CANT BASE AND PIGMENTED NOVOLAC TOPCOAT.

1. FINISH SURFACE MUST HAVE HIGH RESISTANCE TO THERMAL SHOCK FROM HIGH PRESSURE WATER WASH DOWN AND LIQUIDS OF UP TO 160°F.

2. FINISHED SURFACE TO BE FAST CURING, CRACK FREE AFTER EXTENDED USAGE, EASILY CLEANABLE, ZERO POROSITY AND NON DUSTING.

B. PHYSICAL PROPERTIES: THE URETHANE COMPOSITE FLOORING SYSTEM SHALL COMPLY WITH THE FOLLOWING MINIMUM TEST STANDARDS:

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MONOLITHIC RESINOUS FLOORING

MATERIALS MUST BE PTHALATE FREE. PROVIDE VERIFICATION.

COMPRESSIVE STRENGTH, ASTM - C 579 = 8,128 PSI

TENSILE STRENGTH, ASTM - C 307 = 1,450 PSI

FLEXURAL STRENGTH, ASTM - C 580 = 2,900 PSI

MODULUS OF ELASTICITY, ASTM - C 469 = 1.7 X 10^5 PSI

COEFFICIENT OF THERMAL EXPANSION, ASTM - C531 = 2.7 X 10-5 IN/IN/°F

IMPACT RESISTANCE, ASTM - D 2794 = NO CRACKING OR DELAMINATION AT 160 IN-LBS.

FIRE RESISTANCE, MIL-D-24613 = FIRE RETARDANT

NONSLIP PROPERTIES, ASTM D - 2047 = DRY = .7

ABRASION RESISTANCE, CS-17 WHEEL, 1000 GRAM LOAD, 1000 CYCLES = <.050 GRAM LOSS

MATERIALS MUST BE PHTHALATE FREE. PROVIDE VERIFICATION.

C. THE FLOORING SYSTEM SHALL COMPLY WITH SCAQMD RULE #1113 LIMITS FOR VOLATILE ORGANIC COMPOUNDS (VOC)

1. INDUSTRIAL MAINTENANCE COATING: 100 G / L (LESS WATER)

D. AN ANTI-MICROBIAL ADDITIVE SHALL BE USED IN THE BASE. THE REQUIRED ANTI-MICROBIAL ADDITIVE CANNOT BE FIELD ADDED OR APPLIED.

E. THE FLOORING SYSTEM SHALL COMPLY WITH SCAQMD RULE #1113 LIMITS FOR VOLATILE ORGANIC COMPOUNDS (VOC)

1. INDUSTRIAL MAINTENANCE COATING: 100 G / L (LESS WATER)

F. THE URETHANE COMPOSITE FLOORING SYSTEM SHALL SHOW NO CHEMICAL ATTACK WHEN TESTED IN ACCORDANCE WITH ASTM - D 1308 AT 72°F FOR 28 DAYS IMMERSION AGAINST THE FOLLOWING REAGENTS AND CONCENTRATIONS NOTED:

BORIC ACID 100%	ETHYLENE GLYCOL 100%
CITRIC ACID 40%	ACETIC ACID 20%
ETHYLENE DICHLORIDE	ALL DIESEL FUEL 100%
HYDROCHLORIC ACID 35%	MALEIC ANHYDRIDE 100%
STEARIC ACID ALL	SODIUM HYPOCHLORITE
AMONIUM AQUEOUS 30%.	AMYL ACETATE ALL

LACTIC ACID 85%	COPPER SULFATE IN SOLUT.
CHLOROBENZENE ALL	NITRIC ACID 30%
BENZENE 100%	FATTY ACID 100%
MURATIC ACID 35%	BENZOIC ACID 100%
GLYCOLIC 100%	SULFURIC ACID 30%
BUTYL ALCOHOL 100%	PICRIC 5%
PHOSPHORIC ACID 80%	

G. PROVIDE FULL CHEMICAL RESISTANCE AND STAIN RESISTANCE PRODUCT DATA FOR SUBMITTED PRODUCT.

2.05 DECORATIVE RESINOUS FLOORING - ("MRF-3" - PER ROOM FINISH SCHEDULE)

A. UV STABLE EPOXY DECORATIVE FLOORING SYSTEM. SPECIAL DECORATIVE FLOORING SHALL BE A TWO COMPONENT UV STABLE EPOXY FLOOR SYSTEM WITH APPLIED TO A MINIMUM FINISHED THICKNESS OF 1/4 INCH. CONSULT WITH OWNER ON DESIRED DECORATIVE FINISH SUCH AS COLORED QUARTZ AGGREGATE OR OTHER DECORATIVE TECHNIQUES. DECORATIVE SPECIAL FLOORING SHALL BE FINISHED WITH A MINIMUM OF TWO COATS CLEAR UV STABLE EPOXY TO ACHIEVE THE TEXTURE SELECTED.

B. PHYSICAL PROPERTIES: THE URETHANE COMPOSITE FLOORING SYSTEM SHALL COMPLY WITH THE FOLLOWING MINIMUM TEST STANDARDS:

COMPRESSIVE STRENGTH, ASTM - C 579 = 8,000 PSI

TENSILE STRENGTH, ASTM - C 307 = 1,450 PSI

FLEXURAL STRENGTH, ASTM - C 580 = 2,175 PSI

INDENTATION MIL-D-24613 = 24 HRS. RESIDUAL, 0.0008 INCH

IMPACT RESISTANCE, MIL-D-24613 = NO CHIPPING, CRACKING, OR DELAMINATION

FIRE RESISTANCE, MIL-D-24613 = FIRE RETARDANT

NONSLIP PROPERTIES, ASTM D - 2047 = DRY = .7

ABRASION RESISTANCE, C-17 WHEEL

1000 M LOAD, 1000 CYCLES = < .060 GRAM LOSS

C. AN ANTI-MICROBOAL ADDITIVE SHALL BE USED IN THE CLEAR EPOXY RESIN IN APPLICABLE CORRIDORS, LOCKER ROOMS, RESTROOMS, CAFETERIAS, KITCHENS, AND LAB AREAS. THE REQUIRED ANTI-MICROBIAL ADDITIVE CANNOT BE FIELD ADDED OR APPLIED.

D. THE FLOORING SYSTEM SHALL COMPLY WITH SCAQMDRULE #1113 LIMITS FOR VOLATILE ORGANIC COMPOUNDS (VOC)

INDUSTRIAL MAINTENANCE COATING: 100 G/L (LESS WATER)

PART 3 EXECUTION

3.01 SURFACE CONDITIONS

A. NEW CONCRETE IS DEFINED FOR PURPOSES OF THIS SPECIFICATION AS CONCRETE THAT HAS NOT BEEN IN SERVICE, WITH OR WITHOUT FLOORING FINISHES. TYPICALLY, NEW CONCRETE WILL BE LESS THAN 28 DAYS OLD. IN ANY CASE ALL CONCRETE MUST HAVE A CURE PERIOD OF 10 DAYS MINIMUM OF 70° F FOR THE INSTALLATION OF URETHANE FLOORING.

B. VERIFY THAT MOISTURE CONTENT IS WITHIN RANGE ACCEPTABLE TO FLOORING MANUFACTURER, USING A CALCIUM CHLORIDE TEST KIT IN ACCORDANCE WITH ASTM F 1869. ALTERNATELY, THE FLOOR MOISTURE CONTENT MAY BE EVALUATED BY PERFORMING THE PLASTIC SHEET TEST IN ACCORDANCE WITH ASTM - D 4263.

C. CONTRACTOR MUST REPORT, IN WRITING, SURFACES LEFT IN IMPROPER CONDITION BY OTHER TRADES. APPLICATION WILL CONSTITUTE ACCEPTANCE OF SURFACES BY THE APPLICATOR.

3.02 PREPARATION

A. PREPARE SURFACES AS REQUIRED, PER MANUFACTURER'S PRINTED INSTRUCTIONS. PREFERRED SURFACE PREPARATION IS SHOT BLAST OR SIMILAR MECHANICAL METHOD.

B. PATCH ALL DEPRESSIONS, DIVOTS, HONEYCOMBED OR SCALED CONCRETE WITH FILLER AS RECOMMENDED BY MANUFACTURER.

1. THE CONTRACTOR WILL BE REQUIRED TO FIELD VERIFY THAT NO 'BIRD BATHS' EXIST ON SLOPING FLOORS WHICH ARE SCHEDULED TO RECEIVE A RESINOUS FLOORING SYSTEM. IF 'BIRD BATHS' ARE DISCOVERED THE CONTRACTOR SHALL NOTIFY THE CONSTRUCTION MANAGER, PRIOR TO THE INSTALLATION OF THE RESINOUS FLOORING SYSTEM.

C. LEVEL AND SLOPE FLOOR, AS REQUIRED, WITH MANUFACTURER'S ACRYLIC OR EPOXY MODIFIED MORTAR UNDERLAYMENT.

D. FILL ALL NON-MOVING CRACKS OR CONTROL JOINTS WITH JOINT FILLER AS RECOMMENDED BY MANUFACTURER.

E. FILL ALL MOVING CRACKS OR JOINTS WITH A FIRM BUT FLEXIBLE (OR NON-RIGID) POLYUREA JOINT SEALANT MATERIAL AS RECOMMENDED BY MANUFACTURER. EXPANSION JOINTS SHOULD BE RE-CUT IN FINISHED FLOOR, IF REQUIRED, AND FILLED WITH POLYUREA SEALANT.

F. ALL FREE EDGES AROUND PERIMETERS, DRAINS, ALONG CHANNELS OR EXPANSION JOINTS, AT DOORWAYS AND COLUMNS, SHALL BE KEYED IN BY SAW CUTTING A GROOVE IN THE CONCRETE (KEY IN) WITH DEPTH AND WIDTH A MINIMUM OF TWICE THE THICKNESS OF THE FLOORING SYSTEM. KEYWAYS SHOULD BE A MAXIMUM OF 4" FROM THE TERMINATION POINT OR DRAIN.

G. MASKING: MASK SURFACES THAT REQUIRE PROTECTION.

3.03 INSTALLATION

A. "MRF": COMPLY WITH FLOORING SYSTEM MANUFACTURER'S RECOMMENDATION TO PRODUCE A UNIFORM MONOLITHIC WEARING SURFACE OF ¼" THICKNESS MINIMUM, UNINTERRUPTED EXCEPT AT DIVIDER STRIPS, SAWN JOINTS OR OTHER TYPES OF JOINTS (IF ANY) INDICATED OR REQUIRED.

1. MIX 3-COMPONENT COMPOSITE POLYURETHANE FLOORING MATERIALS STRICTLY ACCORDING TO THE MANUFACTURER'S INSTRUCTIONS. USE ONLY THE MIXING EQUIPMENT RECOMMENDED BY THE MANUFACTURER.

2. SPREAD MATERIAL TO A MINIMUM OF ¼" IN ONE APPLICATION WITH A TROWEL, USING THE TROWEL TO CLOSE UP THE SURFACE.

3. ALLOW TO CURE FOR A MINIMUM OF 18-24 HOURS BEFORE PLACING FLOOR INTO SERVICE (FOOT TRAFFIC).

B. CANT BASES: TO BE HEIGHT AS REQUIRED TO COVER IMP BASE TRACK, 2" MINIMUM.

3.04 FIELD QUALITY CONTROL

A. THE RIGHT IS RESERVED TO INVOKE THE FOLLOWING MATERIAL TESTING PROCEDURE AT ANY TIME, AND ANY NUMBER OF TIMES DURING PERIOD OF FLOORING APPLICATION.

B. THE CONTRACTOR MAY ENGAGE SERVICE OF AN INDEPENDENT TESTING LABORATORY TO SAMPLE MATERIALS BEING USED ON THE JOB SITE. SAMPLES OF MATERIAL WILL BE TAKEN, IDENTIFIED AND SEALED, AND CERTIFIED IN PRESENCE OF SUBCONTRACTOR.

C. TESTING LABORATORY WILL PERFORM TESTS FOR ANY OF CHARACTERISTICS SPECIFIED, USING APPLICABLE TESTING PROCEDURES REFERENCED HEREIN, OR IF NONE REFERENCED, IN MANUFACTURER'S PRODUCT DATA.

D. IF TEST RESULTS SHOW MATERIALS BEING USED DO NOT COMPLY WITH SPECIFIED REQUIREMENTS, SUBCONTRACTOR MAY BE DIRECTED TO STOP WORK; REMOVE NON-COMPLYING MATERIALS; PAY FOR TESTING; REAPPLY FLOORING MATERIALS TO PROPERLY PREPARED SURFACES WHICH HAD PREVIOUSLY BEEN COATED WITH UNACCEPTABLE MATERIALS.

3.05 CURING, PROTECTION AND CLEANING

A. CURE RESINOUS FLOORING MATERIALS IN COMPLIANCE WITH MANUFACTURER'S DIRECTIONS, TAKING CARE TO PREVENT CONTAMINATION DURING STAGES OF APPLICATION AND PRIOR TO COMPLETION OF CURING PROCESS. PROTECT THE COMPLETED WORK FROM WATER, AIRBORNE PARTICLES OR OTHER SURFACE CONTAMINANTS UNTIL CURED, TACK FREE, APPROXIMATELY 18-24 HOURS AFTER APPLICATION.

B. PROTECT RESINOUS FLOORING MATERIALS FROM DAMAGE AND WEAR DURING CONSTRUCTION OPERATION. WHERE TEMPORARY COVERING IS REQUIRED FOR THIS PURPOSE, COMPLY WITH MANUFACTURER'S RECOMMENDATIONS FOR PROTECTIVE MATERIALS AND METHOD OF APPLICATION.

C. CLEANING: REMOVE TEMPORARY COVERING AND CLEAN RESINOUS FLOORING JUST PRIOR TO FINAL INSPECTION. USE CLEANING MATERIALS AND PROCEDURES RECOMMENDED BY RESINOUS FLOORING MANUFACTURER.

D. REMOVE WASTE MATERIALS, RUBBISH AND DEBRIS AND DISPOSE OF THEM OFF-SITE. LEAVE WORK AREAS IN A CLEAN CONDITION.

E. PROTECT COMPLETED FLOORING SYSTEM FROM IMMERSION AND CHEMICAL EXPOSURE UNTIL THOROUGHLY CURED, APPROXIMATELY 7 DAYS BEFORE EXPOSURE TO CHEMICALS OR CLEANING COMPOUNDS.

F. PROTECT FLOORING SYSTEM FROM UV LIGHT, WHICH MAY CAUSE A CHANGE IN COLOR HUE BUT WILL NOT AFFECT THE PHYSICAL PROPERTIES OF THE SYSTEM.

G. PROTECT THE FINISHED FLOORS FROM DAMAGE BY OTHER TRADES BY LAYING DOWN AN TAPING RAM-BOARD FLOOR PROTECTION OR ARCHITECT APPROVED EQUAL.

END OF SECTION

SECTION 09 90 00

PAINTING

GENERAL

1.01 RELATED DOCUMENTS

A. CONSTRUCTION DRAWINGS, SPECIFICATIONS AND PROVISIONS OF THE CONTRACT INCLUDING GENERAL AND SUPPLEMENTAL CONDITIONS AND OTHER DIVISION 1 SPECIFICATION SECTIONS, ARE HEREBY MADE A PART OF THIS SECTION AS FULLY AND COMPLETELY AS IF REPEATED HEREIN.

1.02 ITEMS REQUIRED BUT NOT SPECIFIED

A. IF AN ITEM OR MATERIAL OF THIS TRADE IS INDICATED ON THE DRAWINGS BUT NOT SPECIFICALLY LISTED IN THIS SECTION, PROVIDE SUCH ITEM OR MATERIAL AT A STANDARD OF QUALITY EQUAL TO THE STANDARD ESTABLISHED FOR THE BALANCE OF THE WORK SPECIFIED, IN ACCORDANCE WITH THE ARCHITECT'S INTERPRETATION

1.03 EXECUTION, CORRELATION AND INTENT

A. IN CASE OF AN INCONSISTENCY BETWEEN DRAWINGS AND SPECIFICATIONS OR WITHIN EITHER DOCUMENT NOT CLARIFIED BY ADDENDUM, THE BETTER QUALITY OR GREATER QUANTITY OF WORK IS TO BE PROVIDED, IN ACCORDANCE WITH THE ARCHITECT'S INTERPRETATION

1.04 SUMMARY

A. THIS SECTION INCLUDES SURFACE PREPARATION AND FIELD PAINTING OF EXPOSED EXTERIOR AND INTERIOR ITEMS AND SURFACES.

1. SURFACE PREPARATION, PRIMING, AND FINISH COATS SPECIFIED IN THIS SECTION ARE IN ADDITION TO SHOP PRIMING AND SURFACE TREATMENT SPECIFIED IN OTHER SECTIONS.

B. PAINT EXPOSED SURFACES, EXCEPT WHERE THESE SPECIFICATIONS INDICATE THAT THE SURFACE OR MATERIAL IS NOT TO BE PAINTED OR IS TO REMAIN NATURAL. IF AN ITEM OR A SURFACE IS NOT SPECIFICALLY MENTIONED, PAINT THE ITEM OR SURFACE THE SAME AS SIMILAR ADJACENT MATERIALS OR SURFACES. IF A COLOR OF FINISH IS NOT INDICATED, ARCHITECT WILL SELECT FROM STANDARD COLORS AND FINISHES AVAILABLE.

1. PAINTING INCLUDES FIELD PAINTING OF EXPOSED BARE AND COVERED PIPES AND DUCTS (INCLUDING COLOR CODING), HANGERS, EXPOSED STEEL AND IRON SUPPORTS, AND SURFACES OF MECHANICAL AND ELECTRICAL EQUIPMENT THAT DO NOT HAVE A FACTORY-APPLIED FINAL FINISH.

C. DO NOT PAINT PREFINISHED ITEMS, CONCEALED SURFACES, FINISHED METAL SURFACES, OPERATING PARTS, AND LABELS.

1. PREFINISHED ITEMS INCLUDE THE FOLLOWING FACTORY-FINISHED COMPONENTS:

A. INSULATED METAL PANEL.

B. ARCHITECTURAL WOODWORK.

C. METAL TOILET ENCLOSURES.

D. METAL LOCKERS.

E. FINISHED MECHANICAL AND ELECTRICAL EQUIPMENT.

F. LIGHT FIXTURES.

2. CONCEALED SURFACES INCLUDE WALLS OR CEILINGS IN THE FOLLOWING GENERALLY INACCESSIBLE SPACES:

A. FURRED AREAS.

B. PIPE SPACES.

C. DUCT SHAFTS.

D. AREAS ABOVE WALK-ON CEILINGS, UNLESS SCHEDULED.

3. FINISHED METAL SURFACES INCLUDE THE FOLLOWING:

A. STAINLESS STEEL.

B. CHROMIUM PLATE.

C. COPPER AND COPPER ALLOYS.

D. BRONZE AND BRASS.

4. OPERATING PARTS INCLUDE MOVING PARTS OF OPERATING EQUIPMENT AND THE FOLLOWING:

A. VALVE AND DAMPER OPERATORS.

B. LINKAGES.

C. SENSING DEVICES.

D. MOTOR AND FAN SHAFTS.

5. LABELS: DO NOT PAINT OVER UL, FMG, OR OTHER CODE-REQUIRED LABELS OR EQUIPMENT NAME, IDENTIFICATION, PERFORMANCE RATING, OR NOMENCLATURE PLATES.

D. RELATED SECTIONS INCLUDE THE FOLLOWING:

1. DIVISION 5 SECTION "METAL FABRICATIONS" FOR SHOP PRIMING FERROUS METAL.

2. DIVISION 8 SECTION "STEEL DOORS AND FRAMES" FOR FACTORY PRIMING STEEL DOORS AND FRAMES.

3. DIVISION 9 SECTION "GYPSUM BOARD ASSEMBLIES" FOR SURFACE PREPARATION OF GYPSUM BOARD.

4. DIVISION 9 SECTION "EPOXY FLOOR COATING" FOR SPECIAL COATINGS APPLIED TO CONCRETE.

5. DIVISION 9 SECTION “HIGH PERFORMANCE COATINGS”

1.05 DEFINITIONS

A. GENERAL: STANDARD COATING TERMS DEFINED IN ASTM D 16 APPLY TO THIS SECTION.

1. FLAT REFERS TO A LUSTERLESS OR MATTE FINISH WITH A GLOSS RANGE BELOW 15 WHEN MEASURED AT AN 85-DEGREE METER.

2. EGGSHELL REFERS TO LOW-SHEEN FINISH WITH A GLOSS RANGE BETWEEN 20 AND 35 WHEN MEASURED AT A 60-DEGREE METER.

3. SEMI-GLOSS REFERS TO MEDIUM-SHEEN FINISH WITH A GLOSS RANGE BETWEEN 35 AND 70 WHEN MEASURED AT A 60-DEGREE METER.

4. FULL GLOSS REFERS TO HIGH-SHEEN FINISH WITH A GLOSS RANGE MORE THAN 70 WHEN MEASURED AT A 60-DEGREE METER.

1.06 SUBMITTALS

A. PRODUCT DATA: FOR EACH PAINT SYSTEM INDICATED. INCLUDE BLOCK FILLERS AND PRIMERS.

1. MATERIAL LIST: AN INCLUSIVE LIST OF REQUIRED COATING MATERIALS. INDICATE EACH MATERIAL AND CROSS-REFERENCE SPECIFIC COATING, FINISH SYSTEM, AND APPLICATION. IDENTIFY EACH MATERIAL BY MANUFACTURER'S CATALOG NUMBER AND GENERAL CLASSIFICATION.

2. MANUFACTURER'S INFORMATION: MANUFACTURER'S TECHNICAL INFORMATION, INCLUDING LABEL ANALYSIS AND INSTRUCTIONS FOR HANDLING, STORING, AND APPLYING EACH COATING MATERIAL.

B. INITIAL SAMPLES: MANUFACTURER'S COLOR CHARTS FOR SELECTION OF COLORS BY ARCHITECT AND OWNER.

C. FINAL SAMPLES: 216 MM X 280 MM (8 ½ X 11-INCH) “DRAW DOWNS” OF PAINT COLORS SELECTED IN EACH GLOSS NOTED IN PAINTING SCHEDULES.

D. QUALIFICATION DATA: FOR APPLICATOR.

1.07 QUALITY ASSURANCE

A. APPLICATOR QUALIFICATIONS: A FIRM OR INDIVIDUAL EXPERIENCED IN APPLYING PAINTS AND COATINGS SIMILAR IN MATERIAL, DESIGN, AND EXTENT TO THOSE INDICATED FOR THIS PROJECT, WHOSE WORK HAS RESULTED IN APPLICATIONS WITH A RECORD OF SUCCESSFUL IN-SERVICE PERFORMANCE.

B. BENCHMARK SAMPLES (MOCKUPS): PROVIDE A FULL-COAT BENCHMARK FINISH SAMPLE FOR EACH TYPE OF COATING AND SUBSTRATE REQUIRED. COMPLY WITH PROCEDURES SPECIFIED IN PDCA P5. DUPLICATE FINISH OF APPROVED SAMPLE SUBMITTALS.

1. ARCHITECT WILL SELECT ONE ROOM OR SURFACE TO REPRESENT SURFACES AND CONDITIONS FOR APPLICATION OF EACH TYPE OF COATING AND SUBSTRATE.

A. WALL SURFACES: PROVIDE SAMPLES ON AT LEAST 9 SQ. M (100 SQ. FT.).

B. SMALL AREAS AND ITEMS: GENERAL CONTRACTOR WILL DESIGNATE ITEMS OR AREAS REQUIRED.

2. APPLY BENCHMARK SAMPLES, ACCORDING TO REQUIREMENTS FOR THE COMPLETED WORK, AFTER PERMANENT LIGHTING AND OTHER ENVIRONMENTAL SERVICES HAVE BEEN ACTIVATED. PROVIDE REQUIRED SHEEN, COLOR, AND TEXTURE ON EACH SURFACE.

A. AFTER FINISHES ARE ACCEPTED, ARCHITECT WILL USE THE ROOM OR SURFACE TO EVALUATE COATING SYSTEMS OF A SIMILAR NATURE.

1.08 DELIVERY, STORAGE AND HANDLING

A. DELIVER MATERIALS TO PROJECT SITE IN MANUFACTURER'S ORIGINAL, UNOPENED PACKAGES AND CONTAINERS BEARING MANUFACTURER'S NAME AND LABEL AND THE FOLLOWING INFORMATION:

1. PRODUCT NAME OR TITLE OF MATERIAL.

2. PRODUCT DESCRIPTION (GENERIC CLASSIFICATION OR BINDER TYPE).

3. MANUFACTURER'S STOCK NUMBER AND DATE OF MANUFACTURE.

4. CONTENTS BY VOLUME, FOR PIGMENT AND VEHICLE CONSTITUENTS.

5. THINNING INSTRUCTIONS.

6. APPLICATION INSTRUCTIONS.

7. COLOR NAME AND NUMBER.

8. VOC CONTENT.

B. STORE MATERIALS NOT IN USE IN TIGHTLY COVERED CONTAINERS IN A WELL-VENTILATED AREA AT A MINIMUM AMBIENT TEMPERATURE OF 7 DEG C (45 DEG F). MAINTAIN STORAGE CONTAINERS IN A CLEAN CONDITION, FREE OF FOREIGN MATERIALS AND RESIDUE.

1. PROTECT FROM FREEZING. KEEP STORAGE AREA NEAT AND ORDERLY. REMOVE OILY RAGS AND WASTE DAILY.

1.09 PROJECT CONDITIONS

A. APPLY WATERBORNE PAINTS ONLY WHEN TEMPERATURES OF SURFACES TO BE PAINTED AND SURROUNDING AIR ARE BETWEEN 10 AND 32 DEG C (50 AND 90 DEG F).

B. APPLY SOLVENT-THINNED PAINTS ONLY WHEN TEMPERATURES OF SURFACES TO BE PAINTED AND SURROUNDING AIR ARE BETWEEN 7 AND 35 DEG C (45 AND 95 DEG F).

C. DO NOT APPLY PAINT IN SNOW, RAIN, FOG, OR MIST; OR WHEN RELATIVE HUMIDITY EXCEEDS 85 PERCENT; OR AT TEMPERATURES LESS THAN 3 DEG C (5 DEG F) ABOVE THE DEW POINT; OR TO DAMP OR WET SURFACES.

1. PAINTING MAY CONTINUE DURING INCLEMENT WEATHER IF SURFACES AND AREAS TO BE PAINTED ARE ENCLOSED AND HEATED WITHIN TEMPERATURE LIMITS SPECIFIED BY MANUFACTURER DURING APPLICATION AND DRYING PERIODS.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. AVAILABLE PRODUCTS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PRODUCTS THAT MAY BE INCORPORATED INTO THE WORK INCLUDE, BUT ARE NOT LIMITED TO, PRODUCTS

LISTED IN OTHER PART 2 ARTICLES.

B. MANUFACTURERS' NAMES: SHORTENED VERSIONS (SHOWN IN PARENTHESES) OF THE FOLLOWING MANUFACTURERS' NAMES ARE USED IN OTHER PART 2 ARTICLES:

1. ICI PAINT CENTERS (ICI PAINTS).

2. PPG INDUSTRIES, INC. (PITTSBURGH PAINTS).

3. SHERWIN-WILLIAMS CO. (SHERWIN-WILLIAMS).

4. TNEMEC COMPANY, INC (TNEMEC)

2.02 PAINT MATERIALS, GENERAL

A. MATERIAL COMPATIBILITY: PROVIDE BLOCK FILLERS, PRIMERS, AND FINISH-COAT MATERIALS THAT ARE COMPATIBLE WITH ONE ANOTHER AND WITH THE SUBSTRATES INDICATED UNDER CONDITIONS OF SERVICE AND APPLICATION, AS DEMONSTRATED BY MANUFACTURER BASED ON TESTING AND FIELD EXPERIENCE.

B. MATERIAL QUALITY: PROVIDE MANUFACTURER'S BEST-QUALITY PAINT MATERIAL OF THE VARIOUS COATING TYPES SPECIFIED THAT ARE FACTORY FORMULATED AND RECOMMENDED BY MANUFACTURER FOR APPLICATION INDICATED. PAINT-MATERIAL CONTAINERS NOT DISPLAYING MANUFACTURER'S PRODUCT IDENTIFICATION WILL NOT BE ACCEPTABLE.

1. PROPRIETARY NAMES: USE OF MANUFACTURER'S PROPRIETARY PRODUCT NAMES TO DESIGNATE COLORS OR MATERIALS IS NOT INTENDED TO IMPLY THAT PRODUCTS NAMED ARE REQUIRED TO BE USED TO THE EXCLUSION OF EQUIVALENT PRODUCTS OF OTHER MANUFACTURERS. FURNISH MANUFACTURER'S MATERIAL DATA AND CERTIFICATES OF PERFORMANCE FOR PROPOSED SUBSTITUTIONS.

2.03 INTERIOR PRIMERS

A. INTERIOR GYPSUM BOARD PRIMER: FACTORY-FORMULATED LATEX-BASED PRIMER FOR INTERIOR APPLICATION.

1. ICI PAINTS; 1000-1200 DULUX ULTRA BASECOAT INTERIOR LATEX WALL PRIMER: APPLIED AT A DRY FILM THICKNESS OF NOT LESS THAN 0.031 MM (1.2 MILS).

2. PITTSBURGH PAINTS; 6-2 SPEEDHIDE INTERIOR QUICK-DRYING LATEX SEALER: APPLIED AT A DRY FILM THICKNESS OF NOT LESS THAN 0.025 MM (1.0 MIL).

3. SHERWIN-WILLIAMS; PREPRITE 200 LATEX WALL PRIMER B28W200 SERIES: APPLIED AT A DRY FILM THICKNESS OF NOT LESS THAN 0.041 MM (1.6 MILS).

B. INTERIOR ZINC-COATED METAL PRIMER: FACTORY-FORMULATED GALVANIZED METAL PRIMER.

1. ICI PAINTS; 4160-6130 DEVGUARD MULTI-PURPOSE TANK & STRUCTURAL PRIMER: APPLIED AT A DRY FILM THICKNESS OF NOT LESS THAN 0.051 MM (2.0 MILS).

2. PITTSBURGH PAINTS; 90-709 PITT-TECH ONE PACK INTERIOR/EXTERIOR PRIMER/FINISH DTM INDUSTRIAL ENAMEL: APPLIED AT A DRY FILM THICKNESS OF NOT LESS THAN 0.076 MM (3.0 MILS).

3. SHERWIN-WILLIAMS; GALVITE HS B50WZ30: APPLIED AT A DRY FILM THICKNESS OF NOT

LESS THAN 0.076 MM (3.0 MILS).

C. INTERIOR GYPSUM BOARD TO RECEIVE EPOXY PAINT COATING.

1. ICI PAINTS; 4418 DEVO TRU-GLAZE WATERBORNE ACRYLIC EPOXY COATING. APPLIED AT A DRY FILM THICKNESS OF NOT LESS THAN 0.051 MM (2.0 MILS).

2. PITTSBURGH PAINTS; 98-1/98-98 AQUAPON WATERBORNE EPOXY. APPLIED AT A DRY FILM THICKNESS OF NOT LESS THAN 0.076 MM (3.0 MILS).

3. SHERWIN-WILLIAMS; B570 WATER BASED CATALIZED EPOXY. APPLIED AT A DRY FILM THICKNESS OF NOT LESS THAN 0.076 MM (3.0 MILS).

2.04 INTERIOR FINISH COATS

A. INTERIOR FLAT ACRYLIC PAINT: FACTORY-FORMULATED FLAT ACRYLIC-EMULSION LATEX PAINT FOR INTERIOR APPLICATION.

1. ICI PAINTS; 1200-N DULUX PROFESSIONAL VELVET MATTE INTERIOR FLAT LATEX WALL & TRIM FINISH: APPLIED AT A DRY FILM THICKNESS OF NOT LESS THAN 0.036 MM (1.4 MILS).

2. PITTSBURGH PAINTS; 6-70 LINE SPEEDHIDE INTERIOR WALL FLAT-LATEX PAINT: APPLIED AT A DRY FILM THICKNESS OF NOT LESS THAN 0.025 MM (1.0 MIL).

3. SHERWIN-WILLIAMS; PROMAR 200 INTERIOR LATEX FLAT WALL PAINT B30W200 SERIES: APPLIED AT A DRY FILM THICKNESS OF NOT LESS THAN 0.036 MM (1.4 MILS).

B. INTERIOR LOW-LUSTER ACRYLIC ENAMEL: FACTORY-FORMULATED EGGSHELL ACRYLIC-LATEX INTERIOR ENAMEL.

1. ICI PAINTS; 1402-N DULUX PROFESSIONAL ACRYLIC EGGSHELL INTERIOR WALL & TRIM ENAMEL: APPLIED AT A DRY FILM THICKNESS OF NOT LESS THAN 0.036 MM (1.4 MILS).

2. PITTSBURGH PAINTS; 6-400 SERIES SPEEDHIDE EGGSHELL ACRYLIC LATEX ENAMEL: APPLIED AT A DRY FILM THICKNESS OF NOT LESS THAN 0.032 MM (1.25 MILS).

3. SHERWIN-WILLIAMS; PROMAR 200 INTERIOR LATEX EGG-SHELL ENAMEL B20W200 SERIES: APPLIED AT A DRY FILM THICKNESS OF NOT LESS THAN 0.041 MM (1.6 MILS).

C. INTERIOR SEMI-GLOSS ACRYLIC ENAMEL: FACTORY-FORMULATED SEMI-GLOSS ACRYLIC-LATEX ENAMEL FOR INTERIOR APPLICATION.

1. ICI PAINTS; 1406-N DULUX PROFESSIONAL ACRYLIC SEMI-GLOSS INTERIOR WALL & TRIM ENAMEL: APPLIED AT A DRY FILM THICKNESS OF NOT LESS THAN 0.038 MM (1.5 MILS).

2. PITTSBURGH PAINTS; 6-500 SERIES SPEEDHIDE INTERIOR SEMI-GLOSS LATEX: APPLIED AT A DRY FILM THICKNESS OF NOT LESS THAN 0.025 MM (1.0 MIL).

3. SHERWIN-WILLIAMS; PROMAR 200 INTERIOR LATEX SEMI-GLOSS ENAMEL B31W200 SERIES: APPLIED AT A DRY FILM THICKNESS OF NOT LESS THAN 0.033 MM (1.3 MILS).

D. INTERIOR FULL-GLOSS ACRYLIC ENAMEL: FACTORY-FORMULATED FULL-GLOSS ACRYLIC-LATEX INTERIOR ENAMEL.

1. ICI PAINTS; 3028-N DULUX INTERIOR/EXTERIOR ACRYLIC GLOSS FINISH: APPLIED AT A DRY FILM THICKNESS OF NOT LESS THAN 0.041 MM (1.6 MILS).

2. PITTSBURGH PAINTS; 90-374 PITT-TECH ONE PACK INTERIOR/EXTERIOR HIGH PERFORMANCE WATERBORNE HIGH GLOSS DTM INDUSTRIAL ENAMEL: APPLIED AT A DRY FILM THICKNESS OF NOT LESS THAN 0.076 MM (3.0 MILS).

3. SHERWIN-WILLIAMS; PROMAR 200 INTERIOR LATEX GLOSS ENAMEL B21W201: APPLIED AT A DRY FILM THICKNESS OF NOT LESS THAN 0.038 MM (1.5 MILS).

E. INTERIOR GYPSUM BOARD: WATER-BASED “TILE LIKE” EPOXY COATING.

1. ICI PAINTS; 4418 DEVO TRU-GLAZE WATERBORNE ACRYLIC EPOXY COATING. APPLIED AT A DRY FILM THICKNESS OF NOT LESS THAN 0.051 MM (2.0 MILS).

2. PITTSBURGH PAINTS; 98-1/98-98 AQUAPON WATERBORNE EPOXY. APPLIED AT A DRY FILM THICKNESS OF NOT LESS THAN 0.076 MM (3.0 MILS).

3. SHERWIN-WILLIAMS; B570 WATER BASED CATALIZED EPOXY. APPLIED AT A DRY FILM THICKNESS OF NOT LESS THAN 0.076 MM (3.0 MILS).

PART 3 - EXECUTION

3.01 EXAMINATION

A. EXAMINE SUBSTRATES, AREAS, AND CONDITIONS, WITH APPLICATOR PRESENT, FOR COMPLIANCE WITH REQUIREMENTS FOR PAINT APPLICATION.

1. PROCEED WITH PAINT APPLICATION ONLY AFTER UNSATISFACTORY CONDITIONS HAVE BEEN CORRECTED AND SURFACES RECEIVING PAINT ARE THOROUGHLY DRY.

2. START OF PAINTING WILL BE CONSTRUED AS APPLICATOR'S ACCEPTANCE OF SURFACES AND CONDITIONS WITHIN A PARTICULAR AREA.

B. COORDINATION OF WORK: REVIEW OTHER SECTIONS IN WHICH PRIMERS ARE PROVIDED TO ENSURE COMPATIBILITY OF THE TOTAL SYSTEM FOR VARIOUS SUBSTRATES. ON REQUEST, FURNISH INFORMATION ON CHARACTERISTICS OF FINISH MATERIALS TO ENSURE USE OF COMPATIBLE PRIMERS.

1. NOTIFY CONTRACTING OFFICER ABOUT ANTICIPATED PROBLEMS WHEN USING THE MATERIALS SPECIFIED OVER SUBSTRATES PRIMED BY OTHERS.

3.02 PREPARATION

A. GENERAL: REMOVE HARDWARE AND HARDWARE ACCESSORIES, PLATES, MACHINED SURFACES, LIGHTING FIXTURES, AND SIMILAR ITEMS ALREADY INSTALLED THAT ARE NOT TO BE PAINTED. IF REMOVAL IS IMPRACTICAL OR IMPOSSIBLE BECAUSE OF SIZE OR WEIGHT OF THE ITEM, PROVIDE SURFACE-APPLIED PROTECTION BEFORE SURFACE PREPARATION AND PAINTING.

1. AFTER COMPLETING PAINTING OPERATIONS IN EACH SPACE OR AREA, REINSTALL ITEMS REMOVED USING WORKERS SKILLED IN THE TRADES INVOLVED.

B. CLEANING: BEFORE APPLYING PAINT OR OTHER SURFACE TREATMENTS, CLEAN SUBSTRATES OF SUBSTANCES THAT COULD IMPAIR BOND OF THE VARIOUS COATINGS. REMOVE OIL AND GREASE BEFORE CLEANING.

1. SCHEDULE CLEANING AND PAINTING SO DUST AND OTHER CONTAMINANTS FROM THE CLEANING PROCESS WILL NOT FALL ON WET, NEWLY PAINTED SURFACES.

C. SURFACE PREPARATION: CLEAN AND PREPARE SURFACES TO BE PAINTED ACCORDING TO MANUFACTURER'S WRITTEN INSTRUCTIONS FOR EACH PARTICULAR SUBSTRATE CONDITION AND AS SPECIFIED.

1. PROVIDE BARRIER COATS OVER INCOMPATIBLE PRIMERS OR REMOVE AND REPRIME.

2. CEMENTITIOUS MATERIALS: PREPARE CONCRETE, CONCRETE UNIT MASONRY, CEMENT PLASTER, AND MINERAL-FIBER-REINFORCED CEMENT PANEL SURFACES TO BE PAINTED. REMOVE EFFLORESCENCE, CHALK, DUST, DIRT, GREASE, OILS, AND RELEASE AGENTS. ROUGHEN AS REQUIRED TO REMOVE GLAZE. IF HARDENERS OR SEALERS HAVE BEEN USED TO IMPROVE CURING, USE MECHANICAL METHODS OF SURFACE PREPARATION.

A. USE ABRASIVE BLAST-CLEANING METHODS IF RECOMMENDED BY PAINT MANUFACTURER.

B. DETERMINE ALKALINITY AND MOISTURE CONTENT OF SURFACES BY PERFORMING APPROPRIATE TESTS. IF SURFACES ARE SUFFICIENTLY ALKALINE TO CAUSE THE FINISH PAINT TO BLISTER AND BURN, CORRECT THIS CONDITION BEFORE APPLICATION. DO NOT PAINT SURFACES IF MOISTURE CONTENT EXCEEDS THAT PERMITTED IN MANUFACTURER'S WRITTEN INSTRUCTIONS.

3. FERROUS METALS: CLEAN UNGALVANIZED FERROUS-METAL SURFACES THAT HAVE NOT BEEN SHOP COATED; REMOVE OIL, GREASE, DIRT, LOOSE MILL SCALE, AND OTHER FOREIGN SUBSTANCES. USE SOLVENT OR MECHANICAL CLEANING METHODS THAT COMPLY WITH SSPC'S RECOMMENDATIONS.

A. BLAST STEEL SURFACES CLEAN AS RECOMMENDED BY PAINT SYSTEM MANUFACTURER AND ACCORDING TO SSPC-SP 6/NACE NO. 3.

B. TOUCH UP BARE AREAS AND SHOP-APPLIED PRIME COATS THAT HAVE BEEN DAMAGED. WIRE-BRUSH, CLEAN WITH SOLVENTS RECOMMENDED BY PAINT MANUFACTURER, AND TOUCH UP WITH SAME PRIMER AS THE SHOP COAT.

4. GALVANIZED SURFACES: CLEAN GALVANIZED SURFACES WITH NONPETROLEUM-BASED SOLVENTS SO SURFACE IS FREE OF OIL AND SURFACE CONTAMINANTS. REMOVE PRETREATMENT FROM GALVANIZED SHEET METAL FABRICATED FROM COIL STOCK BY MECHANICAL METHODS.

D. MATERIAL PREPARATION: MIX AND PREPARE PAINT MATERIALS ACCORDING TO MANUFACTURER'S WRITTEN INSTRUCTIONS.

1. MAINTAIN CONTAINERS USED IN MIXING AND APPLYING PAINT IN A CLEAN CONDITION, FREE OF FOREIGN MATERIALS AND RESIDUE.

2. STIR MATERIAL BEFORE APPLICATION TO PRODUCE A MIXTURE OF UNIFORM DENSITY. STIR AS REQUIRED DURING APPLICATION. DO NOT STIR SURFACE FILM INTO MATERIAL. IF NECESSARY, REMOVE SURFACE FILM AND STRAIN MATERIAL BEFORE USING.

3. USE ONLY THINNERS APPROVED BY PAINT MANUFACTURER AND ONLY WITHIN RECOMMENDED LIMITS.

3.03 APPLICATION

A. GENERAL: APPLY PAINT ACCORDING TO MANUFACTURER'S WRITTEN INSTRUCTIONS. USE APPLICATORS AND TECHNIQUES BEST SUITED FOR SUBSTRATE AND TYPE OF MATERIAL BEING APPLIED.

1. PAINT COLORS, SURFACE TREATMENTS, AND FINISHES ARE INDICATED IN THE PAINT SCHEDULES.

2. DO NOT PAINT OVER DIRT, RUST, SCALE, GREASE, MOISTURE, SCUFFED SURFACES, OR CONDITIONS DETRIMENTAL TO FORMATION OF A DURABLE PAINT FILM.

3. PROVIDE FINISH COATS THAT ARE COMPATIBLE WITH PRIMERS USED.

4. THE TERM "EXPOSED SURFACES" INCLUDES AREAS VISIBLE WHEN PERMANENT OR BUILT-IN FIXTURES, GRILLES, CONVECTOR COVERS, COVERS FOR FINNED-TUBE RADIATION, AND SIMILAR COMPONENTS ARE IN PLACE. EXTEND COATINGS IN THESE AREAS, AS REQUIRED, TO MAINTAIN SYSTEM INTEGRITY AND PROVIDE DESIRED PROTECTION.

5. PAINT SURFACES BEHIND MOVABLE EQUIPMENT AND FURNITURE THE SAME AS SIMILAR EXPOSED SURFACES. BEFORE FINAL INSTALLATION OF EQUIPMENT, PAINT SURFACES BEHIND PERMANENTLY FIXED EQUIPMENT OR FURNITURE WITH PRIME COAT ONLY.

6. PAINT INTERIOR SURFACES OF DUCTS WITH A FLAT, NONSPECULAR BLACK PAINT WHERE VISIBLE THROUGH REGISTERS OR GRILLES.

7. PAINT BACK SIDES OF ACCESS PANELS AND REMOVABLE OR HINGED COVERS TO MATCH EXPOSED SURFACES.

8. FINISH EXTERIOR DOORS ON TOPS, BOTTOMS, AND SIDE EDGES THE SAME AS EXTERIOR FACES.

9. SAND LIGHTLY BETWEEN EACH SUCCEEDING ENAMEL OR VARNISH COAT.

B. SCHEDULING PAINTING: APPLY FIRST COAT TO SURFACES THAT HAVE BEEN CLEANED, PRETREATED, OR OTHERWISE PREPARED FOR PAINTING AS SOON AS PRACTICABLE AFTER PREPARATION AND BEFORE SUBSEQUENT SURFACE DETERIORATION.

1. THE NUMBER OF COATS AND FILM THICKNESS REQUIRED ARE THE SAME REGARDLESS OF APPLICATION METHOD. DO NOT APPLY SUCCEEDING COATS UNTIL PREVIOUS COAT HAS CURED AS RECOMMENDED BY MANUFACTURER. IF SANDING IS REQUIRED TO PRODUCE A SMOOTH, EVEN SURFACE ACCORDING TO MANUFACTURER'S WRITTEN INSTRUCTIONS, SAND BETWEEN APPLICATIONS.

2. OMIT PRIMER OVER METAL SURFACES THAT HAVE BEEN SHOP PRIMED AND TOUCHUP PAINTED.

3. IF UNDERCOATS, STAINS, OR OTHER CONDITIONS SHOW THROUGH FINAL COAT OF PAINT, APPLY ADDITIONAL COATS UNTIL PAINT FILM IS OF UNIFORM FINISH, COLOR, AND APPEARANCE. GIVE SPECIAL ATTENTION TO ENSURE THAT EDGES, CORNERS, CREVICES, WELDS, AND EXPOSED FASTENERS RECEIVE A DRY FILM THICKNESS EQUIVALENT TO THAT OF FLAT SURFACES.

4. ALLOW SUFFICIENT TIME BETWEEN SUCCESSIVE COATS TO PERMIT PROPER DRYING. DO NOT RECOAT SURFACES UNTIL PAINT HAS DRIED TO WHERE IT FEELS FIRM, AND DOES NOT DEFORM OR FEEL STICKY UNDER MODERATE THUMB PRESSURE, AND UNTIL APPLICATION OF ANOTHER COAT OF PAINT DOES NOT CAUSE UNDERCOAT TO LIFT OR LOSE ADHESION.

C. APPLICATION PROCEDURES: APPLY PAINTS AND COATINGS BY BRUSH, ROLLER, SPRAY, OR OTHER APPLICATORS ACCORDING TO MANUFACTURER'S WRITTEN INSTRUCTIONS.

1. BRUSHES: USE BRUSHES BEST SUITED FOR TYPE OF MATERIAL APPLIED. USE BRUSH OF APPROPRIATE SIZE FOR SURFACE OR ITEM BEING PAINTED.

2. ROLLERS: USE ROLLERS OF CARPET, VELVET-BACK, OR HIGH-PILE SHEEP'S WOOL AS RECOMMENDED BY MANUFACTURER FOR MATERIAL AND TEXTURE REQUIRED.

3. SPRAY EQUIPMENT: USE AIRLESS SPRAY EQUIPMENT WITH ORIFICE SIZE AS RECOMMENDED BY MANUFACTURER FOR MATERIAL AND TEXTURE REQUIRED.

D. MINIMUM COATING THICKNESS: APPLY PAINT MATERIALS NO THINNER THAN MANUFACTURER'S RECOMMENDED SPREADING RATE TO ACHIEVE DRY FILM THICKNESS INDICATED. PROVIDE TOTAL DRY FILM THICKNESS OF THE ENTIRE SYSTEM AS RECOMMENDED BY MANUFACTURER.

E. BLOCK FILLERS: APPLY BLOCK FILLERS TO CONCRETE MASONRY BLOCK AT A RATE TO ENSURE COMPLETE COVERAGE WITH PORES FILLED.

F. PRIME COATS: BEFORE APPLYING FINISH COATS, APPLY A PRIME COAT, AS RECOMMENDED BY MANUFACTURER, TO MATERIAL THAT IS REQUIRED TO BE PAINTED OR FINISHED AND THAT HAS NOT BEEN PRIME COATED BY OTHERS. RECOAT PRIMED AND SEALED SURFACES WHERE EVIDENCE OF SUCTION SPOTS OR UNSEALED AREAS IN FIRST COAT APPEARS, TO ENSURE A FINISH COAT WITH NO BURN-THROUGH OR OTHER DEFECTS DUE TO INSUFFICIENT SEALING.

G. PIGMENTED (OPAQUE) FINISHES: COMPLETELY COVER SURFACES AS NECESSARY TO PROVIDE A SMOOTH, OPAQUE SURFACE OF UNIFORM FINISH, COLOR, APPEARANCE, AND COVERAGE. CLOUDINESS, SPOTTING, HOLIDAYS, LAPS, BRUSH MARKS, RUNS, SAGS, ROPINESS, OR OTHER SURFACE IMPERFECTIONS WILL NOT BE ACCEPTABLE.

H. COMPLETED WORK: MATCH APPROVED SAMPLES FOR COLOR, TEXTURE, AND COVERAGE. REMOVE, REFINISH, OR REPAINT WORK NOT COMPLYING WITH REQUIREMENTS.

3.04 CLEANING

A. CLEANUP: AT THE END OF EACH WORKDAY, REMOVE EMPTY CANS, RAGS, RUBBISH, AND OTHER DISCARDED PAINT MATERIALS FROM PROJECT SITE.

1. AFTER COMPLETING PAINTING, CLEAN GLASS AND PAINT-SPATTERED SURFACES. REMOVE SPATTERED PAINT BY WASHING AND SCRAPING WITHOUT SCRATCHING OR DAMAGING ADJACENT FINISHED SURFACES.

3.05 PROTECTION

A. PROTECT WORK OF OTHER TRADES, WHETHER BEING PAINTED OR NOT, AGAINST DAMAGE FROM PAINTING. CORRECT DAMAGE BY CLEANING, REPAIRING OR REPLACING, AND REPAINTING, AS APPROVED BY ARCHITECT.

B. PROVIDE "WET PAINT" SIGNS TO PROTECT NEWLY PAINTED FINISHES. AFTER COMPLETING PAINTING OPERATIONS, REMOVE TEMPORARY PROTECTIVE WRAPPINGS PROVIDED BY OTHERS TO PROTECT THEIR WORK.

1. AFTER WORK OF OTHER TRADES IS COMPLETE, TOUCH UP AND RESTORE DAMAGED OR DEFACED PAINTED SURFACES. COMPLY WITH PROCEDURES SPECIFIED IN PDCA P1.

3.08 INTERIOR PAINT SCHEDULE

A. FOR MASONRY, CONCRETE AND METAL SURFACES, REFER TO SPECIFICATION SECTION 09 96 00 “HIGH PERFORMANCE COATINGS”

B. EXPOSED TO VIEW SPRAYED FIRE PROOFING: PROVIDE THE FOLLOWING FINISH:

1. FLAT ACRYLIC FINISH: TWO FINISH COATS.

A. FINISH COATS: INTERIOR FLAT ACRYLIC PAINT.

C. GYPSUM BOARD (P-1): PROVIDE THE FOLLOWING FINISH SYSTEMS OVER INTERIOR GYPSUM BOARD SURFACES:

1. LOW-LUSTER ACRYLIC-ENAMEL FINISH: TWO FINISH COATS OVER A PRIMER.

A. PRIMER: INTERIOR GYPSUM BOARD PRIMER.

B. FINISH COATS: INTERIOR LOW-LUSTER ACRYLIC ENAMEL.

2. EPOXY COATING FINISH (P-2): ONE FINISHED COAT OVER PRIMER.

A. PRIMER: WATER-BORNE PRIMER RECOMMENDED BY FINISH COAT MANUFACTURER.

B. FINISH COATS: WATER-BORNE “TILE LIKE” EPOXY COATING.

END OF SECTION

SECTION 09 96 00

HIGH PERFORMANCE COATINGS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. CONSTRUCTION DRAWINGS, SPECIFICATIONS AND PROVISIONS OF THE CONTRACT INCLUDING GENERAL AND SUPPLEMENTAL CONDITIONS AND OTHER DIVISION 01 SPECIFICATION SECTIONS, ARE HEREBY MADE A PART OF THIS SECTION AS FULLY AND COMPLETELY AS IF REPEATED HEREIN.

1.02 ITEMS REQUIRED BUT NOT SPECIFIED

A. IF AN ITEM OR MATERIAL OF THIS TRADE IS INDICATED ON THE DRAWINGS BUT NOT SPECIFICALLY LISTED IN THIS SECTION, PROVIDE SUCH ITEM OR MATERIAL AT A STANDARD OF QUALITY EQUAL TO THE STANDARD ESTABLISHED FOR THE BALANCE OF THE WORK SPECIFIED, IN ACCORDANCE WITH THE ARCHITECT'S INTERPRETATION.

1.03 EXECUTION, CORRELATION AND INTENT

A. IN CASE OF AN INCONSISTENCY BETWEEN DRAWINGS AND SPECIFICATIONS, OR WITHIN EITHER DOCUMENT NOT CLARIFIED BY ADDENDUM, THE BETTER QUALITY OR GREATER QUANTITY OF WORK IS TO BE PROVIDED, IN ACCORDANCE WITH THE ARCHITECT'S INTERPRETATION.

1.04 SECTION INCLUDES

A. THIS SECTION CONSISTS OF FURNISHING ALL MATERIALS, LABOR AND EQUIPMENT FOR THE PAINTING WORK AS SHOWN ON THE DRAWINGS AND OR DESCRIBED HEREIN, BUT NOT LIMITED TO:

1. SCOPE OF WORK:

A. PREPARE SURFACES AT ALL AREAS TO RECEIVE SPECIAL COATINGS.

B. FIELD APPLICATION OF SPECIAL COATINGS AT FOOD AND NON-FOOD PREPARATION AND STORAGE AREAS TO RECEIVE SPECIAL COATINGS AND SUBSEQUENT TOUCH-UP, OF INTERIOR ITEMS AND SURFACES, INCLUDING THE FOLLOWING:

1) COATINGS TO PRECAST CONCRETE SURFACES.

2) COATINGS TO CAST-IN-PLACE CONCRETE SURFACES.

3) COATINGS TO CONCRETE MASONRY SURFACES.

4) COATINGS TO STRUCTURAL STEEL.

5) COATINGS TO METAL FABRICATIONS.

B. WORK NOT INCLUDED:

1. THE FOLLOWING SURFACES ARE NOT TO BE PAINTED:

A. NEW, PRE-FINISHED ITEMS SUCH AS CONNECTORS AND LIGHT FIXTURES, PRE-FINISHED MECHANICAL AND ELECTRICAL EQUIPMENT, EXCEPT WHERE INDICATED OTHERWISE.

B. NEW, PRE-FINISHED ITEMS SUCH AS ALUMINUM FRAMES, IMP WALLS AND IMP CEILINGS.

C. CONCEALED SURFACES, UNLESS SPECIFICALLY INDICATED.

D. MOVING PARTS OF EQUIPMENT.

C. RELATED SECTIONS INCLUDE THE FOLLOWING:

1. 05 5000 - STRUCTURAL STEEL

2. 07 9200 - JOINT SEALERS

3. 09 9100 - PAINTING

1.05 REFERENCES

A. COMPLY WITH APPLICABLE REQUIREMENTS OF THE FOLLOWING STANDARDS AND THOSE OTHERS REFERENCED IN THIS SECTION.

1. ASTM (AMERICAN SOCIETY OF TESTING AND MATERIALS):

A. ASTM E 84 - SURFACE BURNING CHARACTERISTICS OF BUILDING MATERIALS.

2. FS (FEDERAL SPECIFICATIONS, GENERAL SERVICES ADMINISTRATION):

A. FS TT-C-535 - COATING, EPOXY, TWO COMPONENT, FOR INTERIOR USE ON METAL, WOOD, WALLBOARD, PAINTED SURFACES CONCRETE AND MASONRY.

3. SSPC (STEEL STRUCTURES PAINTING COUNCIL):

A. SSPC-VIS1 - PICTORIAL SURFACE PREPARATION STANDARDS FOR PAINTING STEEL STRUCTURES.

B. SSPC-SP 2 - STEEL STRUCTURES PAINTING MANUAL, VOLUME 2, SYSTEMS AND SPECIFICATIONS.

C. SSPC-SP 6 - COMMERCIAL BLAST CLEAN

D. SSPC-SP 13 - SURFACE PREPARATION OF CONCRETE

4. PDCA INDUSTRY STANDARDS (PAINTING AND DECORATING CONTRACTORS OF AMERICA), 2008 EDITION.

5. ALL APPLICABLE FEDERAL, STATE AND MUNICIPAL CODES, LAWS AND REGULATIONS FOR FLAMMABILITY AND SMOKE GENERATION OF INTERIOR FINISHES.

1.06 SUBMITTALS

A. SUBMIT THE FOLLOWING UNDER PROVISIONS OF DIVISION 1:

1. LITERATURE: MANUFACTURER'S PRODUCT DATA SHEETS, SPECIFICATIONS, PERFORMANCE DATA, PHYSICAL PROPERTIES, MATERIAL COMPOSITIONS, AND APPLICATION INSTRUCTIONS FOR ALL FINISHING PRODUCTS TO BE APPLIED HEREUNDER.

2. MATERIAL ANALYSIS INCLUDING VEHICLE TYPE AND PERCENTAGE BY WEIGHT AND BY VOLUME OF VEHICLE, RESIN AND PIGMENT.

3. APPLICATION INSTRUCTIONS INCLUDING MIXING, SURFACE PREPARATION, COMPATIBLE

PRIMERS AND TOPCOATS, RECOMMENDED WET AND DRY FILM THICKNESS AND RECOMMENDED APPLICATION METHODS.

4. ALL PAINT FINISHES USED ON THIS PROJECT, WHETHER SPECIFIED OR NOT, SHALL COMPLY WITH EMISSIONS OF VOLATILE ORGANIC COMPOUNDS (VOC). COORDINATE WITH PAINT MANUFACTURERS FOR CURRENT PAINT PRODUCT NUMBERS AND CROSS-REFERENCE TO THOSE SPECIFIED IN SCHEDULES.

5. INCLUDE CERTIFICATION FOR ALL PAINTS; DATA INDICATING VOLATILE ORGANIC COMPOUND (VOC) CONTENT IS IN COMPLIANCE WITH CONNECTICUT LIMITS.

B. SUBMIT THE FOLLOWING UNDER PROVISIONS OF DIVISION 1:

1. SELECTION SAMPLES: MANUFACTURER'S COLOR SELECTOR FOR OWNER'S SELECTION.

C. WARRANTY: SUBMIT MANUFACTURER'S STANDARD WARRANTY.

1.07 QUALIFICATIONS

A. MANUFACTURER: SPECIALIZING IN MANUFACTURE OF COATING WITH A MINIMUM OF 10 YEARS SUCCESSFUL EXPERIENCE.

B. APPLICATOR: COMPANY SPECIALIZING IN PERFORMANCE OF THE WORK OF THIS SECTION WITH 3 YEARS MINIMUM DOCUMENTED EXPERIENCE AND ACCEPTABLE TO COATING MANUFACTURER.

C. APPLICATOR'S PERSONNEL: EMPLOY PERSONS TRAINED FOR APPLICATION OF SPECIFIED COATINGS.

1.08 QUALITY ASSURANCE

A. PERFORM SURFACE PREPARATION WORK ON PRIMED OR UNFINISHED STEEL SURFACES IN ACCORDANCE WITH SSPC SYSTEMS AND SPECIFICATIONS AS DESCRIBED HEREIN. MAINTAIN ONE COPY OF EACH DOCUMENT ON SITE.

B. SINGLE SOURCE RESPONSIBILITY: PROVIDE PRIMERS AND OTHER UNDERCOAT MATERIALS PRODUCED BY SAME MANUFACTURER AS FINISH COATS. USE ONLY THINNERS APPROVED BY COATINGS MANUFACTURER, AND USE ONLY WITHIN RECOMMENDED LIMITS.

C. BENCHMARK SAMPLES (MOCKUPS): PROVIDE A FULL-COAT BENCHMARK FINISH SAMPLE OF EACH TYPE OF COATING AND SUBSTRATE REQUIRED. COMPLY WITH PROCEDURES SPECIFIED IN PDCA P5. DUPLICATE FINISH OF APPROVED SAMPLE SUBMITTALS.

1. ARCHITECT WILL SELECT ONE ROOM, AREA, OR SURFACE TO REPRESENT SURFACES AND CONDITIONS FOR APPLICATION OF EACH TYPE OF COATING AND SUBSTRATE.

A. WALL SURFACES: PROVIDE SAMPLES ON AT LEAST 100 SQ. FT. (9 SQ. M) OF WALL SURFACE.

2. AFTER PERMANENT LIGHTING AND OTHER ENVIRONMENTAL SERVICES HAVE BEEN ACTIVATED, APPLY COATINGS IN THIS ROOM OR TO EACH SURFACE AS SPECIFIED. PROVIDE THE REQUIRED SHEEN, COLOR, AND TEXTURE OF EACH SURFACE.

A. AFTER FINISHES ARE ACCEPTED, ARCHITECT WILL USE THE ROOM OR SURFACE TO EVALUATE COATING SYSTEMS OF A SIMILAR NATURE.

3. FINAL APPROVAL OF COLORS WILL BE FROM BENCHMARK SAMPLES.

1.09 DELIVERY, STORAGE AND HANDLING

A. DELIVER PRODUCTS TO SITE IN SEALED AND LABELED CONTAINERS; CONTAINER LABELING SHALL INCLUDE MANUFACTURER'S NAME, TYPE OF PAINT, COLOR MIX DESIGNATION, EXPECTED COVERAGE, SURFACE PREPARATION INSTRUCTIONS, INSTRUCTIONS FOR MIXING AND REDUCING, DRYING TIME, AND CLEAN-UP RECOMMENDATIONS.

B. STORE MATERIALS, CONFORMING WITH APPLICABLE CODES AND FIRE REGULATIONS, IN DESIGNATED SPACES. KEEP STORAGE AREA SECURE WHEN DIRECT ACCESS IS NOT REQUIRED OR WHEN NOT PERFORMING WORK UNDER THIS SECTION. TAKE PRECAUTIONARY MEASURES TO PREVENT FIRE HAZARDS AND SPONTANEOUS COMBUSTION, MAINTAIN A DRY-CHEMICAL TYPE FIRE EXTINGUISHER IN ALL AREAS WHERE MATERIALS OF THIS SECTION ARE BEING STORED OR USED.

C. STORE MATERIALS IN A WELL VENTILATED AREA AT MINIMUM AMBIENT TEMPERATURE OF 45 DEGREES FAHRENHEIT AND A MAXIMUM OF 90 DEGREES FAHRENHEIT.

D. DO NOT USE THE SANITARY SYSTEM FOR MIXING OR DISPOSAL OF REFUSE MATERIAL. CARRY WATER TO MIXING ROOMS AND DUMP WASTE MATERIAL IN A SUITABLE REFUSE RECEPTACLE. REMOVE OILY RAGS AND WASTE EACH DAY.

1.10 PROJECT CONDITIONS

A. PROVIDE CONTINUOUS VENTILATION AND HEATING FACILITIES TO MAINTAIN SURFACE AND AMBIENT TEMPERATURES ABOVE 45 DEGREES FAHRENHEIT FOR 24 HOURS BEFORE, DURING AND 48 HOURS AFTER APPLICATION OF FINISHES, UNLESS REQUIRED OTHERWISE BY MANUFACTURER'S INSTRUCTIONS.

B. APPLY COATINGS ONLY UNDER THE FOLLOWING ENVIRONMENTAL CONDITIONS:

1. AIR AND SURFACE TEMPERATURES ARE BETWEEN 50 AND 100 DEGREES F, UNLESS OTHERWISE RECOMMENDED BY MANUFACTURER.

2. SURFACE TEMPERATURE IS AT LEAST 5 DEGREES F ABOVE DEW POINT.

3. RELATIVE HUMIDITY IS LESS THAN 85 PERCENT.

C. DO NOT APPLY COATINGS DURING INCLEMENT WEATHER EXCEPT WITHIN ENCLOSED, CONDITIONED SPACES.

1. PROVIDE TEMPORARY LIGHTING TO ACHIEVE A WELL-LIT SURFACE WITH A LEVEL OF AT LEAST 80 FOOT CANDLES MEASURED MID-HEIGHT:

2. PROVIDE CONTINUOUS VENTILATION AND HEATING TO PREVENT ACCUMULATION OF HAZARDOUS FUMES AND TO MAINTAIN SURFACE AND AMBIENT TEMPERATURES ABOVE 45 DEGREES F FOR 24 HOURS BEFORE, DURING AND FOR 48 HOURS AFTER APPLICATION OF FINISHES, OR LONGER IF REQUIRED TO OBTAIN FULL CURE AS INDICATED BY MANUFACTURER'S INSTRUCTIONS.

3. DO NOT APPLY EXTERIOR PAINT IN SNOW, RAIN, FOG, OR MIST, WHEN THE RELATIVE HUMIDITY EXCEEDS 85%, AT TEMPERATURES LESS THAN 5 DEGREES F ABOVE THE DEW POINT, OR TO DAMP OR WET SURFACES OR OTHER CONDITIONS UNACCEPTABLE TO FINISH MANUFACTURER.

D. PROTECTION:

1. PROTECT WORK BY OTHERS: COVER OR OTHERWISE PROTECT FINISHED WORK OF

OTHER TRADES AND SURFACES NOT BEING PAINTED CONCURRENTLY OR NOT TO BE PAINTED.

2. PROTECTION OF MISCELLANEOUS ITEMS: REMOVE OR OTHERWISE PROTECT FINISH HARDWARE, ELECTRICAL PLATES, LIGHTING FIXTURES, PREFINISHED ACCESSORIES MOUNTED TO SURFACES TO BE PAINTED, AND SIMILAR ITEMS.

3. PROTECTION OF IDENTIFYING MARKINGS: UNDERWRITERS' LABORATORIES LABELS, NAMEPLATES, AND IDENTIFYING STICKERS GIVING FIRE RATINGS, UNIT RATING, DIRECTIONS OR OTHER PERTINENT INFORMATION ON MATERIALS AND EQUIPMENT SPECIFIED TO BE PAINTED SHALL NOT BE PAINTED OVER AND SHALL BE PROTECTED DURING PAINTING FROM OVERSPRAY OR DEFACEMENT. RESTORE IDENTIFYING MARKINGS WHICH ARE DEFACED DURING PAINTING TO THEIR ORIGINAL CONDITION AND TO SATISFACTION OF THE OWNER'S REPRESENTATIVE.

4. SIGNS AND BARRICADES: POST SIGNS AND INSTALL BARRICADES AS REQUIRED TO PROTECT PAINTING WORK FROM DAMAGE.

5. FIRE PREVENTION: TAKE EXTRAORDINARY CARE TO PREVENT FIRE. OPEN CANS OF PAINT OR VARNISH ONLY WHEN NEEDED. KEEP RUBBING CLOTHS AND OILY RAGS SUBMERGED IN WATER.

6. PROTECTION OF OTHER SURFACES: COVER OR IN SOME OTHER WAY PROTECT WINDOWS, SHRUBS, TRUCKS, AUTOS, CYCLES FROM PAINT SPRAY AND CLEANERS.

7. DUST GENERATION: CONTROL ANY DUST GENERATED DURING THE APPLICATION/FINISHING PROCESS TO WITHIN THE AREA OF WORK.

1.11 COORDINATION

A. GENERAL: PERFORM WORK IN PROPER SEQUENCE WITH WORK OF OTHER TRADES TO AVOID DAMAGE TO FINISHED WORK.

B. COORDINATION: WHERE SPECIAL COATINGS WILL BE APPLIED OVER SHOP COATINGS SPECIFIED IN OTHER SECTIONS, COORDINATE WORK OF SUCH OTHER SECTIONS TO ENSURE THAT ONLY APPROVED, COMPATIBLE PRIMERS ARE APPLIED.

1. FURNISH THE ARCHITECT WITH PRODUCT DATA ON BOTH COATINGS DEMONSTRATING COATING COMPATIBILITY.

1.12 SEQUENCING AND SCHEDULING

A. IMMEDIATELY NOTIFY THE ARCHITECT AND CONSTRUCTION MANAGER IN WRITING OF CONDITIONS WHICH MAY REQUIRE A CHANGE IN THE SPECIFICATIONS OF THIS SECTION BEFORE PROCEEDING WITH THE WORK. FAILURE TO DO SO, IN A TIMELY FASHION, SO AS NOT TO INTERFERE WITH THE SCHEDULE OF WORK OF THIS CONTRACT, SHALL BE CONSTRUED AS ACCEPTANCE OF THE COATINGS SPECIFIED. PERFORM ALL CORRECTIVE MEASURES, AT NO ADDITIONAL COST, FOR ANY DEFECTS IN THE WORK, RESULTING FROM THE USE OF SUCH MATERIALS.

B. DO NOT ORDER MATERIALS UNTIL ALL REQUIRED SCHEDULES HAVE BEEN PROPERLY SUBMITTED, REVIEWED AND APPROVED BY ARCHITECT.

C. SEQUENCING, SCHEDULING OF WORK IN SENSITIVE AREAS: DO NOT BLOCK AIR INTAKE OR EXHAUST LOUVERS AND GRILLES IN ORDER TO PREP OR FINISH THESE ITEMS. NOTIFY CONSTRUCTION MANAGER AND OBTAIN TIMES WHEN THESE AREAS CAN BE SHUT DOWN TO ALLOW WORK TO PROCEED. DO NOT BLOCK AIR EXHAUST OR AIR INTAKES OR ALLOW THEM TO DRAW IN DUST OR FUMES FROM WORK OPERATIONS.

1.13 MAINTENANCE STOCK

A. AT TIME OF COMPLETING APPLICATION, DELIVER STOCK OF MAINTENANCE MATERIAL TO THE OWNER. FURNISH NOT LESS THAN THE EQUIVALENT OF A FIVE GALLON CONTAINER OF PROPERLY LABELED AND UNOPENED MATERIALS OF EACH TYPE OF FINISH COAT OF EACH COLOR, TAKEN FROM LOTS FURNISHED FOR THE WORK.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. THE FOLLOWING MANUFACTURERS ARE THE BASIS OF THE CONTRACT DOCUMENTS:

1. CARBOLINE COMPANY - ST. LOUIS, MISSOURI

2. PPG INDUSTRIES - PORTER PAINT (P-P), PITTSBURGH, PENNSYLVANIA

3. THE SHERWIN-WILLIAMS COMPANY, CLEVELAND, OHIO

4. TNEMEC COMPANY, INC., KANSAS CITY, MISSOURI

5. AKZONOBEL - INTERNATIONAL PAINT, HOUSTON, TEXAS

6. COMPARABLE SYSTEMS OF STONHARD COMPANY, SIKA CORPORATION, DOW CORNING AND BENJAMIN-MOORE & CO ARE ACCEPTABLE.

B. MANUFACTURER'S PRODUCT NAMES AND NUMBERS ARE GIVEN TO ESTABLISH A STANDARD OF QUALITY, DESIGN AND FUNCTION DESIRED. DRAWINGS AND SPECIFICATIONS HAVE BEEN BASED ON THOSE PRODUCTS SPECIFIED HEREIN. PRODUCTS FROM OTHER MANUFACTURERS PROVIDED THEY COMPLY WITH THE REQUIREMENTS OF THE CONTRACT DOCUMENTS MAY BE CONSIDERED. ALL SUPPLIERS MUST FURNISH CERTIFICATES THAT THEIR MATERIAL IS IN COMPLIANCE. DETERMINATION OF EQUIVALENCY AND SUBSTITUTION OF MANUFACTURER IS AT THE SOLE DISCRETION OF THE ARCHITECT.

2.02 ACCESSORIES

A. ACCESSORY MATERIALS: PROVIDE ALL ACCESSORY MATERIALS NOT SPECIFICALLY INDICATED, BUT ARE REQUIRED TO ACHIEVE THE FINISHES SPECIFIED, INCLUDING LINSEED OIL, SHELLAC, TURPENTINE, MINERAL SPIRITS AND OTHER MATERIALS.

2.03 FINISHES

A. REFER TO SCHEDULE AT END OF THIS SECTION FOR SURFACE FINISH SCHEDULE.

B. COLORS: OWNER SHALL SELECT COLORS FOR EACH AREA AND SURFACE. TINTING AND MATCHING SHALL BE TO THE SATISFACTION OF THE ARCHITECT.

C. COLORS OF PRIMING COATS SHALL BE LIGHTER IN TINT OR COLOR THAN THOSE OF FINISH COATS.

PART 3 - EXECUTION

3.01 EXAMINATION

A. INSPECT ALL SURFACES AND VERIFY THAT THEY ARE IN PROPER CONDITION TO RECEIVE THE WORK OF THIS SECTION. NOTIFY ARCHITECT OF ANY CONDITION THAT MAY POTENTIALLY

AFFECT PROPER APPLICATION OF COATINGS.

B. MEASURE MOISTURE CONTENT OF SURFACES; DO NOT APPLY FINISHES UNLESS MOISTURE CONTENT OF CONCRETE MASONRY SURFACES IS BELOW 12 PERCENT.

C. BEGINNING WORK OF THIS SECTION MEANS ACCEPTANCE OF EXISTING SUBSTRATE SURFACES AND SITE CONDITIONS.

3.02 PREPARATION - GENERAL

A. FURNISH AND LAY SUITABLE DROP CLOTHS IN ALL AREAS WHERE COATING WORK IS BEING DONE TO PROTECT FLOORS AND ALL OTHER SURFACES FROM DAMAGE DURING THE WORK. PROTECT ADJOINING SURFACES WITH PAINTERS MASK TAPE.

B. MIX AND PREPARE COATINGS IN STRICT ACCORDANCE WITH MANUFACTURER'S WRITTEN INSTRUCTIONS. THOROUGHLY MIX TO ENSURE UNIFORMITY OF COLOR AND MASS, UNLESS OTHERWISE DIRECTED BY THE MANUFACTURER OF THE SPECIFIC COATING USED. EXCEPT FOR EPOXY MIXTURES, STRAIN PREVIOUSLY OPENED MATERIALS TO REMOVE SKINS, COATING LUMPS, AND OTHER FOREIGN MATTER PRIOR TO PAINTING. DISPOSE OF EPOXY MATERIALS WHICH HAVE BEGUN TO SET.

C. THIN OR REDUCE MATERIALS ONLY AS RECOMMENDED BY THE SPECIFIC MATERIAL MANUFACTURER, AND ONLY WITH THE APPROVAL OF THE ARCHITECT.

D. GENERAL: REMOVE PLATES, MACHINED SURFACES, AND SIMILAR ITEMS ALREADY IN PLACE THAT ARE NOT TO BE COATED. IF REMOVAL IS IMPRACTICAL OR IMPOSSIBLE BECAUSE OF SIZE OR WEIGHT OF ITEM, PROVIDE SURFACE-APPLIED PROTECTION BEFORE SURFACE PREPARATION AND COATING.

1. AFTER COMPLETING COATING OPERATIONS, REINSTALL ITEMS THAT WERE REMOVED; USE WORKERS SKILLED IN THE TRADES INVOLVED.

E. CLEANING: BEFORE APPLYING HIGH-PERFORMANCE COATINGS, CLEAN SUBSTRATES OF SUBSTANCES THAT COULD IMPAIR BOND OF COATINGS. REMOVE OIL AND GREASE BEFORE CLEANING.

1. SCHEDULE CLEANING AND COATING APPLICATION SO DUST AND OTHER CONTAMINATES FROM CLEANING PROCESS WILL NOT FALL ON WET, NEWLY COATED SURFACES.

2. REMOVE MILDEW BY SCRUBBING WITH SOLUTION OF TRI-SODIUM PHOSPHATE AND BLEACH. RINSE WITH CLEAN WATER AND ALLOW SURFACE TO THOROUGHLY DRY.

F. SURFACE PREPARATION: CLEAN AND PREPARE SURFACES TO BE COATED ACCORDING TO MANUFACTURER'S WRITTEN INSTRUCTIONS FOR EACH SUBSTRATE CONDITION AND AS SPECIFIED.

1. CEMENTITIOUS SUBSTRATES: PREPARE CONCRETE, BRICK, CONCRETE MASONRY BLOCK, AND CEMENT PLASTER SURFACES TO BE COATED. REMOVE EFFLORESCENCE, CHALK, DUST, DIRT, GREASE, OILS, AND RELEASE AGENTS. ROUGHEN AS REQUIRED TO REMOVE GLAZE. IF HARDENERS OR SEALERS HAVE BEEN USED TO IMPROVE CURING, USE MECHANICAL METHODS TO PREPARE SURFACES.

A. USE ABRASIVE BLAST-CLEANING METHODS IF RECOMMENDED BY COATING MANUFACTURER.

B. DETERMINE ALKALINITY AND MOISTURE CONTENT OF SURFACES BY PERFORMING APPROPRIATE TESTS. IF SURFACES ARE SUFFICIENTLY ALKALINE TO CAUSE THE FINISH PAINT

TO BLISTER AND BURN, CORRECT THIS CONDITION BEFORE APPLICATION. DO NOT COAT SURFACES IF MOISTURE CONTENT EXCEEDS THAT PERMITTED IN MANUFACTURER'S WRITTEN INSTRUCTIONS.

2. STEEL SUBSTRATES: PREPARE STEEL SURFACES IN ACCORDANCE WITH SSPC (STEEL STRUCTURES PAINT COUNCIL) “STEEL STRUCTURES PAINTING MANUAL, VOLUME 2”, TO THE PREPARATION METHODS AND SPECIFICATIONS AS SPECIFIED HEREIN FOR EACH COATING TYPE.

3.03 APPLICATION - GENERAL

A. APPLY ALL MATERIALS IN STRICT ACCORDANCE WITH THE APPROVED MANUFACTURER'S PRINTED INSTRUCTION, AND IN ACCORDANCE WITH THE BEST TRADE PRACTICES. EACH COAT SHALL BE REVIEWED AND APPROVED BY THE ARCHITECT/CONSTRUCTION MANAGER BEFORE SUCCEEDING COATS ARE APPLIED.

B. APPLY EACH COAT TO A UNIFORM FINISH; APPLY PRIMER AND FIRST COAT OF SLIGHTLY LIGHTER IN COLOR TINT THAN THE SCHEDULED COLOR OF THE FINAL COAT.

C. GENERAL: APPLY HIGH-PERFORMANCE COATINGS ACCORDING TO MANUFACTURER'S WRITTEN INSTRUCTIONS.

1. USE APPLICATORS AND TECHNIQUES BEST SUITED FOR THE MATERIAL BEING APPLIED.

2. DO NOT APPLY HIGH-PERFORMANCE COATINGS OVER DIRT, RUST, SCALE, GREASE, MOISTURE, SCUFFED SURFACES, OR CONDITIONS DETRIMENTAL TO FORMING A DURABLE COATING FILM.

3. COATING COLORS, SURFACE TREATMENTS, AND FINISHES ARE INDICATED IN THE COATING SYSTEM DESCRIPTIONS.

4. PROVIDE FINISH COATS COMPATIBLE WITH PRIMERS USED.

5. THE TERM "EXPOSED SURFACES" INCLUDES AREAS VISIBLE WHEN PERMANENT OR BUILT-IN FIXTURES, CONVECTOR COVERS, GRILLES, COVERS FOR FINNED-TUBE RADIATION, AND SIMILAR COMPONENTS ARE IN PLACE. EXTEND COATINGS IN THESE AREAS, AS REQUIRED, TO MAINTAIN SYSTEM INTEGRITY AND PROVIDE DESIRED PROTECTION.

A. COAT SURFACES BEHIND MOVABLE EQUIPMENT AND FURNITURE THE SAME AS SIMILAR EXPOSED SURFACES. BEFORE FINAL INSTALLATION, COAT SURFACES BEHIND PERMANENTLY FIXED EQUIPMENT OR FURNITURE WITH PRIME COAT ONLY.

B. COAT BACK SIDES OF ACCESS PANELS, REMOVABLE OR HINGED COVERS, AND SIMILAR HINGED ITEMS TO MATCH EXPOSED SURFACES.

D. SCHEDULING COATING: APPLY FIRST COAT TO SURFACES THAT HAVE BEEN CLEANED, PRETREATED, OR OTHERWISE PREPARED FOR COATING AS SOON AS PRACTICABLE AFTER PREPARATION AND BEFORE SUBSEQUENT SURFACE DETERIORATION.

1. THE NUMBER OF COATS AND FILM THICKNESS REQUIRED IS THE SAME REGARDLESS OF APPLICATION METHOD.

A. DO NOT APPLY SUCCESSIVE COATING UNTIL THE PRECEDING COAT IS THOROUGHLY DRY, EXCEPT AS OTHERWISE SPECIFIED, AND IN NO CASE IN LESS THAN MINIMUM PERIOD OF TIME RECOMMENDED BY MANUFACTURER.

B. ALLOW SUFFICIENT TIME BETWEEN SUCCESSIVE COATS TO PERMIT PROPER DRYING. DO NOT RECOAT SURFACES UNTIL COATING HAS DRIED TO WHERE IT FEELS FIRM, DOES NOT

DEFORM OR FEEL STICKY UNDER MODERATE THUMB PRESSURE, AND APPLICATION OF ANOTHER COAT DOES NOT CAUSE UNDERCOAT TO LIFT OR LOSE ADHESION.

2. IF UNDERCOATS OR OTHER CONDITIONS SHOW THROUGH FINAL COAT, APPLY ADDITIONAL COATS UNTIL CURED FILM HAS A UNIFORM COATING FINISH, COLOR, AND APPEARANCE. GIVE SPECIAL ATTENTION TO EDGES, CORNERS, CREVICES, WELDS, EXPOSED FASTENERS, AND SIMILAR SURFACES TO ENSURE THAT THEY RECEIVE A DRY FILM THICKNESS EQUIVALENT TO THAT OF FLAT SURFACES.

E. APPLICATION PROCEDURES: APPLY COATINGS BY BRUSH, ROLLER, OR OTHER APPLICATORS ACCORDING TO MANUFACTURER'S WRITTEN INSTRUCTIONS.

1. BRUSH APPLICATION: USE BRUSHES BEST SUITED FOR MATERIAL APPLIED AND OF APPROPRIATE SIZE FOR THE SURFACE OR ITEM BEING COATED.

A. APPLY PRIMERS AND FIRST COATS BY BRUSH UNLESS MANUFACTURER'S WRITTEN INSTRUCTIONS PERMIT USING ROLLER OR MECHANICAL APPLICATORS.

B. BRUSH OUT AND WORK BRUSH COATS INTO SURFACES IN AN EVEN FILM.

C. ELIMINATE CLOUDINESS, SPOTTING, HOLIDAYS, LAPS, BRUSH MARKS, RUNS, SAGS, ROPINESS, OR OTHER SURFACE IMPERFECTIONS. NEATLY DRAW GLASS LINES AND COLOR BREAKS.

2. ROLLERS: USE ROLLERS OF CARPET, VELVET BACK, OR HIGH-PILE SHEEP'S WOOL AS RECOMMENDED BY MANUFACTURER FOR THE MATERIAL AND TEXTURE REQUIRED.

F. MINIMUM COATING THICKNESS: APPLY EACH MATERIAL NO THINNER THAN MANUFACTURERS RECOMMENDED SPREADING RATE. PROVIDE TOTAL DRY FILM THICKNESS OF THE ENTIRE SYSTEM AS RECOMMENDED BY MANUFACTURER.

G. BLOCK FILLERS: APPLY BLOCK FILLERS TO CONCRETE MASONRY BLOCK AT A RATE TO ENSURE COMPLETE COVERAGE WITH PORES FILLED.

H. PRIME COATS: BEFORE APPLYING FINISH COATS, APPLY A PRIME COAT OF MATERIAL, AS RECOMMENDED BY MANUFACTURER, TO MATERIAL REQUIRED TO BE COATED OR FINISHED THAT HAS NOT BEEN PRIME COATED BY OTHERS.

1. RECOAT PRIMED AND SEALED SUBSTRATES IF THERE IS EVIDENCE OF SUCTION SPOTS OR UNSEALED AREAS IN FIRST COAT, TO ENSURE A FINISH COAT WITH NO BURN-THROUGH OR OTHER DEFECTS CAUSED BY INSUFFICIENT SEALING.

I. COMPLETED WORK: MATCH APPROVED SAMPLES FOR COLOR, TEXTURE, AND COVERAGE. REMOVE, REFINISH, OR RECOAT WORK THAT DOES NOT COMPLY WITH SPECIFIED REQUIREMENTS.

3.04 CLEANING

A. UPON COMPLETION OF THE WORK IN EACH AREA, REMOVE ALL COATING SPLATTERS FROM GLASS, PREFINISHED SURFACES, BRIGHT METALS, AND FROM OTHER SURFACES THAT HAVE NOT BEEN PAINTED OR FINISHED HEREUNDER. DO NOT USE ABRASIVE PAPER OR ABRASIVE CLEANER ON ANY PREFINISHED SURFACE OR BRIGHT METAL. REMOVE ALL MATERIALS AND DEBRIS; LEAVE WORK AREA IN A CLEAN CONDITION.

3.05 PROTECTION AND TOUCH-UP

A. DURING APPLICATION OF COATINGS, PROTECT THE WORK OF OTHER TRADES AGAINST

UNDUE SOILAGE AND DAMAGE BY THE EXERCISE OF REASONABLE CARE AND PRECAUTIONS. PROPERLY CLEAN, REPAIR OR REPLACE ANY WORK SO DAMAGED AND SOILED.

B. PROTECT ALL PAINTED AND FINISHED SURFACES AGAINST DAMAGE UNTIL THE DATE OF FINAL ACCEPTANCE OF THE WORK. THE ARCHITECT WILL CONDUCT A FINAL REVIEW OF ALL WORK PERFORMED. RE-COAT OR TOUCH-UP, ALL SCRATCHES AND OTHER BLEMISHES ON SURFACES, AND AS DIRECTED BY THE ARCHITECT, ANY AREAS FOUND WHICH DO NOT COMPLY WITH THE REQUIREMENTS OF THIS SECTION, AND BEAR ALL COSTS THEREFORE.

1. PROVIDE "WET PAINT" SIGNS TO PROTECT NEWLY COATED FINISHES. AFTER COMPLETING COATING OPERATIONS, REMOVE TEMPORARY PROTECTIVE WRAPPINGS PROVIDED BY OTHERS TO PROTECT THEIR WORK.

2. AT COMPLETION OF CONSTRUCTION ACTIVITIES OF OTHER TRADES, TOUCH UP AND RESTORE DAMAGED OR DEFACED COATED SURFACES. COMPLY WITH PROCEDURES SPECIFIED IN PDCA P1.

3.06 SCHEDULE - INTERIOR/EXTERIOR SURFACES

A. GALVANIZED STEEL - INTERIOR: (HP-1)

1. PREPARATION:

A. MECHANICALLY ABRADE, ABRASIVE BLAST AND/OR CHEMICALLY CLEAN SURFACES.

2. FINISH:

A. FIRST COAT: TNEMEC SERIES N69 HI-BUILD EPOXOLINE AT 2.0 - 3.0 MILS DFT.

B. FINISH: TNEMEC SERIES 113 - HIGH-BUILD TNEMEC TUFCOAT AT 4.0 - 6.0 MILS DFT

B. FERROUS METALS - FOOD PROCESSING & NON-FOOD AREAS (NEW UNCOATED & SHOP PRIMED): (HP-1)

1. SHOP PREPARATION:

A. SSPC - SP6 “COMMERCIAL BLAST CLEAN”.

2. FINISH:

A. PRIMER: (AT SURFACES PREVIOUSLY PRIMED, TOUCH UP BARE STEEL): TNEMEC SERIES N69 HI-BUILD EPOXOLINE II AT 4.0 - 6.0 MILS DFT.

B. FIRST COAT: TNEMEC SERIES N69 HI-BUILD EPOXOLINE II AT 4.0 - 6.0 MILS DFT.

C. FINISH: TNEMEC SERIES 75 ENDURA SHIELD AT 2.0 - 3.0 MILS DFT.

C. INTERIOR CONCRETE MASONRY & INTERIOR PRECAST/CAST-IN-PLACE CONCRETE SURFACES - WET AREAS: (HP-2)

1. PREPARATION:

A. REFER TO SECTION 09 9600 - PARAGRAPH 3.06 -SUB-PARAGRAPH C - ITEM 1, 'PREPARATION'.

2. FINISH

A. FILLER: ONE COAT OF CARBOLINE 954 HB FILLER.

1) CARBOLINE PRODUCT #09500000A05D, CARBOGUARD 954 HB PART A.

B. FIRST COAT: ONE COAT CARBOCOAT 30 TOP COAT (FILL ALL PIN HOLES).

1) CAROLINE PRODUCT #0056WITE)SD, CARBOCOAT 30 WITE.

C. FINISH: ONE COAT CARBOCOAT 30 SANITILE.

1) CARBOLINE PRODUCT #S655WITE97SD, SANITILE 655 WITE.

D. INTERIOR PRECAST/CAST-IN-PLACE CONCRETE SURFACES - PENETRATING SEALER: (S)

1. PREPARATION:

A. REFER TO SECTION 09 9600 - PARAGRAPH 3.06 -SUB-PARAGRAPH C - ITEM 1, 'PREPARATION'.

2. FINISH: ONE COAT DAYTON-SUPERIOR DAY-CHEM SURE HARD (J-17).

E. INTERIOR CONCRETE MASONRY SURFACES - DRY AREAS: (HP-2)

1. PREPARATION:

A. REFER TO SECTION 09 9600 - PARAGRAPH 3.06 -SUB-PARAGRAPH C - ITEM 1, 'PREPARATION'.

2. FINISH

A. FILLER: ONE COAT OF CARBOLINE 954 HB FILLER.

1) CARBOLINE PRODUCT #09500000A05D, CARBOGUARD 954 HB PART A.

B. FIRST COAT: ONE COAT CARBOCOAT 30 TOP COAT (FILL ALL PIN HOLES).

1) CAROLINE PRODUCT #0056WITE)SD, CARBOCOAT 30 WITE.

C. FINISH: ONE COAT CARBOCOAT 30 SANITILE.

1) CARBOLINE PRODUCT #S655WITE97SD, SANITILE 655 WITE.

END OF SECTION

SECTION 10 14 00

SIGNS

PART 1 - GENERAL

1.01 SUMMARY

A. THIS SECTION INCLUDES THE FOLLOWING:

1. ROOM SIGNS

2. DIRECTIONAL SIGNS

3. SIGNAGE ACCESSORIES

B. RELATED SECTIONS INCLUDE THE FOLLOWING:

1. DIVISION 15 SECTION "MECHANICAL IDENTIFICATION" FOR LABELS, TAGS, AND NAMEPLATES FOR MECHANICAL EQUIPMENT.

2. DIVISION 16 SECTION "ELECTRICAL IDENTIFICATION" FOR LABELS, TAGS, AND NAMEPLATES FOR ELECTRICAL EQUIPMENT.

3. DIVISION 16 SECTION "INTERIOR LIGHTING" FOR ILLUMINATED EXIT SIGNS.

4. SEE DIVISION 16 SECTIONS FOR ELECTRICAL SERVICE AND CONNECTIONS FOR ILLUMINATED CHARACTERS AND FOR ACCESS TO REMOTE TRANSFORMERS.

1.02 SUBMITTALS

A. PRODUCT DATA: INCLUDE CONSTRUCTION DETAILS, MATERIAL DESCRIPTIONS, DIMENSIONS OF INDIVIDUAL COMPONENTS AND PROFILES, AND FINISHES FOR EACH TYPE OF SIGN.

B. SHOP DRAWINGS: INCLUDE PLANS, ELEVATIONS, AND LARGE-SCALE SECTIONS OF TYPICAL MEMBERS AND OTHER COMPONENTS. SHOW MOUNTING METHODS, GROUNDS, MOUNTING HEIGHTS, LAYOUT, SPACING, REINFORCEMENT, ACCESSORIES, AND INSTALLATION DETAILS.

1. PROVIDE MESSAGE LIST FOR EACH SIGN, INCLUDING LARGE-SCALE DETAILS OF WORDING, LETTERING, AND BRAILLE LAYOUT.

C. SAMPLES FOR INITIAL SELECTION: FOR EACH TYPE OF SIGN MATERIAL INDICATED THAT INVOLVES COLOR SELECTION.

D. SAMPLES FOR VERIFICATION: FOR EACH TYPE OF SIGN, INCLUDE THE FOLLOWING SAMPLES TO VERIFY COLOR SELECTED:

1. PANEL SIGNS: FULL-SIZE SAMPLES OF EACH TYPE OF SIGN REQUIRED.

2. APPROVED SAMPLES WILL NOT BE RETURNED FOR INSTALLATION INTO PROJECT.

E. QUALIFICATION DATA: FOR INSTALLER.

F. MAINTENANCE DATA: FOR SIGNAGE CLEANING AND MAINTENANCE REQUIREMENTS TO INCLUDE IN MAINTENANCE MANUALS.

1.03 QUALITY ASSURANCE

SECTION 10 14 00

SIGNS

A. SOURCE LIMITATIONS: OBTAIN EACH SIGN TYPE THROUGH ONE SOURCE FROM A SINGLE MANUFACTURER.

B. REGULATORY REQUIREMENTS: COMPLY WITH THE AMERICANS WITH DISABILITIES ACT (ADA) AND WITH CODE PROVISIONS AS ADOPTED BY AUTHORITIES HAVING JURISDICTION.

1. INTERIOR CODE SIGNAGE: PROVIDE SIGNAGE AS REQUIRED BY ACCESSIBILITY REGULATIONS AND REQUIREMENTS OF AUTHORITIES HAVING JURISDICTION. THESE INCLUDE, BUT ARE NOT LIMITED TO, THE FOLLOWING:

A. FIRE DOORS

B. ELEVATOR SIGNS

C. STAIRWAY IDENTIFICATION

D. SIGNS FOR ACCESSIBLE SPACES

1.04 PROJECT CONDITIONS

A. FIELD MEASUREMENTS: WHERE SIZES OF SIGNS ARE DETERMINED BY DIMENSIONS OF SURFACES ON WHICH THEY ARE INSTALLED, VERIFY DIMENSIONS BY FIELD MEASUREMENT BEFORE FABRICATION AND INDICATE MEASUREMENTS ON SHOP DRAWINGS.

1.05 COORDINATION

A. COORDINATE LOCATION OF REMOTE TRANSFORMERS WITH BUILDING CONSTRUCTION. ENSURE THAT TRANSFORMERS ARE ACCESSIBLE AFTER COMPLETION OF WORK.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. IN OTHER PART 2 ARTICLES WHERE TITLES BELOW INTRODUCE LISTS, THE FOLLOWING REQUIREMENTS APPLY FOR PRODUCT SELECTION:

1. BASIS-OF-DESIGN PRODUCT: THE DESIGN FOR EACH SIGN IS BASED ON THE PRODUCT NAMED. SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE EITHER THE NAMED PRODUCT OR A COMPARABLE PRODUCT BY ONE OF THE OTHER MANUFACTURERS SPECIFIED.

2.02 PANEL SIGNS

A. GENERAL: PROVIDE PANEL SIGNS THAT COMPLY WITH REQUIREMENTS INDICATED FOR MATERIALS, THICKNESSES, FINISHES, COLORS, DESIGNS, SHAPES, SIZES, AND DETAILS OF CONSTRUCTION.

1. PRODUCE SMOOTH PANEL SIGN SURFACES CONSTRUCTED TO REMAIN FLAT UNDER INSTALLED CONDITIONS WITHIN TOLERANCE OF PLUS OR MINUS 1/16 INCH (1.5 MM) MEASURED DIAGONALLY.

B. BASIS-OF-DESIGN PRODUCT: SETON, CUSTOM BRAILLE SIGNS OR A COMPARABLE PRODUCT OF ONE OF THE FOLLOWING:

1. PROVIDE SETON, NO. #12203, FOR PANEL SIGNS. TYPE: CUSTOM BRAILLE SIGNS.

C. UNFRAMED PANEL SIGNS: FABRICATE SIGNS WITH EDGES MECHANICALLY AND SMOOTHLY FINISHED TO COMPLY WITH THE FOLLOWING REQUIREMENTS:

1. EDGE CONDITION: BEVELED.

2. CORNER CONDITION: ROUNDED TO RADIUS ½ INCH.

D. LAMINATED PANELS: PERMANENTLY LAMINATE FACE PANELS TO BACKING SHEETS OF MATERIAL; USE MANUFACTURER'S STANDARD PROCESS.

E. GRAPHIC CONTENT AND STYLE: PROVIDE SIGN COPY THAT COMPLIES WITH REQUIREMENTS INDICATED ON DRAWINGS AND SPECIFICATIONS FOR SIZE, STYLE, SPACING, CONTENT, MOUNTING HEIGHT AND LOCATION, MATERIAL, FINISHES, AND COLORS OF SIGNAGE.

F. CHANGEABLE MESSAGE INSERTS: FABRICATE SIGNS TO ALLOW INSERTION OF CHANGEABLE MESSAGES IN THE FORM OF SLIDE-IN INSERTS TACTILE AND BRAILLE COPY: MANUFACTURER'S STANDARD PROCESS FOR PRODUCING COPY COMPLYING WITH ADA ACCESSIBILITY GUIDELINES AND ICC/ANSI A117.1. TEXT SHALL BE ACCOMPANIED BY GRADE 2 BRAILLE. PRODUCE PRECISELY FORMED CHARACTERS WITH SQUARE CUT EDGES FREE FROM BURRS AND CUT MARKS.

G. TACTILE AND BRAILLE COPY: MANUFACTURER'S STANDARD PROCESS FOR PRODUCING COPY COMPLYING WITH ADA ACCESSIBILITY GUIDELINES AND ICC/ANSI A117.1. TEXT SHALL BE ACCOMPANIED BY GRADE 2 BRAILLE. PRODUCE PRECISELY FORMED CHARACTERS WITH SQUARE CUT EDGES FREE FROM BURS AND CUT MARKS.

1. PANEL MATERIAL: OPAQUE ACRYLIC SHEET.

2. RAISED-COPY THICKNESS: NOT LESS THAN 1/32 INCH (0.8 MM)

H. SUBSURFACE ENGRAVED ACRYLIC SHEET: REVERSE-ENGRAVE BACK FACE OF CLEAR ACRYLIC SHEET. FILL RESULTING COPY WITH ENAMEL. APPLY OPAQUE BACKGROUND COLOR COATING OVER ENAMEL-FILLED COPY.

I. COLORED COATINGS FOR ACRYLIC SHEET: FOR COPY AND BACKGROUND COLORS, PROVIDE PANTONE MATCHING SYSTEM (PMS) COLORED COATINGS, INCLUDING INKS AND PAINTS, THAT ARE RECOMMENDED BY ACRYLIC MANUFACTURERS FOR OPTIMUM ADHERENCE TO ACRYLIC SURFACE AND ARE NONFADING FOR APPLICATION INTENDED.

2.03 PANEL SIGN TYPES

A. ROOM SIGNS:

1. MATERIAL: ACRYLIC SHEET.

2. PERIMETER: UNFRAMED.

3. COPY: TACTILE AND BRAILLE.

4. CHARACTER STYLE: HELVETICA.

A. SIGN: 8” X 8” (203 MM X 203 MM) INCHES.

B. CHARACTER: MINIMUM 5/8-INCH- (16-MM-) HIGH CHARACTERS.

5. COLORS:

A. CHARACTER: AS SELECTED BY ARCHITECT FROM FULL RANGE OF COLORS

B. BACKGROUND: AS SELECTED BY ARCHITECT FROM FULL RANGE OF COLORS.

6. SCHEDULE: SEE PART 3 OF THIS SECTION.

B. TOILET ROOM SIGNS:

1. MATERIAL: ACRYLIC SHEET.

2. PERIMETER: UNFRAMED.

3. COPY: RAISED.

4. CHARACTER STYLE: HELVETICA.

5. TEXT: ACCORDING TO REQUIREMENTS IN THE ADA OR OF AUTHORITIES HAVING JURISDICTION, WHICHEVER ARE MORE STRINGENT.

A. SIGN: 8” X 8” (203 MM X 203 MM) INCHES.

B. CHARACTER: MINIMUM 5/8-INCH- (16-MM-) HIGH CHARACTERS.

6. COLORS:

A. CHARACTER: TO BE SELECTED FOR FULL RANGE

B. BACKGROUND: TO BE SELECTED FOR FULL RANGE.

7. SCHEDULE: SEE PART 3 OF THIS SECTION.

2.04 ACCESSORIES

A. MOUNTING METHODS: USE SILICONE ADHESIVE FABRICATED FROM MATERIALS THAT ARE NOT CORROSIVE TO SIGN MATERIAL AND MOUNTING SURFACE.

2.05 FINISHES, GENERAL

A. APPEARANCE OF FINISHED WORK: VARIATIONS IN APPEARANCE OF ABUTTING OR ADJACENT PIECES ARE ACCEPTABLE IF THEY ARE WITHIN ONE-HALF OF RANGE OF APPROVED SAMPLES. NOTICEABLE VARIATIONS IN SAME PIECE ARE NOT ACCEPTABLE. VARIATIONS IN APPEARANCE OF OTHER COMPONENTS ARE ACCEPTABLE IF THEY ARE WITHIN RANGE OF APPROVED SAMPLES AND ARE ASSEMBLED OR INSTALLED TO MINIMIZE CONTRAST.

PART 3 - EXECUTION

3.01 EXAMINATION

A. EXAMINE SUBSTRATES, AREAS, AND CONDITIONS, WITH INSTALLER PRESENT, FOR COMPLIANCE WITH REQUIREMENTS FOR INSTALLATION TOLERANCES AND OTHER CONDITIONS AFFECTING PERFORMANCE OF WORK.

B. VERIFY THAT ITEMS PROVIDED UNDER OTHER SECTIONS OF WORK ARE SIZED AND LOCATED TO ACCOMMODATE SIGNS.

C. EXAMINE SUPPORTING MEMBERS TO ENSURE THAT SURFACES ARE AT ELEVATIONS INDICATED OR REQUIRED TO COMPLY WITH AUTHORITIES HAVING JURISDICTION AND ARE FREE FROM DIRT AND OTHER DELETERIOUS MATTER.

D. PROCEED WITH INSTALLATION ONLY AFTER UNSATISFACTORY CONDITIONS HAVE BEEN CORRECTED.

3.02 INSTALLATION

A. GENERAL: LOCATE SIGNS AND ACCESSORIES WHERE INDICATED, USING MOUNTING METHODS OF TYPES DESCRIBED AND IN COMPLIANCE WITH MANUFACTURER'S WRITTEN INSTRUCTIONS.

B. INSTALL SIGNS LEVEL, PLUMB, AND AT HEIGHTS INDICATED, WITH SIGN SURFACES FREE FROM DISTORTION AND OTHER DEFECTS IN APPEARANCE.

1. INTERIOR WALL SIGNS

A. PLACEMENT:

(1) SINGLE LEAF DOORS: INSTALL SIGNS ON WALLS ADJACENT TO LATCH SIDE OF DOORS.

(2) DOUBLE DOORS WITH ONE ACTIVE LEAF: INSTALL SIGNS ON INACTIVE DOOR LEAF.

(3) DOUBLE DOORS WITH BOTH LEAVES ACTIVE: INSTALL SIGN TO RIGHT OF THE RIGHT-HAND DOOR.

B. HEIGHT: MOUNT SIGNS SO THAT THERE IS NOT LESS THAN 48” (1.2 M) TO THE BASELINE OF LOWEST CHARACTER NOR MORE THAN 60” (1.5 M) TO THE BASELINE OF THE HIGHEST CHARACTER.

C. LOCATION: SIGN SHALL BE MOUNTED WITH CENTER OF SIGN 9” (229 MM) MINIMUM FROM THE ARC OF ANY DOOR SWING. SIGNS AT DOUBLE DOORS WITH BOTH LEAVES ACTIVE SHALL BE MOUNTED WITH CENTER OF SIGN 9” (229 MM) MINIMUM FROM THE HINGE SIDE OF THE DOOR LEAF. A MINIMUM 18” X 18” (457 MM X 457 MM) CLEAR FLOOR AREA SHALL BE CENTERED ON THE SIGN. LOCATE TO ALLOW APPROACH WITHIN 3 INCHES (76 MM) OF SIGN WITHOUT ENCOUNTERING PROTRUDING OBJECTS OR STANDING WITHIN SWING OF DOOR.

C. WALL-MOUNTED PANEL SIGNS: ATTACH PANEL SIGNS TO WALL SURFACES USING METHODS INDICATED BELOW:

1. SILICONE-ADHESIVE MOUNTING: USE LIQUID-SILICONE ADHESIVE RECOMMENDED IN WRITING BY SIGN MANUFACTURER TO ATTACH SIGNS TO IRREGULAR, POROUS, OR VINYL-COVERED SURFACES. USE DOUBLE-SIDED VINYL TAPE WHERE RECOMMENDED IN WRITING BY SIGN MANUFACTURER TO HOLD SIGN IN PLACE UNTIL ADHESIVE HAS FULLY CURED.

3.03 CLEANING AND PROTECTION

A. AFTER INSTALLATION, CLEAN SOILED SIGN SURFACES ACCORDING TO MANUFACTURER'S WRITTEN INSTRUCTIONS. PROTECT SIGNS FROM DAMAGE UNTIL ACCEPTANCE BY OWNER.

3.04 SIGN SCHEDULE

A. PROVIDE PANEL SIGNS AS FOLLOWS:

1. ROOM LABEL SIGNS: PROVIDE 8” X 8” INCH (203 MM X 203 MM) PANEL SIGNS FOR ALL

DOORS TO INTERIOR SPACES. PANEL SIGN SHALL BE PROVIDED FOR ALL SPACES IN THE BUILDING. THE PANEL SIGN SHALL INDICATE THE ROOM NAME OR FUNCTION. ROOM LABEL SIGN SHALL BE LOCATED AS DESCRIBED IN THIS SECTION. (SEE FLOOR PLANS AND SIGN SCHEDULE)

A. TOILET ROOMS.

B. CHANGING ROOMS

F. FIRE RISER ROOMS

G. ELECTRICAL ROOMS

2. ACCESSIBILITY SIGNAGE: GRAPHIC AND BRAILLE 8" X 8" INCH (203 MM X 203 MM) PANEL SIGNS SHALL BE PROVIDED FOR THE FOLLOWING BUILDING SERVICES AND FUNCTIONS AND COMPLY WITH ADAAG-2010. PANEL SIGN SHALL BE LOCATED AS DESCRIBED IN THIS SECTION. (SEE FLOOR PLANS AND SIGN SCHEDULE)

A. STAIRS

B. EXITS

C. TOILET ROOMS

D. EXTERIOR ENTRANCES/EXITS WITH RAMP ACCESS.

E. CHANGING ROOMS

F. LOCKER ROOMS

3. REGULATORY SIGNS: GRAPHIC AND BRAILLE, SIZE AS REQUIRED, PANEL SIGNS SHALL BE PROVIDED FOR THE FOLLOWING REGULATORY REQUIREMENTS AND COMPLY WITH ADAAG-1994. PANEL SIGN SHALL BE LOCATED AS DESCRIBED IN THIS SECTION. (SEE FLOOR PLANS)

A. FIRE DOORS: SIGNS WITH 1" HIGH LETTERS WITH ONE OF THE FOLLOWING MESSAGES:

(1) FOR FIRE DOORS THAT ARE HELD OPEN, TO CLOSE AUTOMATICALLY: FIRE DOOR - DO NOT BLOCK.

(2) FOR FIRE DOORS THAT ARE NORMALLY CLOSED: FIRE DOOR - KEEP CLOSED.

END OF SECTION

SECTION 10 26 00

WALL & DOOR PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. CONSTRUCTION DRAWINGS, SPECIFICATIONS AND PROVISIONS OF THE CONTRACT INCLUDING GENERAL AND SUPPLEMENTAL CONDITIONS AND OTHER DIVISION 01 SPECIFICATION SECTIONS, ARE HEREBY MADE A PART OF THIS SECTION AS FULLY AND COMPLETELY AS IF REPEATED HEREIN.

1.2 ITEMS REQUIRED BUT NOT SPECIFIED

A. IF AN ITEM OR MATERIAL OF THIS TRADE IS INDICATED ON THE DRAWINGS BUT NOT SPECIFICALLY LISTED IN THIS SECTION, PROVIDE SUCH ITEM OR MATERIAL AT A STANDARD OF QUALITY EQUAL TO THE STANDARD ESTABLISHED FOR THE BALANCE OF THE WORK SPECIFIED, IN ACCORDANCE WITH THE ARCHITECT'S INTERPRETATION.

1.3 EXECUTION, CORRELATION AND INTENT

A. IN CASE OF AN INCONSISTENCY BETWEEN DRAWINGS AND SPECIFICATIONS, OR WITHIN EITHER DOCUMENT NOT CLARIFIED BY ADDENDUM, THE BETTER QUALITY OR GREATER QUANTITY OF WORK IS TO BE PROVIDED, IN ACCORDANCE WITH THE ARCHITECT'S INTERPRETATION.

1.4 SUMMARY

A. SECTION INCLUDES:

1. CORNER GUARDS.

B. RELATED SECTIONS:

1. DIVISION 01: ADMINISTRATIVE, PROCEDURAL, AND TEMPORARY WORK REQUIREMENTS.

1.5 SUBMITTALS

A. SUBMITTALS FOR REVIEW:

1. PRODUCT DATA: INDICATE PROFILES, ACCESSORIES, AND ATTACHMENTS.

2. SAMPLES: 3 INCHES IN LENGTH.

1.6 QUALITY ASSURANCE

A. SURFACE MOUNT CORNER GUARDS.

1.7 PROJECT CONDITIONS

A. DO NOT INSTALL GUARDS UNTIL AFTER PAINTING AND FINISHING WORK IS COMPLETED.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. ACCEPTABLE MANUFACTURERS:

1. INPRO CORP. (WWW.INPROCORP.COM)

2. CONSTRUCTION SPECIALTIES, INC. (WWW.C-SGROUP.COM)

3. PAWLING CORP. (WWW.PAWLING.COM)

B. SUBSTITUTIONS: UNDER PROVISIONS OF DIVISION 01.

2.2 COMPONENTS

A. CORNER GUARDS:

1. 304 STAINLESS STEEL, 16 GAUGE.

2. SIZE: 1 1/2 INCHES X 1 1/2 INCHES X 4 FEET HIGH.

2.3 ACCESSORIES

A. FASTENERS: TYPE BEST SUITED TO APPLICATION, STAINLESS STEEL SCREW ANCHOR.

PART 3 - EXECUTION

3.1 INSTALLATION

A. INSTALL IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS.

B. SET PLUMB, LEVEL, AND RIGID.

END OF SECTION

SECTION 10 28 00

TOILET & BATH ACCESSORIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. CONSTRUCTION DRAWINGS, SPECIFICATIONS AND PROVISIONS OF THE CONTRACT INCLUDING GENERAL AND SUPPLEMENTAL CONDITIONS AND OTHER DIVISION 1 SPECIFICATION SECTIONS, ARE HEREBY MADE A PART OF THIS SECTION AS FULLY AND COMPLETELY AS IF REPEATED HEREIN.

1.02 ITEMS REQUIRED BUT NOT SPECIFIED

A. IF AN ITEM OR MATERIAL OF THIS TRADE IS INDICATED ON THE DRAWINGS BUT NOT SPECIFICALLY LISTED IN THIS SECTION, PROVIDE SUCH ITEM OR MATERIAL AT A STANDARD OF QUALITY EQUAL TO THE STANDARD ESTABLISHED FOR THE BALANCE OF THE WORK SPECIFIED, IN ACCORDANCE WITH THE ARCHITECT'S INTERPRETATION.

1.03 EXECUTION, CORRELATION AND INTENT

A. IN CASE OF AN INCONSISTENCY BETWEEN DRAWINGS AND SPECIFICATIONS OR WITHIN EITHER DOCUMENT NOT CLARIFIED BY ADDENDUM, THE BETTER QUALITY OR GREATER QUANTITY OF WORK IS TO BE PROVIDED, IN ACCORDANCE WITH THE ARCHITECT'S INTERPRETATION

1.04 SUMMARY

A. THIS SECTION INCLUDES THE FOLLOWING:

1. TOILET AND BATH ACCESSORIES.

B. RELATED SECTIONS INCLUDE THE FOLLOWING:

1. DIVISION 10 SECTION "TOILET COMPARTMENTS" FOR COMPARTMENTS AND SCREENS.

1.05 SUBMITTALS

A. PRODUCT DATA: INCLUDE CONSTRUCTION DETAILS, MATERIAL DESCRIPTIONS AND THICKNESSES, DIMENSIONS, PROFILES, FASTENING AND MOUNTING METHODS, SPECIFIED OPTIONS, AND FINISHES FOR EACH TYPE OF ACCESSORY SPECIFIED.

B. MAINTENANCE DATA: FOR ACCESSORIES TO INCLUDE IN MAINTENANCE MANUALS SPECIFIED IN DIVISION 1. PROVIDE LISTS OF REPLACEMENT PARTS AND SERVICE RECOMMENDATIONS.

1.06 QUALITY ASSURANCE

A. SOURCE LIMITATIONS: PROVIDE PRODUCTS OF SAME MANUFACTURER FOR EACH TYPE OF ACCESSORY UNIT AND FOR UNITS EXPOSED TO VIEW IN SAME AREAS, UNLESS OTHERWISE APPROVED BY CONTRACTING OFFICER.

1.07 COORDINATION

A. COORDINATE ACCESSORY LOCATIONS WITH OTHER WORK TO PREVENT INTERFERENCE WITH CLEARANCES REQUIRED FOR ACCESS BY DISABLED PERSONS, PROPER INSTALLATION, ADJUSTMENT, OPERATION, CLEANING, AND SERVICING OF ACCESSORIES.

B. DELIVER INSERTS AND ANCHORING DEVICES SET INTO CONCRETE OR MASONRY AS

REQUIRED TO PREVENT DELAYING THE WORK.

1.08 WARRANTY

A. GENERAL WARRANTY: SPECIAL WARRANTY SPECIFIED IN THIS ARTICLE SHALL NOT DEPRIVE GOVERNMENT OF OTHER RIGHTS GOVERNMENT MAY HAVE UNDER OTHER PROVISIONS OF THE CONTRACT DOCUMENTS AND SHALL BE IN ADDITION TO, AND RUN CONCURRENT WITH, OTHER WARRANTIES MADE BY CONTRACTOR UNDER REQUIREMENTS OF THE CONTRACT DOCUMENTS.

B. MANUFACTURER'S MIRROR WARRANTY: WRITTEN WARRANTY, EXECUTED BY MIRROR MANUFACTURER AGREEING TO REPLACE MIRRORS THAT DEVELOP VISIBLE SILVER SPOILAGE DEFECTS WITHIN MINIMUM WARRANTY PERIOD INDICATED.

1. MINIMUM WARRANTY PERIOD: 5 YEARS FROM DATE OF SUBSTANTIAL COMPLETION.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. AVAILABLE MANUFACTURERS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, MANUFACTURERS OFFERING ACCESSORIES THAT MAY BE INCORPORATED INTO THE WORK INCLUDE, BUT ARE NOT LIMITED TO, THE FOLLOWING:

1. TOILET AND BATH ACCESSORIES:

A. A & J WASHROOM ACCESSORIES, INC.

B. BOBRICK WASHROOM EQUIPMENT, INC.

C. BRADLEY CORPORATION.

D. GENERAL ACCESSORY MANUFACTURING CO. (GAMCO).

B. PRODUCTS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE PRODUCTS AND ACCESSORIES AS INDICATED IN THE TOILET AND BATH ACCESSORY SCHEDULE.

2.02 MATERIALS

A. STAINLESS STEEL: ASTM A 666, TYPE 304, WITH NO. 4 FINISH (SATIN), IN 0.8-MM (0.0312-INCH) MINIMUM NOMINAL THICKNESS, UNLESS OTHERWISE INDICATED.

B. BRASS: ASTM B 19, LEADED AND UNLEADED FLAT PRODUCTS; ASTM B 16M (ASTM B 16), RODS, SHAPES, FORGINGS, AND FLAT PRODUCTS WITH FINISHED EDGES; ASTM B 30, CASTINGS.

C. SHEET STEEL: ASTM A 366/A 366M, COLD ROLLED, COMMERCIAL QUALITY, 0.9-MM (0.0359-INCH) MINIMUM NOMINAL THICKNESS; SURFACE PREPARATION AND METAL PRETREATMENT AS REQUIRED FOR APPLIED FINISH.

D. GALVANIZED STEEL SHEET: ASTM A 653/A 653M, Z180 (G60).

E. CHROMIUM PLATING: ASTM B 456, HEAVY-DUTY SERVICE CONDITION, NICKEL PLUS CHROMIUM ELECTRODEPOSITED ON BASE METAL.

F. MIRROR GLASS: ASTM C 1036, TYPE I, CLASS 1, QUALITY Q2, NOMINAL 6.0 MM THICK, WITH SILVERING, ELECTROPLATED COPPER COATING, AND PROTECTIVE ORGANIC COATING COMPLYING WITH FS DD-M-411.

G. GALVANIZED STEEL MOUNTING DEVICES: ASTM A 153/A 153M, HOT-DIP GALVANIZED AFTER FABRICATION.

H. FASTENERS: SCREWS, BOLTS, AND OTHER DEVICES OF SAME MATERIAL AS ACCESSORY UNIT, TAMPER AND THEFT RESISTANT WHEN EXPOSED, AND OF GALVANIZED STEEL WHEN CONCEALED.

2.03 FABRICATION

A. GENERAL: ONE, MAXIMUM 38-MM- (1-1/2-INCH-) DIAMETER, UNOBTRUSIVE STAMPED MANUFACTURER LOGO, AS APPROVED BY CONTRACTING OFFICER, IS PERMITTED ON EXPOSED FACE OF ACCESSORIES. ON INTERIOR SURFACE NOT EXPOSED TO VIEW OR BACK SURFACE OF EACH ACCESSORY, PROVIDE PRINTED, WATERPROOF LABEL OR STAMPED NAMEPLATE INDICATING MANUFACTURER'S NAME AND PRODUCT MODEL NUMBER.

B. SURFACE-MOUNTED TOILET ACCESSORIES: UNLESS OTHERWISE INDICATED, FABRICATE UNITS WITH TIGHT SEAMS AND JOINTS, AND EXPOSED EDGES ROLLED. HANG DOORS AND ACCESS PANELS WITH CONTINUOUS STAINLESS-STEEL HINGE. PROVIDE CONCEALED ANCHORAGE WHERE POSSIBLE.

C. FRAMED GLASS-MIRROR UNITS: FABRICATE FRAMES FOR GLASS-MIRROR UNITS TO ACCOMMODATE GLASS EDGE PROTECTION MATERIAL. PROVIDE MIRROR BACKING AND SUPPORT SYSTEM THAT PERMITS RIGID, TAMPER-RESISTANT GLASS INSTALLATION AND PREVENTS MOISTURE ACCUMULATION.

1. PROVIDE GALVANIZED STEEL BACKING SHEET, NOT LESS THAN 0.85 MM (0.034 INCH) AND FULL MIRROR SIZE, WITH NONABSORPTIVE FILLER MATERIAL. CORRUGATED CARDBOARD IS NOT AN ACCEPTABLE FILLER MATERIAL.

D. MIRROR-UNIT HANGERS: PROVIDE MIRROR-UNIT MOUNTING SYSTEM THAT PERMITS RIGID, TAMPER- AND THEFT-RESISTANT INSTALLATION, AS FOLLOWS:

1. ONE-PIECE, GALVANIZED STEEL, WALL-HANGER DEVICE WITH SPRING-ACTION LOCKING MECHANISM TO HOLD MIRROR UNIT IN POSITION WITH NO EXPOSED SCREWS OR BOLTS.

2. HEAVY-DUTY WALL BRACKETS OF GALVANIZED STEEL, EQUIPPED WITH CONCEALED LOCKING DEVICES REQUIRING A SPECIAL TOOL TO REMOVE.

E. KEYS: PROVIDE UNIVERSAL KEYS FOR INTERNAL ACCESS TO ACCESSORIES FOR SERVICING AND RESUPPLYING. PROVIDE MINIMUM OF SIX KEYS TO CONSTRUCTION MANAGER.

PART 3 - EXECUTION

3.01 INSTALLATION

A. INSTALL ACCESSORIES ACCORDING TO MANUFACTURERS' WRITTEN INSTRUCTIONS, USING FASTENERS APPROPRIATE TO SUBSTRATE INDICATED AND RECOMMENDED BY UNIT MANUFACTURER. INSTALL UNITS LEVEL, PLUMB, AND FIRMLY ANCHORED IN LOCATIONS AND AT HEIGHTS INDICATED.

B. SECURE MIRRORS TO WALLS IN CONCEALED, TAMPER-RESISTANT MANNER WITH

SPECIAL HANGERS, TOGGLE BOLTS, OR SCREWS. SET UNITS LEVEL, PLUMB, AND SQUARE AT LOCATIONS INDICATED, ACCORDING TO MANUFACTURER'S WRITTEN INSTRUCTIONS FOR SUBSTRATE INDICATED.

C. INSTALL GRAB BARS TO WITHSTAND A DOWNWARD LOAD OF AT LEAST 1112 N (250 LBF), WHEN TESTED ACCORDING TO METHOD IN ASTM F 446.

3.02 ADJUSTING AND CLEANING

A. ADJUST ACCESSORIES FOR UNENCUMBERED, SMOOTH OPERATION AND VERIFY THAT MECHANISMS FUNCTION PROPERLY. REPLACE DAMAGED OR DEFECTIVE ITEMS.

B. REMOVE TEMPORARY LABELS AND PROTECTIVE COATINGS.

C. CLEAN AND POLISH EXPOSED SURFACES ACCORDING TO MANUFACTURER'S WRITTEN RECOMMENDATIONS.

END OF SECTION

SECTION 10 44 16

PORTABLE FIRE EXTINGUISHERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. CONSTRUCTION DRAWINGS, SPECIFICATIONS AND PROVISIONS OF THE CONTRACT INCLUDING GENERAL AND SUPPLEMENTAL CONDITIONS AND OTHER DIVISION 01 SPECIFICATION SECTIONS, ARE HEREBY MADE A PART OF THIS SECTION AS FULLY AND COMPLETELY AS IF REPEATED HEREIN.

1.02 ITEMS REQUIRED BUT NOT SPECIFIED

A. IF AN ITEM OR MATERIAL OF THIS TRADE IS INDICATED ON THE DRAWINGS BUT NOT SPECIFICALLY LISTED IN THIS SECTION, PROVIDE SUCH ITEM OR MATERIAL AT A STANDARD OF QUALITY EQUAL TO THE STANDARD ESTABLISHED FOR THE BALANCE OF THE WORK SPECIFIED, IN ACCORDANCE WITH THE ARCHITECT'S INTERPRETATION

1.03 EXECUTION CORRELATION AND INTENT

A. IN CASE OF AN INCONSISTENCY BETWEEN DRAWINGS AND SPECIFICATIONS OR WITHIN EITHER DOCUMENT NOT CLARIFIED BY ADDENDUM, THE BETTER QUALITY OR GREATER QUANTITY OF WORK IS TO BE PROVIDED, IN ACCORDANCE WITH THE ARCHITECT'S INTERPRETATION

1.04 SUMMARY

A. THIS SECTION INCLUDES THE FOLLOWING:

1. PORTABLE FIRE EXTINGUISHERS AND MOUNTING BRACKETS.

1.05 SUBMITTALS

A. PRODUCT DATA: INCLUDE CONSTRUCTION DETAILS, MATERIAL DESCRIPTIONS, DIMENSIONS OF INDIVIDUAL COMPONENTS AND PROFILES, AND FINISHES FOR FIRE-PROTECTION CABINETS.

1. FIRE EXTINGUISHERS: INCLUDE RATING AND CLASSIFICATION.

B. MAINTENANCE DATA: FOR FIRE EXTINGUISHERS TO INCLUDE IN MAINTENANCE MANUALS.

1.06 QUALITY ASSURANCE

A. SOURCE LIMITATIONS: OBTAIN FIRE EXTINGUISHERS AND FIRE-PROTECTION CABINETS THROUGH ONE SOURCE FROM A SINGLE MANUFACTURER.

B. NFPA COMPLIANCE: FABRICATE AND LABEL FIRE EXTINGUISHERS TO COMPLY WITH NFPA 10, "PORTABLE FIRE EXTINGUISHERS."

C. FIRE EXTINGUISHERS: LISTED AND LABELED FOR TYPE, RATING, AND CLASSIFICATION BY AN INDEPENDENT TESTING AGENCY ACCEPTABLE TO AUTHORITIES HAVING JURISDICTION.

1.07 COORDINATION

A. COORDINATE SIZE AND CAPACITY OF FIRE EXTINGUISHERS INDICATED ARE ACCOMMODATED.

SECTION 10 44 16

PORTABLE FIRE EXTINGUISHERS

1.08 WARRANTY

A. SPECIAL WARRANTY: MANUFACTURER'S STANDARD FORM IN WHICH MANUFACTURER AGREES TO REPAIR OR REPLACE COMPONENTS OF PORTABLE FIRE EXTINGUISHERS THAT FAIL IN MATERIALS OR WORKMANSHIP WITHIN SPECIFIED WARRANTY PERIOD.

1. FAILURES INCLUDE, BUT ARE NOT LIMITED TO, THE FOLLOWING:

A. FAILURE OF HYDROSTATIC TEST ACCORDING TO NFPA 10.

B. FAULTY OPERATION OF VALVES OR RELEASE LEVERS.

2. WARRANTY PERIOD: SIX YEARS FROM DATE OF SUBSTANTIAL COMPLETION.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. AVAILABLE MANUFACTURERS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, MANUFACTURERS OFFERING PRODUCTS THAT MAY BE INCORPORATED INTO THE WORK INCLUDE, BUT ARE NOT LIMITED TO, MANUFACTURERS SPECIFIED.

2.02 PORTABLE FIRE EXTINGUISHERS

A. AVAILABLE MANUFACTURERS:

1. ANSUL INCORPORATED.

2. JL INDUSTRIES, INC.

3. KIDDE FYRNETICS.

4. LARSEN'S MANUFACTURING COMPANY.

B. GENERAL: PROVIDE FIRE EXTINGUISHERS OF TYPE, SIZE, AND CAPACITY FOR EACH MOUNTING BRACKET INDICATED.

C. MULTIPURPOSE DRY-CHEMICAL OR WATER TYPE IN STEEL CONTAINER: UL-RATED AS DETERMINED FOR USE, MINIMUM 10-A:10-B:C, 4.5-KG (10-LB)

2.03 MOUNTING BRACKETS

A. AVAILABLE MANUFACTURERS:

1. ANSUL INCORPORATED.

2. JL INDUSTRIES, INC.

3. LARSEN'S MANUFACTURING COMPANY.

B. MOUNTING BRACKETS: MANUFACTURER'S STANDARD STEEL, DESIGNED TO SECURE FIRE EXTINGUISHER TO WALL OR STRUCTURE, OF SIZES REQUIRED FOR TYPES AND CAPACITIES OF FIRE EXTINGUISHERS INDICATED, WITH PLATED OR BAKED-ENAMEL FINISH.

SECTION 10 44 16

PORTABLE FIRE EXTINGUISHERS

1. COLOR: RED.

C. IDENTIFICATION: LETTERING COMPLYING WITH AUTHORITIES HAVING JURISDICTION FOR LETTER STYLE, SIZE, SPACING, AND LOCATION. LOCATE AS INDICATED BY ARCHITECT.

1. IDENTIFY BRACKET-MOUNTED FIRE EXTINGUISHERS WITH THE WORDS "FIRE EXTINGUISHER" IN RED LETTER DECALS APPLIED TO MOUNTING SURFACE.

A. ORIENTATION: VERTICAL

2.04 CABINETS

A. AVAILABLE MANUFACTURERS:

1. ANSUL INCORPORATED.

2. JL INDUSTRIES, INC.

3. LARSEN'S MANUFACTURING COMPANY.

B. CABINETS: WALL MOUNTED STAINLESS STEEL OR FIBERGLASS CABINET ENCLOSRE TO BE USED IN AREAS DESIGNATED AS PROCESS PORTIONS OF THE BUILDING.

1. COLOR: RED.

C. IDENTIFICATION: LETTERING COMPLYING WITH AUTHORITIES HAVING JURISDICTION FOR LETTER STYLE, SIZE, SPACING, AND LOCATION. LOCATE AS INDICATED BY ARCHITECT.

1. IDENTIFY CABINET-INSTALLED FIRE EXTINGUISHERS WITH THE WORDS "FIRE EXTINGUISHER" IN RED LETTER DECALS APPLIED TO MOUNTING SURFACE.

A. ORIENTATION: VERTICAL

2.05 FINISHES, GENERAL

A. COMPLY WITH NAAMM'S "METAL FINISHES MANUAL FOR ARCHITECTURAL AND METAL PRODUCTS" FOR RECOMMENDATIONS FOR APPLYING AND DESIGNATING FINISHES.

B. PROTECT MECHANICAL FINISHES ON EXPOSED SURFACES FROM DAMAGE BY APPLYING A STRIPPABLE, TEMPORARY PROTECTIVE COVERING BEFORE SHIPPING.

C. APPEARANCE OF FINISHED WORK: VARIATIONS IN APPEARANCE OF ABUTTING OR ADJACENT PIECES ARE ACCEPTABLE IF THEY ARE WITHIN ONE-HALF OF THE RANGE OF APPROVED SAMPLES. NOTICEABLE VARIATIONS IN THE SAME PIECE ARE NOT ACCEPTABLE. VARIATIONS IN APPEARANCE OF OTHER COMPONENTS ARE ACCEPTABLE IF THEY ARE WITHIN THE RANGE OF APPROVED SAMPLES AND ARE ASSEMBLED OR INSTALLED TO MINIMIZE CONTRAST.

2.06 STEEL FINISHES

A. SURFACE PREPARATION: CLEAN SURFACES OF DIRT, OIL, GREASE, MILL SCALE, RUST, AND OTHER CONTAMINANTS THAT COULD IMPAIR PAINT BOND USING MANUFACTURER'S STANDARD METHODS.

B. BAKED-ENAMEL FINISH: IMMEDIATELY AFTER CLEANING AND PRETREATING, APPLY MANUFACTURER'S STANDARD TWO-COAT, BAKED-ENAMEL FINISH CONSISTING OF PRIME COAT AND THERMOSETTING TOPCOAT. COMPLY WITH PAINT MANUFACTURER'S WRITTEN INSTRUCTIONS FOR APPLYING AND BAKING TO ACHIEVE A MINIMUM DRY FILM THICKNESS OF 0.05 MM (2 MILS).

PART 3 - EXECUTION

3.01 EXAMINATION

A. EXAMINE FIRE EXTINGUISHERS FOR PROPER CHARGING AND TAGGING.

1. REMOVE AND REPLACE DAMAGED, DEFECTIVE, OR UNDERCHARGED UNITS.

B. PROCEED WITH INSTALLATION ONLY AFTER UNSATISFACTORY CONDITIONS HAVE BEEN CORRECTED.

3.02 INSTALLATION

A. GENERAL: CONTRACTOR TO RETAIN THE SEVICES OF A LICENSED FIRE PROTECTION COMPANY TO CALCULATE THE NUMBER, TYPE, AND LOCATION OF PORTABLE FIRE EXTINGUISHERS.

B. FASTEN MOUNTING BRACKETS AND CABINETS TO SURFACES, SQUARE AND PLUMB, AT LOCATIONS INDICATED.

C. IDENTIFICATION: APPLY VINYL LETTERING AT LOCATIONS INDICATED.

3.03 ADJUSTING AND CLEANING

A. REMOVE TEMPORARY PROTECTIVE COVERINGS AND STRIPPABLE FILMS, IF ANY, AS FIRE-PROTECTION SPECIALTIES ARE INSTALLED, UNLESS OTHERWISE INDICATED IN MANUFACTURER'S WRITTEN INSTALLATION INSTRUCTIONS.

END OF SECTION

SECTION 10 51 13

METAL LOCKERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. CONSTRUCTION DRAWINGS, SPECIFICATIONS AND PROVISIONS OF THE CONTRACT INCLUDING GENERAL AND SUPPLEMENTAL CONDITIONS AND OTHER DIVISION 01 SPECIFICATION SECTIONS, ARE HEREBY MADE A PART OF THIS SECTION AS FULLY AND COMPLETELY AS IF REPEATED HEREIN.

1.02 ITEMS REQUIRED BUT NOT SPECIFIED

A. IF AN ITEM OR MATERIAL OF THIS TRADE IS INDICATED ON THE DRAWINGS BUT NOT SPECIFICALLY LISTED IN THIS SECTION, PROVIDE SUCH ITEM OR MATERIAL AT A STANDARD OF QUALITY EQUAL TO THE STANDARD ESTABLISHED FOR THE BALANCE OF THE WORK SPECIFIED, IN ACCORDANCE WITH THE ARCHITECT'S INTERPRETATION.

1.03 EXECUTION, CORRELATION AND INTENT

A. IN CASE OF AN INCONSISTENCY BETWEEN DRAWINGS AND SPECIFICATIONS OR WITHIN EITHER DOCUMENT NOT CLARIFIED BY ADDENDUM, THE BETTER QUALITY OR GREATER QUANTITY OF WORK IS TO BE PROVIDED, IN ACCORDANCE WITH THE ARCHITECT'S INTERPRETATION

1.04 SUMMARY

A. THIS SECTION INCLUDES THE FOLLOWING:

1. WELDED METAL LOCKERS. DOUBLE-TIER ON POURED CONCRETE BASES.

2. LOCKER BENCHES.

1.05 DEFINITIONS

A. UNCOATED STEEL SHEET THICKNESSES: INDICATED AS THE MINIMUM THICKNESSES.

1.06 SUBMITTALS

A. PRODUCT DATA: INCLUDE CONSTRUCTION DETAILS, MATERIAL DESCRIPTIONS, DIMENSIONS OF INDIVIDUAL COMPONENTS AND PROFILES, AND FINISHES FOR EACH TYPE OF METAL LOCKER.

B. SHOP DRAWINGS: INCLUDE PLANS, ELEVATIONS, SECTIONS, DETAILS, AND ATTACHMENTS TO OTHER WORK.

1. SHOW BASE, SLOPING TOPS, FILLER PANELS AND OTHER ACCESSORIES.

2. INCLUDE LOCKER IDENTIFICATION SYSTEM.

C. SAMPLES FOR INITIAL SELECTION: FOR UNITS WITH FACTORY-APPLIED COLOR FINISHES.

D. QUALIFICATION DATA: FOR INSTALLER.

E. MAINTENANCE DATA: FOR ADJUSTING, REPAIRING, AND REPLACING LOCKER DOORS AND LATCHING MECHANISMS TO INCLUDE IN MAINTENANCE MANUALS.

F. WARRANTY: SPECIAL WARRANTY SPECIFIED IN THIS SECTION.

SECTION 10 51 13

METAL LOCKERS

1.07 QUALITY ASSURANCE

A. INSTALLER QUALIFICATIONS: AN AUTHORIZED REPRESENTATIVE OF METAL LOCKER MANUFACTURER FOR INSTALLATION AND MAINTENANCE OF UNITS REQUIRED FOR THIS PROJECT.

B. SOURCE LIMITATIONS: OBTAIN METAL LOCKERS AND ACCESSORIES THROUGH ONE SOURCE FROM A SINGLE MANUFACTURER.

C. REGULATORY REQUIREMENTS: WHERE METAL LOCKERS ARE INDICATED TO COMPLY WITH ACCESSIBILITY REQUIREMENTS, COMPLY WITH "AMERICANS WITH DISABILITIES ACT (ADA), ACCESSIBILITY GUIDELINES FOR BUILDINGS AND FACILITIES (ADAAG).", AND THE CURRENT ACCESSIBILITY REQUIREMENTS OF THE AUTHORITY HAVING JURISDICTION.

1. PROVIDE HARDWARE THAT DOES NOT REQUIRE TIGHT GRASPING, PINCHING, OR TWISTING OF THE WRIST, AND THAT OPERATES WITH A FORCE OF NOT MORE THAN 5 LBF (22.2 N).

D. CONSTRUCTION REQUIREMENTS, DOOR ASSEMBLY: PROVIDE METAL DOOR ASSEMBLIES CONFIGURED AND TESTED FOR APPLICABLE CRITERIA IN ACCORDANCE WITH ASTM F 476-1984(R96) FOR MINIMUM X5 CLASSIFICATION FOR GRADE 10 LOCKERS.

1.08 DELIVERY, STORAGE, AND HANDLING

A. DO NOT DELIVER METAL LOCKERS UNTIL SPACES TO RECEIVE THEM ARE CLEAN, DRY, AND READY FOR METAL LOCKER INSTALLATION.

1.09 PROJECT CONDITIONS

A. FIELD MEASUREMENTS: VERIFY THE FOLLOWING BY FIELD MEASUREMENTS BEFORE FABRICATION AND INDICATE MEASUREMENTS ON SHOP DRAWINGS:

1. CONCEALED FRAMING, BLOCKING, AND REINFORCEMENTS THAT SUPPORT METAL LOCKERS BEFORE THEY ARE ENCLOSED.

1.10 COORDINATION

A. COORDINATE SIZES AND LOCATIONS OF FRAMING, BLOCKING, FURRING, REINFORCEMENTS, AND OTHER RELATED UNITS OF WORK SPECIFIED IN OTHER SECTIONS TO ENSURE THAT METAL LOCKERS CAN BE SUPPORTED AND INSTALLED AS INDICATED.

1.11 WARRANTY

A. SPECIAL WARRANTY: MANUFACTURER'S STANDARD FORM IN WHICH MANUFACTURER AGREES TO REPAIR OR REPLACE COMPONENTS OF METAL LOCKERS THAT FAIL IN MATERIALS OR WORKMANSHIP, EXCLUDING FINISH, WITHIN SPECIFIED WARRANTY PERIOD.

1. FAILURES INCLUDE, BUT ARE NOT LIMITED TO, THE FOLLOWING:

A. STRUCTURAL FAILURES.

B. FAULTY OPERATION OF LATCHES AND OTHER DOOR HARDWARE.

2. DAMAGE FROM DELIBERATE DESTRUCTION AND VANDALISM IS EXCLUDED.

3. WARRANTY PERIOD FOR WELDED METAL LOCKERS: TEN YEARS FROM DATE OF

SUBSTANTIAL COMPLETION.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. IN OTHER PART 2 ARTICLES WHERE TITLES BELOW INTRODUCE LISTS, THE FOLLOWING REQUIREMENTS APPLY TO PRODUCT SELECTION:

1. AVAILABLE PRODUCTS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PRODUCTS THAT MAY BE INCORPORATED INTO THE WORK INCLUDE, BUT ARE NOT LIMITED TO, PRODUCTS SPECIFIED.

2.02 MATERIALS

A. COLD-ROLLED STEEL SHEET: ASTM A 1008, COMMERCIAL STEEL (CS) TYPE B, SUITABLE FOR EXPOSED APPLICATIONS.

B. FASTENERS: ZINC- OR NICKEL-PLATED STEEL, SLOTLESS-TYPE EXPOSED BOLT HEADS, AND SELF-LOCKING NUTS OR LOCK WASHERS FOR NUTS ON MOVING PARTS.

C. ANCHORS: SELECT MATERIAL, TYPE, SIZE, AND FINISH REQUIRED FOR SECURE ANCHORAGE TO EACH SUBSTRATE.

1. PROVIDE NONFERROUS-METAL OR HOT-DIP GALVANIZED ANCHORS AND INSERTS FOR CORROSION RESISTANCE.

2. PROVIDE TOOTHED-STEEL OR LEAD EXPANSION SLEEVES FOR DRILLED-IN-PLACE ANCHORS.

2.03 ALL-WELDED, METAL LOCKERS

A. MANUFACTURERS:

1. REPUBLIC STORAGE SYSTEMS

2. LYON, INC.

3. ASI STORAGE SOLUTIONS, INC.

4. ART METAL PRODUCTS, DIV. OF FORT KNOX STORAGE CO.

5. PENCO PRODUCTS, INC., SUBSIDIARY OF VESPER CORPORATION.

B. LOCKER ARRANGEMENT: DOUBLE TIER.

C. BODY: ASSEMBLED BY WELDING BODY COMPONENTS TOGETHER. FABRICATE FROM UNPERFORATED, COLD-ROLLED STEEL SHEET WITH THICKNESSES AS FOLLOWS:

1. TOPS, BOTTOMS, AND SIDES: 16 GAUGE.

2. BACKS: 18 GAUGE.

D. FRAMES: CHANNEL FORMED; FABRICATED FROM 16 GAUGE, COLD-ROLLED STEEL

SHEET; LAPPED AND FACTORY WELDED AT CORNERS; WITH TOP AND BOTTOM MAIN FRAMES FACTORY WELDED INTO VERTICAL MAIN FRAMES. FORM CONTINUOUS, INTEGRAL DOOR STRIKE FULL HEIGHT ON VERTICAL MAIN FRAMES.

1. CROSS FRAMES BETWEEN TIERS: CHANNEL FORMED AND FABRICATED FROM SAME MATERIAL AS MAIN FRAMES; WELDED TO VERTICAL MAIN FRAMES.

E. DOORS: ONE-PIECE; FABRICATED FROM 14 GAUGE, COLD-ROLLED STEEL SHEET; FORMED INTO CHANNEL SHAPE WITH DOUBLE BEND AT VERTICAL EDGES, AND WITH RIGHT-ANGLE SINGLE BEND AT HORIZONTAL EDGES.

1. REINFORCEMENT: MANUFACTURER'S STANDARD REINFORCING ANGLES, CHANNELS, OR STIFFENERS WELDED TO INNER FACE OF DOORS.

2. DOOR STYLE: VENTED PANEL AS FOLLOWS:

A. VENTED OR SOLID DOOR AS SELECTED BY OWNER.

F. HINGES: SELF-CLOSING; WELDED TO DOOR AND ATTACHED TO DOOR FRAME WITH NOT LESS THAN 2 FACTORY-INSTALLED RIVETS PER HINGE THAT ARE COMPLETELY CONCEALED AND TAMPER RESISTANT WHEN DOOR IS CLOSED; FABRICATED TO SWING 180 DEGREES.

1. CONTINUOUS HINGES: MANUFACTURER'S STANDARD, STEEL CONTINUOUS HINGE.

2. HINGES: MANUFACTURER'S STANDARD, STEEL CONTINUOUS OR KNUCKLE TYPE.

G. RECESSED DOOR HANDLE AND LATCH: STAINLESS-STEEL CUP WITH INTEGRAL DOOR PULL, RECESSED SO LOCKING DEVICE DOES NOT PROTRUDE BEYOND FACE OF DOOR; PRY RESISTANT.

1. MULTIPOINT LATCHING: FINGER-LIFT LATCH CONTROL DESIGNED FOR USE WITH PADLOCKS; POSITIVE AUTOMATIC AND PRELOCKING.

A. LATCH HOOKS: EQUIP DOORS WITH 2 LATCH HOOKS; FABRICATED FROM MINIMUM 0.1116-INCH- (2.8-MM-) THICK STEEL; WELDED TO FULL-HEIGHT DOOR STRIKES; WITH RESILIENT SILENCER ON EACH LATCH HOOK.

B. LATCHING MECHANISM: MANUFACTURER'S STANDARD RATTLE-FREE LATCHING MECHANISM AND MOVING COMPONENTS ISOLATED TO PREVENT METAL-TO-METAL CONTACT AND INCORPORATING A PRELOCKING DEVICE THAT ALLOWS LOCKER DOOR TO BE LOCKED WHILE DOOR IS OPEN AND THEN CLOSED WITHOUT UNLOCKING OR DAMAGING LOCK OR LATCHING MECHANISM.

H. EQUIPMENT: EQUIP EACH METAL LOCKER WITH THE FOLLOWING, UNLESS OTHERWISE INDICATED:

1. COAT RODS: FOR EACH COMPARTMENT OF DOUBLE-TIER METAL LOCKERS.

I. ACCESSORIES:

1. CONTINUOUS SLOPING TOPS: FABRICATED FROM MINIMUM 0.0428-INCH- (1.1-MM-) THICK, COLD-ROLLED STEEL SHEET; APPROXIMATELY 20-DEGREE PITCH.

A. CLOSURES: VERTICAL-END TYPE.

2. FILLER PANELS: FABRICATED FROM 0.0428-INCH- (1.1-MM-) THICK, COLD-ROLLED STEEL SHEET.

J. FINISH: BAKED ENAMEL.

1. COLOR: SELECTED BY OWNER.

2.04 LOCKER BENCHES

A. GENERAL: PROVIDE LOCKER BENCHES FABRICATED BY SAME MANUFACTURER AS METAL LOCKERS.

B. BENCH TOPS: MANUFACTURER'S STANDARD 1-PIECE UNITS, OF THE FOLLOWING MATERIAL, MINIMUM WIDTH AS INDICATED ON DRAWINGS BY 1-1/4 INCHES (32 MM) THICK, WITH ROUNDED CORNERS AND EDGES:

1. ALUMINUM OR STAINLESS STEEL.

C. FIXED PEDESTALS: MANUFACTURER'S STANDARD SUPPORTS, WITH PREDRILLED FASTENER HOLES FOR ATTACHING BENCH TOP AND ANCHORING TO FLOOR, COMPLETE WITH FASTENERS AND ANCHORS, AND AS FOLLOWS:

1. TUBULAR STEEL.

2.05 FABRICATION

A. GENERAL: FABRICATE METAL LOCKERS SQUARE, RIGID, AND WITHOUT WARP; WITH METAL FACES FLAT AND FREE OF DENTS OR DISTORTION. MAKE EXPOSED METAL EDGES FREE OF SHARP EDGES AND BURRS, AND SAFE TO TOUCH.

1. FORM BODY PANELS, DOORS, SHELVES, AND ACCESSORIES FROM ONE-PIECE STEEL SHEET, UNLESS OTHERWISE INDICATED.

2. PROVIDE FASTENERS, FILLER PLATES, SUPPORTS, CLIPS, AND CLOSURES AS REQUIRED FOR A COMPLETE INSTALLATION.

B. UNIT PRINCIPLE: FABRICATE EACH METAL LOCKER WITH AN INDIVIDUAL DOOR AND FRAME; INDIVIDUAL TOP, BOTTOM, AND BACK; AND COMMON INTERMEDIATE UPRIGHTS SEPARATING COMPARTMENTS.

C. ALL-WELDED CONSTRUCTION: FACTORY PREASSEMBLE METAL LOCKERS BY WELDING ALL JOINTS, SEAMS, AND CONNECTIONS, WITH NO BOLTS, NUTS, SCREWS, OR RIVETS USED IN ASSEMBLY OF MAIN LOCKER GROUPS. FACTORY WELD MAIN LOCKER GROUPS INTO ONE-PIECE STRUCTURES. GRIND EXPOSED WELDS FLUSH.

D. COAT RODS: FABRICATED FROM 3/4-INCH- (19-MM-) DIAMETER STEEL; CHROME FINISHED.

E. CONTINUOUS BASE: FORMED INTO CHANNEL OR Z PROFILE FOR STIFFNESS, AND FABRICATED IN LENGTHS AS LONG AS PRACTICABLE TO ENCLOSE BASE AND BASE ENDS OF METAL LOCKERS; FINISHED TO MATCH LOCKERS.

F. CONTINUOUS SLOPING TOPS: FABRICATED IN LENGTHS AS LONG AS PRACTICABLE, WITHOUT VISIBLE FASTENERS AT SPLICE LOCATIONS; FINISHED TO MATCH LOCKERS.

G. FINISHED END PANELS: DESIGNED FOR CONCEALING UNUSED PENETRATIONS AND FASTENERS, EXCEPT FOR PERIMETER FASTENERS, AT EXPOSED ENDS OF NONRECESSED METAL LOCKERS; FINISHED TO MATCH LOCKERS.

2.06 STEEL SHEET FINISHES

SECTION 10 51 13

METAL LOCKERS

A. GENERAL: COMPLY WITH NAAMM'S "METAL FINISHES MANUAL FOR ARCHITECTURAL AND METAL PRODUCTS" FOR RECOMMENDATIONS FOR APPLYING AND DESIGNATING FINISHES.

B. FACTORY FINISH STEEL SURFACES AND ACCESSORIES EXCEPT STAINLESS-STEEL AND CHROME-PLATED SURFACES.

C. SURFACE PREPARATION: CLEAN SURFACES OF DIRT, OIL, GREASE, MILL SCALE, RUST, AND OTHER CONTAMINANTS THAT COULD IMPAIR PAINT BOND. USE MANUFACTURER'S STANDARD METHODS.

D. BAKED-ENAMEL FINISH: IMMEDIATELY AFTER CLEANING, PRETREATING, AND PHOSPHATIZING, APPLY MANUFACTURER'S STANDARD THERMOSETTING BAKED-ENAMEL FINISH. COMPLY WITH PAINT MANUFACTURER'S WRITTEN INSTRUCTIONS FOR APPLICATION, BAKING, AND MINIMUM DRY FILM THICKNESS.

PART 3 - EXECUTION

3.01 EXAMINATION

A. EXAMINE WALLS, FLOORS, AND SUPPORT BASES, WITH INSTALLER PRESENT, FOR COMPLIANCE WITH REQUIREMENTS FOR INSTALLATION TOLERANCES AND OTHER CONDITIONS AFFECTING PERFORMANCE OF WORK.

B. PROCEED WITH INSTALLATION ONLY AFTER UNSATISFACTORY CONDITIONS HAVE BEEN CORRECTED.

3.02 INSTALLATION

A. GENERAL: INSTALL LEVEL, PLUMB, AND TRUE; SHIM AS REQUIRED, USING CONCEALED SHIMS.

1. ANCHOR LOCKER RUNS AT ENDS AND AT INTERVALS RECOMMENDED BY MANUFACTURER, BUT NOT MORE THAN 910 MM (36 INCHES) O.C. INSTALL ANCHORS THROUGH BACKUP REINFORCING PLATES, CHANNELS, OR BLOCKING AS REQUIRED TO PREVENT METAL DISTORTION, USING CONCEALED FASTENERS.

B. ALL-WELDED METAL LOCKERS: CONNECT GROUPS OF ALL-WELDED METAL LOCKERS TOGETHER WITH STANDARD FASTENERS, WITH NO EXPOSED FASTENERS ON FACE FRAMES.

C. EQUIPMENT AND ACCESSORIES: FIT EXPOSED CONNECTIONS OF TRIM, FILLERS, AND CLOSURES ACCURATELY TOGETHER TO FORM TIGHT, HAIRLINE JOINTS, WITH CONCEALED FASTENERS AND SPLICE PLATES.

1. ATTACH SLOPING TOP UNITS TO METAL LOCKERS, WITH CLOSURES AT EXPOSED ENDS. ATTACH FINISHED END PANELS WITH FASTENERS ONLY AT PERIMETER TO CONCEAL EXPOSED ENDS OF NONRECESSED METAL LOCKERS.

3.03 ADJUSTING, CLEANING, AND PROTECTION

A. CLEAN, LUBRICATE, AND ADJUST HARDWARE. ADJUST DOORS AND LATCHES TO OPERATE EASILY WITHOUT BINDING

B. PROTECT METAL LOCKERS FROM DAMAGE, ABUSE, DUST, DIRT, STAIN, OR PAINT. DO NOT PERMIT METAL LOCKER USE DURING CONSTRUCTION.

C. TOUCH UP MARRED FINISHES, OR REPLACE METAL LOCKERS THAT CANNOT BE RESTORED TO FACTORY-FINISHED APPEARANCE. USE ONLY MATERIALS AND PROCEDURES RECOMMENDED OR FURNISHED BY METAL LOCKER MANUFACTURER.

END OF SECTION

SECTION 11 13 16

DOCK SHELTERS & SEALS

PART 1- GENERAL

1.1 SUMMARY

A. WORK INCLUDED:

1. FACTORY ASSEMBLED UNIT WITH NECESSARY MOUNTING HARDWARE.

2. INSTALLATION AND OWNER'S MANUAL

B. RELATED SECTIONS:

1. SECTION 11 13 19.13 - DOCK LEVELERS

2. SECTION 11 13 19.13 - TRAILER RESTRAINTS.

3. SECTION 11 13 13 - DOCK BUMPERS.

C. REFERENCES:

1. GOVERNMENT TEST METHOD STANDARD NO.191A FOR FABRIC.

D. DESCRIPTION (APPLICATION)

1. DOOR SIZE - REFER TO DRAWINGS AND DOOR SCHEDULE.

2. DOCK HEIGHT - REFER TO CIVIL DRAWINGS.

3. BUMPER - PER MANUFACTURER'S RECOMMENDATIONS.

4. DRIVE APPROACH - REFER TO CIVIL DRAWINGS.

5. SERVICE RANGE - REFER TO DRAWINGS AND CONFIRM WITH OWNER VEHICLE INFORMATION.

1.2 SUBMITTALS

A. GENERAL: SUBMIT IN ACCORDANCE WITH SECTION 01 33 00.

B. PRODUCT DATA: SUBMIT PRODUCT DATA FOR DOCK LEVELER EQUIPMENT.

C. MANUFACTURES INSTALLATION INSTRUCTIONS.

D. SUBMIT DIMENSIONAL DRAWING.

E. SUBMIT SPECIFICATION SHEET.

1.3 QUALITY ASSURANCE

A. SINGLE SOURCE RESPONSIBILITY: EACH COMPONENT OF DOCK LEVELER IS REQUIRED TO BE FROM SAME MANUFACTURER.

B. MANUFACTURER QUALIFICATIONS: COMPANY SPECIALIZING IN MANUFACTURING PRODUCTS SPECIFIED IN THIS SECTION WITH MINIMUM TEN YEARS DOCUMENTED EXPERIENCE.

C. INSTALLER QUALIFICATIONS: APPROVED IN WRITING BY MANUFACTURER WITH DOCUMENTED EXPERIENCE ON AT LEAST FIVE PROJECTS OF SIMILAR NATURE IN PAST FIVE YEARS.

D. MANUFACTURER TO HOLD CURRENT ISO 9001 CERTIFICATION.

PART 2 - PRODUCTS

2.1 MANUFACTURES

A. ACCEPTABLE MANUFACTURES:

1. 4FRONT ENGINEERED SOLUTIONS INC.

2. ARCHITECT APPROVED EQUAL

B. ACCEPTABLE MODEL

1. KELLEY MODEL DSS DOCK SEAL

2. ARCHITECT APPROVED EQUAL

C. GENERAL:

1. COMPONENTS: EACH UNIT SHALL CONSIST OF (2) TWO SIDE PADS AND ONE HEAD PAD.

2. SIDE PAD BEVEL: 12” BACK/15” FRONT; HAVING A LENGTH NOT LESS THAN THE DOOR HEIGHT.

3. DOCK SEAL PROTECTION: 10” (STANDARD).

4. FABRIC:

A. THE UNIT BASE FABRIC SHALL BE 40 OZ. VINYL.

B. BASE FABRIC COLOR: BLACK - STANDARD.

C. WEAR PLEAT FABRIC: 40 OZ. VINYL;

D. WEAR PLEAT FABRIC COLOR: BLACK - STANDARD.

E. SIDE PAD REINFORCING FABRIC: NONE.

5. OPTIONS:

A. FIRE RETARDANT: NONE

B. AQUASHIELD HEADER OPTION: NONE

6. UNIT CONSTRUCTION: THE FRAMING SHALL BE ROLLE-FORMED GALVANIZED STEEL. THE BASE FABRIC SHALL ENCLOSE A POLYURETHANE FOAM CORE, WHICH IS TO BE CHEMICALLY BONDED TO THE STEEL FRAME. THE COVER SHALL BE DOUBLE HEMMED ON ALL EDGE AND FASTENED TO THE SIDE LEG OF THE STEEL FRAMING WITH TEK SCREWS INSERTED THROUGH LOAD SPREADING WASHERS. THE UNIT SHALL ALSO INCLUDE FULL LENGTH YELLOW GUIDE

STRIPES.

7. WARRANTY: UNIT SHALL INCLUDE THE MANUFACTURES STANDARD (5) YEAR FRAME WARRANTY AND A (1) ONE YEAR WARRANTY AGAINST DEFECTS IN MATERIALS AND WORKMANSHIP ON THE REMAINING COMPONENTS.

PART 3 - EXECUTION

3.1 INSTALLATION

1. INSTALL IN ACCORDANCE WITH MANUFACTURE'S INSTRUCTIONS.

2. CAULK BETWEEN THE BUILDING WALL AND UNIT.

END OF SECTION

SECTION 11 13 19

DOCK LEVELERS

PART 1 - GENERAL

1.01 SECTION INCLUDES:

A. MANUALLY OPERATED MECHANICAL DOCK LEVELERS.

B. TIRE LAMINATED DOCK BUMPERS.

C. SINGLE/DUAL POINT DOCK LEVELER MASTER CONTROL PANEL.

1.02 RELATED SECTIONS

A. SECTION 08 36 13 - OVERHEAD SECTIONAL DOORS

B. SECTION 11 13 20 - TRUCK RESTRAINING DEVICES

C. SECTION 11 13 26 - DOCK LIGHTS

D. SECTION 11 13 16 - DOCK SHELTERS AND SEALS

E. SECTION 16190 - HANGERS AND SUPPORTS

F. SECTION 16191 - VIBRATION ISOLATION & SEISMIC RESTRAINTS

1.03 REFERENCES

A. COMPLY WITH APPLICABLE REQUIREMENTS OF THE FOLLOWING STANDARDS AND THOSE OTHERS REFERENCED IN THIS SECTION. WHERE THESE STANDARDS CONFLICT WITH OTHER SPECIFIED REQUIREMENTS, THE MOST RESTRICTIVE REQUIREMENTS SHALL GOVERN.

1. BUILDING CODE OF THE PROJECT JURISDICTION.

2. ALL APPLICABLE FEDERAL, STATE AND MUNICIPAL CODES, LAWS AND REGULATIONS FOR DOCK EQUIPMENT REQUIREMENTS.

1.04 SUBMITTALS

A. SUBMIT 5 COPIES OF LARGE SCALE SHOP DRAWING, INDICATING GENERAL ARRANGEMENT OF ALL DOCK EQUIPMENT AND SHOWING ALL COMPONENT LOCATIONS, DIMENSIONS, EMBEDDED PLATES/ANGLES, AND OTHER REQUIREMENTS.

B. SUBMIT 5 COPIES OF ALL TECHNICAL DATA AND DRAWINGS FOR DOCK BUMPERS.

C. SUBMIT 5 COPIES OF MANUFACTURER'S OWNER'S MANUAL, MAINTENANCE MANUAL AND MASTER SERVICE MANUAL TO THE A/E. ALSO, PROVIDE MANUFACTURER'S MAINTENANCE VIDEOTAPE AT SAME TIME.

D. WARRANTY: PROPOSALS SUBMITTED WITHOUT THE FOLLOWING WRITTEN WARRANTIES WILL BE CONSIDERED NON-RESPONSIVE.

1. PROVIDE 12 MONTH MAINTENANCE AND CALL BACK SERVICE FOR DOCK EQUIPMENT FURNISHED.

2. DOCK LEVELER MANUFACTURER SHALL PROVIDE WITH HIS BID A WRITTEN 10-YEAR WARRANTY ON DOCK LEVELERS. THE WARRANTY SHALL COVER ALL PARTS, MATERIAL AND LABOR.

3. MANUFACTURER'S WARRANTIES: MANUFACTURER'S WRITTEN WARRANTY, COUNTERSIGNED BY THE INSTALLER, CLEARLY STATING ALL TERMS AND CONDITIONS OF THE WARRANTY AND COVERING ALL MATERIALS AND WORKMANSHIP PROVIDED FOR A PERIOD OF NOT LESS THAN ONE YEAR FROM DATE OF SUBSTANTIAL COMPLETION OF THE GENERAL CONTRACT.

4. MANUFACTURER'S CERTIFICATION: MANUFACTURER'S LETTER, CERTIFIED BY A NOTARY PUBLIC, THAT NO PROPRIETARY EQUIPMENT AS SPECIFIED UNDER PART 2 - PRODUCTS WILL BE USED IN INSTALLATION.

E. SUBMIT THE FOLLOWING UNDER PROVISION DIVISION 1:

1. PARTS LIST; UPON COMPLETION OF THE INSTALLATION, SUBMIT FOUR (4) COPIES OF A COMPLETE PARTS LIST AND MAINTENANCE INSTRUCTIONAL MANUAL.

2. PROVIDE TECHNICAL INFORMATION FOR SERVICING OPERATING EQUIPMENT.

3. MANUFACTURER'S WRITTEN INSTALLATION WARRANTY AND MAINTENANCE CONTRACT AS SPECIFIED HEREIN BELOW.

1.05 QUALITY ASSURANCE

A. IN THE INTEREST OF UNIFIED RESPONSIBILITY, THE DOCK EQUIPMENT INSTALLER SHALL BE EITHER THE ACTUAL EQUIPMENT MANUFACTURER OR A FIRM FULLY AUTHORIZED BY THE MANUFACTURER OF THE PROPOSED EQUIPMENT TO INSTALL THE EQUIPMENT; REGULARLY ENGAGED IN THE BUSINESS OF MANUFACTURING, INSTALLING AND SERVICING DOCK EQUIPMENT OF THE TYPE AND CHARACTER REQUIRED UNDER THIS SECTION, WITH ALL MAJOR COMPONENTS, INCLUDING DOCK LEVELERS, TIRE-LAMINATED DOCK BUMPERS, TRUCK RESTRAINING DEVICES, DOCK LIGHTS, DOCK SEALS AND DOCK DOORS BEING THE PRODUCTS OF A SINGLE DOCK EQUIPMENT MANUFACTURER.

1.06 SEQUENCING AND SCHEDULING

A. PROVIDE ALL ITEMS WHICH WILL REQUIRE BUILDING INTO THE CONCRETE AND MASONRY IN SUFFICIENT TIME AS NOT TO DELAY THE PROGRESS OF THE RESPECTIVE TRADES. SHOULD SUCH ITEMS NOT BE DELIVERED IN TIME TO BE BUILT IN, PAY ALL COSTS FOR THE REQUIRED CUTTING AND INSTALLATION WORK.

PART 2 - PRODUCTS

2.02 MANUFACTURER AND TYPE

A. MANUFACTURER: TO ESTABLISH A STANDARD OF QUALITY, DESIGN AND FUNCTION DESIRED.

B. PROPRIETARY EQUIPMENT: NO PROPRIETARY EQUIPMENT SHALL BE USED IN THE INSTALLATION. ALL EQUIPMENT INCLUDED IN THE DOCK EQUIPMENT INSTALLATION SHALL

HAVE REPAIR OR REPLACEMENT PARTS READILY ACCESSIBLE TO THE GENERAL DOCK EQUIPMENT TRADE. WITHOUT LIMITATION, THIS SHALL INCLUDE DIAGNOSTIC TOOLS AND CONTROLLER COMPONENTS REQUIRED FOR THE COMPLETE MAINTENANCE OF THE INSTALLED EQUIPMENT.

1. ANY COSTS INCURRED FOR CHANGES IN THE WORK FROM THAT SHOWN ON THE DRAWINGS, INCLUDING WORK OF THIS AND OTHER SECTIONS, DUE TO THE REQUIREMENTS OF THE PARTICULAR EQUIPMENT FURNISHED THEREUNDER ARE THE SOLE RESPONSIBILITY OF THE DOCK EQUIPMENT MANUFACTURER.

2.03 MANUALLY OPERATED MECHANICAL DOCK LEVELER

A. MANUALLY OPERATED MECHANICAL DOCK LEVELERS AS MANUFACTURED BY 4 FRONT ENGINEERED SOLUTIONS, INC., OR SYSTEMS, INC., OR ARCHITECT APPROVED SUBSTITUTE:

1. HYDRAULIC VERTICAL STORING DOCK LEVELERS SHALL BE 6'-0" WIDE WITH A 20" LIP EXTENSION BEYOND BUMPERS, AND AN OPERATIONAL RANGE OF 6" ABOVE AND 5” BELOW DOCK LEVEL.

2. LEVELERS SHALL BE 45,000 LB. CAPACITY.

3. PROVIDE LEADING EDGE HINGED BOTTOM DRAFT PAD.

4. LEVELERS SHALL BE FULLY WEATHER-STRIPPED AND SEALED IN THE OPERATING POSITION FOR MAXIMUM WEATHER PROTECTION. THIS MAY BE ACCOMPLISHED WITH THE AID OF BOTTOM CURTAINS, LOWER PADS OR OTHER MANUFACTURER RECOMMENDED MEANS.

5. PROVIDE ALL HINGE CURB CHANNEL FOR DOCK LEVELERS AND ALL ASSOCIATED FASTENING DEVICES.

2.04 DOCK BUMPERS

A. DOCK BUMPERS AS MANUFACTURED BY 4 FRONT ENGINEERED SOLUTIONS, INC., OR SYSTEMS, INC., OR ARCHITECT APPROVED SUBSTITUTE.

1. LAMINATED RUBBER DOCK BUMPERS SHALL BE 20" HIGH X 11” WIDE X 4" DEEP AND WELDED TO CUSTOM MOUNTING PLATES.

2. BUMPERS SHALL BE TIRE LAMINATED, NOT MOLDED. TIRE LAMINATED BUMPERS SHALL BE INSTALLED SO THAT THE TREADS ARE VERTICAL TO BUILDING WALL.

3. BUMPERS SHALL BE WELDED TO AN EMBEDDED STEEL PLATE PER MANUFACTURE'S SPECIFICATIONS.

PART 3 - EXECUTION

3.01 EXAMINATION

B. INSPECT ALL SURFACES, AND REQUIRED EMBEDDED ANCHORAGE DEVICES, AND VERIFY THAT THEY ARE IN PROPER CONDITION TO RECEIVE THE WORK OF THIS SECTION. VERIFY THAT

FIELD MEASUREMENTS ARE AS INDICATED ON APPROVED SHOP DRAWINGS.

3.02 INSTALLATION

A. INSTALLER SHALL EXAMINE THE SUBSTRATE AND CONDITIONS UNDER WHICH DOCK LEVELERS AND TRUCK RESTRAINTS ARE TO BE INSTALLED AND NOTIFY THE A/E AND CONTRACTOR IN WRITING OF ANY CONDITIONS DETRIMENTAL TO THE PROPER AND TIMELY COMPLETION OF THE WORK. DO NOT PROCEED WITH THE WORK UNTIL SATISFACTORY CONDITIONS HAVE BEEN CORRECTED IN A MANNER ACCEPTABLE TO THE INSTALLER.

B. MANUFACTURER'S REPRESENTATIVE SHALL INSTALL DOCK LEVELERS IN ACCORDANCE WITH APPROVED SHOP DRAWINGS AND MANUFACTURER'S RECOMMENDATIONS. LOCATION OF DOCK LEVELERS SHALL BE INDICATED ON DRAWINGS.

C. ADJUST UNITS TO OPERATE SMOOTHLY.

D. AFTER INSTALLATION IS COMPLETED, A REPRESENTATIVE OF THE MANUFACTURER SHALL EXAMINE THE INSTALLATION AND REQUIRE THAT ALL CONNECTIONS AND ADJUSTMENTS NECESSARY TO ASSURE PROPER OPERATION OF DOCK LEVELERS, AND BUMPERS BE MADE. BEFORE ACCEPTANCE, A DEMONSTRATION SHALL BE CONDUCTED IN THE PRESENCE OF THE OWNER'S REPRESENTATIVE THAT ALL LEVELERS OPERATE PROPERLY IN EVERY RESPECT. IN ADDITION, A DETAILED USER/OPERATOR TRAINING SESSION SHALL BE CONDUCTED AT A TIME AND PLACE AGREED UPON BY OWNER'S REPRESENTATIVE AND MANUFACTURER'S REPRESENTATIVE.

3.03 TOLERANCES, TESTS AND ADJUSTMENTS

A. TO BE IN CONFORMANCE WITH MANUFACTURER'S OPERATING PARAMETERS AND WARRANTY REQUIREMENTS.

3.04 CLEANING

A. AFTER ALL WORK UNDER THIS SECTION HAS BEEN COMPLETED AND SATISFACTORILY TESTED, REMOVE ALL APPLIED PACKING LABELS FROM THE VARIOUS SURFACES, THOROUGHLY CLEAN AND POLISH ALL PLASTIC LAMINATE, STAINLESS STEEL AND PREFINISHED SURFACES. TOUCH UP ALL SCRATCHES, ABRASIONS, AND OTHER SURFACE DEFECTS IN THE PREFINISHED SURFACES, USING THE SAME MATERIAL, COLOR AND GLOSS AS USED IN THE PREFINISHING SYSTEM

B. UPON COMPLETION OF THE WORK OF THIS SECTION, REMOVE TOOLS, AND ALL RUBBISH AND DEBRIS FROM THE WORK AREA; LEAVE AREA IN BROOM-CLEAN CONDITION.

END OF SECTION

SECTION 11 13 20

TRUCK RESTRAINING DEVICE

PART 1 - GENERAL

1.01 SECTION INCLUDES:

A. TRUCK RESTRAINING DEVICE.

1.02 RELATED SECTIONS

A. SECTION 08 36 13 - OVERHEAD SECTIONAL DOORS

B. SECTION 11 13 19 - DOCK LEVELERS

C. SECTION 11 13 26 - DOCK LIGHTS

D. SECTION 11 13 16 - DOCK SHELTERS AND SEALS

E. SECTION 16050 - PROCESS ELECTRICAL

F. SECTION 16110 - RACEWAYS NON-PROCESS

G. SECTION 16120 - CONDUCTORS (600 VOLT)

H. SECTION 16130 - BOXES NON-PROCESS

I. SECTION 16190 - HANGERS AND SUPPORTS

J. SECTION 16191 - VIBRATION ISOLATION & SEISMIC RESTRAINTS

K. SECTION 16195 - ELECTRICAL IDENTIFICATION

L. SECTION 16450 - GROUNDING

1.03 REFERENCES

A. COMPLY WITH APPLICABLE REQUIREMENTS OF THE FOLLOWING STANDARDS AND THOSE OTHERS REFERENCED IN THIS SECTION. WHERE THESE STANDARDS CONFLICT WITH OTHER SPECIFIED REQUIREMENTS, THE MOST RESTRICTIVE REQUIREMENTS SHALL GOVERN.

1. BUILDING CODE OF THE PROJECT JURISDICTION.

2. ALL APPLICABLE FEDERAL, STATE AND MUNICIPAL CODES, LAWS AND REGULATIONS FOR DOCK EQUIPMENT REQUIREMENTS.

1.04 SUBMITTALS

A. SUBMIT 5 COPIES OF LARGE SCALE SHOP DRAWING, INDICATING GENERAL ARRANGEMENT OF ALL DOCK EQUIPMENT AND SHOWING ALL COMPONENT LOCATIONS, DIMENSIONS, EMBEDDED PLATES/ANGLES, AND POWER/CONDUIT REQUIREMENTS.

B. SUBMIT 5 COPIES OF ALL TECHNICAL DATA AND DRAWINGS FOR TRUCK RESTRAINING DEVICES.

C. SUBMIT 5 COPIES OF MANUFACTURER'S OWNER'S MANUAL, MAINTENANCE MANUAL AND MASTER SERVICE MANUAL TO THE A/E. ALSO, PROVIDE MANUFACTURER'S MAINTENANCE VIDEOTAPE AT SAME TIME.

D. WARRANTY: PROPOSALS SUBMITTED WITHOUT THE FOLLOWING WRITTEN WARRANTIES WILL BE CONSIDERED NON-RESPONSIVE.

1. PROVIDE 12 MONTH MAINTENANCE AND CALL BACK SERVICE FOR DOCK EQUIPMENT FURNISHED.

2. MANUFACTURER'S WARRANTIES: MANUFACTURER'S WRITTEN WARRANTY, COUNTERSIGNED BY THE INSTALLER, CLEARLY STATING ALL TERMS AND CONDITIONS OF THE WARRANTY AND COVERING ALL MATERIALS AND WORKMANSHIP PROVIDED FOR A PERIOD OF NOT LESS THAN ONE YEAR FROM DATE OF SUBSTANTIAL COMPLETION OF THE GENERAL CONTRACT.

3. MANUFACTURER'S CERTIFICATION: MANUFACTURER'S LETTER, CERTIFIED BY A NOTARY PUBLIC, THAT NO PROPRIETARY EQUIPMENT AS SPECIFIED UNDER PART 2 - PRODUCTS WILL BE USED IN INSTALLATION.

E. SUBMIT THE FOLLOWING UNDER PROVISION DIVISION 1:

1. PARTS LIST; UPON COMPLETION OF THE INSTALLATION, SUBMIT FOUR (4) COPIES OF A COMPLETE PARTS LIST AND MAINTENANCE INSTRUCTIONAL MANUAL.

2. PROVIDE TECHNICAL INFORMATION FOR SERVICING OPERATING EQUIPMENT.

3. MANUFACTURER'S WRITTEN INSTALLATION WARRANTY AND MAINTENANCE CONTRACT AS SPECIFIED HEREIN BELOW.

1.05 QUALITY ASSURANCE

A. IN THE INTEREST OF UNIFIED RESPONSIBILITY, THE DOCK EQUIPMENT INSTALLER SHALL BE EITHER THE ACTUAL EQUIPMENT MANUFACTURER OR A FIRM FULLY AUTHORIZED BY THE MANUFACTURER OF THE PROPOSED EQUIPMENT TO INSTALL THE EQUIPMENT; REGULARLY ENGAGED IN THE BUSINESS OF MANUFACTURING, INSTALLING AND SERVICING DOCK EQUIPMENT OF THE TYPE AND CHARACTER REQUIRED UNDER THIS SECTION, WITH ALL MAJOR COMPONENTS, INCLUDING DOCK LEVELERS, TIRE-LAMINATED DOCK BUMPERS, TRUCK RESTRAINING DEVICE, DOCK SEALS AND DOCK DOORS BEING THE PRODUCTS OF A SINGLE DOCK EQUIPMENT MANUFACTURER.

1.06 SEQUENCING AND SCHEDULING

A. PROVIDE ALL ITEMS WHICH WILL REQUIRE BUILDING INTO THE CONCRETE AND MASONRY IN SUFFICIENT TIME AS NOT TO DELAY THE PROGRESS OF THE RESPECTIVE TRADES. SHOULD SUCH ITEMS NOT BE DELIVERED IN TIME TO BE BUILT IN, PAY ALL COSTS FOR THE REQUIRED CUTTING AND INSTALLATION WORK.

PART 2 - PRODUCTS

2.02 MANUFACTURER AND TYPE

SECTION 11 13 20

TRUCK RESTRAINING DEVICE

A. MANUFACTURER: TO ESTABLISH A STANDARD OF QUALITY, DESIGN AND FUNCTION DESIRED.

B. PROPRIETARY EQUIPMENT: NO PROPRIETARY EQUIPMENT SHALL BE USED IN THE INSTALLATION. ALL EQUIPMENT INCLUDED IN THE DOCK EQUIPMENT INSTALLATION SHALL HAVE REPAIR OR REPLACEMENT PARTS READILY ACCESSIBLE TO THE GENERAL DOCK EQUIPMENT TRADE. WITHOUT LIMITATION, THIS SHALL INCLUDE DIAGNOSTIC TOOLS AND CONTROLLER COMPONENTS REQUIRED FOR THE COMPLETE MAINTENANCE OF THE INSTALLED EQUIPMENT.

1. ANY COSTS INCURRED FOR CHANGES IN THE WORK FROM THAT SHOWN ON THE DRAWINGS, INCLUDING WORK OF THIS AND OTHER SECTIONS, DUE TO THE REQUIREMENTS OF THE PARTICULAR EQUIPMENT FURNISHED THEREUNDER ARE THE SOLE RESPONSIBILITY OF THE DOCK EQUIPMENT MANUFACTURER.

2.03 TRUCK RESTRAINT DEVICE

A. THE TRUCK RESTRAINING DEVICE SHALL BE MANUAL TYPE KELLEY STAR 1 MODEL AS MANUFACTURED BY 4 FRONT ENGINEERED SOLUTIONS, INC., OR ARCHITECT APPROVED SUBSTITUTE. THE TRUCK RESTRAINING DEVICE SHALL HAVE THE FOLLOWING FEATURES:

1. PROVIDE EMBED STEEL STUDDED MOUNTING PLATE FOR ACHORAGE TO FOUNDATION WALL.

2. OPERATION: VEHICLE RESTRAINT DESIGNED TO HOOK THE REAR IMPACT GUARD OF A TRUCK AND HOLD THE TRUCK AT THE LOADING DOCK. THE RESTRAINT IS ACTIVATED USING PUSH BAR TO TRIGGER THE LATCHING LEVER AND ACTIVATE THE RESTRAINING ARM, WHICH WILL MOVE VERTICALLY ALONG THE REINFORCED T-RAIL UNTIL IT CONTACTS THE VEHICLE'S REAR IMPACT GUARD. WHEN LOADING/UNLOADING IS COMPLETE, THE OPERATOR USES THE PUSH BAR TO RETURN THE RESTRAINING ARM TO ITS STORED POSITION.

3. OPERATING RANGE: RESTRAINT WILL ENGAGE A REAR IMPACT GUARD POSITIONED 0” TO 10” HORIZONTALLY FROM THE FACE OF A 4” BUMPER. VERTICAL HOOKING RANGE OF 11” - 27 ½”. COMPLIES WITH NHTSA REGULATIONS FOR REAR IMPACT GUARDS. UNIT STORES 9 ½” ABOVE GRADE TO ACCOMMODATE LOW TRAILERS.

4. SIGNS: TWO (2) OUTSIDE, READING "BACK IN OR PULL OUT WITH HOOK DOWN ONLY", ONE READING FORWARD; ONE BACKWARD; ONE (1) INSIDE SIGN WITH OPERATING INSTRUCTIONS.

PART 3 - EXECUTION

3.01 EXAMINATION

B. INSPECT ALL SURFACES, AND REQUIRED EMBEDDED ANCHORAGE DEVICES, AND VERIFY THAT THEY ARE IN PROPER CONDITION TO RECEIVE THE WORK OF THIS SECTION. VERIFY THAT FIELD MEASUREMENTS ARE AS INDICATED ON APPROVED SHOP DRAWINGS.

3.02 INSTALLATION

A. INSTALLER SHALL EXAMINE THE SUBSTRATE AND CONDITIONS UNDER WHICH DOCK

LEVELERS AND TRUCK RESTRAINTS ARE TO BE INSTALLED AND NOTIFY THE A/E AND CONTRACTOR IN WRITING OF ANY CONDITIONS DETRIMENTAL TO THE PROPER AND TIMELY COMPLETION OF THE WORK. DO NOT PROCEED WITH THE WORK UNTIL SATISFACTORY CONDITIONS HAVE BEEN CORRECTED IN A MANNER ACCEPTABLE TO THE INSTALLER.

B. MANUFACTURER'S REPRESENTATIVE SHALL INSTALL TRUCK RESTRAINING DEVICES IN ACCORDANCE WITH APPROVED SHOP DRAWINGS AND MANUFACTURER'S RECOMMENDATIONS. LOCATION OF TRUCK RESTRAINING DEVICES SHALL BE INDICATED ON DRAWINGS.

C. ADJUST UNITS TO OPERATE SMOOTHLY.

D. DEVICE SHALL BE WELDED TO AN EMBEDDED STEEL PLATE PER MANUFACTURER'S SPECIFICATIONS.

E. AFTER INSTALLATION IS COMPLETED, A REPRESENTATIVE OF THE MANUFACTURER SHALL EXAMINE THE INSTALLATION AND REQUIRE THAT ALL CONNECTIONS AND ADJUSTMENTS NECESSARY TO ASSURE PROPER OPERATION OF TRUCK RESTRAINING DEVICES BE MADE. BEFORE ACCEPTANCE, A DEMONSTRATION SHALL BE CONDUCTED IN THE PRESENCE OF THE OWNER'S REPRESENTATIVE THAT ALL RESTRAINTS OPERATE PROPERLY IN EVERY RESPECT. IN ADDITION, A DETAILED USER/OPERATOR TRAINING SESSION SHALL BE CONDUCTED AT A TIME AND PLACE AGREED UPON BY OWNER'S REPRESENTATIVE AND MANUFACTURER'S REPRESENTATIVE.

3.03 TOLERANCE, TESTS AND ADJUSTMENTS

A. IN CONFORMANCE WITH MANUFACTURER'S OPERATING PARAMETERS AND WARRANTY REQUIREMENTS.

3.04 CLEANING

A. AFTER ALL WORK UNDER THIS SECTION HAS BEEN COMPLETED AND SATISFACTORILY TESTED, REMOVE ALL APPLIED PACKING LABELS FROM THE VARIOUS SURFACES, THOROUGHLY CLEAN AND POLISH ALL PLASTIC LAMINATE, STAINLESS STEEL AND PREFINISHED SURFACES. TOUCH UP ALL SCRATCHES, ABRASIONS, AND OTHER SURFACE DEFECTS IN THE PREFINISHED SURFACES, USING THE SAME MATERIAL, COLOR AND GLOSS AS USED IN THE PREFINISHING SYSTEM.

B. UPON COMPLETION OF THE WORK OF THIS SECTION, REMOVE TOOLS, AND ALL RUBBISH AND DEBRIS FROM THE WORK AREA; LEAVE AREA IN BROOM-CLEAN CONDITION.

END OF SECTION

SECTION 11 13 26

DOCK LIGHTS

PART 1 - GENERAL

1.01 SECTION INCLUDES:

A. DOCK LIGHTS

1.02 RELATED SECTIONS

A. SECTION 08 36 13 - OVERHEAD SECTIONAL DOORS

B. SECTION 11 13 19 - DOCK LEVELERS

C. SECTION 11 13 20 - TRUCK RESTRAINING DEVICES

D. SECTION 11 13 16 - DOCK SHELTERS AND SEALS

E. SECTION 16050 - PROCESS ELECTRICAL

F. SECTION 16110 - RACEWAYS NON-PROCESS

G. SECTION 16120 - CONDUCTORS (600 VOLT)

H. SECTION 16130 - BOXES NON-PROCESS

I. SECTION 16190 - HANGERS AND SUPPORTS

J. SECTION 16191 - VIBRATION ISOLATION & SEISMIC RESTRAINTS

K. SECTION 16195 - ELECTRICAL IDENTIFICATION

L. SECTION 16450 - GROUNDING

1.03 REFERENCES

A. COMPLY WITH APPLICABLE REQUIREMENTS OF THE FOLLOWING STANDARDS AND THOSE OTHERS REFERENCED IN THIS SECTION. WHERE THESE STANDARDS CONFLICT WITH OTHER SPECIFIED REQUIREMENTS, THE MOST RESTRICTIVE REQUIREMENTS SHALL GOVERN.

1. BUILDING CODE, CURRENT EDITION

2. 2011 NEC (NATIONAL ELECTRIC CODE) WITH STATE AMENDMENTS.

3. UL (UNDERWRITERS LABORATORY):

A. UL: APPLICABLE REQUIREMENTS FOR MOTORS, SWITCHES AND OTHER ELECTRICAL COMPONENTS.

4. ALL APPLICABLE FEDERAL, STATE AND MUNICIPAL CODES, LAWS AND REGULATIONS FOR DOCK EQUIPMENT REQUIREMENTS.

5. ALL ELECTRICAL EQUIPMENT AND ASSEMBLIES; I.E. CONTROL PANELS, MOTORS, PUSH

BUTTON CONTROLS, SENSORS, LIGHTS, ETC. SHALL BE UL LISTED AND LABELED.

1.04 SUBMITTALS

A. SUBMIT 5 COPIES OF LARGE SCALE SHOP DRAWING, INDICATING GENERAL ARRANGEMENT OF ALL DOCK EQUIPMENT AND SHOWING ALL COMPONENT LOCATIONS, DIMENSIONS, EMBEDDED PLATES/ANGLES, AND POWER/CONDUIT REQUIREMENTS.

B. SUBMIT 5 COPIES OF ALL TECHNICAL DATA, PRODUCT DATA SHEETS, MOUNTING INSTRUCTIONS, INSTALLATION INFORMATION AND DRAWINGS FOR DOCK LIGHTS, INDICATING SPECIAL PROCEDURES.

C. SUBMIT 5 COPIES OF ELECTRICAL CHARACTERISTICS AND CONNECTION REQUIREMENTS, WIRING DIAGRAMS.

D. SUBMIT 5 COPIES OF MANUFACTURER'S OWNER'S MANUAL, MAINTENANCE MANUAL AND MASTER SERVICE MANUAL TO THE A/E. ALSO, PROVIDE MANUFACTURER'S MAINTENANCE VIDEOTAPE AT SAME TIME.

E. WARRANTY: PROPOSALS SUBMITTED WITHOUT THE FOLLOWING WRITTEN WARRANTIES WILL BE CONSIDERED NON-RESPONSIVE.

1. MANUFACTURER'S WARRANTIES: MANUFACTURER'S WRITTEN WARRANTY, COUNTERSIGNED BY THE INSTALLER, CLEARLY STATING ALL TERMS AND CONDITIONS OF THE WARRANTY AND COVERING ALL MATERIALS AND WORKMANSHIP PROVIDED FOR A PERIOD OF NOT LESS THAN ONE YEAR FROM DATE OF SUBSTANTIAL COMPLETION OF THE GENERAL CONTRACT.

2. MANUFACTURER'S CERTIFICATION: MANUFACTURER'S LETTER, CERTIFIED BY A NOTARY PUBLIC, THAT NO PROPRIETARY EQUIPMENT AS SPECIFIED UNDER PART 2 - PRODUCTS WILL BE USED IN INSTALLATION.

F. SUBMIT THE FOLLOWING UNDER PROVISION DIVISION 1:

1. PARTS LIST AND WIRING DIAGRAM; UPON COMPLETION OF THE INSTALLATION, SUBMIT FOUR (4) COPIES OF A COMPLETE PARTS LIST AND AS-BUILT WIRING DIAGRAMS FOR CONTROLLER AND MAINTENANCE INSTRUCTIONAL MANUAL.

2. PROVIDE TECHNICAL INFORMATION FOR SERVICING OPERATING EQUIPMENT.

3. INCLUDE LEGIBLE WIRING DIAGRAM OF INSTALLED ELECTRICAL EQUIPMENT AND CHANGES MADE IN THE WORK. LIST SYMBOLS CORRESPONDING TO IDENTITY OF MARKINGS ON APPARATUS.

4. MANUFACTURER'S WRITTEN INSTALLATION WARRANTY AND MAINTENANCE CONTRACT AS SPECIFIED HEREIN BELOW.

1.05 QUALITY ASSURANCE

A. IN THE INTEREST OF UNIFIED RESPONSIBILITY, THE DOCK EQUIPMENT INSTALLER SHALL BE EITHER THE ACTUAL EQUIPMENT MANUFACTURER OR A FIRM FULLY AUTHORIZED BY THE MANUFACTURER OF THE PROPOSED EQUIPMENT TO INSTALL THE EQUIPMENT; REGULARLY ENGAGED IN THE BUSINESS OF MANUFACTURING, INSTALLING AND SERVICING DOCK

EQUIPMENT OF THE TYPE AND CHARACTER REQUIRED UNDER THIS SECTION, WITH ALL MAJOR COMPONENTS, INCLUDING DOCK LEVELERS, TIRE-LAMINATED DOCK BUMPERS, TRUCK RESTRAINING DEVICE, DOCK LIGHTS, DOCK SEALS AND DOCK DOORS BEING THE PRODUCTS OF A SINGLE DOCK EQUIPMENT MANUFACTURER.

1.06 SEQUENCING AND SCHEDULING

A. PROVIDE ALL ITEMS WHICH WILL REQUIRE BUILDING INTO THE CONCRETE AND MASONRY IN SUFFICIENT TIME AS NOT TO DELAY THE PROGRESS OF THE RESPECTIVE TRADES. SHOULD SUCH ITEMS NOT BE DELIVERED IN TIME TO BE BUILT IN, PAY ALL COSTS FOR THE REQUIRED CUTTING AND INSTALLATION WORK.

PART 2 - PRODUCTS

2.02 MANUFACTURER AND TYPE

A. MANUFACTURER: TO ESTABLISH A STANDARD OF QUALITY, DESIGN AND FUNCTION DESIRED.

B. PROPRIETARY EQUIPMENT: NO PROPRIETARY EQUIPMENT SHALL BE USED IN THE INSTALLATION. ALL EQUIPMENT INCLUDED IN THE DOCK EQUIPMENT INSTALLATION SHALL HAVE REPAIR OR REPLACEMENT PARTS READILY ACCESSIBLE TO THE GENERAL DOCK EQUIPMENT TRADE. WITHOUT LIMITATION, THIS SHALL INCLUDE DIAGNOSTIC TOOLS AND CONTROLLER COMPONENTS REQUIRED FOR THE COMPLETE MAINTENANCE OF THE INSTALLED EQUIPMENT.

1. ANY COSTS INCURRED FOR CHANGES IN THE WORK FROM THAT SHOW ON THE DRAWINGS, INCLUDING WORK OF THIS AND OTHER SECTIONS, DUE TO THE REQUIREMENTS OF THE PARTICULAR EQUIPMENT FURNISHED THEREUNDER ARE THE SOLE RESPONSIBILITY OF THE DOCK EQUIPMENT MANUFACTURER.

2.03 DOCK LIGHTS

A. THE DOCK LIGHTS SHALL BE MANUFACTURED BY 4 FRONT ENGINEERED SOLUTIONS, INC., MODEL FT ULTRA LED OR ARCHITECT APPROVED SUBSTITUTE. THE DOCK LIGHTS SHALL HAVE THE FOLLOWING FEATURES:

1. STAINLESS STEEL FLEXIBLE ARM.

2. A NON-CONDUCTIVE, CORROSION-RESISTANT POLYCARBONATE HEAD WITH LED LAMP ASSEMBLY.

3. A 110-VOLT CONNECTION (PLUG-IN CONNECTION) WITH AN ON/OFF TOGGLE SWITCH ON CONTROL BOX.

4. UL LISTED, MEETING NEC AND OSHA GENERAL SAFETY REQUIREMENTS.

5. A 2-YEAR PARTS AND LABOR WARRANTY.

PART 3 - EXECUTION

3.01 EXAMINATION

B. INSPECT ALL SURFACES AND VERIFY THAT THEY ARE IN PROPER CONDITION TO RECEIVE THE WORK OF THIS SECTION. VERIFY THAT FIELD MEASUREMENTS ARE AS INDICATED ON APPROVED SHOP DRAWINGS.

3.02 INSTALLATION

A. MANUFACTURER'S REPRESENTATIVE SHALL INSTALL DOCK LIGHTS IN ACCORDANCE WITH APPROVED SHOP DRAWINGS AND MANUFACTURER'S RECOMMENDATIONS. LOCATION OF DOCK LIGHTS SHALL BE INDICATED ON DRAWINGS.

3.03 TOLERANCES, TESTS AND ADJUSTMENTS

A. IN CONFORMANCE WITH MANUFACTURER'S OPERATING PARAMETERS AND WARRANTY REQUIREMENTS.

3.04 CLEANING

A. AFTER ALL WORK UNDER THIS SECTION HAS BEEN COMPLETED AND SATISFACTORILY TESTED, REMOVE ALL APPLIED PACKING LABELS FROM THE VARIOUS SURFACES, THOROUGHLY CLEAN AND POLISH ALL PLASTIC LAMINATE, STAINLESS STEEL AND PREFINISHED SURFACES. TOUCH UP ALL SCRATCHES, ABRASIONS, AND OTHER SURFACE DEFECTS IN THE PREFINISHED SURFACES, USING THE SAME MATERIAL, COLOR AND GLOSS AS USED IN THE PREFINISHING SYSTEM

B. UPON COMPLETION OF THE WORK OF THIS SECTION, REMOVE TOOLS, AND ALL RUBBISH AND DEBRIS FROM THE WORK AREA; LEAVE AREA IN BROOM-CLEAN CONDITION.

END OF SECTION

SECTION 13 21 26

COLD STORAGE SYSTEMS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. FURNISH AND INSTALL THE FOLLOWING:

1. VAPOR BARRIER MEMBRANES AND FLASHINGS.

2. FOAMED_IN_PLACE URETHANE, INCLUDING INTERNAL SEALING AND PATCHING OF ALL PENETRATIONS THROUGH WALLS IN REFRIGERATED AREAS AND ALL ROOF AREAS. (NOTE SPRINKLER ESCUTCHEON PLATES BY SPRINKLER SUBCONTRACTOR).

1.02 RELATED SECTIONS

A. SECTION 07 42 00: INSULATED METAL WALL PANELS.

B. SECTION 07 92 10: JOINT SEALANTS.

1.03 SUBMITTALS

A. SHOP DRAWINGS

1. SHOWING THE MOUNTING APPLICATION IN DETAIL SHALL BE SUBMITTED FOR APPROVAL AND ANY SPECIFIC VARIATIONS FROM THE PLANS AND SPECIFICATIONS SHALL BE BROUGHT TO THE ATTENTION OF ARCHITECT. SHOP DRAWINGS SHALL DETAIL ALL UNIQUE CONDITIONS THAT OCCUR ON THIS JOB UNDER THIS SUBCONTRACTOR'S SCOPE OF WORK.

2. PRIOR TO SUBMITTAL OF SHOP DRAWINGS, SUBCONTRACTOR SHALL OBTAIN MANUFACTURER'S APPROVAL OF ALL ROOFING RELATED DETAILS AS SHOWN ON THE DRAWINGS.

3. THE PANEL MANUFACTURER SHALL SUBMIT, PRIOR TO START OF FABRICATION, COMPLETE SHOP AND ASSEMBLY DRAWINGS. SHOP DRAWINGS SHALL INCLUDE ALL APPLICABLE DETAILS AND CONNECTIONS TO BE ENCOUNTERED ON THIS PROJECT. UNDER NO CIRCUMSTANCES SHALL FABRICATION OF PANELS COMMENCE PRIOR TO THE COMPLETE APPROVAL OF SUBMITTED SHOP DRAWINGS.

B. TECHNICAL LITERATURE

1. COMPLETE MANUFACTURERS TECHNICAL LITERATURE SHALL BE SUBMITTED. LITERATURE SHALL BE MARKED UP TO INDICATE ALL PRODUCTS TO BE EMPLOYED IN THE WORK IN ORDER THAT A PROPER EVALUATION CAN BE MADE OF THE MATERIALS, METHODS, ASSEMBLIES AND CONSTRUCTION TO BE PROVIDED.

2. THE SUBMITTALS SHALL ALSO INCLUDE SPECIFICATIONS OF THE VARIOUS TYPES OF ADHESIVES AND ATTACHMENT METHODS TO BE USED IN THE WORK.

C. CERTIFICATES

1. SUBMIT USDA LETTERS OF AUTHORIZATION FOR USE FOR ALL PRODUCTS. (INCLUDING BUT NOT LIMITED TO PANEL FINISH, SEALANTS, AND THE LIKE.)

1.04 QUALITY ASSURANCE

A. THE REQUIREMENTS OF THE GOVERNING BUILDING CODES ESTABLISH THE MINIMUM ACCEPTABLE QUALITY OF WORKMANSHIP AND MATERIALS, AND ALL WORK SHALL CONFORM THERETO UNLESS MORE STRINGENT REQUIREMENTS ARE INDICATED OR SPECIFIED BY THE CONTRACT DOCUMENTS.

B. THE ROOFING AND FLASHING SYSTEM SHALL BE APPLIED ONLY BY A FACTORY TRAINED AND APPROVED ROOFING SUBCONTRACTOR FAMILIAR WITH THE PRODUCT.

C. THIS SUBCONTRACTOR SHALL BE RESPONSIBLE FOR THE ACCEPTANCE OF HIS COMPANY BY THE ROOFING SYSTEM MANUFACTURER AND THAT THE MATERIALS, DETAILS, AND WORKMANSHIP HEREIN DESIGNED AND SPECIFIED ARE IN ACCORDANCE WITH THE MANUFACTURER'S SPECIFICATIONS.

1.05 DELIVERY, STORAGE AND HANDLING

A. MATERIALS SHALL BE DELIVERED IN THEIR ORIGINAL, UNOPENED CONTAINERS, CLEARLY LABELED WITH MANUFACTURER'S NAME, BRAND NAME AND SUCH IDENTIFYING NUMBERS AS ARE APPROPRIATE. ADHESIVES SHALL BE STORED AT TEMPERATURES ABOVE 40F. ADHESIVES EXPOSED TO LOWER TEMPERATURES SHALL BE PLACED IN A PROPER TEMPERATURE ENVIRONMENT FOR THREE TO FIVE DAYS PRIOR TO USE. MEMBRANE ROLLS SHALL BE STORED LYING DOWN AND FULLY PROTECTED FROM MOISTURE. DO NOT USE MATERIALS DAMAGED IN HANDLING OR STORAGE. ALL CARDBOARD CONTAINERS SHALL BE STORED IN DRY AREAS.

B. SCHEDULING OF DELIVERY OF THE INSULATED WALL PANELS SHALL BE CLOSELY COORDINATED WITH THE PANEL ERECTION SCHEDULE TO REDUCE THE NUMBER OF PANELS STORED ON THE JOB SITE.

C. PANELS SHALL BE STORED OFF THE GROUND BY MEANS OF BLOCKING. IF A PROLONGED STORAGE TIME OCCURS, THE PANELS SHALL BE COVERED WITH AN OPAQUE SHEET TO KEEP THE PANELS DRY AND MINIMIZE EXPOSURE TO THE SUN.

1.06 WARRANTY

A. VAPOR BARRIER CONTINUITY

1. SUBCONTRACTOR SHALL GUARANTEE IN WRITING A PERFECT VAPOR BARRIER CONTINUITY FOR A PERIOD OF TWO YEARS AFTER ACCEPTANCE. ANY FROST OR DRIPPING WATER IN A REFRIGERATED SPACE IS EVIDENCE THAT SUCH CONTINUITY DOES NOT EXIST AND MUST BE REPAIRED TO THE ARCHITECT'S SATISFACTION AT NO ADDITIONAL COST.

PART 2 - PRODUCTS

2.01 MATERIALS

A. VAPOR BARRIER MEMBRANE

1. SUBJECT TO COMPLIANCE WITH THE REQUIREMENTS SPECIFIED HEREIN,

MANUFACTURERS OFFERING PRODUCTS WHICH MAY BE INCORPORATED IN THE WORK INCLUDE, THE FOLLOWING:

A. CARLISLE SYNTEC SYSTEMS

B. FIRESTONE BUILDING PRODUCTS CO.

C. GENFLEX ROOFING SYSTEMS, MAUMEE, OH. (800) 443_4272.

D. VERSICO INC., AKRON OH. (800) 443_4272.

2. FLOOR VAPOR BARRIER MEMBRANES, AS SHOWN ON THE DRAWINGS, SHALL BE BLACK 10 MIL POLYETHYLENE FILM AT LEAST 20 FEET WIDE.

3. MEMBRANE FLASHING AS SHOWN ON THE DRAWINGS SHALL BE 60 MIL THICK UNCURED EPDM OR NEOPRENE.

4. RUBBER TRANSITION SHEET AS SHOWN ON THE DRAWINGS SHALL BE 45 MIL THICK EPDM.

B. SEALANTS - GENERAL

1. SEALANTS FOR USE IN SEALING SHEETS OF POLYETHYLENE FILM, VAPOR BARRIER MEMBRANE, AND ANCILLARY MATERIALS TO EACH OTHER SHALL BE EITHER 2" X 1/8" #214 WHITE SEALING TAPE AS MANUFACTURED BY UNISEAL CORPORATION, 1181 DIAMOND AVENUE, EVANSVILLE, INDIANA 47717, OR SHALL BE SEALANT AS NOTED IN PARAGRAPH 3 BELOW.

2. POURABLE CAULKING FOR USE IN SEALING THE INSULATED PANELS TO THE BRAKE_FORMED CONNECTION PLATE SHALL BE UREXPAN NR 201 AS MANUFACTURED BY PECORA CORPORATION, HARLEYSVILLE, PENNSYLVANIA, OR APPROVED EQUAL.

3. SEALANT FOR DOORS, WINDOWS, VERTICAL WALL PANEL JOINTS, HORIZONTAL CEILING PANEL JOINTS, FLASHINGS AND TRIMS IN DETAILS SHALL BE ONE-PART, NON SAG, POLYURETHANE BASE SEALANT. COLOR OF CAULKING SHALL MATCH ADJACENT MATERIALS. SEALANT SHALL BE CHEM-CAULK 900 AS MANUFACTURED BY BOSTIK, OR SONNEBORN ULTRA USED WITH #733 PRIMER AS MANUFACTURED BY CHEMREX, INC.

4. ROOFING MANUFACTURER'S BONDING ADHESIVE SHALL BE USED TO BOND MEMBRANE TO PANELS.

5. SEALANT UNDER THIS SECTION IS LIMITED TO THAT REQUIRED TO PROVIDE A POSITIVE VAPOR BARRIER CONTINUITY AND SHALL BE COMPATIBLE WITH THE TYPE OF INSULATED PANEL SYSTEM APPROVED FOR INSTALLATION.

6. ADHESIVE FOR FLEXIBLE SYNTHETIC ELASTOMER PIPE INSULATION APPLICATION AND JOINT SEALER SHALL BE RUBBER BASE CONTACT ADHESIVE #520 AS MANUFACTURED BY ARMSTRONG WORLD INDUSTRIES OR APPROVED EQUAL.

7. BUTYL SEALANTS SHALL NOT BE USED (WITH THE EXCEPTION THAT IT MAY BE USED AS A SUBCONTRACTORS OPTION IN CONCEALED PANEL JOINTS ONLY.)

C. FOAMED-IN-PLACE INSULATION

1. FOAMED_IN_PLACE INSULATION SHALL BE DISPENSED FROM AN AEROSOL UNIT WHICH CONTAINS THE CHEMICAL COMPONENTS FOR MAKING RIGID URETHANE FOAM. KITS SHALL BE INSTA_FOAM FROTH PAK, AS MANUFACTURED BY INSTA_FOAM PRODUCTS, INC., 1500-T CEDARWOOD DRIVE, JOLIET, ILLINOIS 60435, 1/800/435-9359, OR VERSIFOAM, AS MANUFACTURED

BY UNIVERSAL FOAM SYSTEMS, INC., P.O. BOX 548, 6001 S. PENNSYLVANIA AVENUE, CUDAHY, WISCONSIN 53110_0548.

D. MISCELLANEOUS PENETRATION INSULATION

1. WHERE NOTED ON THE DRAWINGS “ARMAFLEX INSULATION”, MATERIAL SHALL BE CLOSED-CELL FOAMED SYNTHETIC ELASTOMER HAVING A DENSITY OF 5 TO 6 LBS. PER CU. FT., AND A THERMAL CONDUCTIVITY OF 0.25 OR BETTER AT 75°F MEAN TEMPERATURE. THE INSULATION SHALL HAVE A PERMEABILITY OF NOT GREATER THAN 0.1 PERM-INCHES. INSULATION SHALL BE ARMAFLEX AS MANUFACTURED BY ARMSTRONG WORLD INDUSTRIES.

A. MISCELLANEOUS GALVANIZED SHEET METAL: FURNISH AND INSTALL, IN SIZES AND GAUGES, AND IN LOCATIONS AS INDICATED ON THE DRAWINGS, ALL MISCELLANEOUS GALVANIZED SHEET METAL ANGLES FOR PANEL ANCHORAGE, ALL GALVANIZED SHEET METAL CLADDING AT DOOR OPENINGS AND ALL OTHER MISCELLANEOUS GALVANIZED SHEET METAL ITEMS DIRECTLY ATTACHED TO INSULATED PANELS.

PART 3 - EXECUTION

3.01 INSTALLATION

A. VAPOR BARRIER MEMBRANE

1. POLYETHYLENE SHEET VAPOR BARRIER MEMBRANE SHALL BE INSTALLED UNDER FREEZER AREAS. SHEETS SHALL BE OVERLAPPED A MINIMUM OF 3" AND SEALED WITH THE SPECIFIED UNISEAL TAPE OR CAULKING SEALANT PLACED IN THE OVERLAP. SHEETS SHALL ALSO BE SEALED IN THE SAME MANNER TO THE EPDM RUBBER TRANSITION SHEET UNDER THE BUILDING STRUCTURAL STEEL COLUMNS AND UNDER THE INSULATED WALL PANEL BASE CHANNELS.

2. EPDM RUBBER TRANSITION VAPOR BARRIER FLASHING SHALL BE USED AT ALL LOCATIONS AS INDICATED ON THE DRAWINGS. EPDM RUBBER TRANSITION VAPOR BARRIER SHALL BE POSITIVELY AND CONTINUOUSLY SEALED TO PANEL SURFACES, POLYETHYLENE VAPOR BARRIER, OR OTHER VAPOR BARRIER MATERIAL AS REQUIRED WITH THE SPECIFIED UNISEAL TAPE OR SEALANTS AS NOTED.

B. INSULATED PANELS

1. AN 18" WIDE EPDM RUBBER VAPOR BARRIER TRANSITION SHEET SHALL BE INSTALLED DIRECTLY ON TOP OF THE PERIMETER FOUNDATION WALLS AS THE INSTALLATION OF INSULATED PANELS PROGRESSES IN THE FREEZER STORAGE AREA.

2. A 12 GAUGE GALVANIZED BREAK_FORMED PANEL BASE CHANNEL SHALL BE INSTALLED AND SEALED ON TOP OF THE EPDM RUBBER TRANSITION PIECE AND SECURED USING TAPCON OR CONFIX FASTENERS THROUGH THE UNISEAL TAPE OR CAULKING SEALANT.

3. THE 1/4" GAP BETWEEN THE EXTERIOR/WARM SIDE PANEL SKIN AND THE OUTSIDE FLASHING OF THE PANEL BASE CHANNEL SHALL BE FILLED WITH POURABLE CAULKING.

4. PANELS SHALL BE SECURED TO THE STRUCTURE AND TO EACH OTHER, AND SEALED VAPORTIGHT BY CAULKING THE FEMALE PORTION OF THE PANEL JOINTS AS THE WORK PROGRESSES. IN ADDITION, THOSE PANELS ERECTED ABOVE A LOWER ROOF (SUCH AS A DOCK OR PENTHOUSE) SHALL HAVE THEIR JOINTS CAULKED IN THEIR ENTIRETY ON THEIR EXTERIOR SKINS TO PREVENT MOISTURE FROM ENTERING THE JOINT FROM THE OUTSIDE AND MIGRATING PAST THE POURABLE CAULKING BELOW. AT ROOMS INDICATED ON THE DRAWINGS AS

CONFORMING TO WASHDOWN STANDARDS, INTERIOR JOINTS SHALL RECEIVE URETHANE CAULKING IN ACCORDANCE WITH THESE STANDARDS.

5. THE GRAVEL STOP, FASCIAS AND EXPANSION JOINTS SHALL BE ATTACHED TO THE PANELS AS SHOWN ON THE DRAWINGS. ALL PENETRATIONS BY FASTENERS THROUGH THE ROOF MEMBRANE SHALL BE SEALED WITH SPECIFIED SEALANT.

C. WALL PENETRATIONS

1. THIS SUBCONTRACTOR SHALL REINSULATE ALL PENETRATION VOIDS, RESEAL AND RE_ESTABLISH VAPOR BARRIER CONTINUITY OF ALL PENETRATION LOCATIONS. THE CUTTING OF THE OPENING AND THE INSULATION FOR THE PIPE OR CONDUIT IS THE RESPONSIBILITY OF THE SUBCONTRACTOR INSTALLING THAT SERVICE, BUT THE FOAMING OF THE VOID IN THE INSULATION ENVELOPE AND THE PROPER RESEALING OF THE VAPOR BARRIER IS THE RESPONSIBILITY OF THIS SUBCONTRACTOR. REFER TO DETAILS OF PENETRATIONS ON THE DRAWINGS.

2. ADHERE FLEXIBLE SYNTHETIC ELASTOMER INSULATION SHEET TO SURFACE, USING ADHESIVE. ADJACENT SHEETS SHALL BE APPLIED USING THE COMPRESSION FIT METHOD. APPLY THE ADHESIVE ON BOTH SURFACES TO BE JOINTED WITH A BRUSH OR SHORT-NAP PAINT ROLLER. JOINT SURFACES AFTER THE ADHESIVE IS DRY TO THE TOUCH.

D. FASTENERS; SHALL BE GALVANIZED FABLOK TYPICALLY (STAINLESS STEEL WHERE ATTACHING STAINLESS STEEL PANELS /TRIM. ALL GALVANIZED STEEL SHEET METAL SCREWS SHALL HAVE PAINTED HEADS TYPICALLY TO MATCH PANEL FINISH.

3.02 CLEANING

A. SUBCONTRACTOR SHALL CLEAN ALL SURFACES, INTERIOR AND EXTERIOR, OF INSULATED PANELS INSTALLED UNDER THIS CONTRACT. CLEANING SHALL BE PERFORMED DURING THE PULL_DOWN PERIOD AND SHALL INCLUDE REMOVAL OF ALL CONSTRUCTION DIRT AND DUST, URETHANE FOAM, AND ANY STAINING AND/OR MISCELLANEOUS RESIDUES FROM THE PANEL SURFACES. CLEANING SHALL BE PERFORMED TO THE SATISFACTION OF THE ARCHITECT, CONSTRUCTION MANAGER AND OWNER.

B. ALL WORK ADJACENT TO OPERATIONS UNDER THIS SECTION SHALL BE INSPECTED FOR DAMAGE AND STAINS AND REPAIRED OR CLEANED PRIOR TO THE COMPLETION OF WORK.

END OF SECTION

THE LIVESTOCK INSTITUTE

WESTPORT, MA

PROJECT NO. 4730

Specification for

GENERAL PROVISIONS

Section 16010

THE DENNIS GROUP, LLC

PLANNING ▲ ENGINEERING ▲ CONSTRUCTION MANAGEMENT

1537 MAIN STREET
SPRINGFIELD, MASSACHUSETTS 01103
413.787.1785 ▲ FAX 413.787.1786

26 WEST MARKET STREET
SALT LAKE CITY, UTAH 84101
801.531.8585 ▲ FAX 810.531.8586

B	**09.30.2016**	**BID**	**MJJ**		
A	**09.20.2016**	**Review**	**MJJ**		
Issue	**Date**	**Description**	**By**	**Approved**	**Section 16010**

Unless notification and/or comments are received from client within two weeks after issue date, all documentation including drawings, specifications, and studies submitted to client shall be considered approved as released.

PART 1 – GENERAL

1.01 PROVISIONS INCLUDED

A. All of the Contract Documents, including the General and Supplementary Documents, as listed on the Table of Contents and applicable parts of Division 1, General Requirements, shall be included in and made part of all electrical work as depicted on the drawings and described in Division 16, Section 16001 through 16999.

B. Examine all drawings and criteria sheets and all other Sections of the specifications for requirements which affect work under this Section whether or not such work is specifically mentioned in this Section.

C. Coordinate work with that of all other Trades affecting or affected by work of this Section. Cooperate with such Trades to assure the steady progress of all work under the Contract.

D. Provide all material, labor and equipment, to complete the work of this Section in strict accordance with the design Architect's and Engineer's plans and specifications, and with all applicable codes, rules, and standards.

1.02 SCOPE OF WORK

A. The work under this Contract shall include all labor, materials, tools, equipment, transportation, insurance, temporary protection, supervision and incidental items essential for proper installation and operation, even though not specifically mentioned or indicated on the drawings but which are usually provided or are essential for proper installation and operation of all systems as indicated on the drawings and specified herein.

B. The specifications and drawings describe the minimum requirements that must be met by the Electrical Contractor for the installation of all work as shown on the drawings and as specified hereinunder.

C. All sections of Division 16 shall be included.

D. The following general systems and equipment shall be provided as a minimum for the new building, but not be limited to the following:

1. Normal distribution system.

2. Emergency distribution system.

3. Grounding.

4. Connections to HVAC, Plumbing, Fire Protection, Automatic Temperature Control, General Contractor and Owner furnished equipment.

5. 120 volt power for remote alarms and connections to oil tank alarms, etc.

6. Hoisting, rigging, setting of all conduit, cable and equipment.

7. Testing, cleaning and adjusting.

8. Power Company related work and backcharges.

9. Fees, permits, royalties, guarantees.
10. Firestopping, smokeproofing, waterproofing.
11. Shop drawings, coordination drawings, record drawings.
12. Power system studies and trip settings.
13. Phasing of construction and power interruptions.
14. Access doors. **(NIC)**
15. Alarm panels. **(NIC)**
16. Automatic transfer switches.
17. Automation Controls. **(NIC)**
18. Boxes.
19. Busway. **(NIC)**
20. Cable assemblies (prefabricated). **(NIC)**
21. Cable tray systems.
22. Clock system. **(NIC)**
23. Conductors – 600 volts.
24. Conductors – medium voltage. **(NIC)**
25. Conduit.
26. Dimmer systems. **(NIC)**
27. Elevator fire alarm and related work. **(NIC)**
28. Emergency generator.
29. Enclosed circuit breakers. **(NIC)**
30. Fire alarm system.
31. Fuses.
32. Gas alarms, oil tank alarms, wiring and connection. **(NIC)**
33. Generator control switchgear. **(NIC)**
34. Hangers and supports.
35. High resistance grounding system. **(NIC)**

36. Intercom system. **(NIC)**

37. Lighting control system. **(NIC)**

38. Lighting fixtures including lamps.

39. Lightning protection system.

40. Load centers. **(NIC)**

41. Low voltage metal enclosed switchgear. **(NIC)**

42. Low voltage insulated case switchboards. **(NIC)**

43. Low voltage distribution switchboards, compartmented. **(NIC)**

44. Low voltage distribution switchboards, group mounted.

45. Manholes – precast. **(NIC)**

46. Mechanical suspension channel. **(NIC)**

47. Medium voltage cable splices and terminations. **(NIC)**

48. Medium voltage load interrupter switchgear – 15 kV. **(NIC)**

49. Medium voltage metal clad switchgear – 15 kV. **(NIC)**

50. Medium voltage metal enclosed switchgear – 15 kV. **(NIC)**

51. Metering switchboards. **(NIC)**

52. Mineral Insulated (MI) metal sheathed cable. **(NIC)**

53. Mini power centers. **(NIC)**

54. Motor control centers.

55. Motor controllers – magnetic starters.

56. Motor controllers – starters, medium voltage. **(NIC)**

57. Motor disconnect devices.

58. Neutral grounding resistors. **(NIC)**

59. Network protectors. **(NIC)**

60. Panelboards – branch circuit and distribution. (100-1200 A)

61. Power factor correction capacitor banks. **(NIC)**

62. Power management system. **(NIC)**

63. Primary unit substation. **(NIC)**

64. Public address system. **(NIC)**

65. Relay and low tension cabinets. **(NIC)**

66. Safety switches. **(NIC)**

67. Secondary unit substation. **(NIC)**

68. Security system.

69. Solderless lugs and connectors. **(NIC)**

70. Surface mounted raceway system. **(NIC)**

71. Switchboards (1600-3000 A).

72. Telecommunications/data empty raceway system. **(NIC)**

73. Telecommunication systems.

74. Transformers – dry type.

75. Transformers – dry type for non-linear loads ("K" factor). **(NIC)**

76. Transformer – pad mounted. **(NIC)**

77. Underground ductbank system.

78. Uninterruptible power supply (UPS) system. **(NIC)**

79. Unitized power center. **(NIC)**

80. Vibration isolation/seismic restraint. **(NIC)**

81. Wireways. **(NIC)**

82. Wiring devices and device plates.

E. General Scope Included

1. Installation of motor starters and disconnect switches furnished with package equipment supplied by other Trades.

2. Counterflashing of all conduits, sleeves, etc., which penetrate the roof.

3. Hoisting, rigging and setting of all electrical equipment under this Section.

4. Smokeproofing, firestopping and waterproofing of all conduit penetrations of walls or floors.

5. Shop drawing submittals for all equipment.

6. Guarantee.

7. Equipment labels – graphic designations.

8. Maintenance manuals.

9. Record as built drawings.

10. Coordination drawings.

11. Instructional classes on equipment and systems operation for Owner's representative and maintenance personnel.

12. Testing of all electrical equipment and wiring.

13. Furnishing of access panels.

14. Start-up of all electrical systems.

15. Temporary electricity.

1.03 RELATED WORK SPECIFIED ELSEWHERE

A. For additional requirements and/or work not included in this Section and required to be performed under other designated Sections, see the following:

1. Cutting and patching in masonry.

2. Finish painting.

3. Flashing of all conduit penetrations.

4. Installation of access panels by Trades as determined by the General Contractor.

5. Heating, ventilating and air conditioning work.

6. Automatic temperature control wiring/conduit.

7. Housekeeping pads, cutting and patching in concrete.

8. Fire protection work.

9. Plumbing work.

10. Trenching, excavation and backfilling.

11. Concrete work.

1.04 SUBMITTALS

A. Prepare and submit shop drawings in accordance with the requirements hereinbefore specified, and with the Shop Drawings, Product Data and Samples Section in the manner described therein, modified as noted hereinafter.

B. All shop drawings shall have clearly marked the appropriate specification number of drawing designation, for identification of the submittal.

C. All equipment and/or work installed without approved submittals/shop drawings shall be installed/ordered at the risk of the contractor. If the equipment and/or work are unacceptable to the Construction Manager it shall be removed and replaced at the Contractor's expense. The cost of removal and replacing shall include overtime as deemed necessary by the Construction Manager.

D. Disposition of shop drawings shall not relieve the Contractor from the responsibility for deviations from drawing or specifications, unless he has submitted in writing a letter itemizing or calling attention to such deviations at time of submission and secured written approval from the Engineer, nor shall such disposition of shop drawings relieve the Contractor from responsibility for errors in shop drawings or schedules.

E. Shop drawings shall include but shall not be limited to the following:

1. Access doors.
2. Alarm panels.
3. Automatic transfer switches.
4. Boxes.
5. Busway.
6. Cable assemblies (prefabricated).
7. Cable tray systems.
8. Clock system.
9. Conductors – 600 volts.
10. Conductors – medium voltage.
11. Conduit.
12. Dimmer systems.
13. Elapsed time indicators.
14. Elevator fire alarm and related work.
15. Emergency generator.
16. Enclosed circuit breakers.
17. Fire alarm system.
18. Fuses.
19. Gas alarms, oil tank alarms, wiring and connection.

20. Generator control switchgear.
21. Hangers and supports.
22. High resistance grounding system.
23. Intercom system.
24. Lighting control system.
25. Lighting fixtures including lamps.
26. Lightning protection system.
27. Load centers.
28. Low voltage metal enclosed switchgear.
29. Low voltage insulated case switchboards.
30. Low voltage distribution switchboards, compartmented.
31. Low voltage distribution switchboards, group mounted.
32. Manholes – precast.
33. Mechanical suspension channel.
34. Medium voltage cable splices and terminations.
35. Medium voltage load interrupter switchgear – 15 kV.
36. Medium voltage metal clad switchgear – 15 kV.
37. Medium voltage metal enclosed switchgear – 15 kV.
38. Metering switchboards.
39. Mineral Insulated (MI) metal sheathed cable.
40. Mini power centers.
41. Motor control centers.
42. Motor controllers – magnetic starters.
43. Motor controllers – starters, medium voltage.
44. Motor disconnect devices.
45. Neutral grounding resistors.
46. Network protectors.

47. Panelboards – branch circuit and distribution (100-1200 A).
48. Power factor correction capacitor banks.
49. Power management system.
50. Primary unit substation.
51. Public address system.
52. Relay and low tension cabinets.
53. Safety switches.
54. Secondary unit substation.
55. Security system.
56. Solderless lugs and connectors.
57. Surface mounted raceway system.
58. Switchboards (1600-3000 A).
59. Telecommunications/data empty raceway system.
60. Telecommunication system.
61. Television system.
62. Transformers – dry type.
63. Transformers – dry type for non-linear loads ("K" factor).
64. Transformer – pad mounted.
65. Underground ductbank system – routing.
66. Uninterruptible power supply (UPS) system.
67. Unitized power center.
68. Vibration isolation/seismic restraint.
69. Wireways.
70. Wiring devices and device plates.
71. Power system studies.
72. Routing of all conduits 2-1/2 inches in diameter and larger.

F. The following equipment rooms with all the electrical equipment laid out with dimensions, Code clearances, etc., indicated shall be submitted with the equipment shop drawings. Acceptance of these shop drawings shall be obtained prior to installation of feeder conduits:

a. All normal and emergency electrical rooms and closets.
b. Emergency generators.
c. Unit substation room.
d. Automatic transfer switches/distribution switchgear.

Note: Equipment shop drawings will not be reviewed without the room/equipment layouts.

G. The switchgear manufacturer shall submit the following information with each submittal:

1. Master drawing index.

2. Front view elevation.

3. Floor plan.

4. Top view.

5. Single line.

6. Schematic diagram.

7. Nameplate schedule.

8. Component list.

9. Conduit entry/exit locations.

10. Assembly ratings including:

a. Short circuit rating.
b. Information regarding series short circuit ratings.
c. Voltage.
d. Continuous current.
e. Basic Impulse level for equipment over 600 volts.
f. kVA.

11. Major component ratings including:

a. Voltage.
b. Continuous current.
c. Interrupting ratings.

12. Cable terminal sizes.

13. Connection details between close-coupled assemblies.

14. Composite floor plan of close-coupled assemblies.

15. Impedance for transformers.

16. The following additional information shall be submitted to the Engineer:

    a. Busway connection.
    b. Key interlock scheme drawing and sequence of operations.

17. The following product information shall be submitted:

    a. Descriptive bulletins.
    b. Product sheets.

18. The following information shall be submitted for record purposes prior to final payment:

    a. Final as-built drawings and information for items listed above.
    b. Wiring diagrams.
    c. Certified production test reports.
    d. Installation information.
    e. Seismic certification and equipment anchorage.

1.05 DEFINITIONS

A. Words in the singular shall also mean and include the plural, wherever the context so indicates, and words in the plural shall mean the singular, wherever the context so indicates.

B. Wherever the term “shown on drawings” is used in the specifications, it will mean “noted”, “indicated”, “scheduled”, “detailed”, or any other diagrammatic or written reference made on the drawings.

C. Wherever the term “provide” is used in the specifications it will mean “furnish” and “install”, “connect”, “apply”, “erect”, “construct”, or similar terms, unless otherwise indicated in the specifications.

D. Wherever the term “material” is used in the specifications it will mean any “product”, “equipment”, “device”, “assembly”, or “item” required under the Contract, as indicated by trade or brand name, manufacturer's name, standard specification reference or other description.

E. The terms “approved” and “approval” shall mean the written approval of the Architect/Engineer/Owner.

F. The term “specification” shall mean all information contained in the bound or unbound volume, including all “Contract Documents” defined therein, except for the drawings.

G. The terms “directed”, “required”, “permitted”, “ordered”, “designated”, “prescribed”, and similar words, shall mean the direction, requirement, permission, order, designation, or prescription of the Architect; the terms “approved”, “acceptable”, “satisfactory”, and similar words, shall mean approved by, acceptable to, or satisfactory to the Architect; and the terms “necessary”, “responsible”, “proper”, “correct”, and similar words, shall mean necessary, reasonable, proper, or correct in the judgment of the Architect/Owner.

H. “Concealed” means hidden from sight in chases, furred spaces, shafts, hung ceilings, or embedded in construction or in crawl spaces.

I. “Exposed” means not installed underground or “concealed” as defined above.

J. "Contractor" shall refer to the Electrical Contractor responsible for furnishing and installing all work indicated on the Electrical drawings and in the Electrical specifications.

K. "Architect" shall refer to the Architect "**The Dennis Group, LLC**" and/or to the Engineer "The Dennis Group, LLC" (DGL).

L. "Owner" shall refer to the Owner "**The Livestock Institute**" or his designated representative.

M. "**General Contractor**" shall refer to "**TBD**".

N. "Other Work Contractor" (O.W.C.) refers to the Contractor(s), or Subcontractor(s) performing work under other Sections of the Contract Documents.

1.06 CODES, STANDARDS, AND REFERENCES

A. All materials and workmanship shall comply with all applicable Codes, Specifications, Local and State Ordinances, Industry Standards, and Utility Company regulations, and the latest editions thereof.

B. In case of difference between Building Codes, State Laws, Local Ordinances, and the Contract Documents, the Contractor shall promptly notify the Architect in writing of any such difference.

C. In case of conflict between the Contract Documents and the requirements of any Code or Authorities having jurisdiction, the most stringent requirements of the aforementioned shall govern.

D. Should the Contractor perform any work that does not comply with the requirements of the applicable Building Codes, State Laws, Local Ordinances, Industry Standards, and Utility Company regulations, he shall bear all costs arising in correcting the deficiencies, as approved by the Architect/Owner.

E. Applicable Codes and Standards shall include all State Laws, Local Ordinances, Utility Company regulations, and the applicable requirements of the following accepted Codes and Standards, without limiting the number, as follows.

1. Building Codes

a. NFPA 13: Sprinkler Systems
b. NFPA 70: National Electrical Code
c. NFPA 72: National Fire Alarm Code
d. NFPA 101: Life Safety Code
e. Occupational Safety and Health Standards
f. Environmental Protection Agency
g. National Fire Protection Association
h. State Department of Environmental Protection
i. Building Officials Code Association (BOCA)
j. Uniform Building Code (UBC)
k. State Building Code
l. State Electrical Code
m. State Inspectional Department
n. ANSI Handicapped Code A117
o. Accessibility Requirements Code
p. NFPA 33: Combustion Engines

q. NFPA 92A: Standard for Smoke Control Systems

F. In these specifications, references made to the following Industry Standards and Code Bodies are intended to indicate the latest volume or publication of the Standard. All equipment, materials and details of installation shall comply with the requirements and latest revisions of the following Bodies, as applicable:

1.	ANSI	American National Standards Institute
2.	ASTM	American Society of Testing Materials
3.	ICEA	Insulated Cable Engineers Association
4.	IEEE	Institute of Electrical and Electronic Engineers
5.	AWG	American Wire Gauge
6.	FM	Factory Mutual Engineering Division
7.	NEMA	National Electrical Manufacturers Association
8.	UL	Underwriters' Laboratories
9.	JIC	Joint Industry Conference
10.	NESC	National Electrical Safety Code
11.	FDA	Food and Drug Administration

G. The Contractor for the work in his scope shall give all necessary notices, obtain all permits, pay all governmental taxes, fees, and other costs in connection with his work, and file for necessary approvals with the jurisdiction under which the work is to be performed. The Contractor shall obtain all required Certificates of Inspection for his respective work and deliver same to the Architect before request for acceptance of his portion of work is made and before final payment.

H. The Contractor shall also follow the building owner's Standards for electrical systems.

1.07 GUARANTEE

A. Attention is directed to provisions of the General Requirements and Supplementary General Requirements regarding guarantees and warranties for work under this Contract.

B. Manufacturers shall provide their standard guarantees for work under the Electrical Trades. However, such guarantees shall be in addition to and not in lieu of all other liabilities which the manufacturer and the Contractor may have by law or by other provisions of the Contract Documents.

C. All materials, items of equipment and workmanship furnished under the Electrical Section shall carry the standard warranty against all defects in material and workmanship. Any fault due to defective or improper material, equipment, workmanship or design which may develop shall be made good, forthwith, by and at the expense of the Contractor for the work under his Contract, including all other damage done to areas, materials and other systems resulting from this failure.

D. The Contractor shall guarantee that all elements of the systems which are to be provided under his Contract are of sufficient capacity to meet the specified performance requirements as set forth herein or as indicated.

E. Upon receipt of notice from the Owner of failure of any part of the systems or equipment during the guarantee period, the affected part or parts shall be replaced by the Contractor for his work.

F. The Contractor shall furnish, before the final payment is made, a written guarantee covering the above requirements.

1.08 THE CONTRACTOR

A. The Contractor shall visit the site and base his bids from his own site examinations and estimates. The Contractor shall not hold the Architect, the Owner or his agents or employees responsible for, or bound by, any schedule, estimate or of any plan thereof. The Contractor shall study the Contract Documents included under this Contract to determine exactly the extent of work provided under this Contract, as well as to ascertain the difficulty to be encountered in performing the work, as shown on the drawings and outlined hereinafter in installing new equipment and systems and coordinating the work with the other Trades and existing building conditions.

B. The Contractor shall faithfully execute his work according to the terms and conditions of the Contract and specifications, and shall take all responsibility for and bear all losses resulting to him in the execution of his work.

C. The Contractor shall be responsible for the location and performance of work provided under his Contract as indicated on the Contract Documents. All parties employed directly or indirectly by the Electrical Contractor shall perform their work according to all the conditions as set forth in these specifications.

D. The Contractor shall furnish all materials and do all work in accordance with these specifications, and any supplementary documents provided by the Architect. The work shall include everything shown on the drawings and/or required by the specifications as interpreted by the Architect, regardless of where such information is indicated (Architectural, HVAC, Plumbing, Fire Protection, etc., Contract Documents). All work and materials furnished and installed shall be new and of the best quality and workmanship. The Contractor shall cooperate with the Architect so that no error or discrepancy in the Contract Documents shall cause defective materials to be used or poor workmanship to be performed.

E. All communication between the Contractor and any other party shall be written. Verbal requests, quotations, orders, change orders, etc., will not be acceptable.

1.09 COORDINATION OF WORK

A. The Electrical Contractor shall compare his drawings and specifications with those of other Trades as well as the Architectural drawings and specifications, and report any discrepancies between them to the Architect and obtain from the Architect written instructions for changes necessary in the electrical work.

B. The electrical contractor shall be responsible for the coordination of light fixtures locations in all areas of the facility with other trades. This shall include the marking of the locations of the light fixtures that are recessed in the metal panel ceilings. The openings in the metal panel ceiling shall be provided by the metal panel contractor.

C. All work shall be installed in cooperation with other Trades installing interrelated work. Before installation, Electrical Contractor shall make proper provisions to avoid interferences, in a manner approved by the Architect. All changes required in the work of the Electrical Contractor or that of any other Trade, caused by the Electrical Contractor's neglect, shall be made by him at his own expense, to the Architect's satisfaction.

D. The Electrical Contractor must include in his bid sufficient dollar amounts to coordinate the work of this Contract. This project is complex and will require additional time to coordinate all Trades and allow implementation of the Owner's standards and maintenance serviceability requirements. This requirement shall include, but not be limited to, producing the coordination drawings, as many times and as many drawings as required, to ensure serviceability of equipment, as approved by the Architect.

E. Locations of conduits, boxes, distribution equipment, systems, etc. shall be adjusted to accommodate the work with interferences anticipated and encountered. The Electrical Contractor shall determine the exact routing and location of his systems prior to fabrication or installation of any system component. Accurate measurements and coordination drawings shall be completed to verify dimensions and characteristics of the various systems installations.

F. Lines that pitch shall have the right-of-way over those that do not pitch. For example, steam piping shall normally have the right-of-way. Lines whose elevations cannot be changed shall have the right-of-way over lines whose elevations can be changed.

G. Offsets, transitions, and changes of direction in all systems shall be made as required to maintain proper headroom and pitch of sloping lines whether or not indicated on the drawings. The Electrical Contractor shall provide elbows, conduit bends, "LB" fittings, etc., as required for his work to effect these offsets, transitions, and changes in direction.

H. All work shall be installed in a way to permit removal (without damage to other parts) of pull and junction box covers, wiring, lighting fixtures, and all other system components provided under this Contract requiring periodic replacement or maintenance. All pull and junction boxes shall be arranged in a manner to clear the openings of swinging overhead access doors as well as ceiling tiles. All work shall be done to allow easy access for maintaining equipment. The Owner and Engineer will require proof via the preparation of large scale sections and part plans that pull and junction boxes, etc. are accessible after the work is completed. Any items in the field discovered to be in non-compliance shall be removed and relocated, as required, and as directed by the Architect.

I. The Contract Drawings are diagrammatic only intending to show general runs and locations of conduits, distribution equipment, lighting fixtures, systems equipment, etc. and not necessarily showing all required offsets, details and accessories and equipment to be connected. All work shall be accurately laid out with other Trades to avoid conflicts and to obtain a neat and workmanlike installation which will afford maximum accessibility for operation, maintenance and headroom.

J. Where there exist discrepancies in scope of work as to what Trade provides items, such as starters, disconnects, flow switches, etc., such conflicts shall be reported to the Architect during bidding and prior to signing of the Contract. If such action is not taken, the Electrical Contractor shall furnish such items as part of his work as necessary, for complete and operable systems and equipment, as determined by the Architect.

K. The Electrical Contractor shall coordinate the installation of all equipment and any catwalks or service platforms provided.

L. Where drawing details, plans, specification requirements and/or scheduled equipment capacities are in conflict and where feeders, branch circuits or equipment are shown to be different between plans and/or between plans and riser diagrams, details or specifications, the most stringent requirement will be included in the Contract. Electrical systems and equipment called for in the specification and/or shown on the drawings shall be provided under this

Contract as if it were required by both the drawings and specifications. However, prior to ordering or installation of any portion of work which appears to be in conflict, such work shall be brought to Architect's attention for direction as to what is to be provided.

M. Final location of all lighting fixtures, smoke detectors, exit signs, switches, receptacles, fire alarm devices, etc., shall be coordinated with the Architectural reflected ceiling plans, Architectural elevations, and/or other Architectural details as applicable, and shall not be scaled from locations indicated on the Electrical drawings. Obtain approval of locations of all devices from Architect in the field. The Owner/Architect reserves the right to relocate any receptacle, device, lighting fixture, etc. 10'-0" in any direction prior to installation at no additional cost to the Project.

N. Autoclaves, fume hoods or other type equipment shown on the Electrical and/or Architectural drawings to be provided with services, shall be included under this Contract as applicable, including all conduit and wiring connections to systems, to make equipment complete and operable. Additional wiring, equipment, etc., shall be provided to accomplish the above requirement, as required, all as part of this Contract, at no extra cost to the Owner. This requirement necessitates that the Electrical Contractor review the Architectural drawings and the drawings of other Trades during bidding to ascertain the extent of all requirements, and interface between the Trades and scope of work.

O. The Electrical Contractor shall coordinate his work with other Trades' work so that all equipment and systems can be easily, safely, and properly serviced and maintained. It is imperative that service personnel can safely access all equipment. Provide safety rails, steps, ladders, valve chains, handle extensions, etc. as required, in addition to the ones shown on the drawings, to ensure safe and easy access to all equipment is provided in a manner approved by the Architect.

P. The HVAC, ATC and Electrical Contractors' Scope of Work shall be implemented in accordance with the division of responsibility matrix located on the electrical drawings. .

1.10 GIVING INFORMATION

A. The Contractor shall keep himself fully informed as to the shape, size, and position of all openings required for his apparatus and shall give information to other Contractors sufficiently in advance of the work so that all openings may be built in advance.

1.11 EQUIPMENT AND MATERIALS

A. Equipment and materials shall be delivered to the site and stored in original sealed containers, suitably sheltered from the elements, yet readily accessible for inspection by the Architect, until installed. All items subject to moisture damage such as controls shall be stored in dry, heated spaces.

B. Equipment shall be tightly covered and protected against dirt, water, and chemical or mechanical injury and theft. At the completion of the work, equipment and materials shall be cleaned, polished thoroughly and turned over to the Owner in a condition satisfactory to the Architect. Damage or defects developing before acceptance of the work shall be made good at the Contractor's expense.

C. The Contractor shall make necessary field measurements to ascertain space requirements, for equipment and connections to be provided under his respective Trade and shall furnish and install such sizes and shapes of equipment to allow for the final installation to conform to the drawings and specifications.

D. The manufacturers listed within this specification have been preselected for use on this project. No submittal will be accepted from a manufacturer other than specified. Should the Contractor wish to propose a substitution during the bid period, such request shall be made in writing to the Architect, no less than seven working days, prior to bid date. If substitutions are deemed acceptable by the Architect, a written authorization will be issued by the Architect to allow such substitution. The above requirement is mandatory. Where specifications indicate “Owner's approved equal”, the Electrical Contractor shall propose “equal” manufacturers, in writing, to the Architect, no less than seven (7) working days prior to bid date. If proposed “equal” is deemed acceptable to the Owner and Architect, a written authorization will be issued by the Architect. If the proposed equal is not deemed acceptable, the Electrical Contractor shall supply equipment from the specified manufacturer.

E. Manufacturers' directions shall be followed completely in the delivery, storage, protection, and installation. Promptly notify the Architect in writing of any conflict between any requirements of the Contract Documents and the manufacturer's directions and shall obtain the Architect's written instructions before proceeding with the work. Should the Contractor perform any work that does not comply with the manufacturer's directions or written instructions from the Architect, he shall bear all costs arising in correcting any deficiencies that should arise.

F. The Contractor shall furnish and install all equipment, accessories, connections and incidental items necessary to fully complete the work under his Contract for use, occupancy and operation by the Owner.

G. Where equipment of the acceptable manufacturers require different arrangement or connections from those shown, it shall be the responsibility of the Contractor to install the equipment to operate properly and in harmony with the original intent of the drawings and specifications. When directed by the Architect, the Contractor shall submit drawings showing the proposed installation. If the proposed installation is approved, the Contractor shall make all necessary changes in all affected related work provided under other Sections including location of roughing-in connections by other Trades, conduit, supports, etc. All changes shall be made at no increase in the Contract amount or additional cost to the other Trades and/or Owner.

H. All equipment and materials required for installation under these specifications shall be new and without blemish or defect unless otherwise noted. Equipment and materials shall be products which will meet with the acceptance of the Authorities having jurisdiction over the work and as specified hereinbefore. Where such acceptance is contingent upon having the products listed or labeled by FM or UL or other testing laboratory, the products shall be so listed or labeled. Where no specific indication as to the type or quality of material or equipment is indicated, a first class standard article shall be provided.

I. All equipment of one type (e.g. switchgear, panelboards, etc.) shall be the products of one manufacturer.

J. **Equipment purchased by the Construction Manager on behalf of the Owner or by the Owner himself, if assigned to the Contractor, shall be received, store, installed, etc., as if the equipment was purchased by the Contractor. All guarantees, service contracts, warranties, etc., shall be assigned to the Contractor and shall be the same as for all other equipment provided under this Contract.**

1. **Provide storage in heated, dry, secure location. During installation provide temporary power to equipment space heaters.**

1.12 USE OF PREMISES

A. The Contractor shall confine all apparatus, storage of materials and construction to the limits indicated on the drawings and directed by the Architect/Construction Manager and he shall not encumber the premises with his materials. The Contractor shall be held responsible for repairs, patching, or cleaning arising from any unauthorized use of premises.

B. Notwithstanding any approvals or instructions which must be obtained by the Contractor from the Architect in connection with the use of the premises, the responsibility for the safe working conditions at the site shall remain that of the Contractor, and the Architect or Owner shall not be deemed to have any responsibility or liability in connection therewith.

1.13 PROTECTION

A. Materials, conduit, lighting fixtures, etc., shall be properly protected and all conduit openings shall be temporarily closed so as to prevent obstruction and damage. Post notice prohibiting the use of all systems provided under the Electrical Contract, prior to completion of work and acceptance of all systems by Owner, unless otherwise instructed by Architect. Take precautions to protect all materials furnished from damage and theft.

B. The Contractor shall furnish, place and maintain proper safety guards for the prevention of accidents that might be caused by the workmanship, materials, equipment or electrical systems provided under his Contract.

1.14 DAMAGE TO OTHER WORK

A. The Contractor shall be held responsible and shall pay for all damages caused by his work to the building structures, equipment, conduits, systems, etc., and all work and finishes installed under this Contract. Repair of such damage shall be done by the Contractor at the expense of the Contractor, to the Architect's satisfaction.

1.15 CORRECTION OF WORK

A. The Contractor shall promptly correct all work provided under his Contract and rejected by the Architect as defective or as failing to conform to the Contract Documents whether observed before or after completion of work and whether or not fabricated, installed or completed.

1.16 EXTRA WORK

A. No claim for extra work will be allowed unless it is authorized by the Architect before commencement of the extra said work.

1.17 TOUCH-UP PAINTING

A. All equipment and systems shall be thoroughly cleaned of rust, splatters and other foreign matter of discoloration leaving every part of all systems in an acceptable prime condition. The Contractor for the work under his Contract shall refinish and restore to the original condition all equipment which has sustained damage to the manufacturer's prime and finish coats of paint and/or enamel.

1.18 FIRESTOPPING AND SMOKEPROOFING

A. Where conduits pass through masonry or concrete walls or floors, the Electrical Contractor shall provide and set individual sleeves for each conduit and all other work under his charge,

as necessary for passage of all raceways. Sleeves shall be of sufficient size to provide 1/2" air space around the conduit passing through the floor or walls. All openings shall be sealed, smokeproofed and made tight. The Electrical Contractor shall be responsible for the exact location of sleeves provided under this Contract and shall coordinate all requirements for conduit sleeves. Refer to Division 7 specifications for additional information.

B. The Electrical Contractor shall review fire stop and smoke stop systems provided under Division 7 specifications, and coordinate the system installation.

C. Except as otherwise specified, underground piping passing through exterior walls, foundation slabs on grade, or manhole walls, shall have penetration closures of the modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the conduit and wall opening. Links shall be loosely assembled with bolts to form a continuous belt around the conduit and with a pressure plate under each bolt head and nut. After the seal assembly is positioned in the sleeve, tightening of the bolts shall cause the rubber sealing elements to expand and provide an absolutely watertight seal between the conduit and wall, reducing chances of cathodic reaction between these members.

D. The Electrical Contractor for work under his charge shall determine the required inside diameter of each individual wall opening or sleeve before ordering, fabrication or installation. The inside diameter of the wall opening shall be sized to fit the conduit and ensure a watertight joint. Where applicable, when installing seals, take into account the conduit O.D. if non-standard due to coating or jacketing.

1.19 WATERPROOFING AND COUNTERFLASHING

A. The Contractor shall hire the services of the facility roofing contractor to provide all counter flashing of all conduit and equipment provided by him that pierce roofs, walls and other weather barrier surfaces.

B. All work shall be performed in a workmanlike manner to assure weatherproof installation. Any leaks developed due to the Contractor's work shall be repaired at his expense, to Architect's satisfaction.

1.20 MISCELLANEOUS IRON AND STEEL

A. Except where specifically indicated for the General Contractor to provide supports, Electrical Trade shall provide all steel supports and hangers as shown on the drawings or required to support all equipment or materials provided under their Contract.

B. All supports shall be cut, assembled, welded and finished by skilled mechanics. Welds shall be ground smooth. Stands, brackets and framework shall be properly sized and strongly constructed.

C. Measurements shall be taken on the job and worked out to suit adjoining and connecting work. All work shall be performed by experienced metal-working mechanics. Members shall be straight and true and accurately fitted.

1.21 PARTS LIST AND INSTRUCTIONS FOR OPERATION AND MAINTENANCE

A. The Contractor shall thoroughly instruct the representative of the Owner, to the complete satisfaction of the Architect, in the proper operation of all systems and equipment provided by him. The Contractor shall make arrangements, via the Architect, as to whom the instructions are to be given in the operation of the basic and auxiliary systems and the period of time in

which they are to be given. The Architect shall be completely satisfied that the representative of the Owner has been thoroughly and completely instructed in the proper operation of all systems and equipment before final payment is made. If the Architect determines that complete and thorough instructions have not been given by the Contractor to the Owner's representative, then the Contractor shall be directed by the Architect to provide whatever instructions are necessary until the intent of this paragraph of the specification has been complied with.

B. The Contractor shall submit to the Architect for approval, the required typed sets (see Division 1; General and Supplementary General Requirements), bound neatly in loose-leaf binders, of all instructions for the installation, operation, care and maintenance of all equipment and systems (including instructions for the ordering and stocking of spare parts for all equipment installed under this Contract). The lists shall include part numbers and suggested supplier. Each set shall also include an itemized list of component parts that should be kept on hand and where such parts can be purchased.

C. Information shall indicate possible problems with equipment and suggested corrective action. The manuals shall be indexed for each type of equipment. Each section shall be clearly divided from the other sections. A sub-index for each section shall also be provided. The methodology of setting-up the manuals shall be submitted to the Architect and Owner for review prior to final submission of manuals.

D. The instructions shall contain information deemed necessary by the Architect and include but not limited to the following:

1. Introduction

    a. Explanation of Manual and its use.

    b. Summary description of the Electrical systems.

    c. Purpose of systems.

2. System

    a. Detailed description of all systems.

    b. Illustrations, schematics, block diagrams, catalog cuts, and other exhibits.

3. Operations

    a. Complete detailed, step-by-step, sequential description of all phases of operation for all portions of the systems, including start-up, shutdown, adjusting. Include all posted instruction charts.

4. Maintenance

    a. Parts list and part numbers.

    b. Maintenance, and replacement charts and Electrical Contractor's recommendations for preventive maintenance.

    c. Troubleshooting charts for systems and components.

d. Instructions for testing each type of part.

e. Recommended list of on-hand spare parts.

f. General or miscellaneous maintenance notes.

5. Manufacturer's Literature

a. Complete listing for all parts with names, addresses and telephone numbers.

b. Care and operation.

c. All and only pertinent brochures, illustrations, drawings, cuts, bulletins, technical data, certified performance charts and other literature with the model actually furnished to be clearly and conspicuously identified.

d. Internal wiring diagrams and engineering data sheets for all items and/or equipment to be furnished.

e. Guarantee and warranty data.

1.22 MANUFACTURER'S REPRESENTATIVE

A. The Contractor shall provide, at appropriate time or as directed by Architect, the on-site services of a competent factory trained engineer of particular manufacturer of equipment, such as generator, switchgear, fire alarm systems, controls systems, etc., to inspect, adjust and place in proper operating condition any and all items of same manufacturer. No additional compensation will be allowed for such services. A written report shall be issued by the particular manufacturer with his findings for the Architect's record.

1.23 CONNECTIONS TO ARCHITECTURAL, HVAC, PLUMBING AND OWNER-FURNISHED EQUIPMENT

A. The Contractor shall provide all conduit connections to equipment provided under other Sections of the specifications as shown on the drawings and herein specified, including final connections to equipment to result in a complete system, fully operational. Coordinate location of all equipment with appropriate Contractor(s). Obtain installation diagrams and methods of installation of all equipment, from manufacturers. Follow instructions strictly. If additional information is required, obtain same from Architect.

1.24 RECORD DRAWINGS

A. The Electrical Contractor shall maintain current at the site a set of his drawings on which he shall accurately show the actual installation of all work provided under his Contract indicating hereon any variation from the Contract Drawings, in accordance with the General Conditions and Division 1. Changes, whether resulting from formal change orders or other instructions issued by the Architect, shall be recorded. Include changes in sizes, location, and dimensions of conduit, switchgear, lighting fixtures, fire alarm equipment, wiring devices, etc.

B. The Electrical Contractor shall indicate progress by coloring in various conduits, equipment and associated appurtenances exactly as they are erected. This process shall incorporate both the changes noted above and all other deviations from the original drawings whether resulting from job conditions encountered or from any other causes.

C. The marked-up and colored-up prints will be used as a guide for determining the progress of the work installed. They shall be inspected periodically by the Architect and Owner and they shall be corrected immediately if found either inaccurate or incomplete. This procedure is mandatory.

D. At the completion of the job, these prints shall be submitted to the General Contractor and then to the Architect for final review and comment. The prints will be returned with appropriate comments and recommendations. These corrected prints, together with corrected prints indicating all the revisions, additions and deletions of work, shall form the basis for preparing a set of As-Built Record Drawings.

E. The Subcontractor shall be responsible for generating As-Built Record Drawings utilizing CAD based documents in AutoCAD Release 14 (or later version) DWG or DXF format. A bound set of plans, as well as the computer files, on disk, shall be turned over to the Architect for review. After acceptance of the as-built documents by the Architect, the Electrical Contractor shall make any corrections necessary to the as-built documents and prepare one reproducible set of drawings as well as bound blueprint set(s) (quantity as determined by the Architect) for distribution to the Owner via the Architect.

F. The Electrical Contractor may use the computer drawing files used for coordination drawings or purchase the Engineer's most recently updated computer drawing files at a nominal charge of $100 per drawing file. The updated drawings may not include all changes made during the course of construction and it shall be the Electrical Contractor's responsibility to update the as-built documents to include all changes brought forth to the project resulting from bulletins, request for information (RFI's), change orders, etc. The Electrical Contractor may review the Engineer's latest computer files for completeness prior to purchase, however the Engineer will not be responsible for updating the computer files.

G. Included with the above shall be a complete drawing list and a standard layering system, which shall be required to be maintained within the As-Built Record CAD documents.

H. The Subcontractor shall be issued bulletins in the same manner as the original Design Documents described above.

I. The as-built CAD documents required shall be in addition to other requirements stated elsewhere.

1.25 COORDINATION DRAWINGS

A. Before materials are purchased, fabricated or work is begun, each Subcontractor shall prepare and obtain approval of coordination drawings, and sections for all floors/areas, including buried system/services, resulting in (1) set of all-Trade-composite at 3/8" scale drawings, showing the size and location of all equipment, in the manner described hereinunder General Requirements. Architects review and approval of coordination drawings must be obtained prior to any fabrication or installation of any equipment or systems.

B. The coordination drawings shall be generated from a computer CAD program compatible with AutoCAD Release 14, in DWG or DXF format. The HVAC Subcontractor shall take the lead, supervise, and coordinate production of coordinated layout drawings, to show and coordinate all equipment. These drawings shall then be circulated to the Electrical Contractor so that he can indicate all his work as directed by the General Contractor and Architect and as required, to result in a fully coordinated installation.

C. The Electrical Contractor shall indicate all electrical equipment and conduit provided by him or his Subcontractors on the coordination drawings. This equipment and conduit shall include, but not be limited to, the following:

1. All electrical distribution equipment, drawn to scale with clearance requirements (substations, switchboards, busway, transformers, panelboards, etc.).

2. All motor control centers, drawn to scale with clearance requirements.

3. Emergency generator and distribution equipment (generator, transfer switches, etc.).

4. All switchboard and panelboard feeder conduits.

5. All conduits for all systems over 2-1/2" in diameter.

6. Conduit routing and rack locations for all conduits regardless of conduit size when more than 4 conduits are grouped in a rack.

7. All pull and splice boxes over 8" in any direction.

8. MC cable routing and rack locations for all MC cable when more than 4 runs are grouped in a rack.

9. Lighting fixture housings and supports that interfere with other system and furnishings.

D. All costs associated with all aspects of coordination drawings, regardless as to how long they take to produce and how many times they have to be redrawn, shall be borne by the Electrical Contractor.

E. The Electrical Contractor may purchase the electrical AutoCAD computer drawing files from the Electrical Contract set on CD or via modem from the Engineer at the nominal cost of $100 per drawing file, if he so chooses.

F. The Electrical Contractor shall issue to the HVAC Subcontractor, via CD, a complete set of equipment installation layout documents in AutoCAD Release 14 (DWG or DXF) format, for use in developing the required coordination drawings.

G. The Electrical Contractor shall be responsible for coordinating the Electrical AutoCAD coordination drawings, including, but not limited to, the drawing lists, layering system, producing copies of the drawings for the Architect as directed, etc.

1.26 PHASING, DEMOLITION AND MAINTAINING EXISTING SYSTEMS

A. During the execution of the work, required relocation, rerouting, etc., of existing equipment and systems on the site or where new work is to be installed or new connections are scheduled to be made, shall be performed by the Electrical Contractor, as indicated on the drawings, and/or as required by job conditions and as determined by the Architect in the field, to facilitate the installation of the new systems.

B. The Owner will require continuous operation of the existing systems, while demolition, relocation work or new tie-ins will be performed. Outages required for construction purposes shall be scheduled for the shortest practical periods of time, in coordination with the Owner's designated representative, for specified, mutually agreeable periods of time, after each of

which the interruption shall cease and the service shall be restored. This procedure shall be repeated to suit the Owner's working schedule, as many times as required until all work is completed. Any outages of service shall be approved by the Owner, prior to commencing the work. No outages or shutdowns of service shall occur without the written authorization of the Owner, prior to commencing the work. Give notice of any scheduled shutdowns, a minimum of two (2) weeks in advance. The Owner shall make their best efforts to meet this request without adversely affecting the electric service to the site. Shutdowns shall not be scheduled during normal business hours (i.e., shutdowns shall be from 6:00 PM to 6:00 AM). Maximum duration of each shutdown shall be eight (8) hours. Not more than one shutdown per twenty-four hour period.

C. The Electrical Contractor shall submit with his bid a preliminary shutdown schedule for review by the Owner, Architect and General Contractor. Shutdown schedule shall be finalized with the successful Electrical Contractor.

D. Prior to any deactivation and relocation or demolition work, consult the drawings and arrange a conference with the Architect and the Owner's representative in the field to inspect each of the items to be deactivated, removed, or relocated. Care shall be taken to protect all equipment designated to be relocated and reused or to remain in operation and be integrated with the new systems.

E. All deactivation, relocation and temporary tie-ins shall be provided by the Electrical Contractor. All demolition, removal and the legal disposal of demolished materials of system designated to be demolished shall be provided by the General Contractor.

F. The Owner reserves the right to inspect the material scheduled for removal, and salvage any items he deems usable as spare parts.

G. Phasing

1. The Electrical Contractor shall construct the subject project in phases as directed by the Architect and General Contractor to suit the project progress schedule, as well as the completion date of the project.

2. For additional information related to phasing, review the General Conditions and Supplementary Conditions and the Architectural drawings.

H. Electrical devices, safety switches, junction boxes, outlet boxes, conduits, branch circuit wiring, etc. located on walls to be demolished shall be completely disconnected and removed.

I. Where existing conduits and equipment are embedded in concrete walls, ceilings or floors, the conduit shall be cut back flush to the surface, all wiring shall be disconnected and removed and equipment shall be removed for the General Contractor to patch the existing opening.

J. The Electrical Contractor shall provide **a temporary fire alarm system, or tie-ins to the existing fire alarm system,** as required to maintain the system in areas to remain functional during the renovation. Upon completion of the renovations, the Electrical Contractor shall provide new fire alarm devices and wiring in the existing areas to remain and provide tie-ins to the new fire alarm system.

1.27 TEMPORARY ELECTRIC AND CONTROLS

A. If the Contractor requires power for job or storage trailers, the Contractor shall coordinate with the local utility company to obtain power. Power has been run to the site trailer area by the

local utility company. The Contractor shall pay all costs associated with getting power from the existing utility pole to their job or storage trailer(s).

B. General services temporary power is provided at the job site for the contractors' use inside the building envelope. The temporary power provide for contractors' use shall be limited to general purpose 120 volt, 20 A receptacles and 480 volt, 3-phase, 30 A services for welders. Any Subcontractor having requirements for power, lighting, or service other than those provided herein, shall make the necessary arrangements to obtain such power, lighting, or service at his own expense. The project temporary electric contractor is the only contractor authorized to perform temporary electric work on the project site except for job trailer area. All contractors shall hire the services of the temporary electric contractor to provide trailer power and temporary services on the project site except for trailer connection.

C. All Contractors and Subcontractors shall, individually, furnish all extension cords and lamps, sockets, motors and accessories required for their work.

D. Construction Electricity: The Electric Contractor shall pay for and be responsible for Construction Electricity facilities as defined above and further specified as follows.

1. The Owner will pay for all electrical energy drawn from normal metered building supply used on the project after the Date of Substantial Completion of the Work.

2. The Construction Electricity will be required to be used during the hours designated by the Construction Manager. No additional charge shall be made by the Electrical Contractor for switching the system on and off to meet this time requirement.

3. Responsibility of compliance with local, state and national codes for installation of the Construction Electric service shall be borne by the Electrical Contractor.

4. Replacement lamps shall be provided by the Electrical Contractor during the Construction Electric period. All lamps in permanent fixtures which have been used during the Interim Electric period shall be replaced with new lamps by the Electrical Contractor at his expense just prior to the Date of Substantial Completion.

5. The following Construction Electricity shall be included by the Electrical Contractor in his subcontract price. This schedule will not necessarily provide for all requirements of the Construction Manager or all Subcontractors. The Construction Manager or any Subcontractor having requirements for power, lighting, or service other than those provided herein, shall make the necessary arrangements to obtain such power, lighting, or service at his own expense.

   a. The Electrical Contractor shall obtain all necessary permits and shall connect to public utility line as a source for temporary electrical power, shall furnish and install all temporary electrical power and lighting systems, and shall pay for all labor, materials, and equipment required therefor. All such temporary electrical work shall meet the requirements of the National Electrical Code and OSHA.

   b. The Electrical Contractor shall furnish and install a feeder, or feeders, of sufficient capacity for the requirements of entire job site. Temporary lighting shall be based on the following requirements:

      1) Rooms or spaces under 250 sq. ft.: One (1) 150-watt lamp.

2) Rooms or spaces over 250 sq. ft. and under 500 sq. ft.: Two (2) 150-watt lamps.

3) Rooms or spaces 500 sq. ft. and over: two (2) 400-watt lamps for spaces 500 sq. ft. to 1000 sq. ft. and two (2) 400-watt lamps for every additional 1000 sq. ft. or fraction thereof.

4) Production & Process Space: Permanent emergency light fixtures shall be installed to provide construction lighting. These light fixtures shall be wired to panelboard specified in the drawings. See contract documentation for additional information. As required at the direction of the Construction Manager, install and power additional permanent light fixtures wired to a temporary source. If required by the Construction Manager, provide additional (1) 400-watt low bay halide light fixture.

5) Sufficient additional wiring outlets and lamps shall be installed to insure proper lighting in stairwells, corridors and passage areas.

6) Temporary power, in addition to the lighting requirements, shall be provided throughout the building for the electrically operated tools, based on a minimum of 0.50 watts per sq. ft.

c. The Electrical Contractor shall furnish and install all lamps, both initial and replacement until the date of Substantial Completion.

d. Temporary light and power requirements herein required are for the use of all trades working at the site.

e. All Contractors and Subcontractors shall, individually, furnish all extension cords and lamps, sockets, motors and accessories required for their work.

f. The General Contractor, Separate Contractors, and other Subcontractors, shall reimburse the Electrical Contractor for the following:

1) Any temporary wiring of a special nature, other than specified above, required for their work.

2) Any temporary wiring of construction offices and buildings used by them.

3) Any temporary wiring for protective night lighting.

g. All temporary wiring, service equipment, and accessories thereto shall be removed by the Electrical Contractor when directed by the Construction Manager.

h. The provisions of the National Electrical Code shall be strictly complied with respect to Article 590 (Temporary Installations) of said code, and the following precautions shall be taken:

1) Open conductors shall be fastened at ceiling height at minimum of 10 ft. intervals. Conductors may not be laid on the floor, and receptacles or fixed equipment circuits shall contain a separate equipment grounding conductor if run as open wiring. Receptacles shall be of the grounding type with individual ground conductors. No bare conductors or earth

returns shall be used for wiring of any temporary circuits. Grounding circuits shall never be interrupted.

2) All 15 A and 20 A receptacle outlets on single-phase circuits which are used for construction purposes shall have approved ground-fault circuit protection for personnel, as required by Article 210 of the National Electrical Code.

E. Interim Electricity: The Electrical Contractor shall be responsible for Interim Electricity facilities as defined above and further specified as follows.

1. The permanent electric power and lighting system in a given area shall be completely installed as designed before the system may be used in such area.

2. At the termination of the use of the permanent electrical light and power system for interim electric, all panelboards shall be inspected and cleaned, and all permanent lighting fixtures which have been used shall be thoroughly cleaned and provided with new lamps, bulbs, fluorescent tubes, etc., to provide like-new performance.

3. The Owner will pay for all electrical energy drawn from normal metered building supply used on the Project after the Date of Substantial Completion of the Work.

4. The furnishing of such electrical energy by the Owner without charge after the Date of Substantial Completion shall be conditional upon the General Contractor and Subcontractors being conservative and prudent in its use. In the event the General Contractor or Subcontractors are repeatedly wasteful in the use of the electrical energy thus provided, the Owner reserves the right to charge General Contractor or Subcontractors at an equitable rate for the energy used.

F. Where a distinction is made above between temporary services to be provided by the Electrical Contractor and those to be provided by a Subcontractor, the purpose is only to clarify which costs are to be included by Subcontractors in their Subcontracts with the Construction Manager. These distinctions have no bearing upon the Contract between the Owner and the Construction Manager and do not limit in any way the Electrical Contractor's responsibility to provide all such temporary services without additional cost to the Owner. For the sake of clarity in this section, the term Construction Manager has been used for the person called Construction Manager in other sections of the Specification, when the intent is that person shall provide a service directly at his own expense rather than at the expense of one of the Subcontractors from whom the Owner has taken filed sub-bids.

G. The temporary services described above may not be adequate to provide for all of the needs of the General Contractor or all Subcontractors, but are intended only to provide a basis for obtaining filed sub-bids. The General Contractor or any Subcontractor requiring additional temporary services for the proper execution of his work or because of climatic conditions shall arrange for and obtain such services at his own expense without further compensation by the Owner.

1.28 NOT USED

1.29 NOT USED

1.30 NOT USED

PART 2 – MATERIALS

2.01 MATERIALS

A. General

1. All equipment and material for permanent installation shall be new unless specifically indicated otherwise. In addition, material shall:

    a. Be without blemish or defect.
    b. Not be used for temporary power or lighting without prior written authorization from the Owner.
    c. Be in accordance with NEMA Standards.
    d. Bear UL label where subject to UL label service.

B. Firestopping Material

1. Firestopping materials shall consist of commercially manufactured products capable of passing ASTM E-814 (UL 1479) Standard Method of Fire Test for Through Penetration Fire Stops.

2. Firestopping materials shall maintain the rating of the wall, partition or floor opening that penetration is made.

3. Firestopping materials shall be UL classified.

4. Acceptable Products

    a. 3M – Fire Barrier
    b. Thomas & Betts – Flame Safe
    c. Nelson Electric – Flameseal

C. Water Seal

1. Seal penetrations of perimeter walls or floors below grade to prevent entry of water. Use materials compatible with wall or floor construction.

PART 3 – EXECUTION

3.01 COOPERATION AND WORK PROGRESS

A. The electrical work shall be carried on under the usual construction conditions, in conjunction with all other work at the site. The Contractor shall cooperate with the Architect, all other Contractors and equipment suppliers working at the site. The Contractor shall coordinate the work and proceed in a manner so as not to delay the progress of the project.

B. The Contractor shall coordinate his work with the progress of the building and other Trades so that he will complete his work as soon as conditions permit and such that interruptions of the building functions will be at a minimum. Any overtime hours worked or additional costs incurred due to lack of or improper coordination with other Trades or the Owner by the Contractor shall be assumed by him without any additional cost to the Owner.

C. The Contractor shall provide information on all equipment that is furnished under this Section but installed under another Section to the Architect or as specified herein.

D. The Contractor shall provide all materials, equipment and workmanship to provide for adequate protection of all electrical equipment during the course of construction of the project. This shall also include protection from moisture and all foreign matter. The Contractor shall also be responsible for damage which he causes to the work of other Trades, and he shall remedy such injury at his own expense.

E. Waste materials shall be removed promptly from the premises on a daily basis. All material and equipment stored on the premises shall be kept in a neat and orderly fashion. Material or equipment shall not be stored where exposed to the weather. The Contractor shall be responsible for the security, safekeeping and damages, including acts of vandalism, of all material and equipment stored at the job site.

F. The Contractor shall be responsible for unloading all electrical equipment and materials delivered to the site. This shall also include all large and heavy items or equipment which require hoisting. If required, the Contractor shall pay all costs for the services of a crane for hoisting, lowering and moving such equipment as required to complete installation of equipment within the building. During construction of the building, the Contractor shall provide additional protection against moisture, dust accumulation and physical damage of the main service and distribution equipment. This shall include furnishing and installing temporary heaters within these units, as approved, to evaporate excessive moisture and ventilate it from the room, as may be required.

G. It shall be the responsibility of the Contractor to coordinate the delivery of the electrical equipment to the project prior to the time installation of equipment will be required; but he shall also make sure such equipment is not delivered too far in advance of such required installation, to assure that possible damage and deterioration of such equipment will not occur. Such equipment stored for an excessively long period of time (as determined in the opinion of the Architect) on the project site prior to installation may be subject to rejection by the Architect.

H. The Contractor shall erect and maintain, at all times, necessary safeguards for the protection of life and property of the Owner, Workmen, Staff and the Public.

I. Prior to installation, the Contractor has the responsibility to coordinate the exact mounting arrangement and location of equipment indicated on the drawings to allow proper space requirements as indicated in the National Electrical Code. Particular attention shall be given in the field to group installations. If it is questionable that sufficient space, conflict with the work of other Contractors, architectural or structural obstructions will result in an arrangement which will prevent proper access, operation or maintenance of the indicated equipment, the Contractor shall immediately notify the Architect and not proceed with this part of the Contract work until definite instructions have been given to him by the Architect.

J. The Contractor shall not allow any equipment or piping foreign to the electrical installation to be installed or pass through any room in which electrical systems or equipment are located, such as electric rooms, electric closets, telephone or data closets. The Contractor shall notify the Architect of such violations and request immediate removal.

K. The Contractor shall provide copies of all shop drawing prints showing the ductwork and piping installation as they will be put in place on the project. These drawings shall be thoroughly checked by the Contractor and the routing of all conduits and installation of all outlets and electrical equipment shall be coordinated with the ductwork and piping so as to

prevent any installation conflict. Such coordination shall be done prior to roughing in conduits, outlets and electrical equipment.

L. Refer to all other drawings associated with this project. Any and all equipment which requires an electrical supply circuit, switch, controls or connections, whether indicated on the Electrical drawings or not, shall be furnished and installed as directed by the Architect. Locations of lighting fixtures shall conform to the Architectural reflected ceiling plans.

M. The Contractor shall employ a competent, licensed foreman on the job throughout the entire period of construction to supervise the workmanship of his trade.

N. The foreman shall have a thorough knowledge of the work to be installed under this contract, be a skilled mechanic experienced with projects of equip size and type and shall be certified as a Journeyman in the County.

O. Location of all wall outlets shall be verified with the Architect prior to roughing in conduits. Refer to details and wall elevations on the Architectural drawings. Mounting heights indicated on these drawings and/or specific dimensional information given to the Contractor by the Architect shall take precedence over such information indicated on the Electrical drawings.

P. Refer to the Architectural drawings for areas in which the concrete slab is poured on grade. In these areas a moisture membrane will be installed on the grade fill or earth prior to pouring of slab. Electrical conduits shall be installed to avoid the necessity of penetrating this moisture proofing membrane. Penetration of the membrane, if required, shall only be made when specifically allowed by the Architect, and shall be made only at locations directed by the Architect.

3.02 INSTALLATION

A. Unless specifically noted or indicated otherwise, all equipment and material specified in Division 16 of these specifications or indicated on the drawings shall be installed under this Contract whether or not specifically itemized herein. This Section covers particular installation methods and requirements peculiar to certain items and classes of material and equipment.

B. The Contractor shall obtain detailed information from manufacturers of equipment provided under Division 16 of this specification as to proper methods of installation.

C. The Contractor shall obtain final roughing dimensions and other information as needed for complete installation of items furnished under other Sections or furnished by the Owner.

D. The Contractor shall keep fully informed of size, shape and position of openings required for material and equipment provided under this and other Sections. Ensure that openings required for work of this Section are coordinated with work of other Sections. Provide cutting and patching as necessary.

E. All miscellaneous hardware and support accessories, including support rods, nuts, bolts, screws and other such items, shall be of a galvanized or zinc plated finish or of another approved rust-inhibiting coating. All supports shall hang independent of other Trades.

F. All equipment and materials shall be installed and completed in a first-class workmanlike manner. The right is reserved to direct the removal and replacement of any item, which in the opinion of the Owner's and/or Architect/Engineer does not present an orderly and reasonably neat or workmanlike appearance, provided such items can be properly installed in an orderly way to usual methods in such work.

G. The approximate location of all equipment and devices is shown on the Drawings. The Owner's and/or Architect/Engineer reserves the right to change the location of all equipment or devices 6'-0" in any direction at no additional cost provided such changes are requested before final installation.

H. In mechanical and electrical equipment spaces, expose ceiling outlets and conduit with due consideration to ventilating ducts and mechanical piping. Where numerous ducts occur, install conduits and outlets after the ventilating ducts. Puncturing of duct work or hanging equipment such as light fixtures, ceiling hangers and conduits from duct work is prohibited unless specifically noted otherwise.

I. Electrical equipment shall be installed to maintain minimum clearances per Article 110 of NEC and ANSI C2 (National Electrical Safety Code).

J. The Contractor shall coordinate the electric service installation with the Utility Company, the Telephone Company, the City Building Department and the City Fire Department.

3.03 CUTTING, PATCHING AND CONDUIT SLEEVES

A. The Contractor shall be responsible for all core drilling required for his work, but in no case shall he cut into any structural elements without the written approval of the Architect.

B. All cutting, rough patching and finish patching required for electrical work shall be provided by the Contractor.

C. Where conduits pass through masonry or concrete walls, foundations or floors, the Electrical Contractor shall set such sleeves as are necessary for passage of the conduits. Sleeves shall be of sufficient size to provide air space around the conduit passing through for fireproofing. The Electrical Contractor shall be responsible for the exact location of sleeves provided under his Contract.

D. Conduit passing through exterior walls and floors below grade shall be made watertight with caulking compound and pipe sleeves with wall collar located at the center of the wall extending 8" all around the conduit. Collar shall be 1/8" thick steel welded to sleeve. Coordinate material requirements with the Contractor.

E. Sleeves and inserts shall not be used in any portions of the building where their use would impair strength or construction features of the building. Elimination of sleeves must be approved by Architect.

F. Pipe sleeves shall be Schedule 40 galvanized steel and shall be set, as follows:

1. Set sleeves 2" above finish floor and flush on each side of walls.

2. Set sleeves 2" above finished floor and flush on each side of walls in toilet and apparatus room floors.

3. Sleeves in walls and partitions shall terminate flush with finished floor.

4. Sleeves shall be set securely in place before concrete is poured.

5. Sleeves shall be at least 2" larger in diameter than the pipe passing through it.

G. Conduits passing through fire partitions shall be provided with 10 gauge steel pipe sleeves.

H. All cutting and patching required by the Contractor in finished areas which requires access shall have access panels as specified elsewhere in this specification.

I. Fill for floor penetrations shall be fire-resistant, compatible with floor material and finished to prevent passage of water, smoke and fumes. Fill in walls shall be similar to wall material, shall be fire-resistant in fire walls, and shall prevent passage of air, smoke and fumes. Fill spaces in openings after installation of conduit or cable.

J. Where conduits passing through openings are exposed in finished rooms, finishes of filling materials shall match and be flush with adjoining floor, ceiling and wall finishes.

K. Fill slots, sleeves and other openings in floors and walls if opening is not used. Identify unused sleeves and slots for future installation.

L. Lay out conduit and openings in advance, to permit provision in work. Set sleeves and conduit in forms before concrete is poured. Provide remedial work where sleeves and conduits are omitted or improperly placed.

M. Where cutting is required to facilitate construction, the Contractor shall patch and repair cut items to the original state. However, structural work shall not be cut without the written approval of the Architect/Structural Engineer or his representative.

N. Holes through concrete and masonry in new and existing structures shall be cut with a diamond core drill or concrete saw. Pneumatic hammer impact, electric hand or manual hammer type drills, shall not be allowed, except where permitted by resident engineer as required by limited working space.

O. All concrete and masonry equipment bases and pads, concrete duct banks, curbs chases, pockets and openings required for the proper installation of the work under this Contract will be provided by the Contractor, using dimensions, templates, bolts, anchors, as shown on the drawings or as required by the manufacturer's installation details of the various equipment.

3.04 CONCRETE HOUSEKEEPING PADS

A. Concrete pads shall be installed for all free standing electrical distribution equipment including:

1. Switchboards.
2. Motor control centers.
3. Dry type transformers.
4. Utility Company transformers.
5. Incoming service switchboards.
6. Emergency generators.
7. Automatic transfer switches.

B. The General Contractor shall provide the concrete work. The Contractor shall supervise and coordinate concrete work to ensure that proper grounding cable, rods, conduit, etc., are located as detailed and as required.

C. All concrete housekeeping pads shall extend a minimum of 3" on each side from the equipment mounted on it. Mounting height of each overcurrent/disconnect device in the above equipment shall not exceed 6'-6" from the above finished floor.

D. The concrete housekeeping pad foundation must be continuously true and level within 0.32mm (0.0125”) in 36” in any direction beneath the equipment assembly. The foundation must be designed to withstand loads imposed on it by the earthquake motion. The maximum equipment reaction loads are to be based upon the maximum tensile strength of a 13mm (.5”) diameter SAE J249 Grade 5 bolt (or ASTM 449, Type 1) at each point of fastening to the foundation, tightened a minimum torque of 10.4Kg-M (75 FT-LB). Use of equal weldments may be utilized.

E. The Electrical Contractor shall hire the services of a Structural Engineer licensed in the state where the generator is to be installed. Generator pad design and layout shall be submitted to DGL Engineer/Structural Engineer for review. The generator pad shall extend a maximum of 1ft on each side from the equipment mounted on it, including intake and exhaust hoods and accommodate (2) 44”w x 37”d stair landing pads on each side of enclosure .

3.05 FIRESTOPPING

A. Where conduits, wireway, bus duct and other electrical raceways pass through fire partitions, fire walls or walls and floors, install a firestop that provides an effective barrier against the spread of fire, smoke and gases. Firestop material shall be packed tight, and completely fill clearances between raceways and openings. Multi-penetrations shall have shop drawings submitted. Firestop material shall conform to the following:

1. Firestopping material shall maintain its dimension and integrity while preventing the passage of flame, smoke and gases under conditions of installation and use when exposed to the ASTM #119 time-temperature curve for a time period equivalent to the rating of the assembly penetrated. Cotton waste shall not ignite when placed in contact with the non-fire side during the test. Firestopping material shall be non-combustible as defined by ASTM E136, and, in addition, for insulation materials, melt point shall be a minimum of 1700°F for 2-hour protection.

2. Unused, spare sleeves in electrical closets shall be sealed with threaded steel caps on each end.

B. Firestopping materials shall be installed in accordance with manufacturers' written instructions.

3.06 MATERIAL AND WORKMANSHIP

A. All materials and equipment shall be new and unused and shall meet requirements of the latest Standards of NEMA, UL, IPCEA, ANSI and IEEE. Equipment shall have components required or recommended by OSHA, applicable NFPA documents and shall be UL approved and labeled.

B. Despite references in the specifications or on the drawings to materials or pieces of equipment by name, make or catalog number, such references shall be interpreted as establishing standards of quality for materials and performance.

C. Finish of materials, components and equipment shall not be less than Industry good practice. When material or equipment is visible or subject to corrosive or atmospheric conditions, the finish shall be as approved by the Architect.

D. Provide proper access to material or equipment that requires inspection, replacement, repair or service. If proper access cannot be provided, confer with the Architect as to the best method of approach to minimize effects of reduced access.

E. All work shall be installed in a neat and workmanlike manner and shall be done in accordance with all Local and State Codes.

F. The Owner will not be responsible for material, equipment or the installation of same before testing and acceptance.

G. It shall be the responsibility of the Contractor to balance the loads on the various panelboards so that the variation in amperes per phase reading shall not exceed 5% under normal operation conditions.

1. Special care shall be taken during the load balance to assure that reverse rotation of motors is not caused.

H. All temporary power feeders and branch circuit wiring shall be run in approved raceways. No exposed wires will be permitted. Remove all temporary at completion of project.

I. All equipment furnished with finished surfaces shall be cleaned to the original finish at the completion of the project.

J. Painting of conduit and other electrical equipment where required, will be done by the general trades. This contractor, however, will be responsible for touch-up painting of all equipment marred in any way during shipment or installation.

3.07 EQUIPMENT CONNECTIONS

A. Motors furnished under Division 15000 shall be 460 V, 3-phase, 60 Hz for motors 0.5 HP and above, except as indicated otherwise on the drawings.

B. Whether shown on the drawings or not the contractor shall provide a local disconnect for all motors.

C. Make all final connections to equipment indicated on the drawings. Special plugs for receptacles indicated on the special purpose receptacle schedule shall be connected to the cord of the equipment, where this equipment is available to the Contractor prior to the completion of the work.

D. Equipment grounding integrity of all equipment and non-current-carrying metal parts must be assured.

E. All equipment shown on the drawings which is furnished under other Sections of these specifications and by others shall be connected under this Section.

F. Before connecting any piece of equipment, check the nameplate rating against the information shown on the drawings and call to the attention of the Architect any discrepancies.

G. The Contractor shall carefully study all equipment manufacturers' wiring diagrams and make corrections accordingly. If corrections are required, notify Owner and make corrections on wiring diagram.

H. The Contractor shall be held responsible for any damage done to motors or equipment driven by motors, due to incorrect direction of rotation, caused by faulty electrical connections, and incorrectly sized motor circuit protection, furnished under this Contract. If this should occur, the equipment shall be replaced with new equipment, at no cost to the Owner. Rebuilt equipment is not acceptable.

I. Drawings and specifications of other Contractors and equipment suppliers furnishing motors shall be consulted for verification of size, speed and operation.

J. Motor and equipment disconnect switches indicated on the drawings are attached to the motor symbol and are indicated this way for drafting convenience only. All such switches shall not be attached to the motor itself, but shall be mounted adjacent to the motor and supported independent of the motor.

K. Motor starters furnished by other Contractors shall be furnished complete with individual running overcurrent protection in each phase and shall be installed and wired by the Contractor. Sizing of motor running overcurrent protection for starters furnished by others shall be the responsibility of the Contractor who furnishes the motor starter. Motor starters for motor control centers shall be furnished complete under this Section. Refer to schedules on the drawings.

L. Furnish, install, wire and connect all motor disconnect switches, motor starters and remote control stations, except as otherwise indicated on the drawings. All automatic temperature control wiring for equipment shall be furnished by the Division 17000 Contractor.

M. Motor starters, where grouped, shall be mounted on Unistrut or tubes steel structure.

N. On multi-speed motors, the isolating switches at the motor location shall be so interlocked or shall be of such a type that operation of one switch shall simultaneously open all conductors to the motor.

3.08 CLEANING

A. This Section of the specifications shall include the cleaning of all equipment on a day-to-day basis and final cleaning of all electrical equipment prior to turning building over to the Owner. All necessary cleaning referred to herein shall be cleaned to the satisfaction of the Architect and the Owner.

B. Electrical Distribution Equipment

1. All electrical distribution equipment shall be completely cleaned inside and out prior to initial energizing.

2. Cleaning shall consist of vacuuming all busses, windings, enclosures (inside and out), etc. After vacuuming is complete, all equipment shall be wiped down. If equipment is wet or contains moisture, it shall be thoroughly dried and inspected by the manufacturer's representative before energizing.

C. Raceways and Junction Boxes

1. All raceways and junction boxes shall be blown out and dried prior to installation of feeder conductors and branch circuit conductors.

D. Low Tension Systems

1. All cabinets and panels for low tension systems shall be thoroughly cleaned and dried prior to system start-up.

E. Electric, Generator and Telephone Rooms

1. Upon completion of cleaning electrical equipment as described in paragraph B. above, but before energizing equipment, the entire room shall be swept clean and all garbage removed from the site. At this time, equipment may be energized.

2. Once equipment and room are cleaned and energized, the area shall remain clean and doors shall remain closed until completion of job. If rooms and equipment are subject to dust and moisture after energizing equipment, the same equipment shall be de-energized and re-cleaned to the same specifications.

F. Final Cleaning

1. All lighting fixtures, devices, device plates, etc., shall be cleaned and left in "like new" condition to the satisfaction of the Architect, prior to Owner occupancy.

2. All rubbish and discarded materials shall be disposed of and removed from the site on a day-to-day basis, as required.

3. All equipment, whether part of the Electrical Contractor's Contract or not, which must be cleaned due to the Electrical Contractor's work, shall be cleaned by the Electrical Contractor to the satisfaction of the Architect.

3.09 POWER SYSTEM AND ARC FLASH HAZARD ANALYSIS STUDY

A. Power System and Arc Flash Hazard Analysis Study shall be performed by the switchboard/switchgear manufacturer. The electrical contractor shall provide all information required by the equipment manufacturer within four weeks of being awarded the contract. Refer to Section 16016 for the extent of the manufacturer's work. The contractor shall be given a copy of the data collection form when the contract is awarded.

3.10 LIGHT FIXTURE INSTALLATION

A. The electrical contractor shall be responsible for the coordination of light fixtures locations in all areas of the facility with other trades. This shall include the marking of the locations of the light fixtures that are recessed in the metal panel ceilings. The openings in the metal panel ceiling shall be provided by the metal panel contractor.

3.11 TESTING

A. The Contractor shall conduct such tests and adjustments of equipment as necessary to verify performance requirements. Submit data taken during such tests to Owner's representative. The Contractor shall test feeders, branch circuits, and equipment, etc., as described in Section 16198 of this Division.

3.12 CONSTRUCTION SCHEDULE

A. The Electrical Contractor shall submit with his bid, a preliminary construction schedule, based on the milestone schedule provided by the construction manager, for review by the Owner,

Architect and Construction Manager. The construction schedule shall be finalized with the successful Electrical Contractor.

3.13 FINAL INSPECTION

A. When all electrical work under Division 16 for this project has been completed as indicated on the drawings and specified herein and is ready for final inspection, such an inspection shall be made. At this time, the Contractor for the work under this Contract shall demonstrate that the requirements of these specifications have been met to the Architect's satisfaction.

****

END OF SECTION

THE LIVESTOCK INSTITUTE

WESTPORT, MA

PROJECT NO. 4730

Power Systems and Arc Flash Hazard Analysis Study

Section 16016

THE DENNIS GROUP, LLC

PLANNING ▲ ENGINEERING ▲ CONSTRUCTION MANAGEMENT

1537 MAIN STREET
SPRINGFIELD, MASSACHUSETTS 01103
413.787.1785 ▲ FAX 413.787.1786

26 WEST MARKET STREET
SALT LAKE CITY, UTAH 84101
801.531.8585 ▲ FAX 810.531.8586

A	**09.20.2016**	**Review**	**MJJ**		
Issue	**Date**	**Description**	**By**	**Approved**	**Section 16010**

Unless notification and/or comments are received from client within two weeks after issue date, all documentation including drawings, specifications, and studies submitted to client shall be considered approved as released.

PART 1 – GENERAL

1.01 PROVISIONS INCLUDED

A. The General Documents, as listed on the Table of Contents and applicable parts of Division 1, General Requirements shall be included in and made part of this Section.

B. Examine all drawings and all other Section of the Specifications for requirements which affect work under this Section whether or not such work is specifically mentioned in this Section.

C. Coordinate work with that of all other Trades affecting or affected by work of this Section. Cooperate with such Trades to ensure the steady progress of all work under the Contract.

D. Provide all material, labor and equipment, to complete the work of this Section in strict accordance with the design Architect's and Engineer's plans and specifications, and with all applicable codes, rules, and standards.

1.02 SCOPE OF WORK

A. Studies

1. Short Circuit Studies, Protective Device Evaluation Studies, Protective Device Coordination Studies and Arc Flash Hazard Analysis Studies for all new systems shall be performed by the **switchboard/switchgear manufacturer (EM)**. The studies shall be submitted to the Project Electrical Engineer prior to receiving final approval of the equipment shop drawings and/or prior to release of equipment for manufacture. If formal completion of the studies may cause delay in equipment manufacture, approval from the Engineer may be obtained for a preliminary submittal of sufficient study data to ensure that the selection of device ratings and characteristics will be satisfactory. Preliminary approval of the study shall not relieve the manufacturer the responsibility of providing equipment of the proper AIC rating.

2. Three studies shall be performed. The first study (Preliminary Study) shall be for the service entrance equipment and first level of distribution equipment. The second and third study (final Study) shall include the remaining distribution equipment and equipment to be purchased at a later date.

   a. Preliminary Study shall include all portions of the electrical distribution systems from the power source or sources to the switchboards and down to the first level of distribution. The first level of distribution shall be the load equipment connected the service entrance equipment feeder breakers. The first level of distribution equipment shall include but not be limited to the following; switchgear, switchboards, distribution panels, panelboards, MCC, unit mounted breakers, fused disconnects, and industrial control panels. Provide preliminary settings for all adjustable breakers prior to equipment startup. Cable lengths estimated from AutoCAD files are acceptable for the preliminary study.

   b. Intermediate Study shall include all portions of the electrical distribution systems from the power source or sources, down to and including all items included in the preliminary study and **20** additional points.

   c. The Final Study shall include additional points included as a unit cost. If no additional points are needed over what was used for the preliminary and

intermediate studies, then the final study shall be issued based on the intermediate report.

d. Each point shall be defined a point in the system that would require an Arc Flash label as determined by the project engineer. A point shall include, but not be limited to switchgear, switchboards, panelboards, MCC, industrial control panels, unit mounted motor starter, and packaged equipment such as HVAC units, air compressors, skid mounted pump packages, etc.

3. The study shall be performed by the **EM.** This firm shall be engaged in field calibration, settings and testing of protective devices. This firm shall have been regularly engaged in such services for a minimum of ten (10) years.

4. The **EM** shall furnish an Arc Flash Hazard Analysis Study per NFPA 70E Standard for Electrical Safety in the Workplace, Section 130.3.

B. The **EM** shall submit each phase of the study and final report for approval.

C. The software used for the studies shall be ESA EasyPower with no equals.

1.03 RELATED WORK SPECIFIED ELSEWHERE

A. The following referenced sections are listed as a minimum of additional requirements and/or work not included in this Section which may be required to be performed under other designated Sections:

1.	Section 16110:	Raceways
2.	Section 16120:	Conductors
3.	Section 16155:	Motor Starters
4.	Section 16170:	Motor and Circuit Disconnects
5.	Section 16195:	Electrical Identification
6.	Section 16197:	Power System Studies
7.	Section 16198:	Start-Up Testing of Electrical Equipment
8.	Section 16200:	Emergency Generators (Diesel Stand-Alone)
9.	Section 16311:	Secondary Unit Substations (Low Voltage Less Than 1000V)
10.	Section 16312:	Primary Unit Substations (Low-Voltage 1000V and Over)
11.	Section 16349	Motor Starters (Medium Voltage)
12.	Section 16426:	Low Voltage Metal Enclosed Switchgear
13.	Section 16450:	Grounding
14.	Section 16470:	Panelboards Branch Circuit and Distribution (100A – 1200A)
15.	Section 16482:	Motor Control Centers

1.04 QUALIFICATIONS

A. The Arc Flash Hazard Analysis Study shall be conducted under the supervision and approval of a Registered Professional Electrical Engineer skilled in performing and interpreting power system studies. The Registered Professional Electrical Engineer shall be a full-time employee of the equipment manufacturer or the engineering firm hired to provide the study.

B. The provider of the study shall have been regularly engaged in the coordination & fault studies of the specified devices for a period of at least ten (10) years and demonstrate proficiency in these studies as they are in satisfactory use in functioning systems for similar applications.

C. The engineer shall have Professional Engineers Liability Insurance. Minimum $1M per claim, $5M aggregate.

1.05 STUDY REPORT

A. The results of the Studies shall be summarized in a final report. Six (6) bound copies of the final report shall be submitted. Include CD with a PDF copy of the report and an electronic copy of the EAS.dez file

B. The report shall include the following sections:

1. Description, purpose, basis and scope of the study and a single-line diagram of that portion of the power system which is included within the scope of the study.

2. Tabulations of circuit breaker, fuse and other protective device ratings versus calculated short circuit duties, and commentary regarding same.

3. Protective device time vs. current coordination curves, tabulations of relay and circuit breaker trip settings, fuse selection, and commentary regarding same.

4. Fault current calculations including a definition of terms and guide for interpretation of computer printout.

5. Arc Flash Hazard Analysis calculations for the following:

   a. Arcing fault magnitude.
   b. Device clearing time.
   c. Duration of arc.
   d. Arc flash boundary.
   e. Working distance.
   f. Incident energy.
   g. Recommendations for arc flash energy reduction.

1.06 COORDINATION

A. The work of this Section shall be coordinated with other work of the Contractor.

1.07 REFERENCE STANDARDS

A. Applicable provisions of the following Codes and Trade Standard Publications shall apply to the work of this Section and are hereby incorporated into, and made a part of, the Contract Documents:

1. NFPA 70: National Electrical Code. 2014
2. NFPA 70E: Standard for Electrical Safety in the Workplace, 2015
3. IEEE: Institute of Electrical and Electronic Engineers.
4. IEEE 1584 Guide to performing Arc Flash Hazard Calculations. 2002 with all amendments.
5. All inspections and tests shall utilize the following references:
   a. Project design specifications.
   b. Project design drawings.
   c. Manufacturer's instruction manuals applicable to each particular apparatus.

1.08 GUARANTEE

A. In addition to the specific guarantee requirements of the General Conditions, the Contractor shall obtain, in the Owner's name, the standard written manufacturer's guarantee of all materials furnished under this Section where such guarantees are offered in the manufacturer's published product data. All these guarantees shall be in addition to, and not in lieu of, other liabilities which the Contractor may have by law or other provisions of the Contract Documents.

PART 2 – PRODUCTS

2.01 POWER SYSTEM STUDIES

A. Short Circuit Studies, Protective Device Evaluation Studies and Protective Device Coordination Studies shall be performed by the distribution equipment manufacturer or otherwise qualified Registered Professional Engineer as indicated in Part 1 of this section of the specifications.

B. The studies shall be submitted to the Engineer/Architect prior to receiving final approval of the distribution equipment shop drawings and prior to release of equipment for manufacture. If formal completion of the studies may cause delay in equipment manufacture, approval from the Engineer/Architect may be obtained for a preliminary submittal of sufficient study data to ensure that the selection of device ratings and characteristics will be satisfactory.

C. Preliminary Study shall include all portions of the electrical distribution systems from the power source or sources to the switchboards and down to the first level of distribution as previously defined in Part 1 of this specification. The first level of distribution shall be the load equipment connected the service entrance equipment feeder breakers. The first level of distribution equipment shall include but not be limited to the following; switchgear, switchboards, distribution panels, panelboards, MCC, unit mounted breakers, fused disconnects, and industrial control panels.

D. The Final Study shall include all portions of the new electrical distribution systems from the normal power source or sources, down to and including all panels, motors, etc. in the distribution systems. All portions of the existing distribution systems that are modified, expanded or serve the new distribution systems shall be included in the studies.

E. The firm should be currently involved in high and low voltage power system evaluation. The study shall be performed by a registered professional engineer in the **project location state**. Credentials of the individual(s) performing the study and background of the firm shall be submitted to the Engineer for approval prior to start of the work. A minimum of ten (10) years' experience in power system analysis is required for the individual in charge of the project.

F. The firm performing the study should demonstrate capability and experience to provide assistance during start up as required.

G. The power system studies are required to confirm the adequacy of the ratings of all electrical system components and proper coordination settings of all circuit breakers to the satisfaction of the Electrical Engineer. These studies shall not be used as a basis to compromise the electrical system and do not imply that short circuit ratings of devices may be lower than those specified for the distribution equipment elsewhere.

H. Motor load loads connected to MCC and industrial control panels shall be modeled as group motor loads. Separated into two groups; motors that can contribute to a fault and motors that can't such as motors connected to Adjustable Frequency Drives.

I. Individual motors such as fire pumps, refrigeration compressors and air compressors with unit mounted starters shall be modeled separately at rated horse power and starter type.

J. HVAC equipment with integral starters shall be modeled as group motor loads. Separated into two groups; motors that can contribute to a fault and motors that can't such as motors connected to Adjustable Frequency Drives and Electronic Soft Start Controllers.

2.02 SHORT CIRCUIT AND PROTECTIVE DEVICE EVALUATION AND COORDINATION STUDY

A. The short circuit study shall be performed with the aid of a digital computer program and shall be in accordance with the latest applicable IEEE and ANSI standards.

B. In the short circuit study, provide calculation methods and assumptions, the base per unit quantities selected, one-line diagrams, source impedance data including power company system characteristics, typical calculations, tabulations of calculation quantities and results, conclusions, and recommendations. Calculate short circuit interrupting and momentary (when applicable) duties for an assumed 3-phase bolted fault at each supply switchgear lineup, low-voltage switchboard lineup, switchboard, motor control center, distribution panelboard, branch circuit panelboards, and all other distribution equipment throughout the system. Provide a ground fault current study for the same system areas. Include in tabulations fault impedance, X-to-R ratios, asymmetry factors, motor contribution, short circuit kVA, and symmetrical and asymmetrical fault currents.

C. In the protective device coordination study, provide time-current curves graphically indicating the coordination proposed for the system. Include one-line diagram with legend identifying the specific portion of the system covered by that particular curve sheet. Include a detailed description of each protective device identifying its type, function, manufacturer, and time-current characteristics and settings. Verify fully selective coordination for emergency life safety branch circuits while running on the generator.

D. Include on the curve sheets power company relay and fuse characteristics, system medium-voltage equipment relay and fuse characteristics, low-voltage equipment circuit breaker trip device characteristics, transformer characteristics, motor and generator characteristics, and characteristics of other system load protective devices. Include all devices down to largest branch circuit and largest feeder circuit breaker in each motor control center, and main breaker in branch panelboards.

E. Include all adjustable settings for ground fault protective devices. Include manufacturing tolerance and damage bands in plotted fuse characteristics. Show transformer full load and 150, 400, or 600 percent currents, transformer magnetizing inrush, ANSI transformer withstand parameters, and significant symmetrical and asymmetrical fault currents. Terminate device characteristic curves at a point reflecting the maximum symmetrical or asymmetrical fault current to which the device is exposed.

F. Select each primary protective device required for a delta-wye connected transformer so that its characteristic or operating band is within the transformer characteristics; including a point equal to 58 percent of the ANSI withstand point to provide secondary line-to-ground fault protection. Where the primary device characteristic is not within the transformer characteristics, show a transformer damage curve. Separate transformer primary protective

device characteristic curves from associated secondary device characteristics by a 16 percent current margin to provide proper coordination and protection in the event of secondary line-to-line faults. Separate medium-voltage relay characteristic curves from curves for other devices by at least a 0.4-second time margin.

G. Include complete fault calculations as specified herein for each proposed and ultimate source combination. Note that source combinations may include present and future supply circuits, large motors, or generators as noted on Drawing one-line diagrams.

H. Utilize equipment load data for the study obtained by the Electrical Contractor from Contract Documents, including all Contract Addendums, bulletins, job modifications, etc.

I. Include fault contribution of all motors in the study. Notify the Engineer, in writing, of circuit protective devices not properly rated for fault conditions.

J. Provide settings for all unit mounted motor starters serving refrigeration compressors, air compressor and other motors greater than 50 HP and any load directly connected to the service entrance equipment. Time Current Coordination to include motor starting curves.

K. The study shall include phase and ground coordination of the generator protective devices. Show the generator decrement curve and damage curve along with the operating characteristic of the protective devices. Obtain the information from the generator manufacturer and include the generator actual impedance value, time constants and current boost data in the study. Do not use typical values for the generator.

L. For motor control circuits, show the MCC full-load current plus symmetrical and asymmetrical of the largest motor starting current and time to ensure protective devices will not trip during major or group start operation.

M. Motor load loads connected to MCC and industrial control panels shall be modeled as group motor loads. Separated into two groups; motors that can contribute to a fault and motors that can’t such as motors connected to drives and electronic soft starter controllers.

N. Individual motors such as fire pumps, refrigeration compressors, air compressors with unit mounted starters shall be modeled separately at rated horse power and starter type.

O. HVAC equipment with integral starters shall be modeled as group motor loads. Separated into two groups; motors that can contribute to a fault and motors that can’t such as Adjustable Frequency Drives and Electronic Soft Start Controllers.

2.03 ARC FLASH HAZARD ANALYSIS STUDY

A. Use fault current momentary duty and protective device clearing times from protective device coordination study.

B. Use IEEE 1584 equations for calculating incident energy and flash protection boundary.

C. Results of the arc flash hazard analysis will be used to define the flash protection boundary and the incident energy at locations in the electrical distribution system where work could be performed on energized parts. Safe working distances will be specified for calculated fault locations based upon the calculated arc flash boundary considering incident energy of 1.2 cal/cm^2.

D. The study calculation shall be based on actual field data and component information provided for each point (node) in the system. “Rule of Thumb” or “Typical “values will not be acceptable.

2.04 DATA COLLECTION FOR THE STUDIES

A. The **Electrical Contractor** shall provide the required data for preparation of the studies. The firm performing the system studies shall furnish the **Electrical Contractor** with a listing of the required data immediately after award of the contract. The **EM** shall provide confirmation of Utility Company available fault current and all other pertinent information and equipment furnished by others.

B. The **Electrical Contractor** shall expedite collection of the data to assure completion of the studies as required for final approval of the distribution equipment shop drawings and prior to release of the equipment for manufacture.

C. Source contribution may include present and future utility feeds, motors, and generators for Arc Flash Hazard Analysis. Analysis will be based on the present configuration.

D. Load data utilized may include existing and proposed loads obtained from Contract Documents provided by Owner or Contractor. Any and all such load data shall be confirmed upon completion of the project and confirm initial values are not less than actual measured values.

2.05 POWER COMPANY APPROVAL

A. Where required, copies of the final report shall be submitted to the power company for their review and approval. Approved copies of the report shall be submitted to the Engineer.

2.06 ONE-LINE DRAWINGS

A. For each study provide three one-line drawings

1. The first one-line shall be the manufactures standard one line showing all sources of power and all distribution equipment as described above.
2. The second one-line shall include the fault current available for all points in the system.
3. The third one-line shall include the Arc Flash Boundary in inches, incident energy at working distance for all points in the system.

PART 3 – EXECUTION

3.01 FIELD SETTINGS

A. The **Equipment Manufacturer’s representative** shall perform field adjustments of the protective devices as required to place the equipment in final operating condition. The settings shall be in accordance with the approved short circuit study, protective device evaluation study, and protective device coordination study.

B. Necessary field settings of devices, adjustments and minor modifications to equipment to accomplish conformance with the approved short circuit and protective device coordination study shall be carried out by the **Equipment Manufacturer’s representative** at no additional cost to the Owner.

C. The selection and settings of the protective devices shall be provided separately in a tabulated form listing circuit identification, IEEE device number, current transformer ratios and connection, manufacturer and type, range of adjustment and recommended settings. A tabulation of the recommended power fuse selection shall be provided for the medium voltage fuses where applied in the system. Any discrepancies, problem areas, or inadequacies shall be promptly brought to the Engineer's attention.

D. Field setting shall be adjusted in each phase of the study by the **EM.** The **EM** shall provide a minimum three (3) field visits to perform this work. One per phase of the study.

3.02 FIELD EQUIPMENT LABELING

A. The **EM** shall provide and field install a 3.5 in. x 5 in. thermal transfer type label of high adhesion polyester for each device analyzed. The label shall have an orange header with the wording, “WARNING, ARC FLASH HAZARD”, and shall identify the arc flash boundary and incident energy for that specific device. The device identification and engineering report number shall be referenced on the label. Labels shall be machine printed, with no field markings. Labeling to be completed by the **EM** under the Startup and Acceptance Testing contract portion.

****

END OF SECTION

THE LIVESTOCK INSTITUTE

WESTPORT, MA

PROJECT NO. 4730

Specification for

PROCESS AREA ELECTRICAL

Section 16050

THE DENNIS GROUP, LLC

PLANNING ▲ ENGINEERING ▲ CONSTRUCTION MANAGEMENT

1537 MAIN STREET
SPRINGFIELD, MASSACHUSETTS 01103
413.787.1785 ▲ FAX 413.787.1786

26 WEST MARKET STREET
SALT LAKE CITY, UTAH 84101
801.531.8585 ▲ FAX 810.531.8586

A	**09.20.2016**	**Review**	**MJJ**		
Issue	**Date**	**Description**	**By**	**Approved**	**Section 16050**

Unless notification and/or comments are received from client within two weeks after issue date, all documentation including drawings, specifications, and studies submitted to client shall be considered approved as released.

PART 1 – GENERAL

1.01 REFERENCES

A. The General Documents, as listed on the Table of Contents and applicable parts of Division 1, General Requirements, and applicable requirements of Section 16010, shall be included in and made part of this Section.

B. Examine all drawings and criteria sheets and all other Sections of the specifications for requirements which affect work under this Section whether or not such work is specifically mentioned in this Section.

C. Coordinate work with that of all other Trades affecting or affected by work of this Section. Cooperate with such Trades to assure the steady progress of all work under the Contract.

D. Provide all material, labor and equipment, to complete the work of this Section in strict accordance with the design Architect's and Engineer's plans and specifications, and with all applicable codes, rules, and standards.

1.02 SCOPE OF WORK

A. The work of this section covers furnishing and field installation of the complete process electrical systems in accordance with these specifications and as indicated on the drawings. The raceway system is defined to include conduit, boxes, and cabinets, and all materials and devices required to install, support, secure, and provide a complete system for support and protection of electrical conductors.

B. The work under this Contract shall also include all labor, materials, tools, equipment, transportation, insurance, temporary protection, supervision and incidental items essential for proper installation and operation, even though not specifically mentioned or indicated on the drawings but which are usually provided or are essential for proper installation and operation of all systems as indicated on the drawings and specified herein.

C. The specifications and drawings describe the minimum requirements that must be met by the Contractor for the installation of all work as shown on the drawings and as specified herein under.

D. Refer to drawing **E0.011 NEMA CLASSIFICATIONS** for building installation classification.

1. Areas listed as NEMA 4X Process shall be classified as process “wet location” and shall utilize 316 grade stainless steel products; conduit, boxes, hardware, fittings, etc. See this specification section for additional requirements.

2. Areas listed as NEMA 12 Process shall be classified as process “dust tight” and shall utilize galvanized steel rigid conduits and galvanized steel hardware. See this specification section for additional requirements.

3. Areas listed as NEMA 1 Process shall be classified as process “dry location” and shall utilize galvanized rigid steel products. See this specification section for additional requirements.

E. The process area shall be defined as any area that is directly involved in the making of the finished product. This includes, but is not limited to, receiving, mixing, cleaning, packaging, palletizing, and storage areas.

1.03 RELATED WORK SPECIFIED ELSEWHERE

A. The following referenced sections are listed as a minimum of additional requirements and/or work not included in this Section which may be required to be performed under other designated Sections:

1.	Section 16120:	Conductors (600V)
2.	Section 16140:	Wiring Devices and Device Plates
3.	Section 16195:	Electrical Identification
4.	Section 16198:	Start-up Testing of Electrical Equipment
5.	Section 16450:	Grounding

1.04 SUBMITTALS

A. Prepare and submit complete shop drawings of all types of raceways provided on this project to the Engineer for approval.

B. Submit samples of each material under this Section requested by the Engineer, for approval. Samples shall be in size and form requested by the Engineer, and reasonable to show characteristics, color and finishes of the materials.

C. Submit complete manufacturer's product data of all materials and systems to the Engineer for approval, consisting of complete product description and specifications, complete performance test data, complete preparation and installation instructions, and all other pertinent technical data required for complete product and product use information.

D. All shop drawings shall have clearly marked the appropriate specification number of drawing designation, for identification of the submittal.

E. Disposition of shop drawings shall not relieve the Contractor from the responsibility for deviations from drawing or specifications, unless he has submitted in writing a letter itemizing or calling attention to such deviations at time of submission and secured written approval from the Engineer, nor shall such disposition of shop drawings relieve the Contractor from responsibility for errors in shop drawings or schedules.

F. Do not order materials or begin installation until the Engineer's approval of submittals has been obtained.

1.05 COORDINATION

A. The work of this Section shall be coordinated with other work of the Contract. The placement of all raceways shall be coordinated with HVAC, Plumbing Process mechanical and Process piping equipment prior to installation.

1.06 REFERENCE STANDARDS

A. Applicable provisions of the following Codes and Trade Standard Publications shall apply to the work of this Section, and are hereby incorporated into, and made a part of, the Contract Documents:

1.	NFPA 70:	National Electrical Code.
2.	ANSI C80.1:	Rigid Steel Conduit, Zinc Coated.

3.	ANSI/NEMA FB1:	Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.
4.	NEMA RN1:	PVC Externally coated galvanized rigid steel conduit.
5.	NEMA TC-3:	PVC fittings for use with rigid PVC coated rigid conduit.
6.	ANSI/NEMA OS 1:	Sheet-Steel Outlet Boxes, Device Boxes, Covers and Box Supports.
7.	NEMA 250:	Enclosures for Electrical Equipment (1000 Volts Maximum).
8.	UL 50:	Cabinets and Boxes.
9.	UL 514:	Electrical Outlet Boxes and Fittings.
10.	UL 98:	Enclosed Switches.
11.	UL 198:	Power Fuses.
12.	ANSI C80.5	Rigid Aluminum Conduit.

1.07 GUARANTEE

A. In addition to the specific guarantee requirements of the General Conditions, the Contractor shall obtain in the Owner's name the standard written manufacturer's guarantee of all materials furnished under this Section where such guarantees are offered in the manufacturer's published product data. All these guarantees shall be in addition to, and not in lieu of, other liabilities which the Contractor may have by law or other provisions of the Contract Documents.

1.08 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery of materials shall be made to the project by the materials supplier in accordance with the instructions of the Contractor.

B. The Contractor shall provide adequate locked storage space with shelving for the materials, shall be responsible for all items of materials after receipt from the supplier, and shall replace all materials lost or damaged after delivery and receipt.

C. The Contractor shall furnish the materials supplier with receipts for all materials and accessory items received, and shall send copies of these receipts to the Engineer.

PART 2 – MATERIALS

2.01 WIRING

A. Minimum size wire for branch circuit and power wiring shall be #12 AWG.

B. Process electrical wiring shall comply with specification Section 16120.

2.02 CONDUITS, COUPLINGS AND FITTINGS

A. STAINLESS STEEL CONDUIT

1. Stainless steel conduit, couplings, and elbows shall be type 316 and shall be fabricated in accordance with ASTM A312, ANSI C80.1, ASTM A-182, ASTM A-511 and UL 6.

2. Acceptable Manufacturers

    a. Cal Pipe
    b. Conduit Pipe Products
    c. Gibson Stainless
    d. Equal approved by Engineer

B. PVC COATED RIGID STEEL CONDUIT

1. PVC coated rigid steel conduit, couplings, and elbows shall be hot-dip galvanized after fabrication, in accordance with NEMA RN1, NEMA TC-3, UL 6 and CSA. The conduit interior shall have a minimum 2 mm urethane coating and exterior surfaces shall have a minimum 40 mm PVC coating with the exposed threads having a urethane coating. Specifications are based on Ocal –Blue with equal by Rob Roy and Perma-Cote.

2. Acceptable Manufacturers

    a. Thomas & Betts – Ocal Inc.
    b. Rob Roy (Plasti-Bond)
    c. Perma-Cote

C. RIGID ALUMINUM CONDUIT

1. Rigid aluminum conduit, couplings, and elbows shall be made from 6063 aluminum alloy, T-1 tempered and manufactured in accordance with ANSI C80.5, UL 6 and CSA requirements.

2. Acceptable Manufacturers

    a. Wheatland
    b. Equal approved by Engineer

D. RIGID STEEL CONDUIT

1. Rigid steel conduit, couplings, and elbows shall be hot-dip galvanized, rigid mild steel, in accordance with ANSI C80.1 and UL 6 and CSA. The conduit interior and exterior surfaces shall have a continuous zinc coating with a transparent overcoat of enamel, lacquer, or zinc chromate.

2. Acceptable Manufacturers

    a. Wheatland
    b. Allied Tube
    c. Equal approved by Engineer

E. NON-METALLIC CONDUIT

1. Schedule 40 PVC – Conduit, couplings and elbows shall be thick wall, 90°C, (EPC), UL listed meeting NEMA standard TC-2 and CSA listed.

2. Schedule 80 PVC – Conduit, couplings and elbows shall be thick wall, 90°C, (EPC), UL listed meeting NEMA standard TC-2 and CSA listed.

3. Acceptable Manufacturers

   a. Wheatland
   b. Allied Tube
   c. Equal approved by Engineer

4. Non-metallic conduit shall be used for sleeves in insulated metal panel walls and for freezer subfloor heating systems only.

F. LIQUIDTIGHT FLEXIBLE METAL CONDUIT

1. NEMA 4X “WET” Process Areas

   a. Liquidtight flexible conduit shall be PVC jacketed stainless steel up to 1-1/2”, as manufactured by Calbrite.

   b. Liquidtight flexible conduit shall be PVC jacketed, stainless steel over 1-1/2” as manufactured by Flextron.

   c. Liquidtight flexible metal conduit shall be used in short runs to connect motors, or transformers, where movement and vibration requires a flexible connection. Maximum length shall not exceed 4'-0".

2. NEMA 4X “DRY” Process Areas

   a. Liquidtight flexible conduit shall be plastic jacketed, galvanized, Sealtite Type EF for sizes up to 1-1/4" and Type UA for sizes over 1-1/4".

   b. Liquidtight flexible metal conduit shall be high temperature, plastic jacketed galvanized steel for high temperature locations.

   c. Liquidtight flexible metal conduit shall be used in short runs to connect motors, or transformers, where movement and vibration requires a flexible connection. Maximum length shall not exceed 4'-0".

      1) Acceptable Manufacturers

         a) Anaconda
         b) Electri-Flex
         c) International Metal Hose
         d) AFC
         e) Appleton/O.Z. Gedney
         f) Raco
         g) Thomas & Betts
         h) Project Electrical Engineer Approved Equal

3. NEMA 12, NEMA 3R and NEMA 1 Process Areas

   a. Liquidtight flexible conduit shall be plastic jacketed, galvanized steel, Sealtite Type EF for sizes up to 1-1/4" and Type UA for sizes over 1-1/4".

   b. Liquidtight flexible metal conduit shall be high temperature, plastic jacketed galvanized steel for high temperature locations.

c. Liquidtight flexible metal conduit shall be used in short runs to connect motors, or transformers, where movement and vibration requires a flexible connection. Maximum length shall not exceed 4'-0".

1) Acceptable Manufacturers

a) Anaconda
b) Electri-Flex
c) International Metal Hose
d) AFC
e) Appleton/O.Z. Gedney
f) Raco
g) Thomas & Betts
h) Project Electrical Engineer Approved Equal

G. ELBOWS, NIPPLES AND COUPLINGS

1. Stainless steel conduit couplings, connectors and fittings shall be stainless steel, threaded, watertight, and specifically designed and manufactured for the purpose. Fittings shall conform to ANSI C80.1 and UL requirements.

a. Acceptable Manufacturers

1) Calbrite
2) Conduit Pipe Products
3) Gibson Stainless
4) Equal approved by Engineer

2. PVC coated rigid steel conduit couplings, connectors and fittings shall be PVC coated rigid steel, threaded, watertight, and specifically designed and manufactured for the purpose. Fittings shall conform to ANSI C80.1, UL6, NEMA RN-1 and CSA requirements. Specifications are based on Ocal –Blue with equal by Rob Roy and Perma-Cote.

a. Acceptable Manufacturers

1) Thomas & Betts – Ocal Inc.
2) Rob Roy(Plasti-Bond)
3) Perma-Cote

3. Rigid steel conduit couplings, connectors and fittings shall be the same material and finish as the conduit, threaded, watertight, and specifically designed and manufactured for the purpose. Fittings shall conform to ANSI C80.4, ANSI C80.5, UL and CSA requirements.

a. Acceptable Manufacturers

1) Wheatland
2) Allied Tube
3) Equal approved by Engineer

4. Aluminum conduit couplings, connectors and fittings shall be the same material and finish as the conduit, threaded, watertight, and specifically designed and

manufactured for the purpose. Fittings shall conform to ANSI C80.4, ANSI C80.5, UL and CSA requirements.

a. Acceptable Manufacturers

1) Wheatland
2) Allied Tube
3) Project Electrical Engineer Approved Equal

5. EMT couplings, connectors and fittings shall be concrete tight compression type interior to the building with steel compression nut. Connectors shall be insulated throat with case hardened locknuts. Fittings shall conform to ANSI C80.4. Quick-fit type connectors will not be acceptable.

a. Acceptable Manufacturers

1) Appleton/O.Z. Gedney
2) Raco
3) Thomas and Betts

6. Flexible conduit connectors shall match the conduit material and finish, and shall be UL and CSA listed for grounding means.

a. Acceptable Manufacturers

1) Midwest
2) Raco
3) Thomas & Betts
4) Appleton/O.Z. Gedney
5) Equal approved by Engineer

7. PVC elbows, nipples and couplings shall be either SCH 40 PVC or SCH 80 PVC and shall be used with the associated conduit system. All material shall be UL listed for its intended use.

a. Acceptable Manufacturers

1) Carlon – Thomas & Betts
2) Wheatland
3) Allied Tube
4) Project Electrical Engineer Approved Equal

8. Each length of threaded conduit shall be complete with a coupling on one end and a thread protector on the other. The thread protector shall have sufficient mechanical strength to protect the threads during normal handling and storage.

2.03 CONDUIT BODIES

A. Stainless Steel condulet bodies shall be threaded cast 316 stainless steel specifically designed and manufactured for the purpose. Bodies shall be Form 8 with raised dome stainless steel covers, neoprene gasket and two stainless steel screws. Condulet Bodies shall conform to ASTM A351, ASTM F593, ASTM A167, UL 514A, CSA Standard 22.2 No. 18.1-04.

1. Acceptable Manufacturers

    a. Gibson Stainless
    b. Calbrite

B. PVC coated Rigid Galvanized Steel Conduit condulet bodies shall be threaded PVC Coated galvanized iron alloy specifically designed and manufactured for the purpose. Bodies shall be Form 8, PCV coated covers with molded flange and two encapsulated stainless steel screws. Condulet Bodies shall conform to ANSI C80.1, UL6 and NEMA RN-1. Specifications are based on Ocal –Blue with equal by Rob Roy and Perma-Cote.

1. Acceptable Manufacturers

    a. Thomas & Betts – Ocal Inc.
    b. Rob Roy (Plasti-Bond)
    c. Perma-Cote

C. Rigid Galvanized Steel Conduit and Intermediate Metal Conduit condulet bodies shall be threaded galvanized iron alloy specifically designed and manufactured for the purpose. Bodies shall be Form 8 with raised dome covers, gasket and two stainless steel screws. Condulet Bodies shall conform to UL 514B, CSA Standard 22.2 No. 18.

1. Acceptable Manufacturers

    a. Cooper Crouse Hinds
    b. Appleton

D. Rigid Aluminum Conduit bodies shall be threaded cast copper free aluminum with copper free epoxy powder coat paint specifically designed and manufactured for the purpose. Bodies shall be Form 8 with raised dome covers, gasket and two wedge nuts. Condulet Bodies shall conform to UL 514B, CSA Standard 22.2 No. 18.

1. Acceptable Manufacturers

    a. Cooper Crouse Hinds
    b. Appleton

E. Rigid Nonmetallic Conduit, conduit bodies shall be nonmetallic specifically designed and manufactured for the purpose. Bodies shall have hubs, gasket and two stainless steel screws. Condulet Bodies shall conform to UL 514 and NEMA TC-3.

1. Acceptable Manufacturers

    a. Carlon – Thomas & Betts
    b. Wheatland
    c. Allied Tube
    d. Project Electrical Engineer Approved Equal

F. EMT Conduit condulet bodies shall be threaded galvanized iron alloy specifically designed and manufactured for the purpose. Bodies shall be Form 8 with raised dome covers, gasket and two stainless steel screws. Condulet Bodies shall conform to UL 514B, CSA Standard 22.2 No. 18.

1. Acceptable Manufacturers

a. Cooper Crouse Hinds
b. Appleton

G. FITTINGS

1. All conduit fittings shall conform to the requirements of ASTM, UL and CSA.

2. Fittings used for stainless steel conduit shall match the material and finish of the conduit and shall bear the UL label.

3. Fittings used for rigid metal conduit shall match the material and finish of the conduit and shall bear the UL label.

4. Fittings used for aluminum conduit shall match the material and finish of the conduit and shall bear the UL label.

5. Fitting used for rigid non-metal conduit shall match the material and finish of the conduit and shall bear the UL label.

6. Fittings used for liquid tight flexible conduit shall match the material and finish of the conduit and shall bear the UL label.

7. Fittings used for flexible metal conduit shall match the material and finish of the conduit and shall bear the UL label.

8. Expansion fittings shall be weatherproof galvanized steel, as manufactured by O.Z. Gedney or Crouse-Hinds. Expansion fittings shall have bonding jumpers.

9. Conduit sealing, explosion proof, dustproof, and other types of special fittings shall be provided as required by the drawings and these specifications, and shall be consistent with the area and equipment with which they are associated. Fittings installed outdoors or in damp locations shall be sealed and gasketed. Outdoor fittings shall be of heavy cast construction. Hazardous area fittings and conduit sealing shall conform to NEC requirements for the area classification.

10. Combination fittings used to connect stainless steel, rigid galvanized steel or rigid nonmetallic conduit to electrical metallic tubing shall have a threaded throat to receive the conduit and a concrete tight compression type throat to receive the electrical metallic tubing.

11. *All fittings will be provided with a nylon insert where the component is not threaded into a hub.*

12. *All ground bushing shall have a nylon insert.*

2.04 BOXES

A. MANUFACTURERS

1. In NEMA 4X wet locations the materials used for stainless steel pull, junction, outlet boxes, etc., shall be manufactured by one of the following:

a. Gibson Stainless

b. Calbrite
c. Appleton
d. Crouse-Hinds
e. Hoffman
f. McKinstry, Inc.
g. Project Electrical Engineer Approved Equal

2. In NEMA 4X Dry locations the materials used for cast aluminum or stainless steel pull, junction, outlet boxes, etc., shall be manufactured by one of the following:

a. Gibson Stainless
b. Calbrite
c. Appleton
d. Crouse-Hinds
e. Hoffman Engineering
f. McKinstry, Inc.
g. Project Electrical Engineer Approved Equal

3. In NEMA 12, NEMA 3R & NEMA 1 locations the materials used for stainless steel or triple coated malleable iron pull, junction, outlet boxes, etc., shall be manufactured by one of the following:

a. Gibson Stainless
b. Calbrite
c. Appleton
d. Crouse-Hinds
e. Hoffman
f. McKinstry, Inc.
g. Project Electrical Engineer Approved Equal

4. In NEMA 1 dry locations, the materials used for triple coated malleable iron or formed steel pull, junction, outlet boxes, etc., shall be manufactured by one of the following:

a. Appleton
b. Crouse Hinds
c. Hoffman
d. McKinstry, Inc.
e. Equal approved by Engineer

B. PULL & JUNCTION BOXES

1. In NEMA 4X locations, pull boxes shall be constructed of stainless steel and shall be installed at points required per the NEC or the specifications whether indicated on the drawings or not. Boxes shall be NEMA 4X “hose down” rated. Minimum dimensions shall not be less than NEC requirements.

2. In NEMA 12 locations, pull boxes shall be constructed of stainless steel or triple coated malleable iron or PVC coated galvanized steel and shall be installed at points required per the NEC or the specifications whether indicated on the drawings or not. Boxes shall be NEMA 12 rated. Minimum dimensions shall not be less than NEC requirements.

3. In NEMA 1 dry locations, pull boxes shall be constructed of code gauge galvanized steel or triple coated malleable iron and shall be installed at points required per the

NEC or the specifications whether indicated on the drawings or not. Minimum dimensions shall not be less than NEC requirements.

4. Covers shall be stainless steel. Covers shall be attached to the boxes by stainless steel screws.

C. OUTLET BOXES

1. In NEMA 4X locations, outlet boxes shall be 1-piece stainless steel, NEMA 4X “hose-down” rated. Minimum dimensions shall not be less than NEC requirements.

2. In NEMA 4 locations, outlet boxes shall be 1-piece cast aluminum, NEMA 4 “hose-down” rated. Minimum dimensions shall not be less than NEC requirements.

3. In NEMA 12 locations, pull outlet boxes shall be 1-piece triple coated malleable iron or PVC coated galvanized steel, and shall be installed at points required whether indicated on the drawings or not. All boxes shall be NEMA 12 rated. Minimum dimensions shall not be less than NEC requirements.

4. In dry locations, outlet boxes shall be 1-piece triple coated malleable iron or cast aluminum construction. Minimum dimensions shall not be less than NEC requirements.

5. Round boxes and handy boxes shall not be used.

6. Blank covers shall be stainless steel. Covers shall be attached to the boxes by stainless steel screws.

7. Outlet boxes shall have integral hubs, two mounting feet on opposite ends of the box and shall be “Ridge Top” by design. Mounting feet shall be part of the box casting.

2.05 CIRCUIT DISCONNECT SWITCHES

A. Furnish and install heavy duty disconnect switches for disconnecting means for all equipment as shown on drawings. Disconnect switches shall be of the Type "A", quick-make, quick-break heavy duty construction. Disconnect switches shall have interlocking doors. Cabinets shall be bonderized and finished in gray enamel. Where (1) feeder supplies more than (1) piece of equipment, disconnecting switches shall be of the fusible type and shall be complete with fuses of the size required for each load.

B. Disconnect switches shall have the following ratings and construction types as required per the NEC:

1. Ratings

a. 30 to 1,200 amperes
b. 250 volts AC, DC
c. 600 volts AC
d. Fusible and non-fusible
e. Copper-aluminum terminals

2. Enclosures

a. Provide NEMA 3R rain-tight enclosures for all areas exterior to the building listed as NEMA 3R. Galvanized steel or non-metallic.
b. Provide NEMA 4X watertight enclosures in all process, production and interior wet locations. Stainless steel.
c. Provide NEMA 12 dust-tight and oil-tight enclosures in all areas interior to the building listed as NEMA 12. Stainless steel.
d. If the rating of the location is not known, provide NEMA 4X. Stainless steel.

C. All equipment shall be provided with the proper size/rating disconnect switch whether indicated on the drawings or not to comply with NEC.

D. Install and connect disconnect switches furnished by other Trades.

E. All power wiring shall be furnished and installed between disconnect switches, control cabinets, contactors and equipment terminals required by equipment furnished by other Trades.

F. Fuses for fused disconnect switches shall be the Rejection type. Fuses shall be sized in accordance with NEC.

G. Provide two (2) auxiliary contact in the switch that follows the position of the disconnect switch handle operator position.

2.06 MOTOR DISCONNECT SWITCHES

A. All motor disconnect devices shown on the drawings shall be furnished and installed by the Contractor.

B. Furnish and install heavy disconnect switches for disconnecting means for all motors as shown on drawings. Disconnect switches shall be of the Type "A", quick-make, quick-break heavy duty construction sized for the horsepower of the motor served. Disconnect switches shall have interlocking doors. Cabinets shall be bonderized and finished in gray enamel.

C. Disconnect switches shall have the following ratings and construction types as required per the NEC:

1. Ratings

a. 30 to 1,200 amperes
b. 250 volts AC, DC
c. 600 volts AC
d. Fusible
e. Copper-aluminum terminals

2. Enclosures

a. Provide NEMA 3R rain-tight enclosures for all areas exterior to the building listed as NEMA 3R. Galvanized steel or non-metallic.
b. Provide NEMA 4X watertight enclosures in all process, production and interior wet locations. Stainless steel.
c. Provide NEMA 12 dust-tight and oil-tight enclosures in all areas interior to the building listed as NEMA 12. Stainless steel.

d. If the rating of the location is not known, provide NEMA 4X. Stainless steel.

D. Where motor disconnect devices are installed between variable speed drives and their associated motor, an interlock switch shall be provided on the motor disconnect devices and 2#14 in 1/2" conduit shall run from the interlock switch to the associated variable speed drive to turn off the drive while the motor disconnect switch is in the off position.

E. All two-speed motors shall be provided with 6-pole motor disconnect devices.

F. Furnish and install manual starting thermal-overload type switch with pilot light as a disconnecting means for all motors under 0.5 HP, unless otherwise indicated on the plans. These thermal switches shall be toggle operated and shall be rated 1 HP, motor overload protection shall be interchangeable heaters. Heaters shall be installed without removing the starter from the housing or disturbing the wiring. Toggle shall be trip-free. Thermal switches shall be furnished in a NEMA 4X enclosures. All heaters shall be sized per the HP of the motor code letter. Coordinate with HVAC and Plumbing Trades.

G. All power wiring shall be furnished and installed between disconnect switches, control cabinets, contactors and equipment terminals required by equipment furnished by other Trades.

H. All motor, pumps, chillers, compressors, etc., shall be provided with the proper fuse size/rating disconnect switch whether indicated on the drawings or not, to comply with NEC. Install and connect disconnect switches furnished by other Trades.

I. Provide two (2) auxiliary contact in the switch that follows the position of the disconnect switch handle operator position.

PART 3 – EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

A. The raceway system throughout the Process Area must be watertight and corrosion resistant. A combination of materials shall be employed to achieve this goal. Conduits from the raceway rack system to Operator Control stations, junction boxes, disconnect switches and control panels, etc., shall be as specified per location classification in Section 1.02 of this specification.

B. All work shall conform to the printed specifications and installations of each of the manufacturers, the approved shop drawings, and to the requirements of the Governing Laws and Building Codes and the NEC.

C. Inspect job conditions and related work and report to the Engineer, any conditions adversely affecting raceway work.

D. Make all changes and adjustments in this work and other work under this Section as needed to accommodate the work of other Trades.

E. All boxes shall be erected, rigidly supported and securely fastened in place, in such a manner that plumb, level, and true finished lines and surfaces will result in the finished work.

F. The location of outlets shown on the drawings is diagrammatic only. Coordinate the exact location of equipment, devices and outlets with architectural, mechanical, plumbing and

process Mechanical drawings, details, equipment connection requirements and work of other contractors. The Owner's representative may alter the locating of equipment, devices and outlets shown within a 10'-0" radius prior to installation.

G. Protect all boxes, raceways, and equipment, from entry of foreign materials.

H. Independently support all boxes. No parts of the weight or stress thereof shall be borne by conduits terminating therein.

I. Independently support all conduits. No parts of the weight or stress thereof shall be borne by the insulated metal panel ceiling or conduit terminations.

J. All boxes shall be rigidly mounted to the process structure or building structure shall be equipped with suitable screw fastened covers. Unused open knockouts in all boxes shall be plugged with suitable blanking devices. All boxes installed that do not have equipment mounted in them shall be provided with blank covers.

K. Conduit as specified per location classification in Section 1.02 of this specification shall be used to serve all loads in process space. The conduit as specified per location classification in Section 1.02 of this specification shall extend to a minimum 1'-0" passed the process area where it shall be allowed to transition to EMT. Refer to specification Section 16110 for conduit requirements outside of the process space.

L. Horizontal conduits installed **within** the joist space of process areas **and** a minimum 20'-0" AFF shall be allowed to be EMT with unistrut and all thread rod. Installation within the joist space shall comply with specification Section 16110. All material shall be hot-dip galvanized.

3.02 INSTALLATION OF RACEWAYS

A. All wiring, unless otherwise noted on the drawings, shall be installed as specified per location classification in Section 1.02 of this specification within the process space.

B. All threaded couplings and fittings shall be made wrench tight; all non-metallic raceways shall be cemented securely.

C. Where non-metallic raceways are installed special means of support shall be used to prevent sagging; the E.C. shall provide double the amount of conduit supports required for rigid steel raceways.

D. All vertical conduit runs shall have a Tee fitting at the bottom with a rigid connection to the control panel or cabinet and a breather drain fitting at the bottom portion of the Tee. Provide a flexible connection to equipment that is subject to vibration or noise transmission.

1. All breather drains shall be stainless steel, explosion proof and dust ignition proof, suitable for hazardous locations Class I, Divisions 1 and 2, Groups B, C, and D, and for hazardous locations Class II, Divisions 1 and 2, Groups E, F, and G. Drain fittings shall be as manufactured by Appleton ECD50B4X Series.

E. Conduit shall be installed in accordance with the following:

1. Minimum size of conduits installed in process areas, including ceiling drops in the process space, shall be 3/4". Minimum size shall be upsized to 1" for vertical conduit runs that exceed 15'-0" length from top to bottom of the vertical riser and that are not supported along a building wall or platform structure.

a. The minimum conduit sizes above shall be applied to the entire length of all Process Electrical conduit runs, including segments that pass through non-process spaces.

2. Liquidtight flexible conduits shall be used as herein specified.

3. Connections between conduits of different types shall be made in an approved manner, using adapters and other materials and methods recommended by conduit manufacturers.

4. Stagger conduit couplings so that couplings on adjacent conduits do not lie on the same transverse plane.

5. Arrange multiple conduits as shown on the drawings. Make minor changes in location, or cross-sectional arrangement as necessary. Where conduit runs cannot be installed as shown because of conditions not discoverable prior to rough-in, request the Engineer instructions before further work is done. Coordinate this work with other contractors and the construction manager.

6. Raceways in ceiling spaces shall be routed in such an approved manner as to eliminate or minimize the number of junction boxes required, but also shall be routed in an orderly and organized manner. Support rods and clamps shall be furnished and installed as directed by the Engineer. Support of conduits by use of wire is strictly prohibited. Conduits shall be supported and secured by conduit support devices as approved by the Engineer.

7. Where conduit is threaded in the field, a standard conduit cutting die providing 3/4" taper per foot shall be employed. Threadless coupling shall not be used on rigid metal conduit except where specifically allowed by the Engineer. Running threads shall not be used on rigid metal conduit.

F. Conduit Runs

1. All conduits shall be sized as in accordance with the NEC, except as otherwise specified or shown on the drawings. All conduit systems shall be mechanically and electrically continuous from source of current to all outlets and grounded in accordance with the NEC.

2. All vertical conduit runs shall have a Tee fitting at the bottom with a rigid connection to the control panel or cabinet and a breather drain fitting at the bottom portion of the Tee. Provide a flexible connection to equipment that is subject to vibration or noise transmission.

a. All breather drains shall be stainless steel, explosion proof and dust ignition proof, suitable for hazardous locations Class I, Divisions 1 and 2, Groups B, C, and D, and for hazardous locations Class II, Divisions 1 and 2, Groups E, F, and G. Drain fittings shall be as manufactured by Appleton ECD50B4X Series.

3. Ream conduit after threads are cut. Cut ends square and butt solidly into couplings.

4. Prevent the accumulation of water, foreign matter or concrete in the conduits during the execution of the work. Temporarily plug conduit, blow out and swab before wires are pulled.

5. Where insulated bushings are used, fasten conduits to all sheet metal boxes and cabinets with two (2) locknuts in accordance with NEC.

6. Provide conduit expansion joints at building expansion joints and long runs of exposed conduit subject to stress for conduit runs 1-1/2" and larger. Provide conduit expansion joints or flexible conduit connection at building expansion joints for conduits less than 1-1/2". Provide copper bonding jumper secured with ground clamp on both ends of the expansion fitting.

7. Make changes in direction of runs with symmetrical bends or appropriate fittings. Make field-made bends and offsets with conduit bending machine to avoid changing the internal diameter of the conduit and not damage its protective coating either inside or outside. Individual bends shall not exceed 90° and not more than 270° total bends will be allowed in any one conduit run. Where more bends are necessary, or conduit runs exceed 150 linear feet, install a suitable pull box or junction box.

8. Use liquidtight flexible conduit for final connections to motors, portable equipment and for equipment subject to vibration and noise transmission. For each conduit size up to 1" trade size, flexible conduit shall be minimum length of 12" and a maximum length of 36". For conduit sizes above 1" trade size, flexible conduit shall be minimum length of 20" and maximum length of 48". Include separate grounding conductor for flexible conduits, greater than 1-1/4" in diameter. Provide separate ground conductor as specified in Section 16450.

9. Flexible conduit shall only be utilized as described above. Provide separate ground conductor as specified in Section 16450.

10. Drawings, in relation to routing of conduits, are diagrammatic. Except where additional conduits may be required to avoid derating of branch circuits, as required elsewhere within this Section, the number and size of conduits and wire shall be furnished and installed as indicated by the drawings. Conduits shall be routed in the field so as to be coordinated with the building structure. Conduit shall be run in straight lines parallel and perpendicular to walls, beams and columns and with right angle bends and threaded conduit fittings.

11. Conduit work shall be installed in such a manner as to keep exposed threads to an absolute minimum, and in no case shall more than three (3) threads be left exposed after the conduit work is made up tight.

12. Conduit runs shall be mechanically and electrically continuous. Conduit shall enter and be secured to cabinet, junction box, pull box or outlet box with liquidtight, threaded, self-locking, grounding bushing. Locknuts and bushings or self-locking adapters will not be required where conduits are screwed into tapped connections.

13. Check raceway sizes to verify that green equipment ground conductor fits into same raceway with phase and neutral conductors to meet NEC percentage of fill requirements. Increase duct, conduit, tubing and raceway sizes shown or specified as required to accommodate conductors.

14. Threaded sealing fittings for PVC coated rigid steel conduits, rigid aluminum, or galvanized rigid steel conduits, shall match the material of the conduit and box system. Fittings that prevent passage of water vapor shall be continuous drain. Install and seal fittings as required by manufacturer's recommendations.

15. Provide all empty conduits installed with a pull wire. Pull wire shall be No. 14 zinc-coated steel, or of plastic having not less than 200 pound tensile strength. Leave not less than 12" of slack at each end of the pull wire. Provide a tag at each end of pull wire indicating location of opposite end.

G. Conduit Routing

1. Install continuous as indicated.

2. Install level, plumb, and parallel to building services.

3. Changes in direction and elevation to be accomplished with factory furnished offsets and corners.

4. Lay out, assemble on job, and coordinate the raceway system with work of other trades to avoid conflicts.

5. Wall or ceiling mounted ***horizontal*** conduits within process areas with an IMP or T-Grid ceiling shall be prohibited.

H. Cleaning

1. All conduit work shall be carefully cleaned and dried inside before the installation of conductors. Wire shall not be pulled into conduit system until building roof and walls are weather tight and all rough plastering is completed. Plug conduit ends to exclude dust, moisture, plaster or mortar while building is under construction. No lubricants or cleaning agents, which might have a deleterious effect on conductor coverings, shall be used for drawing conductors into raceways.

I. Insulated Metal Panel Penetrations

1. Wall and/or ceiling penetrations shall not be sleeved. The Contractor shall drill his access hole as near as possible to the outside diameter of the conduit through the insulated panels to insure the snuggest possible fit. A “C” fitting shall be installed on the warm side of the panel. Provide PVC conduit and couplings on both sides of the IMP per details. All “C” fittings shall be filled with ***NuFlex Sealants Ultra Seal Straw Foam Products*** UL and U.S.D.A. approved expanding foam compound, following a successful system test for all air units, subfloor heating systems, freezer lighting systems, RTD system conduits, etc. Exterior of conduit and all butt joints or cracks shall then be sealed by caulking with a compatible non-hardening, food grade sealant. Apply 12" x ¾" thick Armaflex Pipe Insulation with PVC tape wrap to the conduit as it enters the warm space. The conduit body shall not be covered by the insulation.

J. Insulated Metal Panel Penetrations in Freezers

1. Wall and/or ceiling penetrations shall not be sleeved. The Contractor shall drill his access hole as near as possible to the outside diameter of the conduit through the insulated panels to insure the snuggest possible fit. A “C” fitting shall be installed to the warm and cold side of the panel, and the conduit through the panel shall be Schedule 40 PVC. The PVC conduit shall extend 30" to the warm side of the insulated metal panel. Provide PVC conduit and couplings on both sides of the IMP per details. All “C” fittings shall be filled with ***NuFlex Sealants Ultra Seal Straw Foam Products*** UL and U.S.D.A. approved expanding foam compound, following a successful system

test for all air units, subfloor heating systems, freezer lighting systems, RTD system conduits, etc. Exterior of conduit and all butt joints or cracks shall then be sealed by caulking with a compatible non-hardening, food grade sealant. Apply 30" x ¾" thick Armaflex Pipe Insulation with PVC tape wrap to the conduit as it enters the warm space. The conduit body shall not be covered by the insulation.

K. Sealed/Foamed Conduit Marking

1. After the cable and wiring has been installed in the conduit and the installation is complete the Contractor shall coordinate with the Construction Manager that the conduits are ready to be foamed and sealed and that all the following items have been completed; the wiring is complete, (no more additional cabling or wiring will be installed); the equipment and wiring has been inspected, started up, (i.e. energized), and tested according to specification 16198; and the area is complete and ready to be occupied by the client and/or ready for manufacturing. After each individual conduit has been foamed and sealed the electrical contractor shall clearly visibly indicate the conduit has been foamed and sealed, by an Engineer approved identification method, such as painting, stainless steel tag or by some other acceptable method of identification. The acceptable marking method must be approved by the Engineer prior to any foaming and/or sealing. Different marking methods and materials may be required based on the conduit type (power, fire alarm, life safety, low voltage, security etc.) and the conduit material type, (RGC, PVC coated rigid metal, PVC, Stainless Steel, etc.) according to the NEMA classification drawing(s).

L. Raceway Supports

1. NEMA 4X Process

a. All hardware such as channel, flat bars, nuts and bolts, studs, screws, straps, etc., installed in process areas shall be stainless steel.

b. Conduits run in process areas on walls or ceiling shall be supported off the wall by stainless steel **Behringer CH series one-piece sanitary** clamps. See details on drawings.

c. Conduits run on process equipment or other steel member (galvanized steel, stainless steel, or aluminum) such as frame of equipment, building column, or platforms, shall be supported with stainless steel **Behringer CH series one-piece sanitary** clamps. See details on drawings. All supports located on equipment, building columns, or platforms, shall be welded. Stud weld support shall be used to support the clamps and other electrical boxes, apparatus, etc., to steel members. Holes shall not be drilled in tubular frames. All welds shall be sanitary, ground smooth and free of pits and burrs.

d. Conduits dropping from above the walk-on ceiling to loads below shall be supported above the ceiling from the joist above the ceiling or from angle iron spanning the joist. Materials shall be stainless steel.

e. Conduit racks, trapezes, hangers, and U-bolts located in the process area shall be made of stainless steel. The trapeze shall be made of minimum 2" x 2" stainless steel angle. The rod hangers shall be made of 3/8" minimum stainless steel, threaded only at the ends. No more than 1” of thread shall be exposed after the leveling nuts have been installed. Provide rubber / plastic cover over the exposed treads after installation is complete.

2. NEMA 12 Process

   a. All hardware such as channel, flat bars, nuts and bolts, studs, screws, straps, etc., installed in process areas shall be galvanized steel.

   b. Conduits run in process areas on walls or ceiling shall be supported off the wall by galvanized steel Minerallac clamps. See details on drawings.

   c. Conduits run on process equipment or other steel member (galvanized steel, stainless steel, or aluminum) such as frame of equipment, building column, or platforms, shall be supported with stainless steel Minerallac clamps. See details on drawings. All supports located on equipment, building columns, or platforms, shall be welded. Stud weld support shall be used to support the clamps and other electrical boxes, apparatus, etc., to steel members. Holes shall not be drilled in tubular frames. All welds shall be sanitary, ground smooth and free of pits and burrs.

   d. Conduits dropping from above the walk-on ceiling to loads below shall be supported above the ceiling from the joist above the ceiling or from unistrut / angle iron spanning the joist. Materials shall be galvanized steel.

   e. Conduit racks, trapezes, hangers, and U-bolts, located in the process area shall be made of stainless steel. The trapeze shall be made of minimum 2" x 2" galvanized steel angle. The rod hangers shall be made of 3/8" minimum stainless steel, threaded only at the ends. No more than 1” of thread shall be exposed after the leveling nuts have been installed. Provide rubber / plastic cover over the exposed treads after installation is complete.

3. NEMA 1 Process

   a. All hardware such as channel, flat bars, U-bolts, nuts and bolts, studs, screws, straps, etc., installed in process areas shall be galvanized steel.

   b. Conduits run in process areas on walls or ceiling shall be supported off the wall by galvanized steel Minerallac clamps. See details on drawings.

   c. Conduits run on process equipment or other steel member (galvanized steel, stainless steel, or aluminum) such as frame of equipment, building column, or platforms, shall be supported with galvanized steel Minerallac clamps. See details on drawings. All supports located on equipment, building columns, or platforms, shall be welded. Stud weld support shall be used to support the clamps and other electrical boxes, apparatus, etc., to steel members. Holes shall not be drilled in tubular frames. All welds shall be sanitary, ground smooth and free of pits and burrs.

   d. Conduits dropping from above the walk-on ceiling to loads below shall be supported above the ceiling from the joist above the ceiling or from unistrut / angle iron spanning the joist. Materials shall be hot-dipped galvanized steel.

   e. Conduit racks, trapezes, hangers, and U-bolts, located in the process area shall be made of stainless steel. The trapeze shall be made of minimum 2" x 2" galvanized steel angle. The rod hangers shall be made of 3/8" minimum galvanized steel, threaded only at the ends. No more than 1” of thread shall be

exposed after the leveling nuts have been installed. Provide rubber / plastic cover over the exposed treads after installation is complete.

4. Horizontal conduits installed at a minimum elevation of 20'-0" AFF **and within** the joist space of process areas shall be allowed to be EMT with unistrut and all thread rod. All materials shall be hot-dip galvanized. Installation within this joist space shall comply with specification Section 16110.

3.03 INSTALLATION OF BOXES & CABINETS

A. The Contractor shall furnish and install junction boxes for branch circuits as required. Boxes shall be sized in accordance with NEC.

B. Suitable pull boxes shall be installed in convenient intermediate locations in all conduit runs in excess of 150 linear feet and runs requiring more than (3) 90° bends.

C. Location of all wall outlets, switches, etc., shall be verified with the construction manager prior to roughing in. Refer to details and wall elevations on Architectural drawings. Mounting heights and locations indicated in these drawings and/or specified dimensional information given to the Contractor by the Construction Manager shall take precedence over such information indicated on the Electrical drawings.

D. The Contractor shall furnish and install outlet boxes for all wiring devices as shown on the drawings.

E. If any discrepancies regarding the locations of outlet boxes are found to exist between the Electrical drawings and any other drawings associated with the project, notify the construction manager at once and have location verified before outlets are installed. Any reasonable change in location of outlets prior to roughing shall not involve additional expense to the Owner. The term "reasonable" shall be interpreted as moving outlet locations a maximum of 10'-0" in any direction from the location indicated on the drawings.

F. All boxes shall be rigidly mounted to construction and shall be equipped with suitable screw fastened covers. Unused open knockouts in all boxes shall be plugged with suitable blanking devices and shall retain their NEMA 4X "hose-down rating".

G. The height of outlets and devices is indicated on the drawings or obtainable from the construction. Use the following as a guide for mounting of outlet boxes, unless otherwise indicated on drawings.

Device	Height Above Finished Floor to Center – Line of Box
Receptacles	
Process Areas	48"
Production Areas	48"
Switches	48"
Telephone and Data Outlets	
Wall	54"
Counters	6" above counter
Fire Alarm Pull Stations	48"
Fire Alarm Horns/strobes	80"
Clock Outlets	86"

H. Coordinate height of outlets with Drawings and equipment installations drawings and properly locate height of all outlets.

I. All pull, junction, and outlet boxes shall be thoroughly cleaned prior to installation of conductors and/or wiring devices.

J. All cabinets, control panels, etc., shall have an Appleton BRTB4X* breather field installed at the top of the cabinet / panel and an Appleton ECD50B4X* NEMA 4X drain installed in the bottom of the cabinet / panel.

3.04 INSTALLATION OF MOTOR AND CIRCUIT DISCONNECT SWITCHES

A. Switches and fuses shall be installed as indicated on the drawings and as described in these specifications.

B. All equipment or motors shall have local disconnect switches. These switches shall be mounted on, or adjacent to, the equipment or motor in such a manner that they shall be accessible.

C. The Contractor shall be responsible for replacing all blown fuses until such time that the job is finished and accepted by the Owner. The Contractor shall also, at the time of acceptance, furnish 10% spare fuses of each size used. In no case shall fewer than (3) fuses be furnished of each size.

D. Switches shall be mounted in accordance with the manufacturer's recommendations using the mounting hardware, materials, and methods specified in these specifications.

E. Mounting height of disconnect switches shall be a maximum of 6'-6" above the finished floor to the top of the switch, unless otherwise indicated on the drawings or due to construction interference.

F. Conduit openings and switches shall be made with a hole-saw or shall be punched. All unused openings shall be plugged, capped, and made watertight for NEMA 4X installations.

G. All disconnect switches shall be labeled in accordance with the requirements of Section 16195.

3.05 INSTALLATION OF LIGHT FIXTURES

A. The electrical contractor shall be responsible for the coordination of light fixtures locations in all areas of the facility with other trades. This shall include the marking of the locations of the light fixtures that are recessed in the metal panel ceilings. The openings in the metal panel ceiling shall be provided by the metal panel contractor.

3.06 INSTALLATION OF JUNCTION BOXES ON CABLE TRAY

A. The contractor shall be allowed to install junction boxes in the exterior side wall of the cable tray. The box shall be attached to the tray using two nuts, two bolts and four fender washers. The head side of the nut shall be on the inside of the tray.

B. The junction boxes shall have a minimum 24" clear space from any other junction box. No conduits shall travel over the top of the box except for the conduit associated with the box.

3.07 IDENTIFICATION

A. All boxes shall be provided with nameplates to indicate the panelboard and circuit numbers powering the equipment. Nameplates shall be permanently attached.

B. All boxes shall be identified as indicated in Section 16195.

****

END OF SECTION

THE LIVESTOCK INSTITUTE

WESTPORT, MA

PROJECT NO. 4730

Specification for

RACEWAYS

Section 16110

THE DENNIS GROUP, LLC

PLANNING ▲ ENGINEERING ▲ CONSTRUCTION MANAGEMENT

1537 MAIN STREET
SPRINGFIELD, MASSACHUSETTS 01103
413.787.1785 ▲ FAX 413.787.1786

26 WEST MARKET STREET
SALT LAKE CITY, UTAH 84101
801.531.8585 ▲ FAX 810.531.8586

A	**09.20.2016**	**Review**	**MJJ**		
Issue	**Date**	**Description**	**By**	**Approved**	**Section 16110**

Unless notification and/or comments are received from client within two weeks after issue date, all documentation including drawings, specifications, and studies submitted to client shall be considered approved as released.

PART 1 – GENERAL

1.01 REFERENCES

A. The General Documents, as listed on the Table of Contents and applicable parts of Division 1, General Requirements, and applicable requirements of Section 16010, shall be included in and made part of this Section.

B. Examine all drawings and criteria sheets and all other Sections of the specifications for requirements which affect work under this Section whether or not such work is specifically mentioned in this Section.

C. Coordinate work with that of all other Trades affecting or affected by work of this Section. Cooperate with such Trades to assure the steady progress of all work under the Contract.

D. Provide all material, labor and equipment, to complete the work of this Section in strict accordance with the design Architect's and Engineer's plans and specifications, and with all applicable codes, rules, and standards.

1.02 SCOPE OF WORK

A. The work of this section covers furnishing and field installation of the complete raceway system in accordance with these specifications and as indicated on the drawings. The raceway system is defined to include conduit, boxes, and cabinets, and all materials and devices required to install, support, secure, and provide a complete system for support and protection of electrical conductors.

B. The work under this Contract shall also include all labor, materials, tools, equipment, transportation, insurance, temporary protection, supervision and incidental items essential for proper installation and operation, even though not specifically mentioned or indicated on the drawings but which are usually provided or are essential for proper installation and operation of all systems as indicated on the drawings and specified herein.

C. The specifications and drawings describe the minimum requirements that must be met by the Contractor for the installation of all work as shown on the drawings and as specified herein under.

1.03 RELATED WORK SPECIFIED ELSEWHERE

A. The following referenced sections are listed as a minimum of additional requirements and/or work not included in this Section which may be required to be performed under other designated Sections:

1. Section 16120: Conductors
2. Section 16130: Boxes (pull, junction and outlet)
3. Section 16140: Wiring Devices and Device Plates
4. Section 16190: Hangers and Supports
5. Section 16195: Electrical Identification
6. Section 16450: Grounding
7. Section 16741: Empty Raceway Systems

1.04 SUBMITTALS

A. Prepare and submit complete shop drawings of all types of raceways provided on this project to the Architect for approval.

B. Submit samples of each material under this Section requested by the Architect, for approval. Samples shall be in size and form requested by the Architect, and reasonable to show characteristics, color and finishes of the materials.

C. Submit complete manufacturer's product data of all materials and systems to the Architect for approval, consisting of complete product description and specifications, complete performance test data, complete preparation and installation instructions, and all other pertinent technical data required for complete product and product use information.

D. All shop drawings shall have clearly marked the appropriate specification number of drawing designation, for identification of the submittal.

E. Disposition of shop drawings shall not relieve the Contractor from the responsibility for deviations from drawing or specifications, unless he has submitted in writing a letter itemizing or calling attention to such deviations at time of submission and secured written approval from the Engineer, nor shall such disposition of shop drawings relieve the Contractor from responsibility for errors in shop drawings or schedules.

F. Do not order materials or begin installation until the Architect's and Engineer's approval of submittals has been obtained.

1.05 COORDINATION

A. The work of this Section shall be coordinated with other work of the Contract. The placement of all raceways shall be coordinated with HVAC, Plumbing and Process piping equipment prior to installation.

1.06 REFERENCE STANDARDS

A. Applicable provisions of the following Codes and Trade Standard Publications shall apply to the work of this Section, and are hereby incorporated into, and made a part of, the Contract Documents:

1.	NFPA 70:	National Electrical Code
2.	ANSI C80.1:	Rigid Steel Conduit, Zinc Coated
3.	ANSI C80.3:	Electrical Metallic Tubing, Zinc Coated
4.	ANSI C80.5:	Rigid Aluminum Conduit
5.	ANSI/NEMA FB1:	Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies
6.	NECA:	Standard of Installation
7.	NEMA RN1:	PVC Externally coated galvanized rigid steel conduit and intermediate metal conduit
8.	NEMA TC3:	PVC fittings for use with rigid PVC conduit and tubing

1.07 GUARANTEE

A. In addition to the specific guarantee requirements of the General Conditions, the Contractor shall obtain in the Owner's name the standard written manufacturer's guarantee of all materials furnished under this Section where such guarantees are offered in the

manufacturer's published product data. All these guarantees shall be in addition to, and not in lieu of, other liabilities which the Contractor may have by law or other provisions of the Contract Documents.

1.08 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery of materials shall be made to the project by the materials supplier in accordance with the instructions of the Contractor.

B. The Contractor shall provide adequate locked storage space with shelving for the materials, shall be responsible for all items of materials after receipt from the supplier, and shall replace all materials lost or damaged after delivery and receipt.

C. The Contractor shall furnish the materials supplier with receipts for all materials and accessory items received, and shall send copies of these receipts to the Architect.

PART 2 – MATERIALS

2.01 RIGID STEEL CONDUIT

A. Steel conduit, couplings, and elbows shall be hot-dip galvanized, rigid mild steel, in accordance with ANSI C80.1 and UL 6. The conduit interior and exterior surfaces shall have a continuous zinc coating with a transparent overcoat of enamel, lacquer, or zinc chromate.

B. Acceptable Manufacturers

1. Wheatland
2. Allied Tube

2.02 ELECTRICAL METALLIC TUBING

A. Electrical metallic tubing, including elbows and bends, shall be zinc coated mild steel in accordance with the requirements of ANSI C80.3 and UL 797. The interior and exterior surfaces of the tubing shall have a continuous zinc coating.

B. Acceptable Manufacturers

1. Wheatland
2. Allied Tube

2.03 INTERMEDIATE METAL CONDUIT

A. Intermediate metal Conduit shall be hot-dip galvanized, mild steel conforming to UL 1242 and shall bear the UL label.

B. Acceptable Manufacturers

1. Wheatland
2. Allied Tube

2.04 NON-METALLIC CONDUIT

A. Schedule 40 PVC – Conduit, couplings and elbows shall be thick wall, 90°C, (EPC), UL listed meeting NEMA standard TC-2.

B. Schedule 80 PVC – Conduit, couplings and elbows shall be thick wall, 90°C, (EPC), UL listed meeting NEMA standard TC-2.

C. Acceptable Manufacturers

1. Carlon
2. Wheatland

2.05 LIQUIDTIGHT FLEXIBLE METAL CONDUIT

A. Liquidtight flexible conduit shall be plastic jacketed, galvanized steel, Sealtite Type EF for sizes up to 1-1/4" and Type UA for sizes over 1-1/4".

B. Liquidtight flexible metal conduit shall be high temperature, plastic jacketed galvanized steel for high temperature locations.

C. Liquidtight flexible metal conduit shall be used in short runs to connect motors, or transformers, where movement and vibration requires a flexible connection. Maximum length not to exceed 5'-0".

1. Acceptable Manufacturers

a. Anaconda
b. Electri-Flex
c. International Metal Hose

2.06 FLEXIBLE METAL CONDUIT

A. Flexible conduit shall be hot-dip galvanized steel. In areas where such connections will be exposed to grease, oil, water or weather, flexible liquidtight conduit shall be used. Comply with UL 1, and UL 360.

1. Acceptable Manufacturers

a. Anaconda
b. Electri-Flex
c. International Metal Hose

B. Connectors shall be compatible with flexible conduit used and shall be UL listed for grounding means.

1. Acceptable Manufacturers

a. Midwest
b. Raco
c. Thomas and Betts
d. Appleton/O.Z. Gedney

2.07 ELBOWS, NIPPLES AND COUPLINGS

A. Rigid steel conduit couplings, connectors and fittings shall be threaded galvanized steel specifically designed and manufactured for the purpose. Fittings shall conform to ANSI C80.4.

B. Intermediate Metal Conduit couplings, connectors and fittings shall be threaded galvanized steel specifically designed and manufactured for the purpose. Fittings shall conform to ANSI C80.4.

C. EMT couplings, connectors and fittings shall be watertight compression type in all hose down areas and wet locations and of the steel double set screw type in all other areas. Connectors shall be insulated throat with case hardened locknuts. Fittings shall conform to ANSI C80.4. Compression type shall be **rain tight and concrete tight** with steel compression nuts. Quick-fit type connectors molded into the conduit will not be acceptable.

1. Acceptable Manufacturers

    a. Appleton/O.Z. Gedney
    b. Raco
    c. Thomas and Betts

D. Flexible conduit connectors shall be malleable iron or steel and shall be UL listed for grounding means.

1. Acceptable Manufacturers

    a. Midwest
    b. Raco
    c. Thomas and Betts
    d. Appleton/O.Z. Gedney

E. Each length of threaded conduit shall be complete with a coupling on one end and a thread protector on the other. The thread protector shall have sufficient mechanical strength to protect the threads during normal handling and storage.

2.08 CONDUIT BODIES

A. Rigid Galvanized Steel Conduit and Intermediate Metal Conduit condulet bodies shall be threaded galvanized iron alloy specifically designed and manufactured for the purpose. Bodies shall be Form 8 with raised dome covers, gasket and two stainless steel screws. Condulet Bodies shall conform to UL 514B, CSA Standard 22.2 No. 18

B. EMT condulet bodies shall be threaded die cat copper free aluminum. Covers shall be raised dome aluminum with stainless steel screws. Gasket shall be integral to the cover.. Combination bodies with set screws shall not be allowed. Condulet Bodies shall be UL and cUL listed.

C. Acceptable Manufacturers

1. Cooper Crouse Hinds
2. Appleton
3. Engineer approved equal.

2.09 FITTINGS

A. All metal conduit fittings shall conform to the requirements of UL 514 where these standards apply. Galvanized iron or galvanized steel fittings shall be used with steel conduit. Zinc coated steel fittings shall be used with steel tubing.

B. All liquidtight flexible conduit fittings shall be galvanized steel, and shall bear the UL label.

C. Flexible metal conduit fittings shall be galvanized steel, and shall bear the UL label.

D. Expansion fittings shall be weatherproof galvanized steel, as manufactured by Appleton/O.Z. Gedney or Crouse-Hinds. Expansion fittings shall have bonding jumpers.

E. Conduit sealing, explosion proof, dustproof, and other types of special fittings shall be provided as required by the drawings and these specifications, and shall be consistent with the area and equipment with which they are associated. Fittings installed outdoors or in damp locations shall be sealed and gasketed. Outdoor fittings shall be of heavy cast construction. Hazardous area fittings and conduit sealing shall comply with NEC requirements for the area classification.

F. Combination fittings used to connect rigid steel conduit to electrical metallic tubing shall have a threaded throat to receive the rigid steel conduit and shall have a watertight compression type fitting to receive the electrical metallic tubing.

G. *All fittings will be provided with a nylon insert where the component is not threaded into a hub.*

H. *All ground bushing shall have a nylon insert.*

2.10 WIREWAYS *(NIC)*

A. Provide electrical wireways of types and sizes as indicated. Provide complete wireway assembly including, but not limited to, couplings, offsets, elbows, expansion joints, adapters, holddown straps, end caps, ceiling hangers, and other components and accessories as required for complete system.

1. Lay-In Type: Provide lay-in wireways with hinged covers, in accordance with UL 870 and with components UL listed, including lengths, connectors, and fittings. Select units to allow fastening hinged cover closed without use of parts other than standard lengths, fittings and connectors.

2. Connectors: Provide wireway connectors suitable for “lay-in” conductors, with connector covers permanently attached that removal is not necessary to utilize the lay-in feature.

3. Finish: Protect sheet metal parts with rust inhibiting coating and baked enamel finish. Plate finish hardware to prevent corrosion. Protect screws installed toward inside of wireway with spring nuts to prevent wire insulation damage.

B. Acceptable Manufacturers

1. Square D
2. Hoffman
3. Wiegmann

PART 3 – EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

A. All work shall conform to the printed specifications and installation instructions of each of the manufacturers, the approved shop drawings, and to the requirements of the Governing Laws and Building Code.

B. Inspect job conditions and related work and report to the Architect, any conditions adversely affecting raceway work.

3.02 INSTALLATION OF RACEWAYS

A. All wiring, unless otherwise noted on the drawings, shall be installed in rigid metal conduit or intermediate metal conduit or EMT, subject to the restriction of NEC. Minimum size shall be 3/4".

B. Conduit shall be installed in accordance with the following:

1. All conduits below floor slabs, in vapor barriers, and in masonry and concrete walls shall be rigid steel. All rigid steel conduit routed underground shall be field painted with (2) coats of bitumastic compound, asphaltum or shall have additional outside factory coating of PVC or phenolic-resin-epoxy material or other equally flexible and chemical resistant material. Couplings shall be field-coated with same compound as conduits. Joints shall be threaded.

2. All branch circuit conduits in stud partitions and drop ceiling areas, and exposed above 8'-0" above finish floor may be EMT (thin wall) conduit.

3. All exposed conduit installed below 8'-0" above finished floor shall be rigid steel or intermediate grade conduit.

4. All motor branch circuit conduits shall be rigid steel, IMT or EMT.

5. Conduit systems for telephone, fire alarm, and miscellaneous systems shall consist of EMT (thin wall) conduit in drop ceilings, and stud wall partitions and exposed above 8'-0" of finish floor. Exposed conduit installed below 8'-0" above finished floor shall be rigid steel or Intermediate grade conduit.

6. Schedule 40 PVC conduits may only be utilized for underground applications, unless otherwise indicated on the Drawings. All 90 degree elbows and vertical risers shall be hot-dip galvanized steel conduit.

7. Flexible conduits shall be used as herein specified.

8. All conduit runs for exterior runs shall be hot-dip galvanized steel conduit, except when run underground via concrete encased ductbank as specified elsewhere in these specifications.

9. Where nonmetallic underground conduit enters the building and continues inside to the main electric service, pull box, cabinet or other electrical apparatus, the portion of the conduit that passes through the floor or wall and the remainder of the raceway inside the building shall be steel. Provide an adapter outside the building (5'-0"

beyond building wall minimum) wall to connect plastic and rigid galvanized steel conduit.

10. Where underground conduit enters the building through membrane-waterproofed wall or floor, provide a malleable iron seal with gland assembly and adjustable pressure bushings secured to masonry construction with one or more integral flanges. Membrane waterproofing shall be secured to device in a watertight manner.

11. Where underground conduit, without concrete envelope, enters the building through non-waterproofed wall or floor, provide Schedule 40 galvanized pipe sleeve. Fill space between conduit and sleeve with suitable plastic expandable compound or oakum and lead joint on each side of wall or floor.

12. Excavation, shoring, bracing, backfilling, de-watering, and grading will be provided by the Electrical Contractor. Trenches shall be evenly graded so that conduits slope uniformly at least 3" per 100'-0", without horizontal or vertical waves. Unless specified otherwise, conduit shall slope uniformly from one manhole to the next or from a high point between manholes. Avoid low points between manholes or upturned elbows.

13. Run conduits straight between manholes and upturned elbows. Unavoidable bends in nonmetallic conduits shall be made by assembling couplings at a slight angle if resulting radius is at least 100'-0". For radii less than 100'-0", use 5° angle couplings or 5° factory-made bend sections. Conduit shall terminate in end bells where raceway enters manholes. All conduit bends shall be 12'-6" radius sweeps.

14. Connections between conduits of different types shall be made in an approved manner, using adapters and other materials and methods recommended by conduit manufacturers.

15. Stagger conduit couplings so that couplings on adjacent conduits do not lie on the same transverse plane. Space end bells 9" center-to-center at manhole wall face for 4" conduits and space proportionately for other sizes. Transition to end bell spacing shall start 10'-0" from face of manhole wall. Conduit slope shall equal that of main bank. Make new conduit entrances into manholes and building walls consistent with grading requirements and entrances. Waterproof all conduit entrances into manholes and buildings as required by the Architect.

16. Where underground conduits pass below the grade level floor, they shall be supported every 10'-0" from the concrete floor or as required by the structural engineer.

17. Concrete for conduit envelopes shall be as required or as specified under Division 3. Concrete shall extend at least 3" beyond exterior surface of each conduit in bank. Coordinate work of this Section with that of Division 3.

18. Concrete envelopes may be poured directly against sides of trenches provided the trench wall is clean, even and free of loose material. Remove loose dirt and extraneous material. Concrete shall be spaced during pouring to eliminate voids under and between conduits and to prevent honeycombing of exterior surfaces. Power-driven tampers or agitators shall not be used. Secure bolts sufficiently to prevent movement during concrete placement.

19. Concrete envelopes between manholes, or between manhole and building, shall be poured in a single operation. Where more than one pour is necessary, provide 3/4"

reinforcing rod dowels extending 18" into concrete on each side of joint. Concrete envelopes installed over extensive area or disturbed earth shall have a separate concrete base.

20. Concrete envelopes that cross other conduits or pipelines or are run under roads and driveways shall be reinforced. Provide reinforcement where envelopes connect to manhole and building walls. Concrete envelopes that terminate for future extension shall have dowels as specified for joints between pours. Reinforcement shall be as required; consult with structural engineer.

21. Trenches shall not be backfilled until concrete envelopes have had sufficient time to set. After concrete envelopes have set, nonmetallic conduits shall be cleared with mandrel of the same size as the conduit.

22. Where conduits cross under existing roadways, walks or other paved areas, steel conduits may be driven instead of conduits in trenches. After installation, paved grass areas and other areas disturbed shall be restored to original condition.

23. Cap ends of spare conduits 5'-0" beyond pavement and protect them from mechanical damage. Mark the location of conduit ends with concrete monuments, 6" in diameter by 18" long, set flush in the ground with “S/C” indented in the top.

24. Arrange multiple conduits as shown on the drawings. Make minor changes in location, or cross-sectional arrangement as necessary. Where conduit runs cannot be installed as shown because of conditions not discoverable prior to digging of trenches, request the Architect instructions before further work is done. Coordinate this work with other outside service work.

25. Seal active and spare conduits that enter the building with oakum or other plastic expandable compound until conductors are ready for installation.

26. Raceways in ceiling spaces shall be routed in such an approved manner as to eliminate or minimize the number of junction boxes required, but also shall be routed in an orderly and organized manner. Support rods and clamps shall be furnished and installed as directed by the Architect. Support of conduits by use of wire is strictly prohibited. Conduits shall be supported and secured by conduit support devices as approved by the Architect.

27. Where rigid metal conduit is threaded in the field, a standard conduit cutting die providing 3/4" taper per foot shall be employed. Threadless coupling shall not be used on rigid metal conduit except where specifically allowed by the Engineer. Running threads shall not be used on rigid metal conduit.

28. Provide flexible conduits for connections to equipment furnished under Fire Protection Sections and other equipment as specified under Part 2 of this specification and where available space dictates; and where noise transmission must be eliminated or reduced. Flexible conduit shall be liquid tight except for connections to recessed lighting fixtures.

C. Conduit Runs

1. All conduit shall be sized as in accordance with the National Electrical Code, except as otherwise specified or shown on the drawings. All conduit systems shall be

mechanically and electrically continuous from source of current to all outlets and grounded in accordance with the National Electrical Code.

2. Conceal conduit wherever possible, or expose as shown or noted on the drawings and as specified hereinafter. Run all exposed conduit parallel to building walls using right angle bends. Exposed diagonal runs of conduit will not be permitted. Do not install conduit on roof surfaces unless specifically indicated on the Drawings.

3. No conduit runs are allowed in any floor slabs. Branch circuit conduit runs are not allowed in any floor slabs. Conduits for floor outlets shall be run below floor slab and shall be fed from the panel on the same floor as the outlet.

4. Encase secondary service entrance and telephone conduits in 3" concrete envelope.

5. Install conduit at least 12" from gas steam or hot water piping parallel runs, at 6" in cross runs and at least 3" from cold water piping.

6. Ream conduit after threads are cut. Cut ends square, and butt solidly into couplings.

7. Prevent the accumulation of water, foreign matter or concrete in the conduits during the execution of the work. Temporarily plug conduit, blowout and swab before wires are pulled.

8. Where insulated bushings are used, fasten conduits to all sheet metal boxes and cabinets with (2) locknuts in accord with NEC.

9. Provide conduit expansion joints at building expansion joints and long runs of exposed conduit subject to stress for conduit runs 1-1/2" and larger. Provide conduit expansion joints or flexible conduit connection at building expansion joints for conduits less than 1-1/2". Provide copper bonding jumper secured with ground clamp on both ends of fitting.

10. Seal each underground joint and make watertight.

11. Where building construction or other conditions make it impossible to use standard threaded couplings, install watertight threaded unions.

12. Make changes in direction of runs with symmetrical bends or cast-metal fittings. Make field-made bends and offsets with conduit bending machine to avoid changing the internal diameter of the conduit and not damage its protective coating either inside or outside. Individual bends shall not exceed 90° and not more than 270° total bends will be allowed in any one conduit run. Where more bends are necessary, or conduit runs exceed 150 linear feet, install a suitable pull box or junction box.

13. Provide all empty conduits installed with a pull wire. Pull wire shall be No. 14 zinc-coated steel, or of plastic having not less than 200 pound tensile strength. Leave not less than 12" of slack at each end of the pull wire. Provide a tag at each end of pull wire indicating location of opposite end.

14. Use liquid tight flexible conduit for final connection to motors, portable equipment and for equipment subject to vibration and noise transmission. For each conduit size up to 1" trade size, flexible conduit shall be minimum length of 12" and a maximum length of 36". For conduit sizes above 1" trade size, flexible conduit shall be minimum length of 20" and maximum length of 48". Include separate grounding conductor for flexible

conduits, greater than 1-1/4" in diameter. Provide separate ground conductor as specified in Section 16450.

15. Use flexible metal conduit only to connect light fixtures to adjacent junction boxes where not an integral part of the light fixture. Flexible conduit shall be a minimum 3/8" trade size, minimum 4'-0" long and maximum 6'-0" long.

16. Flexible conduit shall only be utilized as described above. All other wiring shall be in rigid, EMT and IMT conduit. Where flexible conduit is used, provide separate ground conductor as specified in Section 16450.

17. All penetrations through floor slabs shall be rigid steel conduits.

18. Conduit ends shall be cut square, threaded and reamed to remove burrs and sharp edges. Field threads shall be of the same type and have the same effective length as factory cut threads. Excessive exposed threads will not be allowed. Turns, wherever required in exposed conduit runs, shall be made by the use of factory-made bends, or field made bends as approved. In conduits, or in the event of a multiplicity of conduits making the same turn, a steel junction box with a removable steel cover may be used.

19. Offsets and bends for changes in elevation of exposed conduit runs shall be made at walls or beams and not in open spaces between walls or beams. Conduits shall be routed so as not to interfere with the operation or maintenance of any equipment. The entire job shall be done in a neat and workmanlike manner, as approved by the Architect.

20. Drawings, in relation to routing of conduits, are diagrammatic. Except where additional conduits may be required to avoid derating of branch circuits, as required elsewhere within this Section, the number and size of conduits and wire shall be furnished and installed as indicated by the drawings. Conduits shall be routed in the field so as to be coordinated with the building structure. Conduit shall be run in straight lines parallel and perpendicular to walls, beams and columns and with right angle bends and threaded conduit fittings.

21. Conduit work shall be installed in such a manner as to keep exposed threads to an absolute minimum, and in no case shall more than (3) threads be left exposed after the conduit work is made up tight.

22. Flexible conduit shall be liquid tight under following conditions:

    a. Exterior locations.
    b. Moisture or humidity-laden atmospheres.
    c. Corrosive atmospheres.
    d. Where washdown operations are possible.
    e. Where seepage or dripping of oil, grease or water is possible.

23. Conduit and EMT runs shall be mechanically and electrically continuous. Conduit shall enter and be secured to cabinet, junction box, pull box or outlet box with locknut / Meyers hub outside and combination locknut grounding bushing inside, or with liquid tight, threaded, self-locking, cold-weld wedge adapter. Locknuts and grounding bushings or self-locking adapters will not be required where conduits are screwed into tapped connections. Vertical conduit runs that terminate in bottom of wall boxes or cabinets shall be protected from entrance of foreign material before installation of conductors. Ground busing not required where the box has an integral threaded hub.

24. Check raceway sizes to determine that green equipment ground conductor fits into same raceway with phase and neutral conductors to meet NEC percentage of fill requirements. Increase duct, conduit, tubing and raceway sizes shown or specified as required to accommodate conductors.

25. Threaded sealing fittings for rigid steel conduits shall be zinc or galvanized coated, cast or malleable iron. Fittings that prevent passage of water vapor shall be continuous drain. Install and seal fittings as required by manufacturer's recommendations. In concealed work, install fittings in flush steel box with blank cover plate.

    a. Install sealing fittings at the following points:

        1) Where conduits enter or leave hazardous areas equipped with explosion proof lighting fixtures, switches, receptacles and other electrical devices.

        2) Where conduits pass from warm to cold locations.

        3) Where required by NEC.

26. Schedule 40 PVC shall be allowed under paved areas when encased in concrete, which are subjected to vehicular traffic.

27. All conduits located in the fire pump room shall be rigid, intermediate or liquid tight flexible metal type, in accordance with NFPA 20. This requirement shall apply to all systems conduits located in the pump room, whether specified in this Division or elsewhere in this contract.

28. Conduits for fire pump feeders shall be installed in strict accordance with NFPA 20, Chapter 6.

29. Non-metallic raceway shall not be used in building interior.

D. Wireway Routing

1. Install continuous as indicated.

2. Install level and parallel to building services.

3. Changes in direction and elevation to be accomplished with factory furnished offsets and corners.

4. Lay out, assemble on job, and coordinate wireway system with work of other crafts to avoid conflicts.

3.03 RACEWAY SUPPORTS

A. All raceways shall be supported as specified in Section 16190 of this Division.

3.04 SPECIAL INSTALLATION

A. Hazardous Locations

1. Perform all work in hazardous locations as defined by the NEC in strict accordance with the NEC for the particular “Class”, “Division”, and “Group” of hazardous locations involved or indicated on the drawings. Provide conduit and cable seals in accordance with the NEC.

3.05 CLEANING

A. All conduit work shall be carefully cleaned and dried inside before the installation of conductors. Wire shall not be pulled into conduit system until building roof and walls are weather tight and all rough plastering is completed. Plug conduit ends to exclude dust, moisture, plaster or mortar while building is under construction. No lubricants or cleaning agents, which might have a deleterious effect on conductor coverings, shall be used for drawing conductors into raceways.

****

END OF SECTION

THE LIVESTOCK INSTITUTE

WESTPORT, MA

PROJECT NO. 4730

Specification for

UNDERGROUND DUCT SYSTEMS

Section 16116

THE DENNIS GROUP, LLC

PLANNING ▲ ENGINEERING ▲ CONSTRUCTION MANAGEMENT

1537 MAIN STREET
SPRINGFIELD, MASSACHUSETTS 01103
413.787.1785 ▲ FAX 413.787.1786

26 WEST MARKET STREET
SALT LAKE CITY, UTAH 84101
801.531.8585 ▲ FAX 810.531.8586

A	**09.20.2016**	**Review**	**MJJ**		
Issue	**Date**	**Description**	**By**	**Approved**	**Section 16116**

Unless notification and/or comments are received from client within two weeks after issue date, all documentation including drawings, specifications, and studies submitted to client shall be considered approved as released.

PART 1 – GENERAL

1.01 REFERENCES

A. The General Documents, as listed on the Table of Contents and applicable parts of Division 1, General Requirements, and requirements of Section 16010, shall be included in and made part of this Section.

B. Examine all drawings and all other Sections of the Specifications for requirements which affect work under this Section whether or not such work is specifically mentioned in this Section.

C. Coordinate work with that of all other Trades affecting or affected by work of this Section. Cooperate with such Trades to ensure the steady progress of all work under the Contract.

D. Provide all material, labor and equipment, to complete the work of this Section in strict accordance with the design Architect's and Engineer's plans and specifications, and with all applicable codes, rules, and standards.

1.02 SCOPE OF WORK

A. The work of this section covers furnishing and field installation of the complete underground conduit duct system in accordance with these specifications and as indicated on the drawings. The underground duct system is defined to include conduit, connectors, couplings, spacers, reinforced steel, concrete, and all materials and devices required to install, support, secure, and provide a complete system for support and protection of electrical conductors.

B. The work under this Contract shall also include all labor, materials, tools, equipment, transportation, insurance, temporary protection, supervision and incidental items essential for proper installation and operation, even though not specifically mentioned or indicated on the drawings but which are usually provided or are essential for proper installation and operation of all systems as indicated on the drawings and specified herein.

C. The specifications and drawings describe the minimum requirements that must be met by the Contractor for the installation of all work as shown on the drawings and as specified hereinunder.

1.03 RELATED WORK SPECIFIED ELSEWHERE

A. The following referenced sections are listed as a minimum of additional requirements and/or work not included in this Section which may be required to be performed under other designated Sections:

1.	Division 2:	Excavation and Backfilling
2.	Division 3:	Concrete
3.	Section 16110:	Raceways
4.	Section 16120:	Conductors (600 Volt)
5.	Section 16129:	Manholes and Handholes
6.	Section 16130:	Boxes
7.	Section 16190:	Hangers and Supports
8.	Section 16195:	Electrical Identification

1.04 SUBMITTALS

A. Prepare and submit complete shop drawings of materials for underground conduit duct banks required on this project to Architect for approval.

B. Submit samples of each material under this Section requested by the Architect for approval. Samples shall be in size and form requested by the Architect, and reasonable to show characteristics, color and finishes of the materials.

C. Submit complete manufacturer's product data of all materials and systems to the Engineer for approval, consisting of complete product description and specifications, complete performance test data, complete preparation and installation instructions, and all other pertinent technical data required for complete product and product use information.

D. All shop drawings shall have clearly marked the appropriate specification number of drawing designation for identification of the submittal.

E. Disposition of shop drawings shall not relieve the Contractor from the responsibility for deviations from drawings or specifications unless he has submitted, in writing, a letter itemizing or calling attention to such deviations at time of submission and secured written approval from the Structural Engineer, nor shall such disposition of shop drawings relieve the Contractor from responsibility for errors in shop drawings or schedules.

F. Do not order materials or begin installation until approval of submittals by the Architect and Engineer has been obtained.

1.05 GUARANTEE

A. In addition to the specific guarantee requirements of the General Conditions, the Contractor shall obtain, in the Owner's name, the standard written manufacturer's guarantee of all materials furnished under this Section where such guarantees are offered in the manufacturer's published product data. All these guarantees shall be in addition to, and not in lieu of, other liabilities which the Contractor may have by law or other provisions of the Contract Documents.

1.06 COORDINATION

A. The work of this Section shall be coordinated with other work of the Contract. The placement of all raceways shall be coordinated with other underground utilities (existing and new) prior to installation.

1.07 REFERENCE STANDARDS

A. Applicable provisions of the following Codes and Trade Standard Publications shall apply to the work of this Section and are hereby incorporated into, and made a part of, the Contract Documents:

1.	NFPA 70:	National Electrical Code
2.	NEMA:	Publications
3.	ASTM:	American Society for Testing of Materials

1.08 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery of materials shall be made to the project by the materials supplier in accordance with the instructions of the Contractor.

B. The Contractor shall provide adequate storage space, shall be responsible for all items of materials after receipt from the supplier, and shall replace all materials lost or damaged after delivery and receipt.

C. The Contractor shall furnish the materials supplier with receipts for all materials and accessory items received, and shall send copies of these receipts to the Architect.

PART 2 – MATERIALS

2.01 RIGID STEEL CONDUIT

A. Steel conduit, couplings, and elbows shall be hot-dip galvanized, rigid mild steel, in accordance with ANSI C80.1 and UL 6. The conduit interior and exterior surfaces shall have a continuous zinc coating with a transparent overcoat of enamel, lacquer, or zinc chromate.

2.02 NON-METALLIC CONDUIT

A. Nonmetallic conduit shall be heavy wall rigid PVC Schedule 40. Conduit shall be UL listed and shall conform to the requirements of NEMA TC 2 and Federal Specification W-C-1094. Joints shall be solvent welded as recommended by the manufacturer.

2.03 ELBOWS, NIPPLES AND COUPLINGS

A. Elbows, nipples and couplings shall be as manufactured by Wheatland, Shamrock or Pittsburgh Nipple.

B. Each length of threaded conduit shall be complete with a coupling on one end and a thread protector on the other. The thread protector shall have sufficient mechanical strength to protect the threads during normal handling and storage.

2.04 FITTINGS

A. All metal conduit fittings shall conform to the requirements of UL 514 where these standards apply. Galvanized iron or galvanized steel fittings shall be used with steel conduit.

2.05 MANUFACTURERS

A. Rigid steel conduit, electrical metallic tubing and intermediate metal conduit shall be manufactured by Wheatland or Allied Tube and Conduit.

B. Non metallic conduit shall be manufactured by Carlon or Cantex.

2.06 MISCELLANEOUS

A. Concrete shall meet requirements of Division 3.

B. Reinforcing steel shall meet requirements of Division 5.

C. Threaded lubricant/sealant shall be Crouse-Hinds Type STL.

D. Buried utility warning marker tape shall be "Detectable Identoline Underground Warning Tape" as manufactured by W.H. Brady Industrial Products Division. The tape shall have "Caution – Buried Electric Line" printed repeatedly along its entire length.

PART 3 – EXECUTION

3.01 GENERAL REQUIREMENTS

A. The Contractor shall furnish and install raceways and fittings for an underground duct system as indicated on the drawings and as specified herein.

B. The contractor shall hire the services of a licensed professional surveyor to locate site equipment, underground conduit runs, and conduit stub up locations per the drawings. Locations not per the drawings are to be reworked per the schedule at the contractor's expense. It is up to the contractor to maintain the staked locations and reverify them with the professional surveyor as needed during the course of excavation.

C. Raceways for underground system shall be PVC Schedule 40 and/or galvanized steel. Trade size of raceways shall be as per drawings for various systems. All 90 degree elbows and vertical risers shall be hot-dip galvanized steel conduit.

D. Concrete, reinforcing rods, etc., shall be specified by the Structural Engineer and shall be furnished and installed by this Contractor.

E. All bends at underground duct system shall be wide radius sweep.

F. Where raceways transform from PVC Schedule 40 to rigid steel conduit, the Contractor shall furnish and install proper coupling(s) to accommodate aforementioned transition.

G. Where offsets are required to clear obstructions and other underground services, a 5° angle maximum shall be allowed at duct joints.

H. All raceways as previously described shall utilize a mandrel of sufficient size to thoroughly clear raceways of all obstructions prior to installation of any wiring.

I. All duct lines shall be properly marked as follows:

1. Along length of underground duct system, greater than 20'-0" in length, a concrete marker shall be provided. The marker shall be an 8" square by 1'-6" deep set in ground directly above the duct line and shall indicate duct line by letter "E-[Voltage]" (i.e. E-480V, E-208V, E-13,800V) with arrow pointing to indicate direction from whence electricity has emanated and to where the electricity is going. Provide marker at a maximum 100'-0" on center. Where the duct bank length is less that 100'-0" provide one marker equidistant from the origination and end point of the duct bank

J. Duct lines shall be marked with a 5 mil brightly colored tape not less than 3" wide and inscribed at not more than 10'-0" on centers identifying duct service. Tape shall have a metallic backing and a corrosion resistant 1 mil metallic foil core. Place tape approximately 12" below finish grade directly above duct lines. See the electrical details for additional information.

3.02 EXCAVATING, BACKFILLING & COMPACTING FOR UTILITIES

A. Excavation shall be by open cut unless otherwise noted on Drawings. The top portion of the trenches may be excavated as required by the subcontractor to any width which will not cause damage to any adjacent structure. The portion of the trench from 1 foot above the top of the pipe and below shall not exceed the dimensions shown on the Drawings.

B. The bottom of trenches shall be carefully shaped to conform to and support the bottom of the conduit / duct bank. Where rock is encountered, it shall be removed to a depth of 12 inches below the conduit / duct bank and replaced with an approved soil material.

C. Where wet or otherwise unsuitable material is encountered at or below the bottom of the conduit / duct bank during excavation, it shall be removed to a point 12 inches below the bottom of the conduit / duct bank and replaced with drainage fill.

D. Excavated material shall be hauled off site at no additional cost to Owner.

E. Maintain excavations free to surface water. Provide pumps if required to drain excavations. Provide and maintain temporary drainage ditches, as required.

F. Backfilling shall be done with selected material, free from rock larger than 2 inches in size and free of debris. Backfill shall be carefully placed and tamped around and over the pipe to avoid displacement of the conduits or damage to the joints. All backfill shall be placed in 6 inch lifts. Place backfill evenly along both sides of conduit pipe full length. Compact each layer to 95% of maximum dry density.

G. Backfill material for all trenches beneath structures and/or pavement shall be crushed stone or similar material as approved by the engineer.

3.03 INSTALLATION

A. Steel conduits in ground or on vapor barriers shall be field coated with asphaltum or shall have additional outside factory coating of polyvinyl chloride or phenolic-resin-epoxy material or other equally flexible and chemical resistant material. Couplings and damaged areas of coated conduits shall be field-coated with same compound as conduits. Joints shall be threaded.

B. Joints in conduits and fittings shall be watertight and shall meet the requirements of manufacturer's installation recommendations. Threaded portions of steel conduits not encased in concrete, and adjoining ends of conduits, couplings and fittings, shall be coated with asphaltum after installation. Connections between conduits of different types shall be made in an approved manner, using adapters and other materials and methods recommended by conduit manufacturers.

C. Where nonmetallic underground conduit enters the building and continues inside to the main electric service, pull box, cabinet or other electrical apparatus, the PVC encased in concrete may continue below the building slab; however, a transition to rigid steel shall occur prior to penetrating the slab.

D. Where underground conduit enters the building through membrane-waterproofed wall or floor, provide a malleable iron seal with gland assembly and adjustable pressure bushings secured to masonry construction with one or more integral flanges. Membrane waterproofing shall be secured to device in a watertight manner.

E. Where underground conduit, without concrete envelope, enters the building through non-waterproofed wall or floor, provide Schedule 40 galvanized pipe sleeve. Fill space between conduit and sleeve with suitable plastic expandable compound or oakum and lead joint on each side of wall or floor.

F. Excavation, shoring, bracing, backfilling and grading to be provided under other Divisions. Trenches shall be evenly graded so that conduits slope uniformly at least 3" per 100'-0", without horizontal or vertical waves. Unless specified otherwise, conduit shall slope uniformly

from one manhole to the next or from a high point between manholes. Avoid low points between manholes or upturned elbows.

G. Run conduits straight between manholes and upturned elbows. Unavoidable bends in nonmetallic conduits shall be made by assembling couplings at a slight angle if resulting radius is at least 100'-0". For radii less than 100'-0", use 5° angle couplings or 5° factory-made bend sections. Conduit shall terminate in end bells where raceway enters manholes.

H. Support multiple conduit runs and banks on preformed nonmetallic spacing block separators on 4'-0" centers. Separator containing metal shall have metal non-continuous and shall not form a magnetic loop. Unless otherwise shown on the drawings, spacing between exterior surfaces of conduits shall be as follows:

1. 2" between telephone conduits

2. 2" between conduits containing cables operating at 600 V or less

3. 12" between telephone conduit and power conduit in the same concrete envelope

4. 2-1/2" between conduits containing cables operating at more than 600 V

a. Space conduit separators to prevent sagging of raceway and breaking of couplings and watertight seals, to maintain deformation of conduit at separators to 0.10" or less. Secure with cords where necessary. Do not use tie wires, reinforcing rods or other metallic materials.

I. Stagger conduit couplings so that couplings on adjacent conduits do not lie on the same transverse plane. Space end bells 9" center-to-center at manhole wall face for 4" conduits and space proportionately for other sizes. Transition to end bell spacing shall start 10'-0" from face of manhole wall. Conduit slope shall equal that of main bank. Make new conduit entrances into manholes and building walls consistent with grading requirements and entrances. Waterproof all conduit entrances into manholes and buildings as required by the Architect.

J. Where underground conduits pass below the grade level floor, they shall be supported every 10'-0" from the concrete floor as required by the Structural Engineer.

K. Concrete for conduit envelopes shall be as required or as specified under Division 3. Red dye shall be added to concrete mixture. Concrete shall extend at least 3" beyond exterior surface of each conduit in bank. Coordinate work of this Section with that of Division 3.

L. All ductbanks shall **utilize grade forms or be formed with plywood concrete forms on all sides <u>including the bottom</u>**.

M. Concrete envelopes may be poured directly against sides of trenches provided the trench wall is clean, even and free of loose material. Remove loose dirt and extraneous material. Concrete shall be spaced during pouring to eliminate voids under and between conduits and to prevent honeycombing of exterior surfaces. Power-driven tampers or agitators shall not be used. Secure bolts sufficiently to prevent movement during concrete placement. Consult with Structural Engineer and obtain approval.

N. Concrete envelopes between manholes, or between manhole and building, shall be poured in a single operation. Where more than one pour is necessary, provide 3/4" reinforcing rod dowels extending 18" into concrete on each side of joint. Concrete envelopes installed over extensive area of disturbed earth shall have a separate concrete base. Consult with Structural Engineer and obtain approval.

O. Concrete envelopes that cross other conduits or pipelines or are run under roads and driveways shall be reinforced. Provide reinforcement where envelopes connect to manhole and building walls. Concrete envelopes that terminate for future extension shall have dowels as specified for joints between pours. Reinforcement shall be as required; consult with structural engineer.

P. Trenches shall not be backfilled until concrete envelopes have had sufficient time to set. After concrete envelopes have set, nonmetallic conduits shall be cleared with mandrel of the same size as the conduit.

Q. Where conduits cross under existing roadways, walks or other paved areas, steel conduits may be driven instead of conduits in trenches. After installation, paved grass areas and other areas disturbed shall be restored to original condition.

R. Cap ends of spare conduits 5'-0" beyond pavement and protect them from mechanical damage. Mark the location of conduit ends with concrete monuments, 6" in diameter by 18" long, set flush in the ground with "S/C" indented in the top.

S. Arrange multiple conduits as shown on the drawings. Make minor changes in location, or cross-sectional arrangement as necessary. Where conduit runs cannot be installed as shown because of conditions not discoverable prior to digging of trenches, request the Architect's instructions before further work is done. Coordinate this work with other outside service work.

T. Seal active and spare conduits that enter the building with oakum or other plastic expandable compound until conductors are ready for installation.

3.04 CLEANING

A. Underground ducts shall be thoroughly cleaned and dried prior to the installation of any conductors.

3.05 SITE OBSERVATIONS

A. Notify the Architect/Structural Engineer prior to backfilling any underground duct systems for inspection. Notification shall be minimum of (2) working days advance of backfill. Failure to provide said notice will require uncovering of any/all backfill, at the Architect's/Structural Engineer's requires, for inspection of ducts. Such rework shall occur at Contractor's expense. Obtain in writing the Architect/Structural Engineer's waiver of said inspection if so desired by the Architect/Structural Engineer.

****

END OF SECTION

THE LIVESTOCK INSTITUTE

WESTPORT, MA

PROJECT NO. 4730

Specification for

CONDUCTORS (600 VOLT)

Section 16120

THE DENNIS GROUP, LLC

PLANNING ▲ ENGINEERING ▲ CONSTRUCTION MANAGEMENT

1537 MAIN STREET
SPRINGFIELD, MASSACHUSETTS 01103
413.787.1785 ▲ FAX 413.787.1786

26 WEST MARKET STREET
SALT LAKE CITY, UTAH 84101
801.531.8585 ▲ FAX 810.531.8586

Issue	Date	Description	By	Approved	Section 16120
A	09.20.2016	Review	MJJ		

Unless notification and/or comments are received from client within two weeks after issue date, all documentation including drawings, specifications, and studies submitted to client shall be considered approved as released.

PART 1 – GENERAL

1.01 REFERENCES

A. The General Documents, as listed on the Table of Contents and applicable parts of Division 1, General Requirements, and applicable requirements of Section 16010, shall be included in and made part of this Section.

B. Examine all drawings and criteria sheets and all other Sections of the specifications for requirements which affect work under this Section whether or not such work is specifically mentioned in this Section. Particular attention shall be warranted to Division 15, Section 15900.

C. Coordinate work with that of all other Trades affecting or affected by work of this Section. Cooperate with such Trades to assure the steady progress of all work under the Contract.

D. Provide all material, labor and equipment, to complete the work of this Section in strict accordance with the design Architect's and Engineer's plans and specifications, and with all applicable codes, rules, and standards.

1.02 SCOPE OF WORK

A. The work of this Section shall include the furnishing and installation of all conductors, required for feeders, branch circuits, remote control wiring, etc., (600V and below). Installation shall be defined to include placement, splicing, terminating conductors (including spare conductors), identification, testing, and verification of each circuit, cable, and conductor. Terminating a conductor shall include attaching each conductor in its designated location using the specified materials, and insulating the entire connection where specified or required by the application. Spare conductors shall be terminated and appropriately labeled.

B. For purposes of bidding, the below listed shall be followed. However, the Contractor shall provide all conductors required for all systems to be complete and in working condition.

1. Electrical Contractor shall provide:

    a. Wires and cables including splices, connections and supports for complete installation as shown on the drawings and specified.

2. Temperature Control Contractor shall provide:

    a. Wiring for all temperature control work.

C. The work under this Contract shall also include all labor, materials, tools, equipment, transportation, insurance, temporary protection, supervision and incidental items essential for proper installation and operation, even though not specifically mentioned or indicated on the drawings but which are usually provided or are essential for proper installation and operation of all systems as indicated on the drawings and specified herein.

D. The specifications and drawings describe the minimum requirements that must be met by Contractor for the installation of all work as shown on the drawings and as specified hereinunder.

E. Conductors greater than #6 AWG shall be installed as a single continuous cable/conductor. The cable/conductor shall not be spliced without the express written consent of the project electrical engineer.

F. All branch circuits shall have individual neutrals and individual grounds unless otherwise indicated on the contract drawings.

1.03 RELATED WORK SPECIFIED ELSEWHERE

A. The following referenced sections are listed as a minimum of additional requirements and/or work not included in this Section which may be required to be performed under other designated Sections:

1. Section 16110: Raceways
2. Section 16130: Boxes (pull, junction and outlet)
3. Section 16140: Wiring Devices and Device Plates
4. Section 16195: Electrical Identification
5. Section 16198: Start-Up Testing of Electrical Equipment

1.04 SUBMITTALS

A. Prepare and submit complete shop drawings of all types of conductors provided on this project to the Engineer for approval, prior to installation.

B. Submit samples of each material under this Section requested by the Engineer, for approval. Samples shall be in size and form requested by the Engineer, and reasonable to show characteristics, color and finishes of the materials.

C. Submit complete manufacturer's product data of all materials and systems to the Engineer for approval, consisting of complete product description and specifications, complete performance test data, complete preparation and installation instructions, and all other pertinent technical data required for complete product and product use information.

D. All shop drawings shall have clearly marked the appropriate specification number of drawing designation, for identification of the submittal.

E. Disposition of shop drawings shall not relieve the Contractor from the responsibility for deviations from drawing or specifications, unless he has submitted in writing a letter itemizing or calling attention to such deviations at time of submission and secured written approval from the Engineer, nor shall such disposition of shop drawings relieve the Contractor from responsibility for errors in shop drawings or schedules.

F. Do not order materials or begin installation until the Architect's and Engineer's review of submittals has been obtained.

1.05 COORDINATION

A. The work of this Section shall be coordinated with all other work of the Contract. The placement of conductors in raceways shall be coordinated with proper conduit and cable tray sizes prior to installation.

1.06 REFERENCE STANDARDS

A. Applicable provisions of the following Codes and Trade Standard Publications shall apply to the work of this Section, and are hereby incorporated into, and made a part of, the Contract Documents:

1.	ICEA S-61-402:	Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy (NEMA WC 5)
2.	NFPA 70:	National Electrical Code
3.	UL 62:	Flexible Cord and Fixture Wire
4.	UL 83:	Thermoplastic-Insulated Wires and Cables
5.	ICEA S-66-524/NEMA WC-7:	Cross-Linked Thermosetting Polyethylene – Insulated Wire and Cable
6.	NEMA WC-41:	Coaxial Communication Cable

B. AC cable shall comply with 1.06-A above and shall be in compliance with the latest applicable edition of the following standards:

1. NEC 517.13
2. NEC 517.50
3. Federal Specification J-C-30B
4. UL 4
5. UL 1479

C. Tray cable shall comply with 1.06-A above and shall be in compliance with the latest applicable edition of the following standards:

1. NEC 392
2. NEC 336
3. UL 44
4. UL 1277
5. ASTM B-3
6. ASTM B-8
7. ICEA S-68-516
8. ICEA T-29-520
9. ICEA T-30-520
10. IEEE383
11. FT4/IEEE 1202

1.07 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery of materials shall be made to the project by the materials supplier in accordance with the instructions of the Contractor.

B. The Contractor shall provide adequate locked storage space with shelving for the materials, shall be responsible for all items of materials after receipt from the supplier, and shall replace all materials lost or damaged after delivery and receipt.

C. The Contractor shall furnish the materials supplier with receipts for all materials and accessory items received, and shall send copies of these receipts to the Architect.

D. Materials shall be suitably packaged by manufacturer to prevent damage during shipment. Damaged materials will not be acceptable for use.

E. Store materials on site in clean, dry storage area.

F. Handle all materials carefully to preclude damage. Material with damaged insulation shall not be acceptable for use.

1.08 GUARANTEE

A. In addition to the specific guarantee requirements of the General Conditions, the Contractor shall obtain in the Owner's name the standard written manufacturer's guarantee of all materials furnished under this Section where such guarantees are offered in the manufacturer's published product data. All these guarantees shall be in addition to, and not in lieu of, other liabilities which the Contractor may have by law or other provisions of the Contract Documents.

PART 2 – MATERIALS

2.01 BUILDING WIRE – 600 VOLT

A. All wire and cable shall be annealed, coated copper per ASTM B33 or B189 with conductivity of not less than 98%. All stranded wire shall be Class B per ASTM B8.

B. All wire shall have 600V insulation, UL listed and complying with UL 83, ICEA S-61-402 or ICEA S-66-524 for respective insulation type.

C. All feeder, branch circuit, remote control, signal circuit and interlock wiring shall be manufactured of copper, rated at 600 volts, single conductor. All wiring shall be stranded.

D. Minimum size wire for branch circuit and power wiring shall be #12 AWG. The contractor shall increase the conductor size as required per the NEC to ensure a maximum voltage drop not greater than 3% at full circuit capacity.

E. Contractors shall furnish and install cable adaptors when needed to accommodate for smaller lug sizes.

F. Remote control signal wiring and interlock wiring shall be #14 AWG non-shielded.

G. 4–20 mA control signal wiring shall be #14 AWG shielded.

H. Fire alarm wiring shall be per the Fire Alarm System section of these specifications.

I. Wire and cable for lighting, power and control circuits for systems operating between 50 and 600 volts shall be soft drawn, 98% conductive copper with 600 volt rated insulation.

J. Insulation types for all conductors shall be as follows:

Description	Location		
	Dry	Damp	Wet
Branch circuits #6 AWG and smaller.	THHN	THWN	THWN
Feeders, and branch circuits larger than #6 AWG.	XHHW	XHHW	XHHW-2
Exterior feeder and branch circuit wiring.	XHHW-2	XHHW-2	XHHW-2
Feeders connected to 100% rated circuit breakers.	XHHW-2	XHHW-2	XHHW-2

Wiring in areas with an ambient less than 32°F.	XHHW-2	XHHW-2	XHHW-2
Feeders installed in cable tray. *Feeders installed in cable tray shall be CT rated.	XHHW-2	XHHW-2	XHHW-2
Multi-conductor branch circuit wiring installed in cable tray. *Multi-conductor branch circuit wiring installed in cable tray shall be CT rated.	XHHW-2	XHHW-2	XHHW-2

K. Color coding shall match the Owner's color coding standard. If no standard color coding system exists, use the following:

208/120 Volts			480/277 Volts		
A Phase	-	Black	A Phase	-	Brown
B Phase	-	Red	B Phase	-	Orange
C Phase	-	Blue	C Phase	-	Yellow
Neutral	-	White	Neutral	-	Grey
Ground	-	Green	Ground	-	Green with Yellow Stripe

L. Color coding shall be continuous on insulation for #6 AWG or smaller and continuous or marked with color tape at all connections and in all pull, junction and outlet boxes for conductors larger than #6 AWG.

M. All wiring shall conform to the National Electrical Code for construction and use.

N. All wiring shall be installed in conduit (power, low voltage and control wiring), unless specifically indicated otherwise.

O. Wiring in hot locations and for recessed fixtures shall have heat-resistant insulations recognized by NEC such as RHH, etc.

P. Wiring for all recessed HID fixtures shall have heat-resistant insulations recognized by NEC such as SFF-2, etc. EC will provide an 18" cable whip from junction box to light fixture terminals. Home run from junction box to Panelboard shall be 90°C wire. EC to mount junction box to fixture enclosure using 1/4" stand-offs made of non-heat conductive materials.

Q. Conductors #10 AWG and #12 AWG shall be connected with pre-insulated spring connectors encased in a steel shell and rated at not less than 105°C. A minimum of 3/8" skirt shall cover the bare wires. The connector shall meet with UL approval for fixture and pressure work and shall be “B-Cap” Type B1, B2 and B4 electrical spring connectors as manufactured by the Buchanan Co., or “Scotch Lok” Type Y, R and B electrical spring connectors as manufactured by the 3M Co. or approved equal. For wire sizes #8 AWG and larger, all splicing and lug connections shall be compression type.

R. Acceptable Manufacturers

1. Southwire.
2. Nexans
3. General Cable Corp.
4. Okonite.
5. Prysmian.
6. Houston Wire & Cable Company.

S. Color coding of low tension conductors shall be as specified by IEEE.

T. The use of non-metallic sheathed metallic cable in any type of wiring will not be allowed.

U. Refer to feeder schedule on the drawings for conductor sizes.

2.02 CABLE PULLING LUBRICANT

A. Cable pulling lubricant shall be as manufactured by American Polywater Type J.

B. Cable pulling lubricant shall be water-based, non-flammable, non-toxic, and shall dry to a smooth, non-stick film.

C. Cable pull lubricants that reduce a cable's dielectric constant shall not be used.

2.03 SOLDERLESS LUGS AND CONNECTORS

A. All lugs for feeder conductors and connectors for branch circuit joints shall be of solderless, compression type, suitable for copper wire. No mechanical lugs shall be allowed. All cable to bus connection shall be compression type lugs, 2-hole double bolted.

B. Conductors #10 AWG and #12 AWG shall be connected with pre-insulated spring connectors incased in a steel shell and rated at not less than 105°C. A minimum of 3/8" skirt shall cover the bare wires. The connector shall meet with UL listing for fixture and pressure work.

C. Lugs and wire connectors shall be one of the following: Burndy Corp., Thomas & Betts, Ideal or Buchanan.

2.04 CABLE ASSEMBLIES (PRE-FABRICATED)

A. Armored Cable (AC)

1. Uses Permitted

a. AC cable may be utilized in lieu of conduit and cable in dry, hollow partitions and ceiling cavities for general purpose, 20 ampere, single phase, 120 or 277 volt, normal branch circuits for receptacles and lighting fixtures only. AC cable shall not be utilized in places of assembly.

b. For branch circuit homeruns to surface mounted panels, AC cable shall terminate in a junction box 5'-0" (minimum) horizontally away from the panel. If panelboards are located in rooms designated as electric rooms or closets, AC cable shall terminate in a junction box outside of the electric room and conduit shall be run to the panel. AC cable shall not be allowed in electric rooms or closets.

c. AC cable shall not be used in mechanical or plumbing rooms, closets or shafts, including mechanical penthouse.

2. Construction

a. Conductors

1) Conductors shall be minimum #12 AWG, soft drawn 98% conductive copper with 90°C, THHN, 600 volt rated insulation. Included with each length of AC cable shall be the required number of phase conductors

(maximum 3), neutral conductor(s) and an insulated full size green grounding conductor and separate uninsulated bonding wire.

2) Where circuits for power and lighting exceed 60'-0" for 120 volt circuits or 120'-0" for 277 volt circuits to the center of the load, #10 AWG wire or larger, as required, shall be used to ensure a maximum voltage drop not greater than 3% at full circuit capacity.

3) Multi-conductor cables shall **not** have shared neutrals. Provide cable with one neutral per phase conductor when serving multiple branch circuits in a multi-conductor cable.

4) Each conductor, including ground conductor, shall be wrapped with nylon covering.

5) Armored clad cable conductors shall be color coded, continuous on insulation, as called for in the specifications above.

b. Exterior armor

1) The exterior sheath shall be manufactured of galvanized steel armor.

2) When used in damp or wet locations the armor shall be wrapped at the factory with a PVC jacket.

3. Manufacturer

a. AC cable shall be as manufactured by AFC Series HFC-90, or electrical engineer approved equal.

4. Fittings

a. Fittings for AC cable shall be suitable for use with the appropriate cable assembly.

b. Fitting shall be as manufactured by Bridgeport, Electroline, OZ Gedney, Thomas and Betts, Neer, ETP, or Regal.

c. Include manufacturer's literature with shop drawings stating application compatibility with each cable type.

B. Armored Cable (MC)

1. Uses Permitted

a. Shall be used for temporary construction power.

b. MC cable may be utilized in lieu of conduit and cable in dry, hollow partitions and ceiling cavities for general purpose, 20 ampere, single phase, 120 or 277 volt, normal branch circuits for receptacles and lighting fixtures only.

c. For branch circuit homeruns to surface mounted panels, MC cable shall terminate in a junction box 5'-0" (minimum) horizontally away from the panel. If panelboards are located in rooms designated as electric rooms or closets, AC

cable shall terminate in a junction box outside of the electric room and conduit shall be run to the panel. MC cable shall not be allowed in electric rooms or closets.

d. MC cable shall not be used in mechanical or plumbing rooms, closets or shafts, including mechanical penthouse.

2. Construction

a. Conductors

1) Conductors shall be minimum #10 AWG, soft drawn 98% conductive copper with 90°C (Dry Location), 75°C (Wet Location), THHN, 600 volt rated insulation. Included with each length of MC cable shall be the required number of phase conductors (maximum 3), neutral conductor(s) and an insulated full size green grounding conductor.

2) Each conductor, including ground conductor, shall be wrapped with nylon covering.

3) Multi-conductor cables shall not have shared neutrals. Provide cable with one neutral per phase conductor when serving multiple branch circuits in a multi-conductor cable.

4) Armored clad cable conductors shall be color coded, continuous on insulation, as called for in the specifications above.

b. Exterior armor

1) The exterior sheath shall be manufactured of galvanized steel armor.

2) When used in damp or wet locations the armor shall be wrapped at the factory with a PVC jacket.

3. Manufacturer

a. MC cable shall be as manufactured by AFC, or electrical engineer approved equal.

4. Fittings

a. Fittings for MC cable shall be suitable for use with the appropriate cable assembly.

b. Fitting shall be as manufactured by Bridgeport, Electroline, OZ Gedney, Thomas and Betts, Emerson, ETP, or Regal.

c. Include manufacturer's literature with shop drawings stating application compatibility with each cable type.

C. Tray Cable (TC) – Power Wiring

1. Uses Permitted

a. Power tray cable shall be used to serve electrical loads located in areas with insulated metal panel ceilings and where indicated on the design documents.

b. Single phase and three phase branch circuits served via #12 AWG – 3/0 AWG shall be multi-conductor, Type TC-ER rated power cable with integral ground.

c. Feeders served by individual single conductors cables used in cable tray shall be CT rated.

2. Construction

a. Multi-Conductor Type TC-ER – **single phase and three phase branch circuits** served via #12 AWG – 3/0 AWG Power Tray Cable with integral ground:

1) Conductors shall be minimum #12 AWG, soft drawn 98% conductive copper with 90°C dry/wet , XHHW-2, 600 volt rated insulation.

2) Tray Cable (TC-ER) shall have an integral insulated green copper ground conductor sized per the NEC.

3) Cables shall meet the following test / listing requirements:

a) UL 1277
b) UL44
c) ICEA S-95-658
d) NEMA publication No. WC-70
e) UL1685 & IEE 383 – Vertical tray riser test at 70,000 BTU/hr
f) IEEE 1202 and FT4 70,000 BYU/hr flame test

4) Where circuits for power and lighting exceed 60'-0" for 120 volt circuits or 120'-0" for 277 volt circuits to the center of the load, #10 AWG shall be used to ensure a maximum voltage drop not greater than 3% at full circuit capacity.

5) Each conductor, including ground conductor, shall be wrapped with nylon armor covering. The conductors shall have a tape binder and the complete assembly shall have an overall jacket. The jacket shall be gas/vapor-tight Polyvinyl Chloride (black) UL-1277.

6) Each conductor in the assembly shall be identified via a factory applied surface print identification or pigment (color) identification.

7) Tray cable conductors shall be field color coded to match the colors indicated in 2.01-J.

8) The cable shall have ink printed on one side the following: “(size) AWG (number of conductors) W/GND TYPE TC XHHW-2 CDRS PVC JKT SUNLIGHT RESISTANT 600V (UL) (manufacturer's name) DIRECT BURIAL”.

9) Shall be UL listed and labeled UL Type TC-ER.

3. Single Conductor XHHW-2 Tray Cable – **FEEDER CABLES IN TRAY**

    1) All locations the conductors shall be minimum 250 MCM, annealed soft drawn, 98% conductive copper with 90°C, XHHW-2 600 volt rated insulation.

    2) Cables shall meet the following test / listing requirements:

        a) UL 44 – Thermoset-Insulated Wires and Cables
        b) UL 1685 – UL Flame Exposure Test
        c) UL 1581 – UL Flame Exposure Test (VW-1)
        d) IEEE 1202 – Flame Test (70,000 BTU/hr Vertical Tray Test)
        e) ICEA S-95-658 (NEMA WC70)

    3) Insulation shall be an abrasion, moisture and heat resistant, flame retardant cross-linked polyethylene with an overall jacket consistent of a flame retardant, moisture and sunlight resistant PVC.

    4) Each conductor in the assembly shall be identified via a factory applied surface print identification or pigment (color) identification. Factory color coded to match the colors indicated in 2.01-J.

    5) The cable shall have ink printed on one side the following: “(size) AWG TYPE TC XHHW-2 CDRS PVC JKT SUNLIGHT RESISTANT 600V (UL) (manufacturer's name) DIRECT BURIAL”.

4. Manufacturer

    a. Tray Cable (TC) cable shall be as manufactured by General Cable or equivalent product as manufactured by Nexans, Omni Cable, Southwire, or American Insulated Wire Corp.

5. Fittings

    a. Fittings for TC cable shall be suitable for use with the appropriate cable assembly.

    b. Fitting shall be as manufactured by Bridgeport, Electroline, OZ Gedney, Thomas and Betts, Neer, ETP, or Regal.

    c. Include manufacturer's literature with shop drawings stating application compatibility with each cable type.

D. Tray Cable (TC) – Control Wiring

1. Uses Permitted

    a. Tray cable control wiring shall be used to serve control points located in areas with insulated metal panel ceilings and where indicated on the design documents.

2. Construction

   a. Conductors shall be of the quantity and size as indicated on the contact drawings. If quantity and size are not indicated on the contract drawings provide 25#14 AWG cable. Conductors shall be bare soft annealed copper per ASTM B-3 and B-189.

   b. Conductors sizes #18 AWG thru #16 AWG (TFFN) shall be bunch-stranded, size #18 (16/0.010") and size #16 (19/0.0117") UL-62 paragraph 10.2.

   c. Conductors sizes #14 AWG thru #10 AWG (THN/THWN) shall be concentric, compressed, stranded Class B (7 strands) ASTM B-8 and UL-83 table 13.1.

   d. Insulation shall be high dielectric polyvinyl chloride.

      1) UL-1581 Table 50.145 (THWN 75°C)
      2) UL-1581 Table 50.155 (THHN 90°C)
      3) UL-1581 Table 50.155 Class 12B (TFFN 90°C)

   e. Insulation shall be covered by nylon armor.

   f. The conductors shall be assembled round with fillers as needed. A tape binder shall be applied over the complete assembly. The complete assembly shall have an overall jacket and the jacket shall be gas/vapor-tight polyvinyl chloride (black). UL-1277 table-10.1. A nylon rip cord shall be inserted under the jacket for ease of stripping.

   g. Factory color coding shall be ICEA Method 3 Table K-2.

   h. #18 AWG and #16 AWG cable shall have ink printed on one side the following: “(size) AWG TYPE TC 90°C DRY 75°C WET SUNLIGHT RESISTANT 600V (UL) (manufacturer's name) DIRECT BURIAL”. Imprinted on the other side of the jacket: “(number of conductors)”.

   i. #14 AWG thru #10 AWG cable shall have ink printed on one side the following: “(size) AWG TYPE TC THHN or THWN CDRS SUNLIGHT RESISTANT 600V (UL) (manufacturer's name) DIRECT BURIAL”. Imprinted on the other side of the jacket: “(number of conductors)”.

   j. Shall be UL listed and labeled UL Type TC and comply with UL 1277 requirements for TC power and control tray cable and IEEE 383 requirements for 70,000-210,000 BTU flame test requirements.

3. Manufacturer

   a. Tray Cable (TC) cable shall be as manufactured by American Insulated Wire Corp, or equivalent product as manufactured by Omni Cable, Southwire, or General Cable.

4. Fittings

   a. Fittings for TC cable shall be suitable for use with the appropriate cable assembly.

b. Fitting shall be as manufactured by Bridgeport, Electroline, OZ Gedney, Thomas and Betts, Neer, ETP, or Regal.

c. Include manufacturer's literature with shop drawings stating application compatibility with each cable type.

E. 4–20 mA Signal Cable

1. Construction

a. Conductors shall be of the quantity and size as indicated on the contact drawings. If quantity and size are not indicated on the contract drawings provide 2#14 AWG shielded cable. Conductors shall be bare soft annealed copper per ASTM B-3.

b. Conductors sizes #18 AWG thru #16 AWG (TFFN) shall be bunch-stranded, size #18 (16/0.010") and size #16 (19/0.0117") UL-62 paragraph 10.2.

c. Conductors sizes #14 AWG thru #10 AWG (THHN/THWN) shall be concentric, compressed, stranded Class B (7 strands) ASTM B-8 and UL-83 table 13.1.

d. Insulation shall be high dielectric polyvinyl chloride.

1) UL-1581 Table 50.145 (THWN 75°C)
2) UL-1581 Table 50.155 (THHN 90°C)
3) UL-1581 Table 50.155 Class 12B (TFFN 90°C)

e. Insulation shall be covered by nylon armor.

f. Shielding shall be 0.00035 aluminum foil/0.001 polyester tape shield applied helically with a minimum 15% overlap.

g. The conductors shall be assembled round with fillers as needed. A tape binder shall be applied over the complete assembly. The complete assembly shall have an overall jacket and the jacket shall be gas/vapor-tight polyvinyl chloride (black). UL-1277 table-10.1. A nylon rip cord shall be inserted under the jacket for ease of stripping.

h. Factory color coding shall be ICEA Method 3 Table K-2.

i. #18 AWG and #16 AWG cable shall have ink printed on one side the following: “(size) AWG TYPE TC 90°C DRY 75°C WET SUNLIGHT RESISTANT 600V (UL) (manufacturer's name) DIRECT BURIAL”. Imprinted on the other side of the jacket: “(number of conductors)”.

j. #14 AWG thru #10 AWG cable shall have ink printed on one side the following: “(size) AWG TYPE TC THHN or THWN CDRS SUNLIGHT RESISTANT 600V (UL) (manufacturer's name) DIRECT BURIAL”. Imprinted on the other side of the jacket: “(number of conductors)”.

k. Signal Cable shall be TC rated.

2. Manufacturer

a. Signal cable shall be as manufactured by Southwire, or equivalent product as manufactured by Cooper/Belden, or General Cable.

3. Fittings

a. Fittings for signal cable shall be suitable for use with the appropriate cable assembly.

b. Fitting shall be as manufactured by Bridgeport, Electroline, OZ Gedney, Thomas and Betts, Neer, ETP, or Regal.

c. Include manufacturer's literature with shop drawings stating application compatibility with each cable type.

F. Cord Drop – Type SOOW Cable

1. Uses Permitted

a. Conductors shall be of the quantity and size as indicated on the contract drawings.

b. Type SOOW shall be used to serve electrical loads, via cord drops, in process areas.

c. Type SOOW cable shall not be used to serve loads located in electrical, mechanical, or plumbing rooms, closets or shafts, including mechanical penthouses, voids and loads exterior to the building.

2. Construction

a. Conductors shall be minimum #12 AWG, bare, annealed copper per ASTM B-3, flexible, bunch-stranded per UL-62, sizes #12 – #8 AWG and rope lay sizes #6 – #2 AWG.

b. A paper tape separator shall be applied between conductors and insulation to facilitate stripping. Cable shall be assembled round with fillers as needed.

c. Insulation shall be rated 600V, 90°C, color coded synthetic rubber (EPDM), oil and water resistant per UL-62.

d. Assembly shall be certified and tested to have passed MSHA flame test P-136-MSHA and shall be CSA FT1.

e. Cable shall have an extra hard usage oil resistant thermoset jacket (CPE) per UL-62.

f. Cable shall remain flexible from 90°C to -40°C.

g. Factory color coding shall be as follows.

1) 2/C: black, white
2) 3/C: black, white, green*

3) 4/C: black, white, red, green*
4) 5/C: black, white, red, green*, orange

* Green conductor shall be used for grounding purposes only.

h. The cable shall have ink printed on one side with the following (listed types): example “P-136-29-MSHA #12 AWG 3/C SOOW 90°C 600V water resistant (UL) – (manufacturer's name) – CSA-FT1”.

3. Manufacturer

a. Type SOOW cable shall be manufactured by Southwire, or equivalent products as manufactured by General Cable.

4. Fittings

a. Fittings for SOOW cable shall be suitable for use with the appropriate cable assembly.

b. See detail “Typical Process Area Cord Drop” on electrical drawings for additional information.

c. Include manufacturer's literature with shop drawings stating application compatibility with each cable type.

PART 3 – EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

A. All work shall conform to the printed specifications and installations of each of the manufacturers, the approved shop drawings, and to the requirements of the Governing Laws and Building Code.

B. Inspect job conditions and related work and report to the Architect, any conditions adversely affecting raceway work.

C. All wire and cable shall be installed in approved raceways (as specified elsewhere in these Specifications), and as approved by Authorities having jurisdiction. Do not use surface mounted raceways on floor.

D. Furnish and install multi-conductor cable assemblies as shown on the drawings and specified herein, including all necessary fittings, hangers, accessories, etc. Multi-conductor cable assemblies shall be prefabricated at the factory and shipped to the site on cable reels.

3.02 INSTALLATION OF FEEDERS AND BRANCH CIRCUITS

A. All branch circuit conductors that are spliced or tapped shall be pre-twisted and trimmed to the correct length as recommended by the manufacturer of the splice kit. This includes but is not limited to pre-insulated spring steel connectors, etc.

B. Conductors greater than #6 AWG shall be installed as a single continuous cable / conductor. The cable / conductor shall not be spliced without the express written consent of the project electrical engineer.

C. All feeder, branch circuit or auxiliary system wiring passing through pull boxes and/or being made up in panelboards shall be properly grouped, bound and tied together in a neat and orderly manner in keeping with the highest standards of the Trade, with plastic cable ties. Loose ends of the cable ties shall be properly trimmed after making up same. Cable ties shall be Ty-Raps, as manufactured by Thomas and Betts, Holub Industries, Inc., Quick-Wrap, Burndy Unirap or equal.

D. For large size conductors available only in black, use colored plastic tape at all ends and in all junction and pull boxes where connections and splices are made for the specified color code identification. Tape shall be wrapped around the conductor (6) complete turns.

E. For 600V feeders and branch circuits conductors #8 AWG and larger joints and splices shall be made in an approved manner and shall be equivalent, electrically and mechanically, to the conductor insulation. Conductors shall be connected by use of solderless pressure connectors; these joints and splices shall have 3M 8420 Series cold shrink connector insulators. Conductors of size #4 AWG or larger shall have (2) coats of insulating varnish applied over the tape for joints in manholes, handholes or exposed-to-weather conditions.

F. Provide nonferrous identifying tags or pressure-sensitive labels for cables, feeders, and power circuits in pull boxes, wireways, manholes, handholes, switchboard rooms, cable terminations, junction boxes, panels, etc.

G. Tags or labels shall be stamped or printed to correspond with markings on the drawings or marked so that feeder or cable may be identified readily. If suspended tags are provided, attach with 1/32" diameter, nylon, 55 lb. test monofilament line or slip-free plastic cable lacing unit.

H. All wiring shall be installed and supported in accordance with the requirements of the NEC.

I. Wire from point of service connection to receptacles, lighting fixtures, devices, equipment, outlets for future extension, and other electrical apparatus as shown on the drawings. Provide slack wire for connections where required. Tape ends of wires and provide blank covers for outlet boxes designed for future use. All branch circuit wiring shall be installed in conduit.

J. All conductors in branch circuit panelboards, signal cabinets, signal control boards, and in switchboards and motor control centers, shall be bundled.

K. Branch circuits wiring shall be peeled out of the wiring gutters at the terminal cabinet and panels at 90° to circuit breakers and terminal lugs for connecting to same.

L. The number and size of conductors in each run of conduit is indicated on the drawings and where there is a conflict between the number of wires indicated and the actual number required, the actual number and size shall be installed.

M. Follow homerun circuit numbers shown on the drawings to connect circuits to panelboards. Where homerun circuit numbers are not shown on the drawings, divide similar types of connected loads among phase busses so that currents in each phase are within 10% of each other during normal usage.

N. Joints and splices shall be made in an approved manner and shall be equivalent, electrically and mechanically, to the conductor insulation. All conductors shall be connected by use of solderless crimp (compression) type connectors. All splices in manholes or handholes shall be made with King Type silicone filled wire connectors or equivalent for wire sizes #10 AWG and

smaller. Wires #8 AWG through #4 AWG shall be made with compression sleeves and covered with 3M 8420 Series cold shrink connector insulators.

O. All branch circuits shall have individual neutrals. Derating of conductor shall be limited to 80% and not more than six current carrying conductors, (3) phase conductors and (3) neutrals, shall be installed in each conduit.

P. All branch circuits shall be connected to breakers at Contractor's discretion. The balancing of all loads shall be the Contractor's responsibility.

Q. Splices, taps and lugs shall be electrically and mechanically secure. Solderless lugs and crimp connectors shall be used for conductor sizes #8 AWG and larger. All lugs shall be of the proper size, and in no case shall strands be cut from a conductor in order to fit the conductor into a lug. Provide lug/cable adaptors for breakers where oversized cables are indicated. All lug connections to buses in switchboards, unit substations, motor control centers, etc., shall be 2-bolt/nut connections.

R. Provide cable supports for vertical feeders as required by NEC. Vertical feeders shall be supported at every other floor level as a minimum.

S. Provide split wedge cable supports with clamps for cable without metallic sheath in pull boxes. Supports shall be as manufactured by O.Z. Gedney or approved equal.

T. All emergency feeders and branch circuits shall be installed in a separate conduit system as required per NEC Article 700. The use of flexible cable shall be prohibited.

U. Multi-conductor cable assemblies (AC and MC) shall be installed concealed only in areas as permitted in these specifications.

1. Multi-conductor cable assemblies shall be run through openings in metal studs. The cable assembly shall be attached with approved clips to metal studs as follows:

   a. 4'-0" on center for vertical runs.
   b. Within 12" of each outlet box.
   c. 6'-0" on center for horizontal run.

2. Where multiple runs of multi-conductor cable assemblies are run together, all cables shall be bundled and secured together in a neat and workmanlike manner utilizing tie wraps, etc.

3.03 CONTROL WIRING

A. 4–20 mA control signals shall be installed in cable tray and conduit.

B. The drain wire shall be terminated at one end only to avoid the possible “Loop” conditions. Terminate drain wire to control panel chassis ground point.

C. Provide nonferrous identifying tags or pressure-sensitive labels for cables in pull boxes, wireways, manholes, handholes, control rooms, cable terminations, junction boxes, control panels, etc.

D. Tags or labels shall be stamped or printed to correspond with markings on the drawings or marked so that feeder or cable may be identified readily. If suspended tags are provided,

attach with 1/32" diameter, nylon, 55 lb. test monofilament line or slip-free plastic cable lacing unit.

E. All wiring shall be installed and supported in accordance with the requirements of the NEC.

F. All wiring in signal cabinets, control panels, etc., shall be bundled.

3.04 TRAY CABLE

A. All feeder, branch circuit or auxiliary system wiring installed in cable tray, through pull boxes and/or being made up in panelboards shall be properly grouped, bound and tied together (vertical runs) in a neat and orderly manner in keeping with the highest standards of the Trade, with plastic cable ties. Loose ends of the cable ties shall be properly trimmed after making up same. Cable ties shall be Ty-Raps, as manufactured by Thomas and Betts, Holub Industries, Inc., Quick-Wrap, Burndy Unirap or equal.

B. For tray cable conductors available only in black, use colored plastic tape at all ends and in all junction and pull boxes where connections and splices are made for the specified color code identification. Tape shall be wrapped around the conductor and shall cover all the exposed black insulation, minimum six (6) complete turns.

C. Tray cable shall be installed as single, continuous assemblies and without the uses of splices.

D. Provide nonferrous identifying tags or pressure-sensitive labels for cables, feeders, and power circuits in boxes, wireways, manholes, handholes, switchboard rooms, cable terminations, panels, etc.

E. Tags or labels shall be stamped or printed to correspond with markings on the drawings or marked so that feeder or cable may be identified readily. If suspended tags are provided, attach with 1/32" diameter, nylon, 55 lb. test monofilament line or slip-free plastic cable lacing unit.

F. All wiring shall be installed and supported in accordance with the requirements of the NEC.

G. Wire from point of service connection to receptacles, lighting fixtures, devices, equipment, outlets for future extension, and other electrical apparatus as shown on the drawings. Provide slack wire for connections where required. Tape ends of wires and provide blank covers for outlet boxes designed for future use. All branch circuit wiring shall be installed in conduit.

H. All conductors in branch circuit panelboards, signal cabinets, signal control boards in switchboards and motor control centers shall be bundled.

I. All tray cable, single phase branch circuits shall be installed with individual neutrals.

J. All tray cable branch circuits, feeders, etc., shall have individual grounds.

K. Branch circuits wiring shall be peeled out of the wiring gutters at the terminal cabinet and panels at 90° to circuit breakers and terminal lugs for connecting to same.

L. The number and size of conductors in each run of conduit is indicated on the drawings. Where there is a conflict between the number/size of wires indicated and the actual number/size required, the actual number/size shall be installed.

M. Follow homerun circuit numbers shown on the drawings to connect circuits to panelboards. Where homerun circuit numbers are not shown on the drawings, divide similar types of connected loads among phase busses so that currents in each phase are within 10% of each other during normal usage.

N. All branch circuits shall be connected to breakers at Contractor's discretion. The balancing of all loads shall be the Contractor's responsibility.

O. Provide cable supports for vertical feeders as required by NEC.

P. Panelboard feeders, MCC feeders and any branch circuit that requires cable equal to or greater than 4/0 shall not be installed in cable tray and shall be installed in a traditional conduits and wire system.

Q. Lighting branch circuits shall not be installed in cable tray; lighting branch circuits shall be installed in a traditional conduit and wire system.

R. The cable tray sizes shown on the drawings are the minimum recommended size for bidding purposes. The contractor shall be responsible to count cable tray conductors quantities and size cable trays such that the installed cables plus 25% spare capacity does not exceed the maximum cable fill area in Column 1 of Table 392.9 for the appropriate cable tray width.

S. Refer to NEC Article 392 for addition cable fill restriction and multicable conductors derating requirements.

3.05 GENERAL

A. Where conductors are adjusted in size to compensate for voltage drop, equipment grounding conductors and conduits shall be adjusted proportionately.

B. Splice only in accessible junction or outlet boxes.

C. Neatly train and lace wiring inside boxes, equipment and panelboards.

D. Make conductor lengths for parallel circuits equal.

E. Maintain color coding of conductors for all systems.

3.06 CONNECTIONS AND TERMINATIONS

A. Identify each conductor in panelboards, junction or pull boxes, or troughs with a permanent pressure sensitive label with suitable numbers or letters for easy recognition. Identify control wiring at each end and in junction boxes with numeric wire number corresponding to control wiring diagram.

B. Thoroughly clean wire before installing lugs and connectors.

C. Make splices, taps and terminations to carry full ampacity of conductors without perceptible temperature rise.

D. Terminate spare conductors with electrical tape and roll up in box.

3.07 FIELD QUALITY CONTROL

A. Inspect wiring for physical damage and proper connection.

B. Torque conductor terminations to manufacturer's recommended values.

C. Perform continuity tests on all power and branch circuit conductors. Verify proper phasing. Refer to Section 16198 for specific testing requirements.

****

END OF SECTION

THE LIVESTOCK INSTITUTE

WESTPOST, MA

PROJECT NO. 4730

Specification for

BOXES

Section 16130

THE DENNIS GROUP, LLC

PLANNING ▲ ENGINEERING ▲ CONSTRUCTION MANAGEMENT

1537 MAIN STREET
SPRINGFIELD, MASSACHUSETTS 01103
413.787.1785 ▲ FAX 413.787.1786

26 WEST MARKET STREET
SALT LAKE CITY, UTAH 84101
801.531.8585 ▲ FAX 810.531.8586

A	**09.20.2016**	**Review**	**MJJ**		
Issue	**Date**	**Description**	**By**	**Approved**	**Section 16130**

Unless notification and/or comments are received from client within two weeks after issue date, all documentation including drawings, specifications, and studies submitted to client shall be considered approved as released.

PART 1 – GENERAL

1.01 REFERENCES

A. The General Documents, as listed on the Table of Contents and applicable parts of Division 1, General Requirements, and applicable requirements of Section 16010, shall be included in and made part of this Section.

B. Examine all drawings and criteria sheets and all other Sections of the specifications for requirements which affect work under this Section whether or not such work is specifically mentioned in this Section.

C. Coordinate work with that of all other Trades affecting or affected by work of this Section. Cooperate with such Trades to assure the steady progress of all work under the Contract.

D. Provide all material, labor and equipment, to complete the work of this Section in strict accordance with the design Architect's and Engineer's plans and specifications, and with all applicable codes, rules, and standards.

1.02 SCOPE OF WORK

A. The work of this Section covers the furnishing and installation of electrical boxes as specified herein and as indicated on the drawings, except for process and production spaces. Refer to Specification Section 16050 for box requirements in those areas.

B. Boxes shall be furnished in quantities sufficient for a complete installation as indicated on the drawings and in these specifications. Boxes are defined to include all outlet, junction, and pull boxes and all materials and devices to install support, secure, and provide a complete installation.

C. The work under this Contract shall also include all labor, materials, tools, equipment, transportation, insurance, temporary protection, supervision and incidental items essential for proper installation and operation, even though not specifically mentioned or indicated on the drawings but which are usually provided or are essential for proper installation and operation of all systems as indicated on the drawings and specified herein.

D. The specifications and drawings describe the minimum requirements that must be met by Contractor for the installation of all work as shown on the drawings and as specified herein.

E. For purposes of bidding, the below listed shall be followed; however, the Contractor shall provide all boxes required for all systems to be complete and in working condition.

1. Electrical Contractor provide:

    a. Outlet boxes, pull and junction boxes, etc., covers and fittings, as specified below to complete the raceway system for all systems except temperature control.

2. Temperature Control Contractor provide:

    a. All boxes required for Temperature Control wiring.

1.03 RELATED WORK SPECIFIED ELSEWHERE

A. The following referenced sections are listed as a minimum of additional requirements and/or work not included in this Section which may be required to be performed under other designated Sections:

1. Section 16110: Raceways (Non-Process)
2. Section 16120: Conductors (600 Volt)
3. Section 16140: Wiring Devices and Device Plates
4. Section 16190: Hangers and Supports
5. Section 16195: Electrical Identification

1.04 SUBMITTALS

A. Prepare and submit complete shop drawings of all types of boxes provided on this project to the Engineer for approval.

B. Submit samples of each material under this Section requested by the Engineer, for approval. Samples shall be in size and form requested by the Engineer, and reasonable to show characteristics, color and finishes of the materials.

C. Submit complete manufacturer's product data of all materials and systems to the Engineer for approval, consisting of complete product description and specifications, complete performance test data, complete preparation and installation instructions, and all other pertinent technical data required for complete product and product use information.

D. All shop drawings shall have clearly marked the appropriate specification number of drawing designation, for identification of the submittal.

E. Disposition of shop drawings shall not relieve the Contractor from the responsibility for deviations from drawings or specifications, unless he has submitted in writing a letter itemizing or calling attention to such deviations at time of submission and secured written approval from the Engineer, nor shall such disposition of shop drawings relieve the Contractor from responsibility for errors in shop drawings or schedules.

F. Do not order materials or begin installation until the Architect's and Engineer's approval of submittals has been obtained.

1.05 COORDINATION

A. The work of this Section shall be coordinated with other work of the Contractor. The placement of all boxes shall not interfere with HVAC, Plumbing or Process Piping work. All boxes in clean room wall systems shall be provided as a part of the wall system. Coordinate the requirements of these boxes with the successful clean room wall system manufacturer.

1.06 REFERENCE STANDARDS

A. Applicable provisions of the following Codes and Trade Standard Publications shall apply to the work of this Section, and are hereby incorporated into, and made a part of, the Contract Documents:

1. ANSI/NEMA OS 1: Sheet-Steel Outlet Boxes, Device Boxes, Covers and Box Supports

2.	NEMA 250:	Enclosures for Electrical Equipment (1000 Volts Maximum)
3.	NFPA 70:	National Electrical Code
4.	UL 50:	Cabinets and Boxes
5.	UL 514:	Electrical Outlet Boxes and Fittings

1.07 REGULATORY REQUIREMENTS

A. Conform to all applicable Codes of the installation and size of all pull, junction and outlet boxes.

1.08 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery of materials shall be made to the project by the materials supplier in accordance with the instructions of the Contractor.

B. The Contractor shall provide adequate locked storage space with shelving for the materials, shall be responsible for all items of materials after receipt from the supplier, and shall replace all materials lost or damaged after delivery and receipt.

C. The Contractor shall furnish the materials supplier with receipts for all materials and accessory items received, and shall send copies of these receipts to the Architect.

1.09 GUARANTEE

A. In addition to the specific guarantee requirements of the General Conditions, the Contractor shall obtain in the Owner's name the standard written manufacturer's guarantee of all materials furnished under this Section where such guarantees are offered in the manufacturer's published product data. All these guarantees shall be in addition to, and not in lieu of, other liabilities which the Contractor may have by law or other provisions of the Contract Documents.

PART 2 – MATERIALS

2.01 MANUFACTURERS

A. Materials used for pull, junction, outlet boxes, etc., shall be manufactured by one of the following:

1. Appleton
2. Crouse Hinds
3. Killark
4. Raco
5. Steel City
6. Lee Products
7. Hoffman Engineering
8. McKinstry, Inc.

2.02 JUNCTION BOXES

A. Pull boxes shall be constructed of code gauge galvanized steel and shall be installed at points required, whether indicated on the drawings or not. Minimum dimensions shall not be less than NEC Article 314 requirements.

B. Provide flat plain covers with suitable flat head machine screws or slotted truss head bolts. Covers shall be of same gauge as associated box.

C. Pull or junction boxes with maximum side of 4'-0" shall be made of 1 1/2" by 1 1/2" by 1/4" galvanized angle frame covered with 10-gauge galvanized sheet steel riveted or welded to frame. Cover plate shall be 10-gauge galvanized steel secured with round head silicon bronze machine screws spaced at 12" centers maximum.

D. Boxes mounted flush in walls shall have cover oversized 2" on all sides and shall be minimum 14-gauge steel.

2.03 OUTLET BOXES

A. Outlet boxes shall be 1-piece galvanized steel construction conforming to UL 514, shall meet NEC requirements for size and material, and shall be of proper size and suitable for the locations indicated on the drawings.

B. Round boxes and handy boxes shall not be used.

C. Boxes installed in unplastered masonry walls shall have covers of required depth to avoid cutting of masonry.

D. Boxes for exterior work shall be Appleton FD box, ridge top with (2) mounting feet on opposite sides of the box and the cover plate material matching the box material. Non-metallic or steel boxes will not be permitted for this application. The box mounting feet shall be part of the box casting.

E. Outlet boxes on exposed conduit systems shall be Appleton FD box, ridge top with (2) mounting feet on opposite sides of the box and the cover plate material matching the box material. Non-metallic or steel boxes will not be permitted for this application. The box mounting feet shall be part of the box casting.

F. Outlet boxes in exposed surface mount application shall be 2 gang Appleton FD box, ridge top with (2) mounting feet on opposite sides of the box and the cover plate material matching the box material. Non-metallic or steel boxes will not be permitted for this application. The box mounting feet shall be part of the box casting.

G. Outlet boxes above lay-in tile ceilings used as junction boxes shall not be less than 4 11/16" square and 2 1/8" deep.

H. All switch and receptacle boxes shall be minimum 4" square for up to (2) devices, or solid ganged boxes for over (2) devices. Boxes shall be complete with minimum 3/4" deep tile ring for glazed tile, concrete block or concrete walls and minimum 3/4" deep square ring and covers, for plaster, gypsum dry wall or wood paneled finished walls; covered with 1/2" raised galvanized device covers for exposed conduit work.

I. Outlet boxes on exposed conduit systems shall be threaded-hub, cast-metal, conduit type fitting FS or FD suitable for wiring devices installed.

J. Outlet boxes for surface mounted ceiling fixtures shall be minimum 4" square, minimum 1 1/2" deep with lathers channel attached to building construction for suspended ceilings; deep concrete boxes for poured concrete ceiling construction; be installed with 3/4" minimum depth

plaster rings on suspended ceilings; 4" octagonal of square with fixture extension pan or deep fixture canopy to enclose the box for exposed conduit work.

K. All outlet boxes for recessed fixtures in accessible ceilings shall be minimum 4" square or octagonal, minimum 1 1/2" deep installed above fixture opening with flexible conduit connection to fixture.

PART 3 – EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

A. All work shall conform to the printed specifications and installations of each of the manufacturers, the approved shop drawings, and to the requirements of the Governing Laws and Building Code. Refer to the drawings to determine locations of fire-resistive and fire-protective work, and construct this work to conform to the specifications and installation instructions of UL or other testing agencies.

B. Inspect job conditions and related work and report to the Engineer of any conditions adversely affecting raceway work.

C. Make all changes and adjustments in this work and other work under this Section as needed to accommodate the work of other Trades.

D. All boxes shall be erected, rigidly supported, and securely fastened in place, in such a manner that plumb, level, and true finished lines and surfaces will result in the finished work.

E. Locate all ceiling outlets with due consideration to clearance from ventilating ducts and piping.

F. The location of outlets shown on the drawings is diagrammatic only. Coordinate the exact location of outlets with architectural details, equipment connection requirements and work of other contractors. The Owner's representative may alter the locating of outlets shown within a 10'-0" radius prior to installation.

G. Protect all boxes from entry of foreign materials.

H. Independently support all boxes. No parts of the weight or stress thereof shall be borne by conduits terminating therein.

I. All boxes shall be rigidly mounted to the building structure and shall be equipped with suitable screw fastened covers. Unused open knockouts in all boxes shall be plugged with suitable blanking devices. All boxes installed that do not have equipment mounted in them shall be provided with blank covers.

3.02 INSTALLATION OF PULL AND JUNCTION BOXES

A. The Contractor shall furnish and install pull boxes for all feeders as required by NEC. Pull boxes shall be code gauge steel plates fastened to angle iron frames with removable covers. Covers shall be secured with brass machine screws.

B. The Contractor shall furnish and install junction boxes for feeders and branch circuits as required. Boxes shall be sized in accordance with NEC. Junction boxes shall be code gauge steel with removable covers. Covers shall be secured with brass machine screws.

C. Suitable pull boxes shall be installed in convenient intermediate locations in all conduit runs in excess of 150 linear feet and runs requiring more than (3) 90° bends.

3.03 INSTALLATION OF JUNCTION BOXES ON CABLE TRAY

A. The Contractor shall be allowed to install junction boxes in the exterior side wall of the cable tray. The box shall be attached to the tray using two nuts, two bolts and 4 fender washers. The head side of the nut shall be on the inside of the tray.

B. The junction boxes shall a minimum 24" clear space from any other junction box. No conduits shall travel over the top of the box except for the conduit associated with the box.

3.04 INSTALLATION OF OUTLET BOXES

A. Locations of all wall outlets, switches, etc., shall be verified with the Architect prior to roughing in. Refer to details and wall elevations on Architectural drawings. Mounting heights and locations indicated in these drawings and/or specified dimensional information given to the Contractor by the Architect shall take precedence over such information indicated on the Electrical drawings.

B. The Contractor shall furnish and install outlet boxes for all wiring devices as shown on the drawings. Bar hanger type outlet boxes shall be used in hollow frame partitions, other than masonry or construction block partitions, with bar hanger supported from (2) partition studs for wood stud partitions. For metal stud partitions, bar hanger shall be secured with self-threading metal screws or drill through hangers with caddy clips.

C. Through-the-wall outlet boxes shall not be permitted. Outlet boxes shall not be installed back-to-back but shall be staggered on opposite sides of partitions a minimum of 12" on center.

D. If any discrepancies regarding the locations of outlet boxes are found to exist between the Electrical drawings and any other drawings associated with the project, notify the Architect at once and have location verified before outlets are installed. Any reasonable change in location of outlets prior to roughing shall not involve additional expense to the Owner. The term “reasonable” shall be interpreted as moving outlet locations a maximum of 10'-0" in any direction from the location indicated on the drawings.

E. Whenever outlet boxes of any system are installed in brick, masonry or concrete construction, furnish and install the necessary boxes and conduit in connection therewith so that the Masonry Contractor may build them in as the work progresses. Box offsets shall be made at all outlets to provide for proper adjustment to finished surfaces.

F. The Contractor is responsible for cutting openings in brick, tile and all types of construction blocks at outlets. Exposed mortar shall not be permitted around device plates.

G. All boxes shall be rigidly mounted to construction and shall be equipped with suitable screw fastened covers. Unused open knockouts in all boxes shall be plugged with suitable blanking devices. All boxes installed that do not have equipment mounted on them shall be provided with blank covers.

H. Provide permanent barriers in common boxes to limit voltage between adjacent switches to 300 volts or less.

I. Outlet boxes serving pendant mounted fixtures installed in structural slabs shall be installed in bottom of rib section of structural assembly unless otherwise indicated.

J. The height of outlets and devices will be indicated on the drawings or obtainable from the Architect/Engineer. Use the following as a guide for mounting of outlet boxes, unless otherwise indicated on drawings.

Device	Height Above Finished Floor to Center – Line of Box
Receptacles	
Offices and Corridors	18"
Counters	8" Above Counter
Unfinished Areas	48"
Exterior at Grade	24" Above Finished Grade
Switches	48"
Telephone and Data Outlets	
Wall	54"
Desk (Wall)	18"
Counters	8" above counter
Public	See Arch. Elevations
Fire Alarm Break Glass Stations	48"
Fire Alarm Horns/Lights	80"
Clock Outlets	86"

K. Coordinate mounting height of outlets with Drawings and equipment installations drawings and properly locate height of all outlets.

L. Plug all unused openings. Use threaded plugs for cast boxes and snap in metal plugs for sheet metal boxes.

M. Common boxes used for gang installation with switches, receptacles, and low voltage devices, shall include barriers between the devices and the switches or receptacles.

3.05 CLEANING

A. All pull, junction, and outlet boxes shall be thoroughly cleaned prior to installation of conductors and/or wiring devices.

3.06 IDENTIFICATION

A. All boxes shall be provided with nameplates to indicate the panelboard and circuit numbers powering the equipment. Nameplates shall be permanently attached.

B. All boxes shall be identified as indicated in Section 16195.

****

END OF SECTION

THE LIVESTOCK INSTITUTE

WESTPORT, MA

PROJECT NO. 4730

Specification for

WIRING DEVICES AND DEVICE PLATES

Section 16140

THE DENNIS GROUP, LLC

PLANNING ▲ ENGINEERING ▲ CONSTRUCTION MANAGEMENT

1537 MAIN STREET
SPRINGFIELD, MASSACHUSETTS 01103
413.787.1785 ▲ FAX 413.787.1786

26 WEST MARKET STREET
SALT LAKE CITY, UTAH 84101
801.531.8585 ▲ FAX 810.531.8586

Issue	Date	Description	By	Approved	Section 16140
A	09.20.2016	Review	MJJ		

Unless notification and/or comments are received from client within two weeks after issue date, all documentation including drawings, specifications, and studies submitted to client shall be considered approved as released.

PART 1 – GENERAL

1.01 REFERENCES

A. The General Documents, as listed on the Table of Contents and applicable parts of Division 1, General Requirements, and applicable requirements of Section 16010, shall be included in and made part of this Section.

B. Examine all drawings and criteria sheets and all other Sections of the specifications for requirements which affect work under this Section whether or not such work is specifically mentioned in this Section.

C. Coordinate work with that of all other Trades affecting or affected by work of this Section. Cooperate with such Trades to assure the steady progress of all work under the Contract.

D. Provide all material, labor and equipment, to complete the work of this Section in strict accordance with the design Architect's and Engineer's plans and specifications, and with all applicable codes, rules, and standards.

1.02 SCOPE OF WORK

A. The work of this Section covers the furnishing and installation of wiring devices as specified herein and as indicated on the drawings. Wiring devices of each type shall be furnished in quantities sufficient for a complete installation as indicated on the drawings and in these specifications. Wiring devices are defined to include the following:

1. Duplex receptacles
2. Toggle switches/Motion switches
3. Special purpose receptacles
4. Device plates
5. Multi-outlet devices
6. Clock hanger outlets
7. Dimmer switches

B. The work under this Contract shall include all labor, materials, tools, equipment, transportation, insurance, temporary protection, supervision and incidental items essential for proper installation and operation, even though not specifically mentioned or indicated on the drawings, but which are usually provided or are essential for proper installation and operation of all systems as indicated on the drawings and specified herein.

C. The specifications and drawings describe the minimum requirements that must be met by Contractor for the installation of all work as shown on the drawings and as specified hereinunder.

1.03 RELATED WORK SPECIFIED ELSEWHERE

A. The following referenced sections are listed as a minimum of additional requirements and/or work not included in this Section which may be required to be performed under other designated Sections:

1. Section 16120: Conductors
2. Section 16130: Boxes
3. Section 16195: Electrical Identification
4. Section 16500: Lighting Fixtures

1.04 SUBMITTALS

A. Prepare and submit complete shop drawings of all types of wiring devices provided on this project to the Engineer for approval.

B. Submit samples of each material under this Section requested by the Architect, for approval. Samples shall be in size and form requested by the Architect, and reasonable to show characteristics, color and finishes of the materials.

C. Submit complete manufacturer's product data of all materials and systems to the Architect for approval, consisting of complete product description and specifications, complete performance test data, complete preparation and installation instructions, and all other pertinent technical data required for complete product and product use information.

D. All shop drawings shall have clearly marked the appropriate specification number of drawing designation, for identification of the submittal.

E. Disposition of shop drawings shall not relieve the Contractor from the responsibility for deviations from drawing or specifications, unless he has submitted in writing a letter itemizing or calling attention to such deviations at time of submission and secured written approval from the Engineer, nor shall such disposition of shop drawings relieve the Contractor from responsibility for errors in shop drawings or schedules.

F. Do not order materials or begin installation until the Architect's and Engineer's approval of submittals has been obtained.

G. Multi-Outlet raceway systems shall be provided with detailed shop drawings as per the following criteria:

1. Every individual length of each section including devices, circuit numbers, etc. shall be provided with field measured coordinated layout.

2. Complete bill of materials of all components.

3. Illustrated field installation drawings.

1.05 REFERENCE STANDARDS

A. Applicable provisions of the following Code and Trade Standard publications shall apply to the work of this Section and are hereby incorporated into and made a part of the Contract Documents:

1.	ANSI C73:	Plugs and Receptacles
2.	NEMA WD1:	General Purpose Wiring Devices
3.	NEMA WD6:	Wiring Device Configurations
4.	UL 20-79:	General Use Snap Switches
5.	UL 231-77:	Electrical Power Outlets
6.	NFPA 70:	National Electrical Code

1.06 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery of materials shall be made to the project by the materials supplier in accordance with the instructions of the Contractor.

B. The Contractor shall provide adequate locked storage space with shelving for the materials, shall be responsible for all items of materials after receipt from the supplier, and shall replace all materials lost or damaged after delivery and receipt.

C. The Contractor shall furnish the materials supplier with receipts for all materials and accessory items received, and shall send copies of these receipts to the Architect.

1.07 GUARANTEE

A. In addition to the specific guarantee requirements of the General Conditions, the Contractor shall obtain in the Owner's name the standard written manufacturer's guarantee of all materials furnished under this Section where such guarantees are offered in the manufacturer's published product data. All these guarantees shall be in addition to, and not in lieu of, other liabilities which the Contractor may have by law or other provisions of the Contract Documents.

1.08 COORDINATION

A. The work of this Section shall be coordinated with other work of the Contractor. Devices shall match equipment plugs.

B. Coordinate with Owner's representative the type of devices required to support equipment supplied by the Owner prior to installation.

PART 2 – MATERIALS

2.01 GENERAL

A. Furnish and install wiring devices, specification grade, complete with all accessories as indicated on the drawings and as specified hereinunder. All wiring devices shall be the product of a single manufacturer, except where specifically stated otherwise.

B. Surface mounted devices shall be mounted in a finished type (surface box). Boxes shall be primed for painting. Exact color shall be as selected by the Architect.

C. Wiring devices shall be manufactured by one of the following. No other manufacturers will be approved: Hubbell, Bryant Electric Co, Cooper Wiring Devices, or Pass & Seymour.

2.02 DUPLEX RECEPTACLES

A. Furnish and install wiring devices, Industrial specification grade, complete with all accessories as indicated on the drawings and as specified hereunder. All wiring devices shall be the product of a single manufacturer except where specifically stated otherwise.

B. Extra Heavy Duty Industrial specification grade duplex receptacles shall be one-piece back strap, rated for 125 volts, 20 amperes. Receptacles used exterior to the building or in damp / wet locations shall be weather resistant and carry the “WR” designation. Catalog numbers shall be as follows:

1. Hubbell: #HBL5362
2. Bryant: #BRY5362
3. Cooper: #AH5362

4. Pass & Seymour: #5362

C. Duplex receptacles with ground fault interrupter characteristics shall be U-ground, rated for 125 volts, 20 amperes, Industrial specification grade, tamper resistant, feed-through type. All receptacles process, production, warehouse, shipping, receiving, bathrooms/toilets, within 6'-0" of sink locations (except in laboratories), exterior outlets, utility vault, in wet areas, etc. shall be ground fault type whether indicated on the drawings or not. Provide in-use weatherproof covers for exterior outlets. Catalog numbers shall be as follows:

1. Hubbell: #GFR5362TR
2. Bryant: #GFR53FTTR
3. Cooper: #VGF20TR

2.03 SWITCHES

A. Toggle switches shall be full size, heavy duty, AC type, rated for 120/277 volts, 20 amperes. Catalog numbers shall be as follows:

	Manufacturer	Single Pole	3-Way	4-Way	Key Switches
1.	Hubbell:	#1221	#1223	#1224	#1221-L
2.	Bryant:	#4901	#4903	#4904	#4900-L
3.	Cooper:	#AH1221	#AH1223	#AH1224	#AH1221-L
4.	Pass & Seymour:	#20AC1	#20AC3	#20AC4	#20AC1-L

B. Occupancy Sensors

1. Dual Technology Wall Mount Single Switch

a. Occupancy sensors shall be ultrasonic and passive infrared technology rated 1,200 watts at 277 volts or 800 watts at 120 volts, and shall require no minimum load. Sensors shall be compatible with all load types, including electronic and compact fluorescent ballasts. Sensor shall have 180° field of view and shall cover up to 300 ft^2. Sensor shall have an adjustable time delay from automatic (Smartset) to 30 minutes and a manual “off” override switch. The sensor shall have adjustable light level setting of 8–180 fc (86–1,937 lux). The contractor shall set the light level setting to 80 fc and the adjustable time delay shall be set to Smartset. Catalog numbers shall be as follows:

1) Hubbell: #LHMTD0
2) Equal approved by Engineer

2. Dual Technology Wall Mount Dual Switch

a. Occupancy sensors shall be ultrasonic and passive infrared technology rated 1,200 watts at 277 volts or 800 watts at 120 volts, and shall require no minimum load. Sensors shall be compatible with all load types, including electronic and compact fluorescent ballasts. Sensor shall have 180° field of view and shall cover up to 300 ft^2. Sensor shall have an adjustable time delay from automatic (Smartset) to 30 minutes and two (2) manual “off” override switches. The sensor shall have adjustable light level setting of 8–180 fc (86–1,937 lux). The contractor shall set the light level setting to 80 fc and the adjustable time delay shall be set to Smartset. Catalog numbers shall be as follows:

1) Hubbell: #LHMTD2
2) Equal approved by Engineer

3. Dual Technology Ceiling Mount Sensor

a. Ceiling mounted occupancy sensors shall be ultrasonic and passive infrared technology 1,200 watts at 277 volts or 800 watts at 120 volts, and shall require no minimum load. Sensors shall be compatible with all load types, including electronic and compact fluorescent ballasts. Sensor shall have 360° field of view and shall cover up to 1,000 ft^2. Sensor shall have an adjustable time delay from automatic (Smartset) to 30 minutes and two (2) manual "off" override switches. The sensor shall have adjustable light level setting of 8–180 fc (86–1,937 lux). The contractor shall set the light level setting to 80 fc and the adjustable time delay shall be set to Smartset. Catalog numbers shall be as follows:

1) Watt Stopper: #DT-355 Series
2) Equal approved by Engineer

4. Sensors for loads in excess of 1,200 watts at 277 volts or 800 watts at 120 volts shall utilize relay control of the branch circuit.

2.04 SPECIAL PURPOSE RECEPTACLES

A. General Use Areas

1. Special purpose receptacles shall be specification grade, back and side wired, U-ground. Catalog numbers shall be as shown on general use special purpose receptacle schedule on drawings.

2. Provide and install manufacturer's matching plug for each receptacle. Provide all accessories required for a complete installation.

B. Process & Production Area

1. Special purpose receptacles shall be industrial grade, unfused, with safety shroud and Twist-Lock or Pin & Sleeve with mechanical interlock, rated NEMA 4X. Catalog numbers shall be as shown on process and production area special purpose receptacle schedule on drawings.

2. Provide and install manufacturer's matching weather proof NEMA 4X rated plug for each receptacle. Provide all accessories required for a complete installation.

2.05 DIMMERS

A. All devices shall be UL listed specifically for the required loads (i.e. incandescent, fluorescent, low voltage, electronic low voltage). Manufacturer shall provide file card upon request. Universal dimmers shall not be acceptable.

B. Manufacturer shall maintain ISO 9001 certification. Provide a copy of the certificate as part of the submittal.

C. All dimmers and 3-way switches shall incorporate an air gap which shall be accessible without removing the faceplate. The air gap switch shall be capable of meeting all applicable requirements of UL 20 and UL 1472 for air gap switches in incandescent dimmers.

D. All dimmers and 3-way switches shall provide power failure memory. Should power be interrupted and subsequently returned, the lights will come back on to the same levels set prior to the power interruption. Restoration to some other default level is not acceptable.

E. Dimmers and 3-way switches shall meet ANSI/IEEE Std. C62.41-1980, tested to withstand voltage surges of up to 6000 V and current surges of up to 200 A without damage.

F. Dimmers and 3-way switches shall meet the UL 20 and UL 1472 limited short circuit test requirement for snap switches.

G. Dimmer control shall be linear slide. Dimmer shall provide a smooth and continuous Square Law dimming curve.

H. Dimmer shall be voltage regulated so that +10% variation in line voltage shall cause not more than a +5% variation in load voltage when dimmer is operating at 40 V (5% light output).

I. Dimmers shall utilize an LC filtering network to minimize interference with properly installed radio, audio, and video equipment.

J. Dimmer control slider shall be captured.

K. Faceplate shall snap on to device with no visible means of attachment. Heat-fins shall not be visible on front of device. At locations with multiple devices, one seamless, multi-gang faceplate shall be provided. Contractor is responsible for coordination of proper backbox size and faceplate type.

L. Dimmers, 3-way switches, and faceplates shall be Lutron Nova style, Lutron Nova T* style, or Lutron Vareo style, as selected by the Engineer.

M. Wattage rating of light fixtures connected to the dimmer shall not exceed 80% of dimmer rating. Provide additional dimmer as required whether shown on drawings or not.

2.06 COLOR

A. Color of all wiring devices shall be selected by the Architect.

B. Receptacles and light switches fed from the Emergency systems shall be red.

2.07 DEVICE PLATES

A. Switch and receptacle device plates shall be manufactured of nylon or stainless steel and shall be used in the following areas:

1. Stainless device plates shall be utilized in the walk-on ceiling area and shall be used for switch plates in dry process and support areas.

2. Nylon device plates shall be utilized in offices areas. Coordinate color with Architect.

3. Device plate screws shall match plates in material and color.

B. Receptacle covers for exposed, surface mounted boxes in interior wet locations or exterior to the building area shall be NEMA 3R in-use weatherproof covers. Catalog number shall be **Pass & Seymour thermoplastic cover #WIUC10-* (select cover depth per application), Hubbell cast aluminum cover #WP26E, or Calbrite stainless steel s60000VCD**. Mounting screws shall be stainless steel.

C. Receptacle covers for exposed, surface mounted boxes in dry process areas, freezers, equipment rooms, mechanical rooms, boiler rooms, electrical rooms, etc., and shall be weatherproof covers. Hubble No. WP26V. Mounting screws shall be stainless steel.

D. Device plates for GFI protected receptacles shall be red with white engraved letters indicating "Protected by GFI. Test before using."

E. Device plates shall be as follows:

1. Metallic normal power wiring device plates, stainless steel shall be **smooth or brushed** finish, type 316:

a.	Hubbell:	#S Series
b.	Cooper:	#93000 Series
c.	Bryant:	#S6 Series
d.	Pass & Seymour:	#S-N Series

2. Non-metallic normal power wiring device plates, high impact nylon/thermoplastic:

a.	Hubbell:	#P Series
b.	Cooper:	#5100 Series
c.	Bryant:	#N Series
d.	Pass & Seymour:	#SRP Series

3. All metallic emergency receptacle plates shall be stainless steel with a **smooth or brushed** finish, type 316 with red filled "EMERGENCY" engraved in plate:

a.	Hubbell:	#S*ME Series
b.	Cooper:	#EM 93000 Series
c.	Bryant:	#S6* EM Series
d.	Pass & Seymour:	#S-N Series Engraved

—OR—

4. All non-metallic emergency power wiring device plates shall be red high impact nylon/thermoplastic with white filled "EMERGENCY" engraved in the plate:

a.	Hubbell:	#PJ*RME Series
b.	Cooper:	#PJ*MERD Series
c.	Bryant:	#N MEM Series
d.	Pass & Seymour:	#SRP ERED Series

F. All receptacles and switches shall have panel and circuit identification labeled on their faceplates. The method of identification shall be:

1. In process, mechanical, and support (non-office spaces) spaces, the device plate identification shall be **engraving**.

2. In office areas the device plate identification shall be Brady labels, clear background with black letters.

2.08 RECESSED FLOOR BOXES

A. Non-Metallic Floor Box

1. Furnish and install at all locations indicated on drawings, a nonmetallic, multi-compartmented, floor box approved for use in concrete floor construction as manufactured by Wiremold Wire Management Systems, 880MP Series.

2. The box shall be approved for above grade and on grade applications. The floor box shall have been examined and tested by Underwriters Laboratories Inc. to their Standard UL514A and Canadian Standard C22.2. The floor box shall bear the cUL and UL mark. This floor box shall conform to the standards set in the National Electrical Code.

3. Boxes shall be manufactured through use of injection molded PVC material. Box shall be rectangular in shape. Box shall allow for ganging of boxes together through dovetail, interlocking mechanism. Knockouts shall be provided on the sidewalls of each box to provide for pass-through capability between each gang. Box shall also have concrete depth markings on the exterior of the box to indicate box depth at the time of pour. Box shall also provide graduated cubic inch markings on the interior of the box to indicate volume capacity at the appropriate box depth. Box shall accommodate concrete depths from 3-1/2" [89 mm] minimum to 6" [152 mm] maximum. Cubic inch capacity shall be a minimum of 50 cubic inches [819 mL] to a maximum of 100 cubic inches [1639 mL].

4. Box shall include internal spacer to prevent deformation of the box sidewalls when high temperature additives are used in the concrete pour. Box shall also include a high impact mudcap to protect the box from damage when heavy equipment such as scissor lift trucks coming into contact with the box during installation. The box mudcap shall withstand loads up to 700 lbs over a 2" [50.8 mm] diameter.

5. Floor box shall provide two 1-1/4" trade size conduit openings to feed cabling to the box. Each box shall also provide the means to reduce this opening down to fit 1", 3/4", and 1/2" trade size conduit. Box shall also provide a means to plug off unused conduit openings. Box shall be equipped with a nonmetallic, reusable mudcap to prevent concrete entry during the pour and debris entry after the pour. Box shall also provide ratchet teeth along interior box walls to attach cover options.

6. Adjusting ring shall be used to attach flanges and covers to the floor box body. Adjusting ring shall have ratchet teeth to align with teeth on box wall to connect to box body without use of glue or mechanical fasteners. Adjusting ring shall provide for 10° of adjustment after concrete pour to adjust to various concrete conditions and floor finishes. Adjusting ring will provide brass inserts to mount finish flanges to box body. Adjusting ring shall also provide for grounding locations through use of brass inserts.

7. Adjusting ring shall provide the ability to accept an Ortronics modular connectivity system. Modular communication inserts shall snap directly into the adjusting ring opening. Adjusting ring shall also provide a fiber storage loop to maintain proper fiber optic bend radius control and excess fiber optic storage. Each adjusting ring shall accept up to six connectivity activation locations. Adjusting ring shall allow modular connectivity inserts to be mounted recessed and protected when not in use.

8. All compartments shall receive Scrub Water Gaskets.

9. All floor box options shall accept both brass and nonmetallic cover plates and flanges. Flanges for both brass and nonmetallic shall be available for one-, two-, or three-gang applications and install on the previously mentioned boxes. Each flange shall provide 1/2" [12.7 mm] of adjustment to accommodate various floor covering and concrete pour depths.

   a. Non-Metallic Flange and Cover Plates

      1) All nonmetallic flanges shall be approved for use on carpet, tile or wood floor applications. Nonmetallic flanges shall be provided in a black or brown finish. All flanges shall also accommodate Ortronics workstation connectivity outlets and modular inserts. Modular inserts shall snap directly into each flange through use of a mounting bezel.

      2) Nonmetallic cover plate options shall seat inside the nonmetallic flanges and be flush with the finished floor. Nonmetallic cover plate dimensions shall be 3-3/16" [81 mm] wide by 4-1/8" [105 mm] long. Nonmetallic cover plate options shall provide for both power and communication services. Communication covers shall accommodate workstation connectivity outlets and modular inserts.

      3) Cover Plate Dimensions

         a) One-gang: 5-3/4" W x 4-3/4" L
         b) Two-gang: 5-3/4" W x 8-7/8" L
         c) Three-gang: 5-3/4" W x 13" L

   b. Brass Combination Carpet and Tile Flanges and Cover Plates

      1) All brass flanges and cover plates are made from a solid brass forging. Each part shall have a buff appearance and be protected with a lacquer finish. Brass flanges shall be approved for carpet, wood, or tile floor applications. All flanges shall also accommodate Ortronics workstation connectivity outlets and modular inserts. Modular inserts shall snap directly into these flanges through use of a mounting bezel.

      2) Brass cover plate options shall seat inside the brass carpet and combination flanges and be flush with the finished floor. Brass cover plate dimensions are 3-1/8" [79 mm] wide by 4-1/8" [105 mm] long. Brass cover plate options shall provide for power and communication services. Communication covers shall accommodate workstation connectivity outlets and modular inserts.

      3) Cover Plate Dimensions

         a) One-gang: 6-1/16" W x 5-1/16" L
         b) Two-gang: 6-1/16" W x 9-3/16" L
         c) Three-gang: 6-1/16" W x 13-5/16" L

c. Communication Devices and Accessories

1) The floor box manufacturer shall have available a complete line of Ortronics workstation connectivity outlets and modular inserts and modular inserts for UTP, Fiber Optic, Coaxial, and other cabling types with faceplates and bezels to facilitate mounting.

2) For each data compartment provide a communications activation bezel. The communications bezel shall be capable of accepting up to three (3) dual port communications inserts.

3) Provide insert types as indicated in the schedule below: If the room or quantity of devices are not listed provide as a minimum one (1) dual port RJ45 T56A insert, one (1) dual port RJ45 T568B insert and one (1) blank insert.

ROOM	DEVICE QUANTITY	INSERT TYPE	DUAL PORT
		RJ45, T568B, CAT. 5 Jack	
		RJ45, T568A, CAT. 5 Jack	
		RJ45, 8W, USOC Jack	
		Duplex SC Connector	
		ST Multi-Mode Connector	
		RCA Audio Connectors	
		BNC Connectors	
		Video “F” Connectors	
		Combination (1) BNC & (1) Video “F” Connector	
		Keystone/Open System Insert	
		Blank Insert	NA

B. Flush Poke-Thru

1. Furnish and install at all locations indicated on drawings, a flush-quad poke-thru approved for use in concrete floor construction as manufactured by Wiremold Wire Management Systems, RC4 Series.

2. The poke-thru shall have been examined and tested by Underwriters Laboratories Inc. to Standard UL514A and UL514C and tested to Canadian Standard C22.2, No. 18-92 and bear the cUL and UL mark. The poke-thru shall conform to the standards set in the National Electrical Code, Section 300-21. This poke-thru device shall also have been tested by Underwriters Laboratories Inc. as to fire resistance and bear the fire classification mark. This poke-thru device shall also have been evaluated by UL to meet applicable U.S and Canadian safety standards for scrub water exclusion when used for tile, terrazzo, wood, and carpet covered floors. Suitable for use in air handling spaces in accordance with Sec. 300-22 (C) of the National Electrical Code.

3. The poke-thru device shall be compatible to accept a complete line of Ortronics workstation connectivity outlets and modular inserts, or the Pass & Seymour Network Wiring System.

4. This assembly shall be made up of an insert and an activation cover.

5. Insert device shall be for use in 1, 1-1/2, or 2-hour rated, unprotected reinforced concrete floors and 1, 1-1/2, or 2-hour rated floors employing unprotected steel floor units and concrete toppings or concrete floors with suspended ceilings (fire resistive designs with suspended ceilings should have provisions for accessibility in the ceiling area below the poke-thru fittings).

6. The insert body shall have the necessary channels to provide complete separation of power and communication services. There shall be one 3/4" [19.1 mm] conduit channel and two 1/2" [12.7 mm] conduit channels for power and communication cabling.

7. The channels shall be arranged such that communication cables can be conduit protected and connected to the insert body using a die-cast conduit connector with two 1/2" trade size threaded openings to accept both rigid and flexible conduit connections. The insert shall also consist of four 20 amp receptacles. The four receptacles shall be wired with six #12 AWG solid conductors. Each duplex receptacle shall be wired with individual neutral and individual ground wires. Circuit identifiers shall be clearly marked on each duplex receptacle and a wiring diagram shall be stamped inside the junction box.

8. The insert body shall also contain a nonmetallic bracket that will accommodate Ortronics workstation connectivity modular inserts, or the Pass & Seymour Network Wiring Systems. The bracket shall allow the inserts to mount flush and recessed. The nonmetallic bracket shall also provide the necessary separation of power and communication services throughout the poke-thru body. The nonmetallic bracket shall also have an integral grommet at the communication compartment opening to protect communication cables as they pass through the poke-thru body.

9. The body will consist of an encapsulated intumescent fire stop material to maintain the fire rating of the floor slab. The intumescent material will be held securely in place in the insert body and shall not have to be adjusted to maintain the fire rating of the unit and the floor slab. Insert shall have a spring steel-retaining ring that will hold the poke-thru device in the floor slab without additional fasteners. The poke-thru insert shall also consist of a 3/4" trade size conduit stub that is connected to the insert body and a 24.5 cubic inch [402 mL] stamped-steel junction box for wire splices and connections. Stamped steel junction box shall contain the necessary means to electrically ground the poke-thru assembly.

10. The trim flange shall be manufactured of die-cast aluminum alloy and be capable of being powder-coated or plated. Coated finish to be textured, two-stage epoxy paint in gray, black, or ivory. Coordinate color with Architect. The trim flange shall also be available in an aluminum and brass finish. Brass and aluminum finish shall be a brushed finish with a lacquer sealant. The trim flange shall be a total of 7-1/2" [191 mm] in diameter. A gasket is attached to the underside of the trim flange to maintain scrub water tightness by preventing water, dirt, and debris from entering the power and communication compartments.

11. The activation cover slide holder shall be manufactured from textured PVC and be available in black, ivory, and brass colors. Coordinate color with Architect. A gasket is attached to the slide cover assembly to maintain scrub water tightness. The activation slide cover shall be a total of 4-5/8" [118 mm] in diameter. The activation slide cover shall provide spring-loaded slides that snap back in place when not in use to protect the flush mounted power receptacles. The activation slide cover shall also provide a two-level slide cover system for the communication connectors to provide individual

access and to protect connectors when not in use. Each activation cover shall also provide locations to adhere labels to identify both power and communication circuits.

12. The poke-thru manufacturer shall have available a complete line of faceplates and bezels to facilitate mounting UTP, STP (150 ohm), fiber optic, coaxial, and communication devices. The unit shall also accommodate a mechanism to permit protection of communication cabling. The mechanism shall be zinc die-cast with two openings to accept both flexible and rigid conduit. Openings shall accept 1/2" trade size conduit.

13. Provide manufacturers communications adapter that allows for two (2) 1/2" connections for Tel/Data cable.

C. Floor Box Designations

1. Type “FB1”: Provide three-compartment box with two (2) power compartments and one (1) data compartment. Provide brass flanges and cover plates. Provide duplex flip lid cover plates for the power compartments and GFI cover plate for the data compartment. Provide two (2) duplex receptacles. Provide (3) 1-1/4" conduits, one per floor box compartment. Conduits shall be run within the slab to closest stud wall and terminate above the closest LAT ceiling to (3) 6" x 6" x 2" junction boxes.

2. Type “FB2”: Powered Furniture floor box. Provide three-compartment box with two (2) power compartments and one (1) data compartment. Provide brass flanges and cover plates. Provide three (3) cover plates each with a 2-5/8" plug and 1" plug. Provide power infeed whip with 90° connection to one of the power compartments. See electrical details for additional information. Provide (3) 1-1/4" conduits, one per floor box compartment. Conduits shall be run within the slab to closest stud wall and terminate above the closest LAT ceiling to (3) 6" x 6" x 2" junction boxes.

3. Type “FB3”: Flush Poke-Thru with two (2) duplex receptacles and two (2) active dual Cat. 5e T568A/B inserts. Brass flange and brass color slide holder. Wiremold No. 6ATC Series with 175CHA data in feed attachment.

4. Type “FB4”: Provide three-compartment box with two (2) power compartments and one (1) data compartment. Provide black non-metallic flanges and cover plates. Provide duplex flip lid cover plates for the power compartments and GFI cover plate for the data compartment. Provide two (2) duplex receptacles. Provide (3) 1-1/4" conduits, one per floor box compartment. Conduits shall be run within the slab to closest stud wall and terminate above the closest LAT ceiling to (3) 6" x 6" x 2" junction boxes.

5. Type “FB5”: Powered Furniture floor box. Provide three-compartment box with two (2) power compartments and one (1) data compartment. Provide black non-metallic flanges and cover plates. Provide three (3) cover plates each with a 2-5/8" plug and 1" plug. Provide power infeed whip with 90° connection to one of the power compartments. See electrical details for additional information. Provide (3) 1-1/4" conduits, one per floor box compartment. Conduits shall be run within the slab to closest stud wall and terminate above the closest LAT ceiling to (3) 6" x 6" x 2" junction boxes.

6. Type “FB6”: Flush Poke-Thru with two (2) duplex receptacles and two (2) active dual Cat. 5e T568A/B inserts. Black non-metallic flange and slide holder. Wiremold No. . 6ATC Series with 175CHA data in feed attachment.

7. Type “FB7”: Flush Poke-Thru for powered furniture infeed. Power and Data. Wiremold No. 6STC-6CFFTC with 152CHA data in feed assembly.

2.09 MULTI-OUTLET RACEWAY SYSTEM *(NIC)*

2.10 120 VOLT CLOCKS *(NIC)*

PART 3 – EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

A. All work shall conform to the printed specifications and installations of each of the manufacturers, the approved shop drawings, and to the requirements of the Governing Laws and Building Code.

B. Inspect job conditions and related work and report to the Engineer, of any conditions adversely affecting raceway work.

C. Make all changes and adjustments in this work and other work under this Section as needed to accommodate the work of other Trades.

D. All wiring devices shall be securely fastened in place, in such manner that plumb, level, and true finished lines and surfaces will result in the finished work.

3.02 INSTALLATION OF WIRING DEVICES AND DEVICE PLATES

A. All wiring devices shall be installed in appropriately sized outlet boxes. Where more than one switch or a double duplex receptacle is indicated on the drawings, outlet boxes shall be ganged together to accept all devices in the area. Separate boxes are required for wiring devices on emergency systems. Ganging of systems using barriers shall not be approved.

B. All duplex convenience and power receptacles shall be mounted **vertically** with the grounding posts at the **top** of the device. Where duplex receptacles are indicated to be mounted horizontally, the grounding posts shall be on the left as the outlet is viewed from the front.

C. Each and every receptacle, either wall or raceway mounted, shall be appropriately labeled, as indicated in Section 16195 indicating the panel and circuit number from which they are served.

D. All toggle switches, single-pole, 3-way and 4-way, shall be so installed such that, when lights are off, all switch posts shall be in the down position.

E. All device plate screws shall be colored alike to the device plates. All screws shall be installed “finger-tight” to avoid device plate cracking.

F. All switches and receptacles shall be flush mounted, where possible. All flush type outlets to be fitted with device plate that completely conceals opening. Use multiple gang plates where several devices are grouped.

G. Connect wiring device grounds in accordance with NEC requirements.

H. Locations shown on drawings are approximate. Determine exact locations on site by reference to building drawings and in conjunction with work by other Trades. Coordinate location of devices in casework with the Architect.

I. Exterior outlets shall be mounted horizontally in UL listed weatherproof enclosures.

J. Emergency system devices shall be installed in separate boxes from normal system devices. Ganging of emergency and normal system devices shall not be allowed.

3.03 TESTING

A. Make the following tests on all switches:

1. Check that switching is properly installed including dimmers.
2. Check all lamps for proper operation.

B. Make the following tests on all receptacles and wiring devices:

1. Check for proper polarity.
2. Check for damaged or missing device plates.
3. Test and reset all GFI receptacles.

C. Refer to Section 16198 for additional testing requirements.

3.04 CLEANING AND ADJUSTING

A. All wiring devices shall be cleaned for all construction debris prior to final acceptance by Owner.

****

END OF SECTION

THE LIVESTOCK INSTITUTE

WESTPORT, MA

PROJECT NO. 4730

Specification for

MOTOR STARTERS

Section 16155

THE DENNIS GROUP, LLC

PLANNING ▲ ENGINEERING ▲ CONSTRUCTION MANAGEMENT

1537 MAIN STREET
SPRINGFIELD, MASSACHUSETTS 01103
413.787.1785 ▲ FAX 413.787.1786

26 WEST MARKET STREET
SALT LAKE CITY, UTAH 84101
801.531.8585 ▲ FAX 810.531.8586

A	**09.20.2016**	**Review**	**MJJ**		
Issue	**Date**	**Description**	**By**	**Approved**	**Section 16155**

Unless notification and/or comments are received from client within two weeks after issue date, all documentation including drawings, specifications, and studies submitted to client shall be considered approved as released.

PART 1 – GENERAL

1.01 PROVISIONS INCLUDED

A. The General Documents, as listed on the Table of Contents and applicable parts of Division 1, General Requirements, and requirements of Section 16010, shall be included in and made part of this Section.

B. Examine all drawings and all other Section of the Specifications for requirements which affect work under this Section whether or not such work is specifically mentioned in this Section.

C. Coordinate work with that of all other Trades affecting or affected by work of this Section. Cooperate with such Trades to ensure the steady progress of all work under the Contract.

D. Provide all material, labor and equipment, to complete the work of this Section in strict accordance with the design Architect's and Engineer's plans and specifications, and with all applicable codes, rules, and and standards.

1.02 SCOPE OF WORK

A. The work under this Section consists of furnishing and installing individual and combination motor starters for motors as indicated on the drawings which are not directly served from motor control centers.

B. The work under this Contract shall also include all labor, materials, tools, equipment, transportation, insurance, temporary protection, supervision and incidental items essential for proper installation and operation, even though not specifically mentioned or indicated on the drawings but which are usually provided or are essential for proper installation and operation of all systems as indicated on the drawings and specified herein.

C. The specifications and drawings describe the minimum requirements that must be met by the Contractor for the installation of all work as shown on the drawings and as specified hereinunder.

1.03 RELATED WORK SPECIFIED ELSEWHERE

A. The following referenced sections are listed as a minimum of additional requirements and/or work not included in this Section which may be required to be performed under other designated Sections:

1. Section 16110: Raceways
2. Section 16120: Conductors
3. Section 16170: Motor and Circuit Disconnects
4. Section 16181: Fuses
5. Section 16190: Hangers and Supports
6. Section 16195: Electrical Identification
7. Section 16198: Start-Up Testing of Electrical Equipment
8. Section 16450: Grounding
9. Section 16482: Motor Control Centers

1.04 SUBMITTALS

A. Prepare and submit complete shop drawings of motor starters required on this project to Engineer for approval.

B. Submit samples of each material under this Section requested by the Engineer for approval. Samples shall be in size and form requested by the Engineer, and reasonable to show characteristics, color and finishes of the materials.

C. Submit complete manufacturer's product data of all materials and systems to the Engineer for approval, consisting of complete product description and specifications, complete performance test data, complete preparation and installation instructions, and all other pertinent technical data required for complete product and product use information.

D. All shop drawings shall have clearly marked the appropriate specification number of drawing designation for identification of the submittal.

E. Disposition of shop drawings shall not relieve the Contractor from the responsibility for deviations from drawings or specifications unless he has submitted, in writing, a letter itemizing or calling attention to such deviations at time of submission and secured written approval from the Engineer, nor shall such disposition of shop drawings relieve the Contractor from responsibility for errors in shop drawings or schedules.

F. Do not order materials or begin installation until approval of submittals by the Architect and Engineer has been obtained.

1.05 GUARANTEE

A. In addition to the specific guarantee requirements of the General Conditions, the Contractor shall obtain, in the Owner's name, the standard written manufacturer's guarantee of all materials furnished under this Section where such guarantees are offered in the manufacturer's published product data. All these guarantees shall be in addition to, and not in lieu of, other liabilities which the Contractor may have by law or other provisions of the Contract Documents.

1.06 COORDINATION

A. The work of this Section shall be coordinated with other work of the Contractor.

1.07 REFERENCE STANDARDS

A. Applicable provisions of the following Codes and Trade Standard Publications shall apply to the work of this Section, and are hereby incorporated into, and made a part of, the Contract Documents.

1.	UL 98:	Enclosed Switches
2.	NEMA ICS-2:	Industrial Control Devices, Controllers and assemblies
3.	NEMA AB-1:	Molded Case Circuit Breakers
4.	NFPA-70:	National Electrical Code

1.08 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery of materials shall be made to the project by the materials supplier in accordance with the instructions of the Contractor.

B. The Contractor shall provide adequate storage space for the materials, shall be responsible for all items of materials after receipt from the supplier, and shall replace all materials lost or damaged after delivery and receipt.

C. The Contractor shall furnish the materials supplier with receipts for all materials and accessory items received, and shall send copies of these receipts to the Architect.

PART 2 – MATERIALS

2.01 STARTERS

A. Manufacturers – Standard Non-Microprocessor-Based Starters

1. Cutler-Hammer, Freedom Series 2100
2. General Electric NEMA Series
3. Square D, NEMA Rated
4. Siemens

B. Manufacturers – Microprocessor-Based Starters

1. Cutler-Hammer, Advantage Series
2. General Electric, NEMA with ECM modules
3. Square D, NEMA Rated with Motor-Logic
4. Siemens 3RB12

C. Combination Motor Controllers

1. Combination starter units through NEMA size 3 shall be full voltage, non-reversing. Combination starters NEMA size 4 and above shall be auto-transformer type reduced voltage, closed transition starters with starting taps at 65%, 80% and 90% of full voltage. All accessories for reduced voltage starters shall be the same as full voltage starters. All starters shall utilize magnetic only breakers.

2. All 480 volt starters sizes shall be as follows:

a.	1/2 to 10 HP:	NEMA Size 1
b.	15 to 25 HP:	NEMA Size 2
c.	30 to 50 HP:	NEMA Size 3
d.	60 to 100 HP:	NEMA Size 4 – Reduced Voltage
e.	125 to 200 HP:	NEMA Size 5 – Reduced Voltage
f.	225 to 400 HP:	Powerflex 700 VFD Drive

3. All 208 volt starters sizes shall be as follows:

a.	1/2 to 7½ HP:	NEMA Size 1
b.	10 HP:	NEMA Size 2
c.	15 to 25 HP:	NEMA Size 3
d.	30 to 40 HP:	NEMA Size 4 – Reduced Voltage
e.	50 to 75 HP:	NEMA Size 5 – Reduced Voltage
f.	100 to 150 HP:	NEMA Size 6 – Reduced Voltage

4. Each combination unit shall be rated **65,000** AIC symmetrical at 480V. The magnetic only breaker shall provide adjustable magnetic protection up to, but not over 1300% motor nameplate full load current to comply with NEC requirements. All magnetic only breaker/combination starter units shall have a “tripped” position on the unit disconnect

and a push-to-test button on the magnetic only breaker. Magnetic only breakers shall be sized based on motor full load amperes as scheduled on the drawings. (Also refer to nameplate rating of motors.)

5. For all 480-volt normal power motors, provide ground fault protection, with pick-up of approximately 20% of device rating for all starters.

6. Line starters shall be electrically-operated, electrically-held, three-pole assemblies with arc extinguishing characteristics and shall have silver-to-silver renewable contacts. They shall have provisions for a total of four normally open or four normally closed auxiliary contacts wired to a terminal block with two normally open and two normally closed unused spare auxiliary contacts.

7. For non-microprocessor based starters, the overload relay assembly shall be of the thermal bimetallic ambient compensated type. Overload relays shall be reset from outside the enclosure by means of an insulated button. Overload heaters for each motor shall be determined by the actual nameplate full load ampere rating and service factor of the motor. The Electrical Contractor shall obtain this information from the final accepted shop drawings for each motor to be served and shall provide this information to the motor control center manufacturer. The overload relay shall have a built-in push-to-test button, electrically isolated normally open – normally closed contacts and single phase protection.

8. For microprocessor-based starters, the overload relay assembly shall be of the electronic type with the following features:

   a. Ambient insensitive
   b. Class 10, 20 or 30 protection (selectable)
   c. Ground fault protection
   d. Network communication capabilities **compatible with HVAC Building Automation System specified by other trades**
   e. Fixed phase loss protection (selectable on/off)
   f. Adjustable (20 – 50%) phase unbalance protection

9. Each starter shall be equipped with a primary and secondary fused control power transformer (minimum 150 VA), two indicating lights and HOA selector switch. Device panel to have space to accommodate five oil-tight pilot-control devices or indicating ammeters, voltmeters, or elapsed time meters.

10. Each starter shall be equipped with a local E-Stop button, rewired to the terminal block, for remote E-Stop stations to be terminated to. **Provide relay prewired to terminal block for remote indication of E-Stop activation.**

11. Two-speed, two-winding starters shall be provided for two-speed, two-winding motors. Starters shall be provided with over current protection, sized for each speed. Two (2) motor circuit protectors per starter shall be provided. In addition, three (3) pilot lights (High, Low, Off) and a 4-position selector switch (High/Low/Off/Automatic) shall be provided. Refer to HVAC schedule for quantities. Single short circuit protective device for both speeds will not be acceptable.

12. Two-speed, two-winding, reversing starters shall be provided for two-speed, two-winding motors. Starter shall be provided with overload protection in each speed. Two (2) motor circuit protectors per starter, one sized for each speed shall be provided. In addition, five (5) pilot light (Forward, Reverse, High, Low, Off) and three (3) selector switches ([1] 3-position [Local, Off, Auto]) ([1] 2-position [Forward, Reverse]), and ([1] 2-position [High, Low]) shall be provided. Two-speed and

reversing contactors shall be mechanically and electrically interlocked. Each contactor (Forward, Reverse, High, Low) shall be provided with two (2) spare normally open contacts and two (2) spare normally closed contacts.

13. For all motors, provide a combination current transformer and transducer with a 4-20 milliampere analog output mounted on Phase B of output of starter. Wire current transformer/transducer to shorting time terminal board for remote use by HVAC Subcontractor.

14. No IEC control devices shall be used.

15. Time delay relays shall be provided as follows:

    a. All motors 15 HP and above to delay starting of motor upon energizing.

    b. All two-speed motors for delay between “high” and “low” speeds to allow coast down of motor.

    c. All reversing starters between forward and reverse and between reverse and forward to allow motor to stop.

    d. All timers shall be adjustable between 1 and 60 seconds continuous. Final adjustment shall be made by the Electrical Contractor to coordinate with system conditions. List of settings shall be provided to the Owner and Electrical Engineer for review.

D. Manual Starters

1. Manual starters shall be provided with thermal overload protection in each phase, quick-break operating mechanism, silver contacts, pressure.

PART 3 – EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

A. All work shall conform to the printed specifications and installations of each of the manufacturers, the approved shop drawings, and to the requirements of the Governing Laws and Building Codes. Refer to drawings to determine locations of fire-resistive and fire-protective work, and construct this work to conform to the specifications and installation instructions of UL or other testing agencies.

B. Inspect job conditions and related work and report to the Architect any conditions adversely affecting raceway work.

C. Make all changes and adjustments in this work and other work under this Section as needed to accommodate the work of other Trades.

D. All boxes shall be erected, rigidly supported and securely fastened in place in such a manner that plumb, level, and true finished lines and surfaces shall result in the finished work.

E. Furnish overloads based on the nameplate rating of the installed motor to be controlled.

F. Each motor shall be supplied by an individual branch circuit in separate branch conduit.

G. All final connections to motor shall be made with flexible conduit, not less than 18" or more than 36" long. Provide ground wire to motor frame. Conduit shall be adequately supported at each motor.

H. Proper direction of rotation of all motors shall be the responsibility of this Contractor.

I. All disconnects, combination starters, starters, and control devices, etc., shall have nameplates or legends indicating the equipment served and/or the functions of the device. These nameplates or legends shall be sized relative to the device, be made of engraved phenolic compound, and properly secured to the device. Refer to Section 16195.

J. It shall be the responsibility of the Contractor for work under this Section to confer with the Contractors of other trades involved and provide connections of proper capacity at proper locations thereof. This Contractor shall be fully responsible to furnish and install proper fuses, starters, conduit, thermal heaters and conductors to the individual starters, leaving same ready for operation.

K. Where starters and other devices are furnished with the equipment, this Contractor shall receive these starters and other devices in connection with the units and do all necessary power field wiring between equipment and starters. This work is to be done under the supervision of the respective Contractor or Subcontractor, who shall be fully responsible for providing adequate and correct wiring diagrams and instructions.

3.02 INSTALLATION OF STARTERS

A. Install motor starters as follows:

1. Location: Approximately as shown on drawings. Choose precise location to provide ample space for operation and maintenance. Confirm with Architect/Engineer.

2. Mounting Method

a. Wall Mounting: Use expansion anchors and bolts. Install collars around mounting bolts, to provide air space between wall and device enclosure.

b. Structural Steel Mountings: Bolt to steel or brackets welded to steel. Provide air space between steel and device enclosure.

c. Angle Iron Framework Mounting: Provide where walls or structural steel not available. Bolt device enclosure or enclosures to angle iron or to steel panel attached to iron as directed.

d. Floor Mounting: Install on 4" high concrete equipment pad, in plumb and level attitude. Use expansion anchors and bolts as required.

3.03 CLEANING

A. All starters shall be thoroughly cleaned prior to final acceptance by Owner.

3.04 TESTING

A. Test motors and starters as specified in Section 16198. Coordinate with other Trades.

****

END OF SECTION

THE LIVESTOCK INSTITUTE

WESTPORT, MA

PROJECT NO. 4730

Specification for

MOTOR AND CIRCUIT DISCONNECTS

Section 16170

THE DENNIS GROUP, LLC

PLANNING ▲ ENGINEERING ▲ CONSTRUCTION MANAGEMENT

1537 MAIN STREET
SPRINGFIELD, MASSACHUSETTS 01103
413.787.1785 ▲ FAX 413.787.1786

26 WEST MARKET STREET
SALT LAKE CITY, UTAH 84101
801.531.8585 ▲ FAX 810.531.8586

A	**09.20.2016**	**Review**	**MJJ**		
Issue	**Date**	**Description**	**By**	**Approved**	**Section 16170**

Unless notification and/or comments are received from client within two weeks after issue date, all documentation including drawings, specifications, and studies submitted to client shall be considered approved as released.

PART 1 – GENERAL

1.01 PROVISIONS INCLUDED

A. The General Documents, as listed on the Table of Contents and applicable parts of Division 1, General Requirements, and requirements of Section 16010, shall be included in and made part of this Section.

B. Examine all drawings and all other Section of the Specifications for requirements which affect work under this Section whether or not such work is specifically mentioned in this Section.

C. Coordinate work with that of all other Trades affecting or affected by work of this Section. Cooperate with such Trades to ensure the steady progress of all work under the Contract.

D. Provide all material, labor and equipment, to complete the work of this Section in strict accordance with the design Architect's and Engineer's plans and specifications, and with all applicable codes, rules, and standards.

1.02 SCOPE OF WORK

A. The work of this Section covers the furnishing and installation of motor and circuit disconnect switches in accordance with these specifications and as indicated on the drawings. Switches shall be furnished in quantities sufficient for a complete installation as indicated on the drawings and in these specifications.

B. The work under this Contract shall also include all labor, materials, tools, equipment, transportation, insurance, temporary protection, supervision and incidental items essential for proper installation and operation, even though not specifically mentioned or indicated on the drawings, but which are usually provided or are essential for proper installation and operation of all systems as indicated on the drawings and specified herein.

C. The specifications and drawings describe the minimum requirements that must be met by the Contractor for the installation of all work as shown on the drawings and as specified hereinunder.

1.03 RELATED WORK SPECIFIED ELSEWHERE

A. The following referenced sections are listed as a minimum of additional requirements and/or work not included in this Section which may be required to be performed under other designated Sections:

1. Section 16110: Raceways (Non-Process)
2. Section 16120: Conductors (600 Volt)
3. Section 16155: Motor Starters
4. Section 16181: Fuses
5. Section 16190: Hangers and Supports
6. Section 16195: Electrical Identification
7. Section 16198: Start-Up Testing of Electrical Equipment

1.04 SUBMITTALS

A. Prepare and submit complete shop drawings of motor and circuit disconnects required on this project to Engineer for approval.

B. Submit samples of each material under this Section requested by the Engineer for approval. Samples shall be in size and form requested by the Engineer, and reasonable to show characteristics, color and finishes of the materials.

C. Submit complete manufacturer's product data of all materials and systems to the Engineer for approval, consisting of complete product description and specifications, complete performance test data, complete preparation and installation instructions, and all other pertinent technical data required for complete product and product use information.

D. All shop drawings shall have clearly marked the appropriate specification number of drawing designation for identification of the submittal.

E. Disposition of shop drawings shall not relieve the Contractor from the responsibility for deviations from drawings or specifications unless he has submitted, in writing, a letter itemizing or calling attention to such deviations at time of submission and secured written approval from the Engineer, nor shall such disposition of shop drawings relieve the Contractor from responsibility for errors in shop drawings or schedules.

F. Do not order materials or begin installation until approval of submittals by the Architect and Engineer has been obtained.

1.05 GUARANTEE

A. In addition to the specific guarantee requirements of the General Conditions, the Contractor shall obtain, in the Owner's name, the standard written manufacturer's guarantee of all materials furnished under this Section where such guarantees are offered in the manufacturer's published product data. All these guarantees shall be in addition to, and not in lieu of, other liabilities which the Contractor may have by law or other provisions of the Contract Documents.

1.06 REFERENCE STANDARDS

A. Applicable provisions of the following Codes and Trade Standard Publications shall apply to the work of this Section and are hereby incorporated into, and made a part of, the Contract Documents.

1. UL 98: Enclosed Switches
2. UL 198: Power Fuses

1.07 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery of materials shall be made to the project by the materials supplier in accordance with the instructions of the Contractor.

B. The Contractor shall provide adequate storage space for the materials, shall be responsible for all items of materials after receipt from the supplier, and shall replace all materials lost or damaged after delivery and receipt.

C. The Contractor shall furnish the materials supplier with receipts for all materials and accessory items received, and shall send copies of these receipts to the Architect.

PART 2 – MATERIALS

2.01 MANUFACTURERS

A. Cutler-Hammer

B. General Electric

C. Square D

D. Siemens

2.02 CIRCUIT DISCONNECT SWITCHES

A. Furnish and install disconnect switches for disconnecting means for all equipment as shown on drawings. Disconnect switches shall be of the Type "A", quick-make, quick-break heavy duty construction. Disconnect switches shall have interlocking doors. Cabinets shall be bonderized and finished in gray enamel. Where (1) feeder supplies more than (1) piece of equipment, disconnecting switches shall be of the fusible type and shall be complete with fuses of the size required for each load.

B. Disconnect switches shall have the following ratings and construction types as required per the NEC:

1. Ratings

   a. 30 to 1,200 Amperes
   b. 250 Volts AC, DC
   c. 600 Volts AC
   d. Fusible and non-fusible
   e. Copper-Aluminum terminals

2. Enclosures

   a. Provide NEMA 1 general purpose enclosures for all dry interior areas.
   b. Provide NEMA 3R raintight enclosures for all exterior areas.
   c. NEMA 4X watertight stainless steel enclosures in all process, production and interior wet locations.
   d. Provide NEMA 12 dust-tight and oil-tight enclosures in oil tank/storage areas.
   e. Provide NEMA 7 & NEMA 8 enclosures for Class 1 Groups A, B, C, D.
   f. Provide NEMA 9 enclosures for Class 2 Groups E, F, G, H.

C. All equipment shall be provided with the proper size/rating disconnect switch whether indicated on the drawings or not to comply with NEC.

D. Install and connect disconnect switches furnished by other Trades.

E. All power wiring shall be furnished and installed between disconnect switches, control cabinets, contactors and equipment terminals required by equipment furnished by other Trades.

F. Fuses for fused disconnect switches shall be the Rejection type. Fuses shall be sized in accordance with NEC.

G. Provide two (2) auxiliary contact in the switch that follows the position of the disconnect switch handle operator position.

2.03 MOTOR DISCONNECT SWITCHES

A. All motor disconnect devices shown on the drawings shall be furnished and installed by the Contractor.

B. Furnish and install disconnect switches for disconnecting means for all motors as shown on drawings. Disconnect switches shall be of the Type "A", quick-make, quick-break heavy duty construction sized for the horsepower of the motor served. Disconnect switches shall have interlocking doors. Cabinets shall be bonderized and finished in gray enamel.

C. Disconnect switches shall have the following ratings and construction types as required per the NEC:

1. Ratings

   a. 30 to 1,200 Amperes
   b. 250 Volts AC, DC
   c. 600 Volts AC
   d. Fusible
   e. Copper-Aluminum terminals

2. Enclosures

   a. Provide NEMA 1 general purpose enclosures for all dry interior areas.
   b. Provide NEMA 3R raintight enclosures for all exterior areas.
   c. NEMA 4X watertight stainless steel enclosures in all process, production and interior wet locations.
   d. Provide NEMA 12 dust-tight and oil-tight enclosures in oil tank/storage areas.
   e. Provide NEMA 7 & NEMA 8 enclosures for Class 1 Groups A, B, C, D.
   f. Provide NEMA 9 enclosures for Class 2 Groups E, F, G, H.

D. Where motor disconnect devices are installed between variable speed drives and their associated motor, an interlock switch shall be provided on the motor disconnect devices and 2#14 in 1/2" C shall run from the interlock switch to the associated variable speed drive to turn off the drive while the motor disconnect switch is in the off position.

E. All two speed motors shall be provided with 6 pole motor disconnect devices.

F. Furnish and install manual starting thermal-overload type switch with pilot light as a disconnecting means for all motors under 0.5 HP, unless otherwise indicated on the plans. These thermal switches shall be toggle operated and shall be rated 1 HP, motor overload protection shall be interchangeable heaters. Heaters shall be installed without removing the starter from the housing or disturbing the wiring. Toggle shall be trip-free. Thermal switches shall be furnished in a NEMA, Type 1 enclosure in mechanical and utility areas and flush in walls with stainless steel plates in Architecturally finished areas. All heaters shall be sized per the HP of the motor code letter. Coordinate with HVAC and Plumbing Trades.

G. All power wiring shall be furnished and installed between disconnect switches, control cabinets, contactors and equipment terminals required by equipment furnished by other Trades.

H. All motor, pumps, chillers, compressors, air handling units, etc., shall be provided with the proper fuse size/rating disconnect switch whether indicated on the drawings or not, to comply with NEC. Install and connect disconnect switches furnished by other Trades.

I. Provide two (2) auxiliary contact in the switch that follows the position of the disconnect switch handle operator position.

PART 3 – EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

A. All work shall conform to the printed specifications and installations of each of the manufacturers, the approved shop drawings, and to the requirements of the Governing Laws and Building Code.

3.02 INSTALLATION OF MOTOR AND CIRCUIT DISCONNECT SWITCHES

A. Switches and fuses shall be installed as indicated on the drawings and as described in these specifications.

B. All equipment or motors shall have local disconnect switches. These switches shall be mounted on, or adjacent to, the equipment or motor in such a manner that they shall be accessible.

C. The Contractor shall be responsible for replacing all blown fuses until such time that the job is finished and accepted by the Owner. The Contractor shall also, at the time of acceptance, furnish 10% spare fuses of each size used. In no case shall fewer than (3) fuses be furnished of each size.

D. Switches shall be mounted in accordance with the manufacturer's recommendations using the mounting hardware, materials, and methods specified in Section 16190 of these specifications.

E. Mounting height of disconnect switches shall be a maximum of 6'-6" above the finished floor to the top of the switch, unless otherwise indicated on the drawings or due to construction interference.

F. All disconnect switches mounted within 6'-0" of the center line of sinks, emergency showers, and/or eyewash shall be equipped with a NEMA 3R rated enclosure.

G. Conduit openings and switches shall be made with a hole saw or shall be punched. All unused openings shall be plugged, capped and made watertight for 3R and 4X installations.

H. All disconnect switches shall be labeled in accordance with the requirements of Section 16195.

3.03 CLEANING

A. All disconnect switches shall be thoroughly cleaned prior to final acceptance by Owner.

****

END OF SECTION

THE LIVESTOCK INSTITUTE

WESTPORT, MA

PROJECT NO. 4730

Specification for

FUSES (600 VOLT)

Section 16181

THE DENNIS GROUP, LLC

PLANNING ▲ ENGINEERING ▲ CONSTRUCTION MANAGEMENT

1537 MAIN STREET
SPRINGFIELD, MASSACHUSETTS 01103
413.787.1785 ▲ FAX 413.787.1786

26 WEST MARKET STREET
SALT LAKE CITY, UTAH 84101
801.531.8585 ▲ FAX 810.531.8586

A	**09.20.2016**	**Review**	**MJJ**		
Issue	**Date**	**Description**	**By**	**Approved**	**Section 16181**

Unless notification and/or comments are received from client within two weeks after issue date, all documentation including drawings, specifications, and studies submitted to client shall be considered approved as released.

PART 1 – GENERAL

1.01 PROVISIONS INCLUDED

A. The General Documents, as listed on the Table of Contents and applicable parts of Division 1, General Requirements, and requirements of Section 16010, shall be included in and made part of this Section.

B. Examine all drawings and all other Section of the Specifications for requirements which affect work under this Section whether or not such work is specifically mentioned in this Section.

C. Coordinate work with that of all other Trades affecting or affected by work of this Section. Cooperate with such Trades to ensure the steady progress of all work under the Contract.

D. Provide all material, labor and equipment, to complete the work of this Section in strict accordance with the design Architect's and Engineer's plans and specifications, and with all applicable codes, rules, and standards.

1.02 SCOPE OF WORK

A. The work of this section shall include the furnishing and installation of all fuses for equipment protection, motors requiring fused protection, control circuits, control power transformers also including conductor short circuit protection utilizing cable protectors or limiters. Fuse blocks and mounting hardware required for proper fuse installation shall be furnished.

B. The work under this Contract shall also include all labor, materials, tools, equipment, transportation, insurance, temporary protection, supervision and incidental items essential for proper installation and operation, even though not specifically mentioned or indicated on the drawings but which are usually provided or are essential for proper installation and operation of all systems as indicated on the drawings and specified herein.

C. The specifications and drawings describe the minimum requirements that must be met by the Contractor for the installation of all work as shown on the drawings and as specified hereinunder.

1.03 RELATED WORK SPECIFIED ELSEWHERE

A. The following referenced sections are listed as a minimum of additional requirements and/or work not included in this Section which may be required to be performed under other designated Sections:

1. Section 16120: Conductors (600 Volt)
2. Section 16155: Motor Starters
3. Section 16170: Motor and Circuit Disconnects
4. Section 16195: Electrical Identification
5. Section 16482: Motor Control Centers

1.04 SUBMITTALS

A. Prepare and submit complete shop drawings of all fuses required on this project to Engineer for approval.

B. Submit samples of each material under this Section requested by the Engineer for approval. Samples shall be in size and form requested by the Engineer, and reasonable to show characteristics, color and finishes of the materials.

C. Submit complete manufacturer's product data of all materials and systems to the Engineer for approval, consisting of complete product description and specifications, complete performance test data, complete preparation and installation instructions, and all other pertinent technical data required for complete product and product use information.

D. All shop drawings shall have clearly marked the appropriate specification number of drawing designation for identification of the submittal.

E. Disposition of shop drawings shall not relieve the Contractor from the responsibility for deviations from drawings or specifications unless he has submitted, in writing, a letter itemizing or calling attention to such deviations at time of submission and secured written approval from the Engineer, nor shall such disposition of shop drawings relieve the Contractor from responsibility for errors in shop drawings or schedules.

F. Do not order materials or begin installation until approval of submittals by the Architect and Engineer has been obtained.

1.05 GUARANTEE

A. In addition to the specific guarantee requirements of the General Conditions, the Contractor shall obtain, in the Owner's name, the standard written manufacturer's guarantee of all materials furnished under this Section where such guarantees are offered in the manufacturer's published product data. All these guarantees shall be in addition to, and not in lieu of, other liabilities which the Contractor may have by law or other provisions of the Contract Documents.

1.06 COORDINATION

A. The work of this Section shall be coordinated with other work of the Contract.

1.07 REFERENCE STANDARDS

A. Applicable provisions of the following Codes and Trade Standard Publications shall apply to the work of this Section and are hereby incorporated into, and made a part of, the Contract Documents:

1. UL: Standard Classification for Fuses

1.08 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery of materials shall be made to the project by the materials supplier in accordance with the instructions of the Contractor.

B. The Contractor shall provide adequate storage space for the materials, shall be responsible for all items of materials after receipt from the supplier, and shall replace all materials lost or damaged after delivery and receipt.

C. The Contractor shall furnish the materials supplier with receipts for all materials and accessory items received, and shall send copies of these receipts to the Architect.

PART 2 – MATERIALS

2.01 GENERAL

A. All fuses shall be rated for proper voltage in which they are applied. Interrupting ratings shall be greater than the short circuit current available at the terminals of the switch.

2.02 FUSE TYPES

A. Fuses shall be current limiting Class J with blown fuse indicator.

B. Medium voltage fuses for primary protection for transformers shall be as specified in specification section 16182.

C. Control power transformers for motor controller circuits shall be as recommended by motor starter and motor control center manufacturer.

D. Fuses shall be sized at 125% of rated FLA of equipment served.

E. Fuses for elevator lifts shall be dual element type and sized in accordance with elevator manufacturers recommendations.

2.03 SPARE FUSES *(NIC)*

A. Provide spare fuses for each and every disconnect switch, starter, etc.

B. Spare fuses shall include general purpose fuses, motor fuses, and control fuses used in motor control centers, starters, etc.

C. A complete list and quantity of spare fuses shall be submitted with record drawings for review.

2.04 SPARE FUSE CABINET *(NIC)*

A. Furnish and install a heavy duty steel cabinet 2'-0" wide by 3'-0" high by 1'-0" deep with shelves.

B. Cabinet shall be provided with hinged locking cabinet door.

2.05 MANUFACTURERS

A. Merson/Ferraz Shawmut

B. Cooper/Bussman

PART 3 – EXECUTION

3.01 GENERAL

A. Fuses shall not be installed until equipment is ready to be energized.

B. Final testing and inspections shall be made prior to energizing of equipment.

3.02 INSPECTION

A. The proper fuse rating shall be determined from the equipment manufacturer's recommendation for all equipment required to be protected with fuses.

B. The proper size switch with fuse holders shall match the fuse application.

C. The spare fuse cabinet shall be wall mounted within the main electric room. Coordinate location with Owner prior to installation.

****

END OF SECTION

THE LIVESTOCK INSTITUTE

WESTPORT, MA

PROJECT NO. 4730

Specification for

HANGERS AND SUPPORTS

Section 16190

THE DENNIS GROUP, LLC

PLANNING ▲ ENGINEERING ▲ CONSTRUCTION MANAGEMENT

1537 MAIN STREET
SPRINGFIELD, MASSACHUSETTS 01103
413.787.1785 ▲ FAX 413.787.1786

26 WEST MARKET STREET
SALT LAKE CITY, UTAH 84101
801.531.8585 ▲ FAX 810.531.8586

A	**09.20.2016**	**Review**	**MJJ**		
Issue	**Date**	**Description**	**By**	**Approved**	**Section 16190**

Unless notification and/or comments are received from client within two weeks after issue date, all documentation including drawings, specifications, and studies submitted to client shall be considered approved as released.

PART 1 – GENERAL

1.01 REFERENCES

A. The General Documents, as listed on the Table of Contents and applicable parts of Division 1, General Requirements, and applicable requirements of Section 16010, shall be included in and made part of this Section.

B. Examine all drawings and criteria sheets and all other Sections of the specifications for requirements which affect work under this Section whether or not such work is specifically mentioned in this Section.

C. Coordinate work with that of all other Trades affecting or affected by work of this Section. Cooperate with such Trades to assure the steady progress of all work under the Contract.

D. Provide all material, labor and equipment, to complete the work of this Section in strict accordance with the design Architect's and Engineer's plans and specifications, and with all applicable codes, rules, and standards.

1.02 SCOPE OF WORK

A. The work under this Section consists of furnishing and installing hangers and supports and mechanical suspension channels where required for installing raceways, boxes, and all other electrical equipment which must be supported.

B. Hangers, supports, clamps, etc., shall be provided as required for all electrical equipment, including but not limited to, lighting fixtures, junction boxes, pull boxes, conduit, cable tray, busway, trapeze mounted transformers, open plenum type cabling, etc.

C. Supporting devices and materials shall be defined to include, but not be limited to, the following items:

1. Hanger rods.
2. Conduit clamps.
3. Support channels.
4. Bracket supports.
5. Pipe clamps.
6. Miscellaneous support channel fittings.
7. Bolts and associated hardware.
8. Concrete anchors.
9. Vibration mounts.

D. The work under this Contract shall also include all labor, materials, tools, equipment, transportation, insurance, temporary protection, supervision and incidental items essential for proper installation and operation, even though not specifically mentioned or indicated on the drawings, but which are usually provided or are essential for proper installation and operation of all systems as indicated on the drawings and specified herein.

E. The specifications and drawings describe the minimum requirements that must be met by the Contractor for the installation of all work as shown on the drawings and as specified hereinunder.

1.03 RELATED WORK SPECIFIED ELSEWHERE

A. The following referenced sections are listed as a minimum of additional requirements and/or work not included in this Section which may be required to be performed under other designated Sections:

1. Section 16110: Raceways (Non-Process)
2. Section 16130: Boxes (Non-Process)
3. Section 16133: Cabinets (Relay and Low Tension)
4. Section 16170: Motor and Circuit Disconnects
5. Section 16191: Vibration Isolation/Seismic Restraints
6. Section 16470: Panelboards

1.04 SUBMITTALS

A. Prepare and submit complete shop drawings of all work of this Section to the Engineer for approval.

B. Submit samples of each material under this Section requested by the Engineer, for approval. Samples shall be in size and form requested by the Engineer, and reasonable to show characteristics, color and finishes of the materials.

C. Submit complete manufacturer's product data of all materials and systems to the Engineer for approval, consisting of complete product description and specifications, complete performance test data, complete preparation and installation instructions, and all other pertinent technical data required for complete product and product use information.

D. All shop drawings shall have clearly marked the appropriate specification number of drawing designation, for identification of the submittal.

E. Disposition of shop drawings shall not relieve the Contractor from the responsibility for deviations from drawing or specifications, unless he has submitted in writing a letter itemizing or calling attention to such deviations at time of submission and secured written approval from the Engineer, nor shall such disposition of shop drawings relieve the Contractor from responsibility for errors in shop drawings or schedules.

F. Do not order materials or begin installation until the Architect's and Engineer's approval of submittals has been obtained.

1.05 GUARANTEE

A. In addition to the specific guarantee requirements of the General Conditions, the Contractor shall obtain in the Owner's name the standard written manufacturer's guarantee of all materials furnished under this Section where such guarantees are offered in the manufacturer's published product data. All these guarantees shall be in addition to, and not in lieu of, other liabilities which the Contractor may have by law or other provisions of the Contract Documents.

1.06 COORDINATION

A. The work of this Section shall be coordinated with other work of the Contractor.

1.07 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery of materials shall be made to the project by the materials supplier in accordance with the instructions of the Contractor.

B. The Contractor shall provide adequate locked storage space with shelving for the materials, shall be responsible for all items of materials after receipt from the supplier, and shall replace all materials lost or damaged after delivery and receipt.

C. The Contractor shall furnish the materials supplier with receipts for all materials and accessory items received, and shall send copies of these receipts to the Architect.

PART 2 – MATERIALS

2.01 GENERAL

A. Hangers, supports, clamps, etc., shall be provided as required for all electrical equipment, including but not limited to, lighting fixtures, junction boxes, pull boxes, conduit, cable tray, busway, trapeze mounted transformers, open plenum type cabling, etc.

B. The Electrical Contractor shall provide all labor, materials, equipment and incidentals required for hangers and supports for all electrical equipment including concrete inserts, anchor bolts, metallic hanging and supporting devices, etc. for supporting electrical equipment.

C. Hangers and supports shall be approved standard design and shall be adequate to maintain the supported load in proper position and alignment under all operating conditions. All supports shall be designed to adequately secure the equipment against excessive dislocation due to thermal expansion and contraction and all probable external forces such as equipment, conduit and personnel contact.

D. All electrical equipment shall be supported in such a manner as to prevent any strain being imposed on the equipment supported.

E. All material used in manufacturing hangers and supports shall be capable of meeting the respective ASTM Standard Specifications with regards to tests and physical and chemical properties, and be in accordance with MSS SP-58.

F. Hangers and supports shall be spaced in accordance with MSS SP-69 Table 3.

2.02 MANUFACTURERS

A. Hangers and supports shall be as manufactured the following manufacturers. Product numbers used herein are based on B-Line Systems, Inc.

1. B-Line Systems, Inc.
2. Caddy/Eristrut
3. Unistrut
4. Superstrut

2.03 HANGERS

A. All hangers and supports shall have some form of adjustment available after installation. Hanger material shall be hot-dip galvanized in all areas except office areas. In office areas, hanger material shall be electro-plated zinc.

B. The use of spring steel hangers shall be prohibited.

2.04 HANGER RODS

A. Wire and strap hangers will not be permitted. All electrical equipment shall be supported by rods, hangers, etc., using bolts.

B. Above the walk-on ceiling and within non-process area joist space, hanger rods shall be B-Line series ATR (All Threaded Rod). Hanger rods shall be hot-dip galvanized except in office areas. In office areas, hanger material shall be electro-plated zinc.

C. In dry and wet process areas, hanger rods shall be **as specified in section 16050**.

D. Hanger rods shall be subjected to tension only. Lateral and axial movements shall be accommodated by proper linkage in the rod assembly.

E. Hanger rod diameters shall be based on MSS SP-69 Table 4.

2.05 CHAIN HANGER

A. The use of chain and chain hangers shall be prohibited. Electrical power distribution conduits, equipment, etc., shall not be supported by chain hangers.

2.06 BEAM HANGERS

A. All beam clamps shall engage both edges of the beam flange. The hanger shall be located directly below the web of the beam. Consult with Structural Engineer to ascertain maximum loading on hanger in each area.

B. The use of “Bang On Spring Steel” hanger shall be prohibited.

C. Hanger material shall be electro-galvanized in all areas.

D. All hangers and supports shall have some form of adjustment available after installation. Hanger material shall be compatible with the conduit material.

E. Hangers for conduit shall be B-Line series B3055 and UL listed for electrical use.

2.07 CONCRETE INSERTS

A. Concrete inserts for hangers shall be continuous metal or spot inserts designed to be used in ceilings, walls or floors and shall be as follows:

1. Continuous concrete inserts shall be used where applicable for hanger rod sizes up to 3/4" diameter. Inserts may be used where supports are parallel to the main slab reinforcement and shall be B-Line series B22I, B32I or B52I.

2. Spot concrete inserts shall be used where applicable for hanger rod sizes up to and including 7/8" diameter. Inserts shall be B-Line series B2505 through B2508, B2500, B2501 or B3014.

2.08 WELDED STEEL BRACKETS

A. Wall or column supported conduits shall be supported by welded steel brackets B-Line series B3064 or B3066.

2.09 STANCHIONS

A. For floor supported equipment, such as safety switches in mechanical areas, provide either cast-in-place concrete supports or field installed supports. Each support shall be screwed or welded to the corresponding size base stand. Supporting pipe shall be of schedule 40 steel pipe construction. Each base stand shall be secured to the concrete floor by expansion bolts. Base stands shall be B-Line series B3088 or B3088T.

2.10 RISER CONDUITS

A. Riser conduits shall be supported independently from of any horizontal conduits.

B. Support all vertical runs of conduits at each floor with B-Line series B3373 or B3373CT as required.

2.11 STRUT CHANNEL

A. Strut channel trapeze hangers shall be used to support parallel conduit runs. Conduit racks or stanchions fabricated with strut channel shall be used in areas with multiple conduit runs. Strut clamps and straps shall be used to maintain proper alignment. Strut shall be a minimum of 1 5/8" wide, B-Line series B22 or heavier as required. Clamps and straps shall be B-Line series B2000 suitable for the conduit material (EMT, IMC or RGS).

B. Provide strut channel above ceilings for support of electrical equipment such as lighting fixtures where mechanical equipment and ductwork interfere with direct mounting methods. Strut shall be used to span the width of the interference and supported by rods on each end.

C. Provide all required appurtenances required to properly hang and assemble strut supports.

D. Strut material shall be hot-dip galvanized in all areas except office areas. In office areas, material shall be electro-plated zinc.

2.12 CORROSIVE AREA CONDUIT SUPPORTS

A. Conduit supports in areas designated as corrosive on the drawings shall be in accordance with the following requirements:

1. Hanger rods shall be 1/2" diameter fiberglass with fiberglass channel nuts and locknuts. Hanger rods and nuts shall be Type V as manufactured by Aickinstrut, Inc., or an acceptable equal.

2. Conduit Clamps

a. PVC conduits in single runs or groups of (2) shall be supported by 1-hole PVC clamps and clamp-backs. Clamps shall be of the same manufacturer as the

conduit and shall be approved by the manufacturer for this purpose. Attachment hardware, including screws, bolts, nuts, washers, and concrete anchors, shall be stainless steel. Clamps shall be as manufactured by Carlon or an acceptable equal.

3. Support Channels

a. Supports for banks of (3) or more conduits shall be constructed of fiberglass support channels, channel fittings, and thermoplastic fasteners with associated thermoplastic conduit or tubing clamps.

b. Support channels, fittings, fasteners, and clamps shall be Type V as manufactured by Aickinstrut, Inc., or an acceptable equal.

2.13 CABLE TRAY SUPPORTS

A. Support members for cable trays shall be as supplied by the cable tray manufacturer or shall be field fabricated from steel channel or angle. Supports shall be attached to structural members with hot-dipped galvanized steel or stainless steel mounting hardware. Refer to specification section 16921 for additional information.

2.14 CABINET AND BOX MOUNTING

A. Cabinets and boxes shall be securely mounted. Mounting on concrete shall be accomplished using self-drilling anchors. Mounting on steel shall be by drilled and tapped screw holes or by support channels with channel nuts. When indicated on the drawings, free-standing or wall-mounted equipment mounting racks shall be provided by field fabricating them from support channel and fittings. Racks shall be secured to the floor or slab with self-drilling anchors. Mounting racks for use outdoors shall be fabricated from hot-dip galvanized support channel, fittings, and fastening hardware. Support channels, fittings, and fastening hardware shall be as manufactured by Unistrut or an approved equal.

2.15 CORROSIVE AREA EQUIPMENT MOUNTING

A. Wall-mounted equipment and cabinets in areas designated as corrosive on the drawings shall be rigidly mounted. Mounting on concrete shall be accomplished using stainless steel expansion anchors and fastening hardware. When indicated on the drawings, free-standing or wall-mounted equipment racks shall be provided. The racks shall be field-fabricated from fiberglass support channel and channel fittings and thermoplastic fastening hardware. Racks shall be secured to the floor or slab using stainless steel expansion anchors and hardware. Support channel, fittings, and fastening hardware shall be Type V as manufactured by Aickinstrut, Inc., or an approved equal.

2.16 BRACKETS

A. Bracket supports as detailed on the drawings shall be used where specifically indicated. Other type hangers acceptable to the Engineer may also be used.

2.17 ANCHORS

A. Where support for raceways, boxes, and cabinets are mounted on concrete surfaces, they shall be fastened with self-drilling tubular expansion shell anchors with externally split expansion shells, single-cone expanders, and annular break-off grooved chicking cones. Anchors shall be Phillips “Red Head” or acceptable equal. Anchors in corrosive or outdoor

areas shall be shell type constructed of stainless steel and shall be Type HDI-SS303 as manufactured by Hilti, Inc.

2.18 VIBRATION MOUNTS

A. See specification section 16191 – Vibration Isolation/Seismic Restraints, for requirements.

2.19 MECHANICAL SUSPENSION CHANNEL

A. Mechanical suspension channel shall be furnished and installed to support electrical equipment independent of walls (panelboards, disconnect switches, starters, transfer switches, transformers, conduits, etc.).

B. Channel shall be Unistrut, Type P3000 or approved equal. All fasteners and fittings shall be supplied to provide a complete installation as required.

C. All channel and fittings shall be furnished with the manufacturer's standard rustproofed finish.

D. Channel shall be manufactured by one of the following: Unistrust Products Co., Power-Strut, Steel City Electric.

PART 3 – EXECUTION

3.01 INSTALLATION OF HANGERS AND SUPPORTS

A. Provide all required hangers, supports, sleeves, clamps, etc., as required for all equipment indicated on the drawings.

B. All horizontal runs of conduits shall be properly grouped, aligned, using substantial hangers, straps, etc. Hangers and supports shall be installed at intervals not exceeding NEC recommendations.

C. Supporting rods shall be threaded at ends with allowance for adjustments. Wire and strap hangers will not be permitted. All conduit and fittings shall be supported by hangers, channels, etc., using bolts and/or lead expansion sleeves.

D. Lighting fixtures shall be supported and hung from building steel or masonry, independent of the ceiling construction either using rods, aircraft cable or mechanical suspension channel. All pendant lighting fixtures shall be suspended by using threaded conduit 1/2" minimum, with canopy kit and painted per Architect's selection. All recessed light fixtures shall have two support rods, cables, or mechanical suspension channels.

E. Structural Support Interface

1. All conduits, raceways, electrical equipment, and other similar system components, which are supported by roof joists shall be hung from the top chord or bottom chord panel point, or a panel point shall be provided by applying a vertical web member. The maximum load shall not exceed 250 pounds.

2. All conduits, raceways, electrical equipment, etc., which are supported by roof/floor beams shall be hung from the beams with clamp attachments which engage both edges of the beam flange. The hanger shall be located directly below the web of the beam and the hanger load shall be limited to 1000 pounds in area above mechanical

room and 250 pounds in remaining areas, unless otherwise approved by the Architect.

3. All additional supports, clamps, web members, etc., required to comply with the above requirements shall be provided by the Electrical Contractor, as applicable, for the work furnished and installed under this Contract.

3.02 RACEWAY SUPPORTS AND HANGERS

A. Raceways shall be securely fastened to the structure, with support mechanisms spaced as dictated by the NEC or as specified below, whichever is more stringent.

Material	Max. Spacing of Supports
1/2" – 1" Trade Size Conduit	6'-0"
1 1/4" – 1 1/2" Trade Size Conduit	8'-0"
2" – 4" Trade Size Conduit	10'-0"
Flexible Metal Conduit	4'-6"
Wireways	5'-0"
Cable Tray	10'-0"

B. Support rigid conduits, IMC, or EMT, within 3'-0" of every outlet box, junction box, pull box, cabinet, or termination. Support flexible conduit within 12" on each side of every outlet box or fitting and at other points so that it will not lie on top of accessible ceiling tiles.

C. Support vertical runs of conduits at each floor level and at interval not to exceed 10'-0".

D. The load applied to fasteners shall not exceed 1/3 the proof test load of the fasteners.

E. Fasteners attached to concrete shall be vibration and shock resistant.

F. In partitions of light steel construction, use sheet metal screws.

G. In suspended-ceiling construction, spring steel fasteners to ceiling supports may be used for the support of conduits serving lighting branch circuit conduits. No other conduits may be supported from the ceiling suspension system.

H. Where (2) or more conduits 1" trade size or larger run parallel, trapeze hangers may be used consisting of threaded solid rods, washers, nuts and galvanized “L” angle or channel iron. Individually fasten conduits to the cross member of every other trapeze hanger with one hold straps or clamp backs with proper size bolts, washers and nuts. When adjustable trapeze hangers are used, use U-bolt type clamps at end of conduit runs, at each elbow and at each third intermediate hanger to fasten each conduit.

I. Make hangers of durable materials suitable for the application involved. Applied loads shall not exceed 1/3 of their loading capacity.

J. Fabricate all screws, bolts, washers and miscellaneous hardware used for conduit supports from rust-resisting metal. Trapeze hangers shall have hanger assemblies protected by a galvanized finish.

K. Support multiple conduit runs and banks on preformed nonmetallic spacing block separators on 4'-0" centers. Separator containing metal shall have metal non-continuous and shall not

form a magnetic loop. Unless otherwise shown on the drawings, spacing between exterior surfaces of conduits shall be as follows:

- 2" between telephone conduits.
- 2" between conduits containing cables operating at 600V or less.
- 12" between telephone conduit and power conduit in the same concrete envelope.
- 2 1/2" between conduits containing cables operating at more than 600V.

a. Space conduit separators to prevent sagging of raceway and breaking of couplings and watertight seals, to maintain deformation of conduit at separators to 0.10" or less. Secure with cords where necessary. Do not use tie wires, reinforcing rods or other metallic materials.

L. Cable tray shall be supported as follows:

1. From building steel; 10'-0" maximum spacing; support straight sections and fittings in accordance with NEMA VE-1 requirements.

2. Type: Cantilever bracket type for continuous access from one side.

3. Construction: Prefabricated galvanized or bonderized.

3.03 INSTALLATION OF MECHANICAL SUSPENSION CHANNEL

A. Mechanical suspension channel shall be furnished and installed to support electrical equipment independent of walls (panelboards, disconnect switches, starters, transfer switches, transformers, etc.).

B. All fasteners and fittings shall be supplied to provide a complete installation as required. Channel shall be sized and mounted to allow for future conduits.

3.04 MISCELLANEOUS IRON AND STEEL

A. The Electrical Contractor shall provide all steel supports and hangers as shown on the drawings or required to support all equipment, systems or materials provided under this Contract.

B. All supports shall be cut, assembled, welded and finished by skilled mechanics. Welds shall be ground smooth. Stands, brackets, and framework, shall be properly sized and strongly constructed.

C. Measurements shall be taken on the job and worked out to suit adjoining and connecting work. All work shall be done by experienced metal-working mechanics. Members shall be straight, true and accurately fitted.

D. Welded joints shall be ground smooth where exposed. Drilling, cutting, and fitting, shall be done as required to properly install the work and accommodate the work of other Trades as directed by them.

E. Members shall be generally welded except that bolting may be used for field assembly where welding would be impractical. Welders shall be skilled and certified.

F. All shop fabricated iron and steel work shall be cleaned and dried and given a shop coat of rust-inhibiting paint on all surfaces and in all openings and crevices.

****

END OF SECTION

THE LIVESTOCK INSTITUTE

WESTPORT, MA

PROJECT NO. 4730

Specification for

ELECTRICAL IDENTIFICATION

Section 16195

THE DENNIS GROUP, LLC

PLANNING ▲ ENGINEERING ▲ CONSTRUCTION MANAGEMENT

1537 MAIN STREET
SPRINGFIELD, MASSACHUSETTS 01103
413.787.1785 ▲ FAX 413.787.1786

26 WEST MARKET STREET
SALT LAKE CITY, UTAH 84101
801.531.8585 ▲ FAX 810.531.8586

A	**09.20.2016**	**Review**	**MJJ**		
Issue	**Date**	**Description**	**By**	**Approved**	**Section 16195**

Unless notification and/or comments are received from client within two weeks after issue date, all documentation including drawings, specifications, and studies submitted to client shall be considered approved as released.

PART 1 – GENERAL

1.01 REFERENCES

A. The General Documents, as listed on the Table of Contents and applicable parts of Division 1, General Requirements, and applicable requirements of Section 16010, shall be included in and made part of this Section.

B. Examine all drawings and criteria sheets and all other Sections of the specifications for requirements which affect work under this Section whether or not such work is specifically mentioned in this Section.

C. Coordinate work with that of all other Trades affecting or affected by work of this Section. Cooperate with such Trades to assure the steady progress of all work under the Contract.

D. Provide all material, labor and equipment, to complete the work of this Section in strict accordance with the design Architect's and Engineer's plans and specifications, and with all applicable codes, rules, and standards.

1.02 SCOPE OF WORK

A. The work under this Contract shall include all labor, materials, tools, equipment, transportation, insurance, temporary protection, supervision and incidental items essential for proper installation and operation, even though not specifically mentioned or indicated on the drawings, but which are usually provided or are essential for proper installation and operation of all systems as indicated on the drawings and specified herein.

B. The specifications and drawings describe the minimum requirements that must be met by the Contractor for the installation of all work as shown on the drawings and as specified hereinunder.

C. Identification materials and supplies shall be defined to include, but not be limited to, the following:

1. Nameplates.
2. Cable tags.
3. Wire markers.
4. Adhesive labels.
5. Colored tape.
6. Paint.
7. Circuit directories.

D. All electrical equipment and conductors shall be identified.

1.03 RELATED WORK SPECIFIED ELSEWHERE

A. The following referenced sections are listed as a minimum of additional requirements and/or work not included in this Section which may be required to be performed under other designated Sections:

1. Section 16110: Raceways
2. Section 16120: Conductors (600 Volt)
3. Section 16130: Boxes
4. Section 16140: Wiring Devices and Device Plates

5. Section 16155: Motor Starters
6. Section 16170: Motor and Circuit Disconnects
7. Section 16428: Low Voltage Distribution Switchboards (Compartmented)
8. Section 16429: Low Voltage Distribution Switchboards (Group Mounted)
9. Section 16441: Safety Switches
10. Section 16482: Motor Control Centers
11. Section 16460: Dry Type Transformers
12. Section 16470: Panelboards
13. Section 16500: Lighting Fixtures
14. Section 16721: Fire Alarm Systems
15. Section 16921: Cable Tray Systems

1.04 SUBMITTALS

A. Prepare and submit complete shop drawings of all types of identification markers provided on this project to the Engineer for approval.

B. Submit samples of each material under this Section requested by the Engineer, for approval. Samples shall be in size and form requested by the Engineer, and reasonable to show characteristics, color and finishes of the materials.

C. Submit complete manufacturer's product data of all materials and systems to the Engineer for approval, consisting of complete product description and specifications, complete performance test data, complete preparation and installation instructions, and all other pertinent technical data required for complete product and product use information.

D. All shop drawings shall have clearly marked the appropriate specification number of drawing designation, for identification of the submittal.

E. Disposition of shop drawings shall not relieve the Contractor from the responsibility for deviations from drawing or specifications, unless he has submitted in writing a letter itemizing or calling attention to such deviations at time of submission and secured written approval from the Engineer, nor shall such disposition of shop drawings relieve the Contractor from responsibility for errors in shop drawings or schedules.

F. Do not order materials or begin installation until the Architect's and Engineer's approval of submittals has been obtained.

1.05 COORDINATION

A. The work of this Section shall be coordinated with other work of the Contractor.

1.06 REFERENCE STANDARDS

A. Applicable provisions of the following Codes and Trade Standard Publications shall apply to the work of this Section, and are hereby incorporated into, and made a part of, the Contract Documents.

1. National Electrical Code (NEC), Latest Edition.

1.07 GUARANTEE

A. In addition to the specific guarantee requirements of the General Conditions, the Contractor shall obtain in the Owner's name the standard written manufacturer's guarantee of all

materials furnished under this Section where such guarantees are offered in the manufacturer's published product data. All these guarantees shall be in addition to, and not in lieu of, other liabilities which the Contractor may have by law or other provisions of the Contract Documents.

PART 2 – MATERIALS

2.01 NAMEPLATES

A. Provide nameplates on all switchgear, switchboards, transformers, motor control center, remote mounted enclosed circuit breakers, receptacles (see Wiring Device Section), individual motor starters / disconnects, panelboards and for special purpose motor disconnect switches, remote control stations, starters, etc., or other controls furnished or installed under this section. Nameplates shall designate equipment controller, function, ratings, source of power and voltage. Owner shall approve name plates and wording.

B. Nameplates shall be laminated, white bakelite with 1/4" high, black recessed letters. Nameplates shall be securely attached to the equipment with food grade adhesives, cements or epoxies.

C. Provide a shop drawing of nameplate schedules for approval.

D. Nameplates for devices and panelboards on emergency power shall be red in color.

E. Receptacle face plates shall be engraved. See specification section 16140.

2.02 PANEL DIRECTORIES

A. Panelboards shall have typed directories, listing all circuit loads, breaker sizes and phases.

2.03 WIRE MARKERS

A. Each power and control wire and cable shall be permanently identified at both ends and at each splice with a pre-printed Heat Shrink flattened Polyolefin Type wire markers.

B. Adhesive backed and/or write-on type markers are not acceptable.

C. Markers shall be manufactured by Panduit, Thomas & Betts, Brady, or approved equal.

2.04 TERMINAL BLOCKS

A. Each terminal block assembly (terminal strip) shall have a unique label (e.g. TB-1, TB-2, etc.) permanently affixed on the terminal strip or to the backplate. Each terminal shall be marked with a unique identifier, either pre-printed by the manufacturer or neatly hand lettered with an indelible marking pen. Wire and terminal identification shall be the same wherever practical (e.g. wire number 10 shall be connected to terminal number 10).

2.05 CABLE TAGS

A. Cable tags shall be stainless steel identification tags attached via heavy duty plastic tie wrap with stainless steel inserts. See Part 3 below for labeling requirements.

2.06 CORD DROP ID TAGS

A. Cable tags shall be stainless steel identification tags attached via stainless steel tie wraps.

B. Identification shall indicate voltage, phase, panel and circuit number shall be stamped into the tag.

2.07 CONDUIT IDENTIFICATION

A. Provide manufacturer's standard pre-printed, flexible or semi-rigid, permanent, plastic-sheet conduit markers, extending 360° around conduits, designed for attachment to conduit by adhesive, adhesive lap joint of marker, matching adhesive plastic tape at each end of marker, or pretensioned snap-on. Except as otherwise indicated, provide lettering which indicates voltage of conductor(s) in conduit. Provide minimum 8" length for 2" and smaller conduit, 12" length for larger conduit. Install conduit identification at a minimum 25'-0" on center and a minimum one marker per room if the room is less than 25'-0" in length. Provide a minimum two (2) conduit markers per vertical drop; one above the walk-on ceiling and one below. When there is no walk-on ceiling provide one marker within 10'-0" of the termination point.

B. Paint conduits for emergency systems and low voltage systems in accord with 3.01 – K.1. Spacing of paint markings shall be 10'-0" on centers for entire length of conduit.

C. Paint conduits and boxes for the fire alarm system as specified in specification section 16721.

2.08 COLOR-CODE TAPE

A. Colored tape shall be polyvinyl chloride, self-adhesive not less than 3 mils thick and 1 1/2" wide, suitable for use on 90°C conductors, UL listed and shall be furnished in colors as specified herein.

PART 3 – EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

A. Major components of the distribution system, such as circuit breakers, switches, transformers, switchboards, panelboards, bus ducts, motor control centers, and other electrical equipment, shall have nameplates provided by the contractor identifying equipment as shown on the drawings, unless otherwise noted. Starters, disconnect switches, and control stations, shall have nameplates identifying the equipment served. Engraved nameplate shall include the item designation, voltage, phase, ampere rating of upstream feeder breaker or main circuit breaker, and upstream panel feeder as follows:

PANEL L42
100 AMPERE, 480/277 VOLT, 3 PHASE, 4 WIRE,
FED FROM PANEL D42-1,3,5

EF-1, 5 HP
20 AMPERE, 480/277 VOLT, 3 PHASE, 3 WIRE,
FED FROM PANEL D42-2,4,6

B. Conductors

1. Identify conductors #6 AWG and above with less than 600 volts in manholes and pull boxes by phase. Use colored tape bands within 4" of entry of conduit. Color coding shall be as specified elsewhere in these specifications.

C. Circuit Tagging and Identification

1. All power and control circuit cables shall be identified with the circuit and conductor identification nomenclature shown on the drawings in accordance with the following articles:

a. All normal end emergency feeders, mains, and special circuits shall be identified in all pull boxes, splice boxes, and panels in which they travel through or terminate.

b. All Process and Production area mains, feeders, branch circuits, and control wires/cables shall be identified in all pull boxes, splice boxes, and panels in which they travel through or terminate.

c. Each conductor of single or multi-conductor control or cables shall be labeled with two (2) separate wire markers. The first marker shall contain the designated equipment/terminal identification number of the nearest equipment to which the conductor terminates. The second marker shall contain the designated equipment/terminal identification number to which the opposite end of the conductor or cable is terminated.

D. Conductor Color Code

1. The color code for wire and cable used for feeders and branch circuits shall be in accordance with the requirements of Section 16120 of these specifications. Colored tape shall be provided as required to provide the specified color coding. Conductors above #10 AWG may be taped with proper colored tape to match color coding requirements, while conductors #10 AWG and below must have properly colored insulation.

E. Ground Fault Protected Devices

1. Devices protected by personnel ground fault interrupters shall be so identified. Receptacles, not otherwise identified by the manufacturer, shall have cover plates with the words, “Protected by GFI” and “Test Before Using” engraved thereon. If protected by a remote panel circuit breaker, cover plate shall, in addition, indicate the panel and circuit identifications.

F. Lighting and Receptacle Outlet Boxes and Junction Boxes

1. Boxes shall be identified with the panel and circuit designation.

G. Labeling of Light Switches

1. Labeling of light switches on back of device plate shall include circuit number, panel name.

H. Wall Switches and Receptacles

1. All receptacles shall be clearly labeled with panel and circuit number.

I. Emergency Equipment

1. Distribution equipment connected to emergency power shall be labeled with red identification tags/nameplates. Receptacles shall have red cover plates. Lighting fixtures shall include the designation “E” with standard labeling.

J. Terminal Blocks

1. Terminal blocks requiring identification numbers shall be numbered by the Contractor with designations shown on the wiring diagram using nameplates. Terminal block nameplates shall be installed at the top of vertically mounted terminal blocks and at the end of horizontally mounted terminal blocks. Terminal block marking strips shall be filled out by the Contractor using permanent ink and shall indicate the individual terminal point designations shown on the wiring diagrams.

K. Junction/Pull Boxes

1. All junction and pull boxes for emergency systems and low voltage systems shall have cover plates painted. Colors for covers shall be as indicated below:

System/Branch	Identification Color
Life Safety Branch	Yellow
Equipment Branch	Green
Fire Alarm System	Red
Data/Telephone System	Brown

3.02 OWNER'S DESIGNATIONS

A. Final identification markers shall be based on the drawings and any Owner requested designations listed on the drawings or herein specified.

B. Submit a list of all equipment identification labels as part of shop drawing submittals. Submitted list shall indicate drawing designations of equipment and proposed final identification labels, including Owner requested designations. Do not order identification markers prior to shop drawing approval.

C. Contractor's “as-built” drawings shall reflect actual final equipment identification labels, including Owner requested designations.

3.03 TEMPORARY IDENTIFICATION

A. All panelboards, distribution panels, wiring devices, etc. shall have temporary identification. All equipment shall have temporary identification in place prior to the equipment being energized.

B. Major components of the distribution system, such as circuit breakers, switches, transformers, switchboards, panelboards, bus ducts, motor control centers, and other electrical equipment, shall have nameplates identifying equipment as shown on the drawings, unless otherwise noted. Starters, disconnect switches, and control stations, shall have nameplates identifying the equipment served. Temporary nameplate shall be 2" wide blue painters tape with panel

labeling written in permanent black marker. Nameplate shall include the item designation, upstream panel feeder, and circuit number as follows:

PANEL L42
FED FROM PANEL D42 – CKT #

EF-1, 5 HP
FED FROM PANEL D42 – CKT #

C. Wall Switches and Receptacles

1. All receptacles shall be clearly temporarily labeled with panel and circuit number using Dymo labels.

****

END OF SECTION

THE LIVESTOCK INSTITUTE

WESTPORT, MA

PROJECT NO. 4730

Specification for

START-UP TESTING OF ELECTRICAL EQUIPMENT

Section 16198

THE DENNIS GROUP, LLC

PLANNING ▲ ENGINEERING ▲ CONSTRUCTION MANAGEMENT

1537 MAIN STREET
SPRINGFIELD, MASSACHUSETTS 01103
413.787.1785 ▲ FAX 413.787.1786

136 SOUTH MAIN STREET
SALT LAKE CITY, UTAH 84101
801.531.8585 ▲ FAX 810.531.8586

A	**09.20.2016**	**Review**	**MJJ**		
Issue	**Date**	**Description**	**By**	**Approved**	**Section 16198**

Unless notification and/or comments are received from client within two weeks after issue date, all documentation including drawings, specifications, and studies submitted to client shall be considered approved as released.

PART 1 – GENERAL

1.01 PROVISIONS INCLUDED

A. The General Documents, as listed on the Table of Contents and applicable parts of Division 1, General Requirements, and requirements of Section 16010, shall be included in and made part of this Section.

B. Examine all drawings and all other Section of the Specifications for requirements which affect work under this Section whether or not such work is specifically mentioned in this Section.

C. Coordinate work with that of all other Trades affecting or affected by work of this Section. Cooperate with such Trades to ensure the steady progress of all work under the Contract.

D. Provide all material, labor and equipment, to complete the work of this Section in strict accordance with the design Architect's and Engineer's plans and specifications, and with all applicable codes, rules, and standards.

1.02 SCOPE OF WORK

A. The Equipment Manufacturer (EM) shall not be required to engage the services of an independent testing firm for the purpose of performing inspections and tests as herein specified. The equipment manufacturers lead, on site, technical person shall be currently certified by the InterNational Electrical Testing Association (NETA) or the National Institute for Certification in Engineering Technologies (NICET) in electrical power distribution system testing. All other requirements of this document shall apply to the EM.

B. The Electrical Contractor shall engage the services of a recognized independent testing firm for the purpose of performing inspections and tests as herein specified.

C. The testing firm shall provide all material, equipment, labor, and technical supervision to perform such tests and inspections.

D. It is the purpose of these specifications to assure that all tested electrical equipment, both Electrical Subcontractor and Owner supplied, is operational and within industry and manufacturer's tolerances and is installed in accordance with design specifications.

E. The tests and inspections shall determine suitability for energizing.

F. The work under this Contract shall include all labor, materials, tools, equipment, transportation, insurance, temporary protection, supervision and incidental items essential for proper execution, even though not specifically mentioned or indicated on the drawings but which are usually provided or are essential for proper testing of all systems as specified herein.

G. The specifications describe the minimum requirements that must be met by the Contractor for the work as specified hereinunder.

1.03 QUALIFICATIONS OF TESTING FIRM

A. The testing firm shall be an independent testing organization which can function as an unbiased testing authority, professionally independent of the manufacturers, suppliers, and installers of equipment or systems evaluated by the testing firm.

B. The testing firm shall be regularly engaged in the testing of electrical equipment devices, installations, and systems.

C. The testing firm shall meet the criteria for Full Membership or be a Full Member company of the InterNational Electrical Testing Association.

D. The lead, on site, technical person shall be currently certified by the InterNational Electrical Testing Association (NETA) or the National Institute for Certification in Engineering Technologies (NICET) in electrical power distribution system testing.

E. The testing firm shall utilize technicians who are regularly employed by the firm for testing services.

F. The testing firm shall submit proof of the above qualifications with bid documents.

1.04 RELATED WORK SPECIFIED ELSEWHERE

A. The following referenced sections are listed as a minimum of additional requirements and/or work not included in this Section which may be required to be performed under other designated Sections:

1. Section 16120: Conductors
2. Section 16155: Motor Starters
3. Section 16472: Switchboards
4. Section 16471: Panelboards
5. Section 16450: Grounding
6. Section 16920: Motor Control Centers
7. Section 16460: Dry Type Transformers

1.05 GENERAL

A. The Contractor shall provide start-up, testing and inspection of the electrical equipment as specified in this Section.

B. The Contractor shall provide the equipment and required technical personnel to perform such tests and inspections.

C. When the tests and inspections have been completed, a label shall be attached to all devices tested. The label shall provide the name of the testing firm, the date the tests were completed, and the initials of the Technician who performed the tests.

D. The tests shall ensure that the equipment is operational and functioning within Industry Standards and manufacturer's tolerances.

1.06 REFERENCE STANDARDS

A. All inspections and field tests shall be in accordance with the latest edition of the following codes, standards, and specifications except as provided otherwise herein.

1. American National Standards Institute – ANSI.

2. Institute of Electrical and Electronic Engineers – IEEE.

3. ANSI/IEEE C2-1993, National Electrical Safety Code.

4. ANSI/IEEE C37, Guides and Standards for Circuit Breakers, Switchgear, Relays, Substations, and Fuses.

5. ANSI/IEEE C57, Distribution, Power, and Regulating Transformers.

6. ANSI/IEEE C62, Surge Protection.

7. ANSI/IEEE Std. 43-1974 (R1992). IEEE Recommended Practice for Testing Insulation Resistance of Rotating Machinery.

8. ANSI/IEEE Std. 81-1991. IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System.

9. ANSI/IEEE Std. 95-1977 (R1992). IEEE Recommended Practice for Insulation Testing of Large AC Rotating Machinery with High Direct Voltage.

10. ANSI/IEEE Std. 142-1991. IEEE Recommended Practice for Grounding of Industrial and Commercial Power Systems (IEEE Green Book.).

11. ANSI/IEEE Std. 241-1990. IEEE Recommended Practice for Electric Power Systems in Commercial Buildings (Gray Book).

12. ANSI/IEEE Std. 242-1986. IEEE Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems (Buff Book).

13. ANSI/IEEE Std. 399-1990. IEEE Recommended Practice for Power Systems Analysis (Brown Book).

14. ANSI/IEEE Std. 446-1987. IEEE Recommended Practice for Emergency and Standby Power Systems for Industrial and Commercial Applications (Orange Book).

15. ANSI/IEEE Std. 493-1990. IEEE Recommended Practice for the Design of Reliable Industrial and Commercial Power Systems (Gold Book).

16. ANSI/IEEE Std. 739-1984. IEEE Recommended Practice for Energy Conservation and Cost-Effective Planning in Industrial Facilities (Orange Book).

17. ANSI/IEEE Std 1100-1992. IEEE Recommended Practice for Powering and Grounding Sensitive Electronic Equipment (Emerald Book).

18. Insulated Cable Engineers Association – ICEA.

19. InterNational Electrical Testing Association – NETA.

    a. NETA Maintenance Testing Specifications for Electrical Power Distribution Equipment and Systems.

20. National Electrical Manufacturer's Association – NEMA.

    a. NEMA Standard for Publication No. AB4-1991: Guidelines for Inspection and Preventive Maintenance of Molded-Case Circuit Breakers Used in Commercial and Industrial Applications.

b. NEMA Publication MG1: Motors and Generators.

21. National Fire Protection Association – NFPA.

a. ANSI/NFPA 70-1993: National Electrical Code.

b. ANSI/NFPA 70B-1994: Recommended Practice for Electric Equipment Maintenance.

c. ANSI/NFPA 70E-1995: Electrical Safety Requirements for Employee Workplaces.

d. ANSI/NFPA 99-1993: Standard for Healthcare Facilities.

e. ANSI/NFPA 101-1991: Life Safety Code.

f. ANSI/NFPA 110-1993: Emergency and Standby Power Systems.

g. ANSI/NFPA 780-1992: Lightning Protection Code.

22. Occupational Safety and Health Administration – OSHA.

23. State and local codes and ordinances.

24. Underwriters' Laboratory – UL.

B. The inspection and testing shall comply with the project plans and specifications as well as with the manufacturer's drawings, instruction manuals, and other applicable data for the apparatus tested.

1.07 DIVISION OF RESPONSIBILITIES

A. The equipment manufacturer shall perform all test indicated as by the Equipment Manufacturer (EM).

B. The Electrical Subcontractor shall perform all test indicated as by the Electrical Contractor (EC).

C. The Electrical Subcontractor shall perform routine insulation-resistance, continuity, and rotation tests for all distribution and utilization equipment prior to, and in addition to, tests performed by the testing firm specified herein.

D. The Electrical Subcontractor shall supply a suitable and stable source of electrical power to each test site. The testing firm shall specify the specific power requirements.

E. The Electrical Subcontractor shall notify the testing firm when equipment becomes available for acceptance tests. Work shall be coordinated to expedite project scheduling.

F. The Electrical Subcontractor shall supply a short-circuit analysis and coordination study, a protective device setting sheet, a complete set of electrical plans, specifications, and any pertinent change orders to the testing firm prior to commencement of testing.

G. The Engineer shall be notified prior to commencement of any testing.

H. Any system, material, or workmanship which is found defective on the basis of acceptance tests shall be reported.

I. The testing firm shall maintain a written record of all tests and shall assemble and certify a final test report.

J. Safety and Precautions

1. Safety practices should include, but are not limited to, the following requirements:

a. Occupational Safety and Health Act.

b. Accident Prevention Manual for Industrial Operations, National Safety Council.

c. Applicable state and local safety operating procedures.

d. Owner's safety practices.

e. ANSI/NFPA 70E, Electrical Safety Requirements for Employee Workplaces.

f. American National Standards for Personnel Protection: Lockout/Tagout.

2. All tests shall be performed with apparatus de-energized except where otherwise specifically required.

3. The testing organization shall have a designated safety representative on the project to supervise operations with respect to safety.

1.08 IMPLEMENTATION

A. Safety practices shall comply with applicable State and Local Safety Orders as well as with the OSHA 1970. Compliance with the NFPA 70E and the Accident Prevention Manual for Industrial Operations of the National Safety Council shall be observed.

B. Tests shall only be performed on apparatus which is de-energized. Work shall not proceed until the testing entity has determined that it is safe to do so.

C. Power circuits shall have conductors shorted to ground by a hotline grounded device approved for the purpose. Warning signs and protective barriers shall be provided as necessary to conduct the tests safely.

1.09 TEST EQUIPMENT

A. Suitability of Test Equipment

1. All test equipment shall be in good mechanical and electrical condition.

a. Split-core current transformers and clamp-on or tong-type ammeters require careful consideration of the following in regard to accuracy:

1) Position of the conductor within the core.

2) Clean, tight fit of the core pole faces.

3) Presence of external fields.

4) Accuracy of the current transformer ratio in addition to the accuracy of the secondary meter.

b. Selection of metering equipment should be based on a knowledge of the waveform of the variable being measured. Digital multimeters may be average or RMS sensing and may include or exclude the dc component. When the variable contains harmonics or dc offset and, in general, any deviation from a pure sine wave, average sensing, RMS scaled meters may be misleading.

c. Field test metering used to check power system meter calibration must have an accuracy higher than that of the instrument being checked.

d. Accuracy of metering in test equipment shall be appropriate for the test being performed but not in excess of two percent of the scale used.

e. Waveshape and frequency of test equipment output waveforms shall be appropriate for the test and tested equipment.

2. Test Instrument Calibration

a. The testing firm shall have a calibration program which assures that all applicable test instruments are maintained within rated accuracy.

b. The accuracy shall be directly traceable to the National Institute of Standards and Technology (NIST).

c. Instruments shall be calibrated in accordance with the following frequency schedule:

1) Field instruments: Analog, 6 months maximum; Digital, 12 months maximum.

2) Laboratory instruments: 12 months.

3) Leased specialty equipment: 12 months where accuracy is guaranteed by leaser.

d. Dated calibration labels shall be visible on all test equipment.

e. Records, which show date and results of instruments calibrated or tested, must be kept up-to-date.

f. Up-to-date instrument calibration instructions and procedures shall be maintained for each test instrument.

g. Calibrating standard shall be of higher accuracy than that of the instrument tested.

1.10 REPORTS

A. The test report shall include the following sections:

1. Scope of Testing

2. Equipment Tested

3. Description of Test

4. Test Results

5. Conclusions and Recommendations

6. Appendix (including Test Forms)

B. Each piece of equipment shall be recorded on a data sheet listing the condition of the equipment as found and as left. Included shall be recommendations for any necessary repair and/or replacement parts. The data sheets shall indicate the name of the Technician who tested the equipment and the date of the test completion.

C. Record copies of the completed test report shall be submitted no more than 30 days after completion of the testing and inspection.

1.11 EQUIPMENT TO BE TESTED

A. The following equipment shall be tested in accordance with the scopes of work which follow:

1. Switchgear and Switchboard Assemblies
2. Dry Type Transformers
3. Cables – 600 Volt and below
4. Insulated Case/Molded Case Circuit Breakers
5. Grounding Systems
6. Ground Fault Systems
7. AC Motors
8. Motor Control Centers – Low Voltage
9. Low Voltage Surge Protection Devices
10. Engine Generators
11. Automatic Transfer Switches
12. Thermography

1.12 GUARANTEE

A. In addition to the specific guarantee requirements of the General Conditions, the Contractor shall obtain, in the Owner's name, the standard written manufacturer's guarantee of all materials furnished under this Section where such guarantees are offered in the manufacturer's published product data. All these guarantees shall be in addition to, and not in lieu of, other liabilities which the Contractor may have by law or other provisions of the Contract Documents.

PART 2 – PRODUCTS – NOT USED

PART 3 – EXECUTION

3.01 TEST PROCEDURES

A Switchgear and Switchboard Assemblies

1. Visual and Mechanical Inspection

   a. Compare equipment nameplate data with drawings and specifications.

   b. Inspect physical, electrical, and mechanical condition.

   c. Confirm correct application of manufacturer's recommended lubricants.

   d. Verify appropriate anchorage, required area clearances, physical damage, and correct alignment.

   e. Inspect all doors, panels, and sections for paint, dents, scratches, fit, and missing hardware.

   f. Verify that fuse and/or circuit breaker sizes and types correspond to drawings and coordination study as well as to the circuit breaker's address for microprocessor-communication packages.

   g. Verify that current and potential transformer ratios correspond to drawings.

   h. Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data.

   i. **Perform thermographic survey as indicated elsewhere in these specifications.**

   j. Confirm correct operation and sequencing of electrical and mechanical interlock systems.

      1) Attempt closure on locked-open devices. Attempt to open locked-closed devices.

      2) Make key exchange with devices operated in off-normal positions.

   k. Clean switchgear.

   l. Inspect insulators for evidence of physical damage or contaminated surfaces.

   m. Verify correct barrier and shutter installation and operation.

   n. Exercise all active components.

   o. Inspect all mechanical indicating devices for correct operation.

   p. Verify that filters are in place and/or vents are clear.

   q. Test operation, alignment, and penetration of instrument transformer withdrawal disconnects, current-carrying and grounding, as indicated elsewhere in these specifications.

r. Inspect control power transformers.

1) Inspect physical damage, cracked insulation, broken leads, tightness of connections, defective wiring, and overall general condition.

2) Verify that primary and secondary fuse ratings or circuit breakers match drawings.

3) Verify correct functioning of drawout disconnecting and grounding contacts and interlocks.

2. Electrical Tests

a. Perform tests on all instrument transformers as indicated elsewhere in these specifications.

b. Perform ground resistance tests as indicated elsewhere in these specifications.

c. Perform resistance tests through all bus joints with a low-resistance ohmmeter. Any joints that cannot be directly measured due to permanently installed insulation wrap shall be indirectly measured from closest accessible connection.

d. Perform insulation-resistance tests on each bus section, phase-to-phase and phase-to-ground.

e. After insulation resistance test levels are above minimum published values, perform an overpotential test on each bus section, each phase to ground with phases not under test grounded, in accordance with manufacturer's published data. The test voltage shall be applied for one minute.

f. Perform insulation-resistance tests at 1000 volts dc on all control wiring. Do not perform this test on wiring connected to solid-state components.

g. Perform control wiring performance test in accordance with System Function Tests indicated elsewhere in these specifications.

h. Perform current injection tests on the entire current circuit in each section of switchgear.

1) Perform current tests by primary injection, where possible, with magnitudes such that a minimum of 1.0 ampere flows in the secondary circuit.

2) Where primary injection is impractical, utilize secondary injection with a minimum current of 1.0 ampere.

3) Test current at each device.

i. Determine accuracy of all meters and calibrate watt-hour meters in accordance with the metering section of these specifications. Verify multipliers.

j. Perform phasing check on double-ended switchgear to insure correct bus phasing from each source.

k. Perform the following tests on control power transformers.

1) Perform insulation-resistance tests. Perform measurements from winding-to-winding and each winding-to-ground. Test voltages shall be in accordance with manufacturers published data.

2) Perform secondary wiring integrity test. Disconnect transformer at secondary terminals and connect secondary wiring to correct secondary voltage. Confirm potential at all devices.

3) Verify correct secondary voltage by energizing primary winding with system voltage. Measure secondary voltage with the secondary wiring disconnected.

4) Verify correct function of control transfer relays located in switchgear with multiple power sources in following energized source for control power transformers.

l. Potential Transformer Circuits

1) Perform secondary wiring integrity test. Disconnect transformer at secondary terminals and connect secondary wiring to correct secondary voltage. Confirm correct potential at all devices.

2) Verify secondary voltage by energizing primary winding with system voltage. Measure secondary voltage with the secondary wiring disconnected.

m. Verify operation of switchgear/switchboard heaters.

3. Test Values

a. Bolt-torque levels shall be in accordance with manufacturers published data.

b. Compare bus connection resistances to values of similar connections.

c. Insulation-resistance values for bus, control wiring, and control power transformers shall be in accordance with manufacturer's published data. Values of insulation resistance less than manufacturer's minimum should be investigated. Overpotential tests should not proceed until insulation-resistance levels are raised above minimum values.

d. Apply overpotential test voltages in accordance with manufacturer's recommendations. The insulation shall withstand the overpotential test voltage applied.

B Dry Type Transformers

1. Air-Cooled, 600 Volt and Below – Small (167 kVA Single-Phase, 500 KVA Three-Phase, and Smaller)

a. Compare equipment nameplate data with drawings and specifications.

b. Inspect physical and mechanical condition.

c. Verify that resilient mounts are free and that any shipping brackets have been removed.

d. Perform insulation-resistance test. Calculate polarization index. Measurements shall be made from winding-to-winding and each winding-to-ground. Test voltages and minimum resistance shall be in accordance with manufacturers published data. Results shall be temperature corrected as applicable.

e. Verify that winding turns-ratio measurements and polarities are in accordance with nameplate.

f. Verify that as-left tap connections are as specified.

C Cables – 600 Volt, Maximum

1. Visual and Mechanical Inspection

a. Compare cable data with drawings and specifications.

b. Inspect exposed sections of cables for physical damage and correct connection in accordance with single-line diagram.

c. Verify tightness of accessible bolted connections by calibrated torque wrench in accordance with manufacturer's published data.

d. **Perform thermographic survey as indicated elsewhere in these specifications.**

e. Inspect compression-applied connectors for correct cable match and indention.

f. Verify cable color coding with applicable engineer's specifications and National Electrical Code standards.

2. Electrical Tests

a. Perform insulation-resistance test on each conductor with respect to ground and adjacent conductors. Applied potential to be 1000 volts dc for one minute.

b. Perform continuity test to insure correct cable connection.

c. All feeder conductors shall be tested in the presence of an Owner/Architect selected representative.

d. 20% of all branch circuits shall be tested in the presence of an Owner/Architect selected representative. The wiring tested shall be randomly selected by the Owner/Architect selected representative.

3. Test Values

a. Bolt-torque levels shall be as specified by the manufacturer.

b. Minimum insulation-resistance values shall be not less than 50 megohms.

c. Investigate deviations between adjacent phases.

D Insulated Case/Molded Case Circuit Breakers

1. Visual and Mechanical Inspection

a. Compare nameplate data with drawings and specifications.

b. Inspect circuit breaker for correct mounting.

c. Operate circuit breaker to insure smooth operation.

d. Inspect case for cracks or other defects.

e. Verify tightness of accessible bolted connections and/or cable connections by calibrated torque-wrench method in accordance with manufacturer's published data.

f. **Perform thermographic survey as indicated elsewhere in these specifications.**

g. Inspect mechanism contacts and arc chutes in unsealed units.

2. Electrical Tests

a. Perform a contact-resistance test.

b. Perform an insulation-resistance test at 1000 volts dc from pole-to-pole and from each pole-to-ground with breaker closed and across open contacts of each phase.

c. **Perform insulation resistance test at 1000 volts dc on all control wiring. Do not perform the test on wiring connected to solid state components.**

d. Perform adjustments for final settings in accordance with coordination study supplied by EC or EM.

e. **Perform long-time delay time-current characteristic tests by passing 300 percent rated current through each pole separately unless series testing is required to defeat ground fault functions.**

f. **Determine short-time pickup and delay by primary current injection.**

g. **Determine ground-fault pickup and time delay by primary current injection.**

h. **Determine instantaneous pickup current by primary injection using run-up or pulse method.**

i. Test and verify the calibration of the following functions of the circuit breaker trip unit by means of the equipment manufacturer's standard circuit breaker test kit:

1) Long-time pickup and delay.

2) Short-time pickup and delay.

3) Instantaneous pickup

4) Ground fault pickup and delay.

j. Verify correct operation of any auxiliary features such as trip and pickup indicators, zone interlocking, electrical close and trip operation, trip-free, and anti-pump function.

3. Test Values

a. Bolt-torque levels shall be in accordance with manufacturers published data.

b. Compare microhm or millivolt drop values to adjacent poles and similar breakers. Investigate deviations of more than 25 percent. Investigate any value exceeding manufacturer's recommendations.

c. Insulation resistance shall not be less than 100 megohms.

d. Trip characteristic of breakers shall fall within manufacturer's published time-current characteristic tolerance band, including adjustment factors.

e. For molded-case circuit breakers all trip times shall fall within times indicated in Table 5-3 of NEMA Standard AB4-1991. Circuit breakers exceeding specified trip time at 300 percent of pickup shall be tagged defective.

f. For molded-case circuit breakers instantaneous pickup values shall be within values shown on Table 5-4 of NEMA Standard AB4-1991.

E Grounding Systems

1. Visual and Mechanical Inspection

a. Verify ground system is in compliance with drawings and specifications.

2. Electrical Tests

a. Perform fall-of-potential test or alternative in accordance with IEEE Standard 81-1991 on the main grounding electrode or system.

b. Perform point-to-point tests to determine the resistance between the main grounding system and all major electrical equipment frames, system neutral, and/or derived neutral points.

3. Test Values

a. The resistance between the main grounding electrode and ground should be no greater than five ohms for commercial or industrial systems and one ohm or less for generating or transmission station grounds unless otherwise specified by the owner. (Reference: IEEE Standard 142.)

b. Investigate point-to-point resistance values which exceed 0.5 ohm.

F Ground-Fault Protection Systems

1. Visual and Mechanical Inspection

a. Compare equipment nameplate data with drawings and specifications.

b. Visually inspect the components for damage and errors in polarity or conductor routing.

1) Verify that ground connection is made ahead of neutral disconnect link and on the line side of any ground fault sensor.

2) Verify that neutral sensors are connected with correct polarity on both primary and secondary.

3) Verify that all phase conductors and the neutral pass through the sensor in the same direction for zero sequence systems.

4) Verify that grounding conductors do not pass through zero sequence sensors.

5) Verify that the grounded conductor is solidly grounded.

c. Verify tightness of all electrical connections including control circuits.

d. Verify correct operation of all functions of the self-test panel.

e. Verify that the control power transformer has adequate capacity for the system.

f. Set pickup and time-delay settings in accordance with the settings provided in the short circuit study. Record appropriate operation and test sequences as required by NEC Article 230-95.

2. Electrical Tests

a. Measure the system neutral-to-ground insulation resistance with the neutral disconnect link temporarily removed. Replace neutral disconnect link after testing.

b. **Measure insulation resistance of the control wiring at 1000 volts dc for one minute. Refer to manufacturer's instructions for devices with solid state components.**

c. Perform the following pickup tests using secondary injection or use of manufacturers test kit:

1) Verify that the relay does not operate at 90 percent of the pickup setting.

2) Verify pickup is less than 125 percent of setting.

d. For summation type systems utilizing phase and neutral current transformers, verify correct polarities by applying current to each phase-neutral current transformer pair. This test also applies to molded-case breakers utilizing an external neutral current transformer.

1) Relay should operate when current direction is the same relative to polarity marks in the two current transformers.

2) Relay should not operate when current direction is opposite relative to polarity marks in the two current transformers.

e. Measure time delay of the relay at 150 percent or greater of pickup.

f. Verify reduced control voltage tripping capability: 55 percent for ac systems and 80 percent for dc systems.

3. Test Values

a. System neutral-to-ground insulation shall be a minimum of one megohm.

b. Insulation resistance values shall be in accordance with manufacturers published data.

c. Relay timing shall be in accordance with manufacturer's specifications but must be no longer than one second at 3000 amperes.

G AC Motors

1. Visual and Mechanical Inspection

a. Compare equipment nameplate data with drawings and specifications.

b. Inspect physical and mechanical condition.

c. Inspect for correct grounding, and connection.

d. Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data.

e. **Perform thermographic survey as indicated elsewhere in these specifications.**

f. When applicable, perform special tests such as air gap spacing and pedestal alignment.

g. Verify the absence of unusual mechanical or electrical noise or signs of overheating during initial test run.

2. Electrical Tests – Induction Motors

a. Perform insulation-resistance tests in accordance with ANSI/IEEE Standard 43.

b. For motors larger than 200 horsepower, Test duration shall be for ten minutes. Calculate polarization index.

c. For motors 200 horsepower and less, Test duration shall be for one minute. Calculate the dielectric-absorption ratio.

d. Perform dc overpotential tests on motors rated at 1,000 horsepower and greater and at 4,000 volts and greater in accordance with ANSI/IEEE Standard 95.

e. **Perform insulation power-factor or dissipation-factor tests.**

f. **Perform surge comparison tests.**

g. Perform insulation-resistance test on pedestal in accordance with manufacturer's published data.

h. Test surge protection devices as indicated elsewhere in these specifications.

i. Test motor starter as indicated elsewhere in these specifications.

j. Verify that resistance temperature detector (RTD) circuits conform to drawings. Verify that metering or relaying devices using the RTDs have the correct rating.

k. Verify that the motor space heater is functional.

l. Perform a rotation test to insure correct shaft direction.

m. Measure running current and evaluate relative to load conditions and nameplate full-load amperes.

3. Test Values

a. Bolt-torque levels shall be in accordance with manufacturers published data.

b. Insulation-resistance test results should comply with values listed NETA standards. Investigate dielectric absorption ratios less than 1.4 and polarization index ratios less than 2.0 for Class B and Class F insulation.

c. NOTE: Overpotential, high-potential, and surge comparison tests shall not be made on motors having values lower than those indicated above.

d. Stator winding dc overpotential test voltage shall be in accordance with NEMA publication MG 1, paragraph 3.01. Test results are dependent on ambient conditions, and evaluation is on a withstand basis. If phase windings can be separately tested, values of leakage current may be compared for similar windings.

e. Vibration amplitudes shall not exceed values shown in MG 1-1987.

f. Salient pole voltage drop should be equal for each pole. Investigate values that differ by more than ten percent.

g. The measured resistance values of motor-field winding, exciter-stator winding, exciter-rotor windings, and field-discharge resistors shall be compared to manufacturer's recommended values.

H Motor Control Centers and Stand-Alone Motor Starters – Low Voltage

1. Motor Starters

a. Visual and Mechanical Inspection

1) Compare equipment nameplate data with drawings and specifications.

2) Inspect physical and mechanical condition.

3) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data.

4) **Perform thermographic survey as indicated elsewhere in these specifications.**

b. Motor-Running Protection

1) Adjust electronic motor circuit protector based on manufacturer's written procedures and motor name plate data.

2) Compare overload element rating with motor full-load current rating to verify correct sizing.

3) If power-factor correction capacitors are connected on the load side of the overload protection, include the effect of the capacitive reactance in determining appropriate overload element size.

4) If motor-running protection is provided by fuses, verify correct rating considering motor characteristics and power-factor correction capacitors, if applicable.

c. Electrical Tests

1) Insulation Tests

a) Measure insulation resistance of each combination starter, phase-to-phase and phase-to-ground, with the starter contacts closed and the protective device open. Test voltage shall be in accordance with manufacturers published data. Refer to manufacturer's instructions for devices with solid-state components.

2) Test the motor overload relay elements by injecting primary current through the overload circuit and monitoring trip time of the overload element.

3) NOTE: Test times for thermal trip units will, in general, be longer than manufacturer's curve if single-pole testing is performed. Optionally test with all poles in series for time test and each pole separately for comparison. (Refer to NEMA ICS 2-1993, Part 4.)

4) Test circuit breakers as indicated elsewhere in these specifications.

5) Perform operational tests by initiating control devices.

d. Test Values

1) Bolt-torque levels shall be in accordance with manufacturers published data.

2) Insulation-resistance values shall be in accordance with NETA standards.

3) Control wiring insulation test voltage shall be 1,000 volts dc. Manufacturer shall be consulted for test voltage where solid-state control devices are utilized.

4) Overload trip times shall be in accordance with manufacturer's published data.

2. Motor Control Center Assembly.

a. Visual and Mechanical Inspection

1) Compare equipment nameplate data with drawings and specifications.

2) Inspect physical, electrical, and mechanical condition.

3) Confirm correct application of manufacturer's recommended lubricants.

4) Verify appropriate anchorage, required area clearances, physical damage, and correct alignment.

5) Inspect all doors, panels, and sections for paint, dents, scratches, fit, and missing hardware.

6) Verify that fuse and/or circuit breaker sizes and types correspond to drawings and coordination study as well as to the circuit breaker's address for microprocessor-communication packages.

7) Verify that current and potential transformer ratios correspond to drawings.

8) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data.

9) **Perform thermographic survey as indicated elsewhere in these specifications.**

10) Confirm correct operation and sequencing of electrical and mechanical interlock systems.

a) Attempt closure on locked-open devices. Attempt to open locked-closed devices.

b) Make key exchange with devices operated in off-normal positions.

11) Clean MCC.

12) Inspect insulators for evidence of physical damage or contaminated surfaces.

13) Verify correct barrier and shutter installation and operation.

14) Exercise all active components.

15) Inspect all mechanical indicating devices for correct operation.

16) Verify that filters are in place and/or vents are clear.

17) Test operation, alignment, and penetration of instrument transformer withdrawal disconnects, current-carrying and grounding, as indicated elsewhere in these specifications.

18) Inspect control power transformers.

a) Inspect physical damage, cracked insulation, broken leads, tightness of connections, defective wiring, and overall general condition.

b) Verify that primary and secondary fuse ratings or circuit breakers match drawings.

c) Verify correct functioning of drawout disconnecting and grounding contacts and interlocks.

b. Electrical Tests

1) Perform tests on all instrument transformers as indicated elsewhere in these specifications.

2) Perform ground-resistance tests.

3) Perform resistance tests through all bus joints with a low-resistance ohmmeter. Any joints that cannot be directly measured due to permanently installed insulation wrap shall be indirectly measured from closest accessible connection.

4) Perform insulation-resistance tests on each bus section, phase-to-phase and phase-to-ground.

5) After insulation resistance test levels are above minimum values recommended by NETA, perform an overpotential test on each bus section, each phase to ground with phases not under test grounded, in accordance with manufacturer's published data. The test voltage shall be applied for one minute.

6) Perform insulation-resistance tests at 1000 volts dc on all control wiring. Do not perform this test on wiring connected to solid-state components.

7) Perform control wiring performance test.

8) Perform current injection tests on the entire current circuit in each section of switchgear.

a) Perform current tests by primary injection, where possible, with magnitudes such that a minimum of 1.0 ampere flows in the secondary circuit.

b) Where primary injection is impractical, utilize secondary injection with a minimum current of 1.0 ampere.

c) Test current at each device.

9) Determine accuracy of all meters and calibrate watt-hour meters as indicated elsewhere in these specifications. Verify multipliers.

10) Perform phasing check on double-ended switchgear to insure correct bus phasing from each source.

11) Perform the following tests on control power transformers.

a) Perform insulation-resistance tests. Perform measurements from winding-to-winding and each winding-to-ground. Test voltages shall be in accordance with manufacturers published data.

b) Perform secondary wiring integrity test. Disconnect transformer at secondary terminals and connect secondary wiring to correct secondary voltage. Confirm potential at all devices.

c) Verify correct secondary voltage by energizing primary winding with system voltage. Measure secondary voltage with the secondary wiring disconnected.

d) Verify correct function of control transfer relays located in switchgear with multiple power sources in following energized source for control power transformers.

12) Potential Transformer Circuits

a) Perform secondary wiring integrity test. Disconnect transformer at secondary terminals and connect secondary wiring to correct secondary voltage. Confirm correct potential at all devices.

b) Verify secondary voltage by energizing primary winding with system voltage. Measure secondary voltage with the secondary wiring disconnected.

13) Verify operation of heaters.

c. Test Values

1) Bolt-torque levels shall be in accordance with manufacturers published data.

2) Compare bus connection resistances to values of similar connections.

3) Insulation-resistance values for bus, control wiring, and control power transformers shall be in accordance with manufacturer's published data. Values of insulation resistance less than manufacturer's minimum should be investigated. Overpotential tests should not proceed until insulation-resistance levels are raised above minimum values.

4) Apply overpotential test voltages in accordance with manufacturer's recommendations. The insulation shall withstand the overpotential test voltage applied.

I Low Voltage Surge Protection Devices

1. Visual and Mechanical Inspection

   a. Compare equipment nameplate data with drawings and specifications.

   b. Inspect physical and mechanical condition.

   c. Inspect for correct mounting and adequate clearances.

   d. Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data.

   e. **Perform thermographic survey as indicated elsewhere in these specifications.**

   f. Verify that the ground lead on each device is individually attached to a ground bus or ground electrode.

2. Electrical Tests

   a. Perform insulation-resistance tests. Use manufacturer's recommended values.

3. Test Values

   a. Bolt-torque levels shall be in accordance with manufacturers published data.

   b. Insulation-resistance values shall be in accordance with NETA standards.

J Engine Generator

1. Visual and Mechanical Inspection

   a. Compare bus arrangement with drawings and specifications.

   b. Inspect physical and mechanical condition.

   c. Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data.

   d. **Perform thermographic survey as indicated elsewhere in these specifications.**

2. Electrical Tests

   a. **Measure insulation resistance of each bus, phase-to-ground with other phases grounded.**

   b. Perform overpotential test on each bus phase, phase-to-ground with other phases grounded. Potential application shall be for one minute.

   c. Measure resistance of bus section joints with low-resistance ohmmeter.

3. Test Values

a. Bolt-torque levels shall be in accordance with manufacturer's published data.

b. Insulation-resistance tests shall be in accordance with NETA standards.

c. Compare measured bus connector joint resistance to an equal length of bus and to similar connections.

d. Overpotential test voltage shall be in accordance with manufacturer's published data. The insulation shall withstand the overpotential test voltage applied.

K Automatic Transfer Switches

1. Visual and Mechanical Inspection

a. Compare equipment nameplate data with drawings and specifications.

b. Inspect physical and mechanical condition.

c. Confirm correct application of manufacturer's recommended lubricants.

d. Verify that manual transfer warnings are attached and visible.

e. Verify tightness of all control connections.

f. Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data.

g. **Perform thermographic survey as indicated elsewhere in these specifications.**

h. Perform manual transfer operation.

i. Verify positive mechanical interlocking between normal and alternate sources.

2. Electrical Tests

a. Measure contact-resistance.

b. Perform insulation-resistance tests, phase-to-phase and phase-to-ground, with switch in both source positions.

c. Verify settings and operation of control devices.

d. Calibrate and set all relays and timers as indicated elsewhere in these specifications.

e. Perform automatic transfer tests:

1) Simulate loss of normal power.

2) Return to normal power.

3) Simulate loss of emergency power.

4) Simulate all forms of single-phase conditions.

f. Verify correct operation and timing of the following functions:

1) Normal source voltage-sensing relays.

2) Engine start sequence.

3) Time delay upon transfer.

4) Alternate source voltage-sensing relays.

5) Automatic transfer operation.

6) Interlocks and limit switch function.

7) Time delay and retransfer upon normal power restoration.

8) Engine cooldown and shutdown feature.

g. Test Values

1) Bolt-torque levels shall be in accordance with manufacturers published data.

2) Insulation-resistance test voltages and minimum values shall be in accordance with NETA standards.

3) Compare microhm values to adjacent poles and similar switches. Investigate deviations of more than 25 percent.

L System Function Tests

1. General

a. Perform system function tests upon completion of equipment tests as defined here-in. It is the purpose of system function tests to prove the correct interaction of all sensing, processing, and action devices.

b. Implementation

1) Develop test parameters for the purpose of evaluating performance of all integral components and their functioning as a complete unit within design requirements. Perform these tests.

2) Verify the correct operation of all interlock safety devices for fail-safe functions in addition to design function.

3) Verify the correct operation of all sensing devices, alarms, and indicating devices.

M Thermographic Survey

1. Visual and Mechanical Inspection

a. Inspect physical, electrical, and mechanical condition.

b. Remove all necessary covers prior to thermographic inspection.

2. Equipment to be inspected shall include all current-carrying devices.

3. Provide report including the following:

a. Discrepancies.

b. Temperature difference between the area of concern and the reference area.

c. Cause of temperature difference.

d. Areas inspected. Identify inaccessible and/or unobservable areas and/or equipment.

e. Identify load conditions at time of inspection.

f. Provide photographs and/or thermograms of the deficient area.

4. Test Parameters

a. Inspect distribution systems with imaging equipment capable of detecting a minimum temperature difference of 1°C at 30°C.

b. Equipment shall detect emitted radiation and convert detected radiation to visual signal.

c. Thermographic surveys should be performed during periods of maximum possible loading but not less than 40 percent of rated load of the electrical equipment being inspected. Refer to NFPA 70B-1994, Section 18-16 (Infrared Inspection).

5. Test Results

a. Temperature differences of 1°C to 3°C indicate possible deficiency and warrant investigation.

b. Temperature differences of 4°C to 15°C indicate deficiency; repair as time permits.

c. Temperature differences of 16°C and above indicate major deficiency; repair immediately.

3.02 FINAL INSPECTION

A. When all Electrical work on the project has been completed and is ready for final inspection, such an inspection shall be made. At this time, and in addition to all other requirements in the Contract Documents, the Electrical Subcontractor, for the work under this Contract, shall demonstrate that the requirements of these specifications have been met to the Architect's satisfaction.

****

END OF SECTION

DIVISION 16 ELECTRICAL
SECTION 16200 ENGINE GENERATOR

PART 1 GENERAL

1.1 SUMMARY

A This section includes the following items from a single supplier:
1. Engine Generator Set.
2. Enclosure
3. Related Accessories as specified

B Related Requirements
1. It is the intent of this specification to secure an engine-driven generator set that has been prototype tested, factory built, production-tested, and site-tested together with all accessories necessary for a complete installation as shown on the plans and drawings and specified herein.
2. Any exceptions to the published specifications shall be subject to the approval of the engineer and submitted minimum 10 days prior to the closing of the bid with a line by line summary description of all the items of compliance, any items that have been are omitted or have been taken exception to, and a complete description of all deviations.
3. It is the intent of this specification to secure a generator set system that has been tested during design verification, in production, and at the final job site. The generator set will be a commercial design and will be complete with all of the necessary accessories for complete installation as shown on the plans, drawings, and specifications herein. The equipment supplied shall meet the requirements of the National Electrical Code and applicable local codes and regulations.
4. All equipment shall be new and of current production by an international, power system manufacturer of generators, transfer switches, and paralleling switchgear. The manufacturer shall be a supplier of a complete and coordinated system. There will be single-source responsibility for warranty, parts, and service through a factory-authorized representative with factory-trained technicians.

1.2 SUBMITTALS

A Action Submittals
1. Product Data
   a The submittal shall include prototype test certification and specification sheets showing all standard and optional accessories to be supplied; schematic wiring diagrams, dimension drawings, and interconnection diagrams identifying by terminal number each required interconnection between the generator set, the transfer switch, and the remote annunciator panel if it is included elsewhere in these specifications.
2. Shop Drawings
3. Samples

B Informational Submittal
1. Certificates
   a The generator set shall be listed to UL 2200 or submitted to an independent third party certification process to verify compliance as installed.
2. Test and Evaluation Reports
3. Manufacturer's Instruction
4. Source Quality Control Submittals

5. Field or Site Quality Control

6. Manufacturer's Report
7. Special Procedure Submittal
8. Qualification Statement

C Closeout Submittal
1. Maintenance Contracts
2. Operation And Maintenance Data
3. Bonds
4. Warranty Documentation
5. Record Documentation
6. Software

D Maintenance Material Submittals
1. Provide two (2) paper copies and one electronic copy of the following documents and manuals for the engine, the alternator, and the generator set:
   a) Operation Manuals
   b) Parts Catalogs
   c) Service Manuals
   d) Installation Manuals
   e) Wiring Diagrams
   f) NFPA-110 Startup and Test Procedure.

1.3 Quality Assurance

A Regulatory Agency
1. The generator set shall conform to the requirements of the following codes and standards:
   a CSA C22.2, No. 14-M91 Industrial Control Equipment.
   b EN50082-2, Electromagnetic Compatibility-Generic Immunity Requirements, Part 2: Industrial.
   c EN55011, Limits and Methods of Measurement of Radio Interference Characteristics of Industrial, Scientific and Medical Equipment.
   d IEC8528 part 4, Control Systems for Generator Sets.
   e IEC Std 61000-2 and 61000-3 for susceptibility, 61000-6 radiated and conducted electromagnetic emissions.
   f IEEE446 Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications.
   g NFPA 70, National Electrical Code, Equipment shall be suitable for use in systems in compliance to Article 700, 701, and 702.
   h NFPA 99, Essential Electrical Systems for Health Care Facilities.
   i NFPA 110, Emergency and Standby Power Systems. The generator set shall meet all requirements for Level 1 systems. Level 1 prototype tests required by this standard shall have been performed on a complete and functional unit. Component level type tests will not substitute for this requirement.
2. Qualifications
   a The equipment shall be produced by a manufacturer who is ISO 9001 certified for the design, development, production and service of its complete product line.

b The power system shall be produced by a manufacturer who has produced this type of equipment for a period of at least 10 years and who maintains a service organization available twenty-four hours a day throughout the year.

3. Manufacturers

a The power system shall be furnished by a single manufacturer who shall be responsible for the design, coordination, and testing of the complete system. The entire system shall be installed as shown on the plans, drawings, and specifications herein.

4. Suppliers
5. Fabricators
6. Installers/ Applicators/ Erectors
7. Testing Agencies
8. Licensed Professional
9. Certificates
10. Preconstruction testing
11. Field and Site Samples
12. Mock-ups

1.4 Field or Site Conditions

A Ambient Conditions

1. Engine- generator set shall operate in the following conditions without any damage to the unit or its loads.

a Ambient Temperature: 77 °F

b Altitude : 500 ft

c Relative Humidity: 95%

B Existing Conditions

1.5 Warranty or Bond

A Manufacturer’s Warranty

1. The generator set shall include a standard warranty covering five (5) years or 3000 hours, whichever occurs first, to guarantee against defective material and workmanship in accordance with the manufacturer's published warranty from the date of initial startup.
2. The generator set manufacturer and its distributor shall maintain a 24-hour parts and service organization. This organization shall regularly engage in maintenance contract programs to perform preventive maintenance and service on equipment similar to that specified. A service agreement shall be available and shall include system operation under simulated operating conditions; adjustment to the generator set, transfer switch, and switchgear controls as required, and certification in the owner's maintenance log of repairs made and functional tests performed on all systems.

B Special Warranty

C Extended Correction Period

PART 2 PRODUCTS

2.1 Equipment

A Equipment

1. The generator set shall be a Kohler model 400REZXB with a 5M4024 alternator, or equal if satisfactory to engineer that generator will start the staged loads indicated on the transfer switches on the plans. It shall provide 500.00 kVA and 400.00 kW when operating at 277/480 volts, 60 Hz, 0.80 power factor. The generator set shall be capable of a 130°C Standby rating while operating in an ambient condition of less than or equal to 77 °F and a maximum elevation of 500 ft above sea level. The standby rating shall be available for the duration of the outage.

B Engine

1. The minimum 21.9 liter displacement engine shall deliver a minimum of 605 HP at a governed engine speed of 1800 rpm, and shall be equipped with the following:
    a. Electronic isochronous governor capable of 0.5% steady-state frequency regulation
    b. 24-volt positive-engagement solenoid shift-starting motor
    c. 45-ampere automatic battery charging alternator with a solid-state voltage regulation
    d. Positive displacement, full-pressure lubrication oil pump, cartridge oil filters, dipstick, and oil drain
    e. Dry-type replaceable air cleaner elements for normal applications
    f. The engine shall be turbocharged and fueled by Natural Gas
    g. The engine shall have a minimum of 12 cylinders and be liquid-cooled
2. The engine shall be EPA certified from the factory
3. The generator must accept rated load in one-step.

C Cooling System

1. The engine shall be liquid-cooled by a closed loop, unit mounted radiator rated to operate the generator set at full load at an ambient temperature of 50 degrees C (122 degrees F). The radiator fan and other rotating engine parts shall be guarded against accidental contact.

D Standard Air Cleaner

1. The air cleaner shall provide engine air filtration which meets the engine manufacturer's specifications under typical operating conditions.

E Battery

1. Each genset requires a BCI group 31 batteries which must meet the engine manufactures' specifications for the ambient conditions specified in Part 1 Project Conditions and shall comply with the NFPA requirements for engine cranking cycles. Each battery shall be rated according to SAE Standards J-537 with a minimum cold cranking amp of 950 amps and a minimum reserve capacity of 185 Minutes at 80F. The battery plates shall be constructed of a Calcium-Lead alloy to provide long waterless operation and extended battery life. The battery elements must be anchor-locked with full-frame grids and tight-packed commercial plates to resist the effects of vibration. The battery must contain a handle to aid in lifting and the case must be constructed of polypropylene to resist breakage and extend service life. Removable cell covers shall be provided to allow for checking of electrolyte specific gravity.
2. Battery rack and battery cables capable of holding the manufacturer's recommended batteries shall be supplied.

F Housing

1. Level 1 Sound Attenuated Enclosure

a The generator set shall be supplied with a Sound Attenuated Enclosure, providing a sound pressure of 71 dB(A) while the generator is operating at 100% load at 7 meters (23 feet) – free field – using acoustic insulation and acoustic-lined inlet hoods, constructed from a minimum of 0.125 inch thick formed heavy duty aluminum panels. The acoustic insulation used shall meet

UL 94 HF1 flammability classification. The enclosure shall be manufactured from bolted panels to facilitate service, future modifications, or field replacement. The enclosure shall use external vertical air inlet and outlet hoods with 90 degree angles to discharge air up and reduce noise. The enclosure shall have an integral rodent guard and skid end caps and shall have bracing to meet 241 kph (150 mph) wind loading.

b The enclosure components and skid shall be cleaned with a two-stage alkaline cleaning process to remove grease, grit, and grime from parts. Components shall then be subjected to a Zirconium-based conversion coating process to prepare the metal for electrocoat (e-coat) adhesion. All enclosure parts shall receive an 100% epoxy primer electrocoat (e-coat) with high-edge protection. Following the e-coat process, the parts shall be finish coated with powder baked paint for superior finish, durability, and appearance with a Power ArmorTM industrial finish that provides heavy duty durability in harsh conditions, and is fade-, scratch- and corrosion-resistant.

c The enclosure must surpass a 3,000 hour salt spray corrosion test per ASTM B-1117.

d Enclosures will be finished in the manufacturer's standard color.

e The enclosures shall allow the generator set to operate at full load in an ambient temperature of 50°C with no additional derating of the electrical output of the generator set.

f Enclosures shall be equipped with sufficient side and end doors to allow access for operation, inspection, and service of the unit and all options. Minimum requirements are two doors per side. When the generator set controller faces the rear of the generator set, an additional rear facing door is required. Access to the controller and main line circuit breaker shall meet the requirements of the National Electric Code.

g Doors shall be fitted with hinges, hardware, and the doors shall be removable.

h Doors shall be equipped with lockable latches. Locks shall be keyed alike. Door locks shall be recessed to minimize potential of damage to door/enclosure.

i A duct between the radiator and air outlet shall be provided to prevent re-circulation of hot air.

j The complete exhaust system shall be internal to the enclosure.

k The critical silencer shall be fitted with a tailpipe and rain cap.

l The generator set enclosure shall be furnished with two-(2) DC lights powered by the starting battery on a fused circuit with a 0-60 minute “No-Lock-On” timer.

m Enclosure Heater- The enclosure shall be supplied with a 5 kW, thermostatically controlled heater wired to the enclosure's distribution panel. Rated at 17100 Btu. Shall include adjustable louvers offering down flow and horizontal air tuning, built-in thermostat with automatic fan delay controls.

n Basic Electrical Panel –The generator set enclosure shall be furnished with a load center 120/208/240VAC three phase, 100 amp max w/ main and 12 branch circuits. (1) switch control, (3) AC lights vapor tight and gasketed, and (2) duplex GFI receptacles.

G Controller

1. Decision-Maker® 3000 Generator Set Controller
   a. The generator set controller shall be a microprocessor based control system that will provide automatic starting, system monitoring, and protection. The controller system shall also provide local monitoring and remote monitoring. The control system shall be capable of PC based updating of all necessary parameters, firmware, and software.
   b. The controller shall be mounted on the generator set and shall have integral vibration isolation. The controller shall be prototype and reliability tested to ensure operation in the conditions encountered.
2. Codes and Standards
   a. The generator set controller shall meet NFPA 110 Level 1 requirements and shall include an integral alarm horn as required by NFPA.
   b. The controller shall meet NFPA 99 and NEC requirements.
   c. The controller shall be UL 508 listed.
3. Applicability

a. The controller shall be a standard offering in the manufacturer's controller product line.
b. The controller shall support 12-volt and 24volt starting systems.
c. The controller's environmental specification shall be: -40°C to 70°C operating temperature range and 5-95% humidity, non-condensing.
d. The controller shall mount on the generator or remotely within 40 feet with viewable access.

4. Controller Buttons, Display and Components
   a. The generator set controller shall include the following features and functions:
      1. Push button Master Control buttons. The buttons shall be tactile-feel membrane with an indicator light to initiate the following functions:
         a. Run Mode: When in the run mode the generator set shall start as directed by the operator.
         b. Off/Reset Mode: When in the Off/Reset mode the generator set shall stop, the reset shall reset all faults, allowing for the restarting of the generator set after a shutdown.
         c. Auto Mode: When in Auto the mode the generator set shall be ready to accept a signal from a remote device.
      2. Emergency Stop Switch. The remote stop switch shall be red in color with a "mushroom" type head. Depressing the stop button will immediately stop the generator set and lockout the generator set for any automatic remote starting.
      3. Push Button/Rotary Selector dial. This dial shall be used for selection of all Menus and sub-menus. Rotating the dial moves you through the menus, pushing the dial selects the menu and function/features in that menu. Pushing the button selects the feature/function and sub-menus.
      4. Digital Display. The digital display shall be alphanumeric, with 2 lines of data and approximately 24 charters. The display shall have back lighting for ease of operator use in high and low light conditions. The display shall display status of all faults and warnings. The display shall also display any engine faults. While the generator set is running, the display shall scroll all-important information across the screen for ease of operator use. The scroll can be stopped by pushing the rotary dial. The display shall fall asleep when the generator set is not running and will wake-up when the generator set starts or the rotary dial is depressed.
      5. Fault Light. The controller shall have an annunciator fault light that glows red for faults and yellow for warnings. These faults and warnings shall be displayed in the digital display. The fault light will also glow yellow when not in AUTO.
      6. Alarm Horn. The controller shall provide an alarm horn that sounds when any faults or warnings are present. The horn shall also sound when the controller is not in the AUTO mode.
      7. Alarm Silence/Lamp Test Button. When this button is depressed, it shall test all controller lamps. This button will also silence the alarm horn when the unit is not AUTO.
      8. USB Connection. The controller shall have a USB connection on the face of the controller. This connection shall allow for updating of all software and firmware. This port shall also allow for all servicing of generator set parameters, fault diagnostics and viewing of all controller information via use a laptop computer.
      9. Dedicated user inputs. The controller shall have dedicated inputs for remote emergency stop switch, remote 2-wire star for transfer switch and auxiliary

shutdown.

10. The controller shall have auto resettable circuit protection integral on the circuit board.

5. System Controller Monitoring and Status Features and Functions
   a. The generator controller shall display and monitor the following engine and alternator functions and allow adjustments of certain parameters at the controller:
      1. Overview menu
         a. Active shutdowns and warnings shall be displayed if present and without the need of operator interface
         b. Engine runtime with total hours
         c. Average line to line voltage
         d. Coolant temperature
         e. Fuel level or pressure
         f. Oil pressure
         g. Battery voltage
         h. Software version
         i. Frequency
         j. Average current
      2. Engine metering menu.
         a. Engine speed
         b. Oil pressure
         c. Coolant temperature
         d. Battery voltage
      3. Generator metering menu.
         a. Total power in VA
         b. Total power in W
         c. Rated power % used
         d. Voltage L-L and L-N for all phases
         e. Current L1, L2, L3
         f. Frequency
      4. Generator set information.
         a. Generator set model number
         b. Generator set serial number
         c. Controller set number
      5. Generator set run time.
         a. Engine run time total hours
         b. Engine loaded total hours
         c. Number of engine starts
         d. Total energy in kW
      6. Generator set system
         a. System voltage
         b. System frequency 50/60Hz
         c. System phase, single/three phase
         d. Power rating kW
         e. Amperage rating
         f. Power type standby/prime
         g. Measurement units, metric/English units adjustable
         h. Alarm silence, always or auto only
      7. Generator set calibration, the following are adjustable at the controller.
         a. Voltage L-L and L-N all phases
         b. Current L1, L2, L3

c. Reset all calibrations

8. Voltage regulation, +/-0.5% regulation, the following is adjustable at the controller.
    a. Voltage Adjustable +/- 10%
9. Digital and Analog Inputs and outputs
    a. Displays settings and status
10. Event Log
    a. Stores event history, up to 1000 events

6. Controller Engine control features and functions
    a. Automatic restart - the controller has automatic restart feature that initiates the start routine and re-crank after a failed start attempt.
    b. Cyclic cranking - the controller shall have programmable cyclic cranking
    c. Engine starting aid - the controller shall have the capability of providing control for an optional engine starting aid.
    d. The control system shall include time delays for engine start and cool down.
    e. The control system shall interface with the engine ECM and display engine fault codes and warnings. The ECM shall also include sender failure monitoring to help distinguish between failed senders and actual failure conditions.
    f. The controller shall monitor and display engine governor functions with include steady state and transient frequency monitoring
7. Controller Alternator control features and functions
    a. Integrated hybrid voltage regulator. The system shall have integral microprocessor based voltage regulator system that provides +/- 5% voltage regulation, no-load to full load with three phase sensing. The system is prototype tested and control variation of voltage to frequency. The voltage regulator shall be adjustable at the controller with maximum +/- 10% adjustable of nominal voltage.
    b. AC output voltage regulator adjustment. The system shall allow for adjustment of the integral voltage regulator with maximum of +/- 10% adjustment of the system voltage.
    c. Alternator thermal overload protection. The system shall have integral alternator overload and short circuit protection matched to each alternator for the particular voltage and phase configuration.
    d. Power metering. The controller digitally displays power metering of kW and kVA.
8. Other control features and functions
    a. Event logging. The controller keeps a record of up to 1000 events, for warning and shutdown faults. This fault information becomes a stored record of systems events and can be reset.
    b. Historical data logging. The controller total number of generator set successful start shall be recorded and displayed.
    c. Programmable access. The control system shall include a USB port that gives service technicians the ability to provide software and firmware upgrades. The system shall also be capable of allowing setting of all critical parameters using the service software and a laptop computer. All parameters and setting should be capable to being stored on a laptop for future upgrades of printing for analysis.
9. Generator Set Warning, Shutdown Alarm and Status
    a. The generator set shall have alarms and status indication lamps that show non-automatic status and warning and shutdown conditions. The controller shall indicate with a warning lamp and or alarm and on the digital display screen any shutdown, warning or engine fault condition that exists in the generator set system. The following alarms and shutdowns shall exist as a minimum:
        1. Engine functions

a. Critical high fuel level (alarm)
b. ECM communication loss (shutdown)
c. ECM diagnostics (alarm & shutdown)
d. Engine overspeed (shutdown)
e. Engine start aid active
f. Engine under speed (shutdown)
g. Fuel tank leak (alarm & shutdown)
h. High DC battery voltage (alarm)
i. High coolant temperature (alarm & shutdown)
j. High fuel level (alarm)
k. Low DC battery voltage (alarm)
l. Low coolant level (shutdown)
m. Low coolant temperature (alarm)
n. Low cranking voltage (alarm)
o. Low engine oil level (alarm & shutdown)
p. Low fuel level (alarm & shutdown)
q. Low fuel pressure (alarm)
r. Low oil pressure (alarm & shutdown)
s. No coolant temperature signal (shutdown)
t. No oil pressure signal (shutdown)
u. Overcrank (shutdown)
v. Speed sensor fault (alarm)

2. Generator functions
   a. AC sensing loss over & under current (alarm & shutdown)
   b. Alternator protection (shutdown)
   c. Ground fault input (alarm)
   d. kW overload (shutdown)
   e. Locked rotor (shutdown)
   f. Over-frequency (shutdown)
   g. Over AC voltage (shutdown)
   h. Under-frequency (shutdown)
   i. Under AC voltage (shutdown)
   j. Emergency stop (shutdown)
3. Other General functions
   a. Battery charger fault (alarm)
   b. Common fault (shutdown)
   c. Common warning (alarm)
   d. Master switch not in auto (alarm)
   e. Generator running
   f. Input/Output fault (alarm)
4. The generator set controller shall also be capable of meeting all necessary NFPA 110 level 1 requirements that include several of the above along with; EPS supplying load, Master switch “not in auto”, and contacts for local and remote common alarm.

10. Communications
    a. If the generator set engine is equipped with an ECM (engine control module), the controller shall communicate with the ECM for control, monitoring, diagnosis, and meet SAE J1939 standards
    b. Kohler proprietary RBUS communication shall be available.
    c. A RBUS shall be able to monitor and alter parameters, and start or stop a generator.
    d. The controller shall have the capability to communicate to a personal computer (IBM

or compatible) and appropriate application software

e. A variety of connections shall be available based on requirements:
   1. A single control connection to a PC via USB
   2. Internet connection via Ethernet
f. Generator and transfer switch controls shall be equipped with communications modules capable of connecting to the same communication network.

H Generator Overcurrent and Fault Protection

1. The generator shall be provided with a factory installed, 100% rated line circuit breaker rated at 400.00 amperes that is UL489 listed. Line circuit breakers shall be sized for the rated ampacity of the loads served by the breaker per the NEC.
2. The generator shall be provided with a 2nd factory installed, 100% rated line circuit breaker, if applicable, rated at 400.00 amperes that is UL489 listed. Line circuit breakers shall be sized for the rated ampacity of the loads served by the breaker per the NEC.
3. Test The generator shall be provided with a 3rd factory installed, 100% rated line circuit breaker, if applicable, rated at 200.00 amperes that is UL489 listed. Line circuit breakers shall be sized for the rated ampacity of the loads served by the breaker per the NEC.
4. The circuit breaker(s) shall incorporate a thermo-magnetic trip unit.
5. Load side lugs shall be provided from the factory. The line circuit breaker shall include auxiliary contacts, shunt trip, undervoltage trip, alarm switch, and overcurrent switch functionality. Load side breaker connections made at the factory shall be separated from field connections.
6. The shunt trip device shall be connected to trip the generator breaker when the generator-set is shut down by other protective devices.
7. When GFI is required per the NEC, additional neutrals shall be factory installed, and the alarm indication shall be integrated with the other generator-set alarms.
8. Barriers to provide segregation of wiring from an emergency source to emergency loads from all other wiring and equipment, if required by the NEC, shall be provided.

I Alternator

1. The alternator shall be salient-pole, brushless, 2/3-pitch, with 4 bus bar provision for external connections, self-ventilated, with drip-proof construction and amortisseur rotor windings, and skewed for smooth voltage waveform. The ratings shall meet the NEMA standard (MG1-32.40) temperature rise limits. The insulation shall be class H per UL1446 and the varnish shall be a vacuum pressure impregnated, fungus resistant epoxy. Temperature rise of the rotor and stator shall be limited to 130°C Standby. The PMG based excitation system shall be of brushless construction controlled by a digital, three phase sensing, solid- state, voltage regulator. The AVR shall be capable of proper operation under severe nonlinear loads and provide individual adjustments for voltage range, stability and volts-per-hertz operations. The AVR shall be protected from the environment by conformal coating. The waveform harmonic distortion shall not exceed 5% total RMS measured line-to-line at full rated load. The TIF factor shall not exceed 50.
2. The alternator shall have a maintenance-free bearing, designed for 40000 hour B10 life. The alternator shall be directly connected to the flywheel housing with a semi-flexible coupling between the rotor and the flywheel.
3. The generator shall be inherently capable of sustaining at least 300% of rated current for at least 10 seconds under a 3-phase symmetrical short circuit without the addition of separate current-support devices.
4. Motor starting performance and voltage dip determinations shall be based on the complete generator set. The generator set shall be capable of supplying 1,350.00 LRKVA for starting motor loads with a maximum instantaneous voltage dip of 35%, as measured by a digital RMS transient recorder in accordance with IEEE Standard 115. Motor starting performance and

voltage dip determination that does not account for all components affecting total voltage dip, i.e., engine, alternator, voltage regulator, and governor will not be acceptable. As such, the generator set shall be prototype tested to optimize and determine performance as a generator set system.

J Vibration Isolation

1. Vibration isolators shall be provided between the engine-alternator and heavy-duty steel base.

2.2 Accessories

A. The generator set shall be supplied with a common failure relay to provide means of signaling fault and/or shutdown conditions.
   i. The common failure relay shall remotely signal auxiliary faults, emergency stop, high engine temperature, low oil pressure, overcrank, and over speed via one single-pole, double-throw relay with 10 amps at 120 VAC contacts.
   ii. The relay contacts shall be gold flashed to allow use of low current draw devices (100ma @ 28VDC min.).
   iii. Once energized the relay shall remain latched until the system is reset by the main controller switch.

B. The generator set shall be provided with a run relay which shall provide a three-pole, double-throw relay with 10-amp/ 250 VAC contacts to indicate that the generator is running. The run relay dry contacts can be used for energizing or de-energizing customer devices while the generator is running (e.g. louvers, indicator lamps, etc.)

C. Battery rack and battery cables capable of holding the manufacturer's recommended batteries shall be supplied.

D. The generator shall be furnished with an externally mounted, recessed, emergency stop switch (break glass, pushbutton style) protected from accidental operation.

E. The generator set shall be supplied with a 6-ampere automatic float/equalize battery charger capable of charging both lead-acid and gel-cell type batteries, with the following features:
   i. Automatic 3-stage float to equalization charge
   ii. 1% steady-state voltage regulation from no load to full load over 10% AC input line voltage variation
   iii. Indicator LED lamps for charge state indication (bulk charge/absorption/float)
   iv. Ambient temperature operating range: -40°C to 70°C
   v. Potting for durability and waterproofing
   vi. Short-circuit and reverse polarity protection
   vii. UL 1236 listed
   viii. UL 2200 compliant
   ix. CSA certified
   x. Ring terminals for battery connection.

F. The exhaust piping shall be gas proof, seamless, stainless steel, flexible exhaust bellows and includes the flex exhaust tube and the mounting hardware.

G. Supply flexible fuel lines to provide a flexible connection between the engine fuel fittings and the fuel supply tank piping and for the fuel return lines from the injector pump per engine manufacturer's recommendations. Flex line shall have a protective steel wire braid to protect the hose from abrasion.

H. Block Heater - The block heater shall be thermostatically controlled, 6,000 watt, with isolating valves, to maintain manufacturers recommended engine coolant temperature to meet the start-up requirements of NFPA 99 and NFPA 110, Level 1.

I. Supply a Modbus to Ethernet Converter that provides one RJ45 jack for standard Ethernet 10/100 connection, and a terminal block for RS-485 connection, and is powered by 12 VDC. The Baud rate on the Modbus RTU side shall be selectable 9600 or 19200. The converter shall support Simple Network Management Protocol (SNMP) users to poll or issue trap commands.

J. Remote annunciator panel – The remote annunciator shall meet NFPA 110, Level 1 requirements and enable remote viewing of the generator status. The panel shall be connected to the generator controller via either network communication wires or via hard wired connections. Options shall be available to

provide ATS source availability, contactor position, and loaded or unloaded test for up to four transfer switches. The panel shall have the capability to be either flush- mounted or surface-mounted. The annunciator shall meet UL508 requirements.

2.3 Source Quality Control

A. Non-Conforming Work

1. To ensure that the equipment has been designed and built to the highest reliability and quality standards, the manufacturer and/or local representative shall be responsible for three separate tests: design prototype tests, final production tests, and site tests.

a. **Design Prototype Tests.** Components of the emergency system, such as the engine/generator set, transfer switch, and accessories, shall not be subjected to prototype tests because the tests are potentially damaging. Rather, similar design prototypes and preproduction models shall be subject to the following tests:

i. Maximum power (kW)
ii. Maximum motor starting (kVA) at 35% instantaneous voltage dip.
iii. Alternator temperature rise by embedded thermocouple and/or by resistance method per NEMA MG1-32.6.
iv. Governor speed regulation under steady-state and transient conditions.
v. Voltage regulation and generator transient response.
vi. Harmonic analysis, voltage waveform deviation, and telephone influence factor.
vii. Three-phase short circuit tests.
viii. Alternator cooling air flow.
ix. Torsional analysis to verify that the generator set is free of harmful torsional stresses.
x. Endurance testing.

b. **Final Production Tests.** Each generator set shall be tested under varying loads with guards and exhaust system in place. Tests shall include:

i. Single-step load pickup
ii. Safety shutdown device testing
iii. Rated Power @ 0.8 PF
iv. Maximum power
v. Upon request, a witness test, or a certified test record sent prior to shipment.

c. **Site Tests.** The manufacturer's distribution representative shall perform an installation check, startup, and building load test. The engineer, regular operators, and the maintenance staff shall be notified of the time and date of the site test. The tests shall include:

i. Fuel, lubricating oil, and antifreeze shall be checked for conformity to the manufacturer's recommendations, under the environmental conditions present and expected.
ii. Accessories that normally function while the set is standing by shall be checked prior to cranking the engine. These shall include: block heaters, battery chargers, alternator strip heaters, remote annunciators, etc.
iii. Generator set startup under test mode to check for exhaust leaks, path of exhaust gases outside the building, cooling air flow, movement during starting and stopping, vibration during operation, normal and emergency line-to-line voltage and frequency, and phase rotation.
iv. Automatic start by means of a simulated power outage to test remote-automatic starting, transfer of the load, and automatic shutdown. Prior to this test, all transfer switch timers shall be adjusted for proper system coordination. Engine coolant temperature, oil pressure, and battery charge level along with generator set voltage, amperes, and frequency shall be monitored throughout the test.

PART 3 EXECUTION

3.01 SERVICE

A. Service Guarantee: Without additional cost to Owner provide complete inspection and adjustment service on standby Diesel Generator Set for a period of 1 year from date of acceptance. During this period, make quartily inspection and test of equipment at least once per quarter, perform all adjustment, and repair and correct all defects, and provide a written report for Owner's Records. Provide service within 24 hours of notification of any defect or malfunction of system.

B. Contractor shall make available to purchaser the local service department of a duly authorized distributor of equipment manufacturer which is to stock manufacturer's standard parts.

3.02 TRAINING

A. The Electrical Subcontractor shall provide a training session for Owner's representative for **2** normal workdays at a jobsite location determined by the owner.

B. The training session shall be conducted by a manufacturer's qualified representative. The training program shall consist of the instruction on the operation of the assembly, circuit breakers, and major components within the assembly.

C. The training program shall include the following:

1. Review of the project one-line drawings and schedules.

    a. Review of the factory record shop drawings.

    b. Review of all equipment in the electrical distribution system.

    c. Discuss the maintenance timetable and procedures to be followed in an ongoing maintenance program.

    d. Provide three ring binders to participants complete with copies of drawings and other course material covered.

END OF SECTION

THE LIVESTOCK INSTITUTE

WESTPORT, MA

PROJECT NO. 4730

Specification for

SWITCHBOARDS

(GROUP MOUNTED)

Section 16429

THE DENNIS GROUP, LLC

PLANNING ▲ ENGINEERING ▲ CONSTRUCTION MANAGEMENT

1537 MAIN STREET
SPRINGFIELD, MASSACHUSETTS 01103
413.787.1785 ▲ FAX 413.787.1786

26 WEST MARKET STREET
SALT LAKE CITY, UTAH 84101
801.531.8585 ▲ FAX 810.531.8586

B	**09.30.2016**	**Bid**	**MJJ**		
A	**09.20.2016**	**Review**	**MJJ**		
Issue	**Date**	**Description**	**By**	**Approved**	**Section 16429**

Unless notification and/or comments are received from client within two weeks after issue date, all documentation including drawings, specifications, and studies submitted to client shall be considered approved as released.

PART 1 – GENERAL

1.01 PROVISIONS INCLUDED

A. The General Documents, as listed on the Table of Contents and applicable parts of Division 1, General Requirements, and requirements of Section 16010, shall be included in and made part of this Section.

B. Examine all drawings and all other Section of the Specifications for requirements which affect work under this Section whether or not such work is specifically mentioned in this Section.

C. Coordinate work with that of all other Trades affecting or affected by work of this Section. Cooperate with such Trades to ensure the steady progress of all work under the Contract.

D. Provide all material, labor and equipment, to complete the work of this Section in strict accordance with the design Architect's and Engineer's plans and specifications, and with all applicable codes, rules, and standards.

1.02 SCOPE OF WORK

A. The work under this Contract shall include all labor, materials, tools, equipment, transportation, insurance, temporary protection, supervision and incidental items essential for proper installation and operation, even though not specifically mentioned or indicated on the drawings but which are usually provided or are essential for proper installation and operation of all systems as indicated on the drawings and specified herein.

B. The specifications and drawings describe the minimum requirements that must be met by the Contractor for the installation of all work as shown on the drawings and as specified hereinunder.

1.03 RELATED WORK SPECIFIED ELSEWHERE

A. The following referenced sections are listed as a minimum of additional requirements and/or work not included in this Section which may be required to be performed under other designated Sections:

1. Section 16016: Power System and Arc Flash Hazard Analysis Study
2. Section 16110: Raceways
3. Section 16120: Conductors (600 Volt)
4. Section 16190: Hangers and Supports
5. Section 16195: Electrical Identification
6. Section 16198: Start-Up Testing of Electrical Equipment
7. Section 16450: Grounding

1.04 SUBMITTALS

A. Prepare and submit complete shop drawings of distribution switchboards required on this project to Engineer for approval.

B. Submit complete manufacturer's product data of all materials and systems to the Engineer for approval, consisting of complete product description and specifications, complete performance test data, complete preparation and installation instructions, and all other pertinent technical data required for complete product and product use information.

C. All shop drawings shall have clearly marked the appropriate specification number of drawing designation for identification of the submittal.

D. Disposition of shop drawings shall not relieve the Contractor from the responsibility for deviations from drawings or specifications unless he has submitted, in writing, a letter itemizing or calling attention to such deviations at time of submission and secured written approval from the Engineer, nor shall such disposition of shop drawings relieve the Contractor from responsibility for errors in shop drawings or schedules.

E. Do not order materials or begin installation until approval of submittals by the Architect and Engineer has been obtained.

F. Shop drawings shall include but not be limited to the following:

1. Structural arrangement.

2. Dimensional plan and elevations, front view, side views, and other pertinent elevation views.

3. Conduit entrance location and dimensions.

4. Bus bar locations and configurations.

5. Incoming and outgoing power conductor terminator positions, and complete 3-line schematic diagrams of all switchboard sections.

6. Neutral and ground bus connections.

7. Base plans showing dimensions, base anchoring and installation details.

8. Equipment weights.

9. Circuit breaker and component drawings, manufacturers' pertinent literature.

10. Protective relay scheme and wiring diagrams including written descriptions of operation.

11. List of sub-assemblies, devices, part numbers and bill of materials.

12. Control wiring diagrams.

13. Performance data on switchboard components.

14. Plan indicating shipping splits.

15. Other information that is necessary for full documentation of switchboard and as requested.

G. The switchboard manufacturer shall be responsible for providing the coordinating wiring diagrams showing wiring diagrams and interconnections to all switchboard.

1.05 GUARANTEE

A. In addition to the specific guarantee requirements of the General Conditions, the Contractor shall obtain, in the Owner's name, the standard written manufacturer's guarantee of all materials furnished under this Section where such guarantees are offered in the manufacturer's published product data. All these guarantees shall be in addition to, and not in

lieu of, other liabilities which the Contractor may have by law or other provisions of the Contract Documents.

1.06 COORDINATION

A. The work of this Section shall be coordinated with other work of the Contractor. The placement of all access panels shall be coordinated with all other Trades and with the Engineer.

1.07 REFERENCE STANDARDS

A. Applicable provisions of the following Codes and Trade Standard Publications shall apply to the work of this Section and are hereby incorporated into, and made a part of, the Contract Documents:

1.	NFPA 70:	National Electrical Code
2.	UL 891:	Dead-front Switchboards
3.	NEMA PB2:	Dead-front Distribution Switchboards
4.	UL 489:	Molded Case Circuit Breakers

1.08 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery of materials shall be made to the project by the materials supplier in accordance with the instructions of the Contractor.

B. The Contractor shall provide adequate storage space for the materials, shall be responsible for all items of materials after receipt from the supplier, and shall replace all materials lost or damaged after delivery and receipt.

C. The Contractor shall furnish the materials supplier with receipts for all materials and accessory items received, and shall send copies of these receipts to the Engineer.

D. Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment.

PART 2 – PRODUCTS

2.01 LOW-VOLTAGE DISTRIBUTION SWITCHBOARDS (GROUP MOUNTED)

A. General

1. The Electrical Subcontractor shall furnish and install where indicated a free-standing, dead-front type low-voltage distribution switchboard utilizing group mounted circuit protective devices as specified herein and as shown on the contract drawings.

2. The low-voltage switchboards and all components shall be designed, manufactured, and tested in accordance with the latest applicable following standards:

   a. NEMA PB-2.

   b. UL Standard 891.

3. The manufacturer of the assembly shall be the manufacturer of the circuit protective devices within the assembly.

4. For the equipment specified herein, the manufacturer shall be ISO 9000, 9001 or 9002 certified.

5. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

6. The low-voltage switchboard shall be UL labeled.

B. Manufacturers

1. EATON, Pow-R-Line C
2. Square D, QED 2

C. Ratings

1. The assembly shall be rated to withstand mechanical forces exerted during short circuit conditions when connected directly to a power source having available fault current of **50,000** amperes symmetrical at rated voltage.

2. Voltage rating shall be **480/277** volts, 3 phase, 4 wire.

D. Construction

1. Switchboard shall consist of the required number of vertical sections bolted together to form a rigid assembly. The sides shall be covered with removable bolt-on covers. All edges of front covers or hinged front panels shall be formed. Provide adequate ventilation within the enclosure.

2. All sections of the switchboard shall be front and rear-aligned. All protective devices shall be group mounted. Devices shall be front-removable, with front-accessible load connections, enabling switchboard to be mounted against a wall.

3. The assembly shall be provided with adequate lifting means.

4. The switchboard shall be suitable for use as service entrance equipment and be labeled in accordance with UL requirements.

E. Bus

1. All bus bars shall be silver plated copper. Main horizontal bus bars shall be mounted with all three phases arranged in the same vertical plane. Bus sizing shall be based on NEMA standard temperature rise criteria of 65 degrees C over a 40 degrees C ambient (outside the enclosure).

2. Provide a full capacity neutral bus.

3. A copper ground bus (minimum 1/4 x 2 inch) shall be furnished firmly secured to each vertical section structure and shall extend the entire length of the switchboard.

4. All hardware used on conductors shall be high-tensile strength and zinc plated. All bus joints shall be provided with conical spring type washers.

F. Wiring/Terminations

1. Small wiring, necessary fuse blocks and terminal blocks within the switchboard shall be furnished as required. Control components mounted within the assembly, such as fuse blocks, relays, pushbuttons, switches, etc., shall be suitably marked for identification corresponding to appropriate designations on manufacturer's wiring diagrams.

2. NEMA type lugs shall be provided for all line and load terminations suitable for copper or aluminum cable rated for 75 degrees C of the size indicated on the drawings. A termination system shall be provided such that no additional cable bracing, tying or lashing is required to maintain the short circuit withstand ratings of the assembly through 65kA.

3. Lugs shall be provided in the incoming line section for connection of the main grounding conductor. Additional lugs for connection of other grounding conductors shall be provided.

4. All control wire shall be type SIS, bundled and secured with nylon ties. Insulated locking spade terminals shall be provided for all control connections, except where saddle type terminals are provided integral to a device. All current transformer secondary leads shall first be connected to conveniently accessible short circuit terminal blocks before connecting to any other device. All groups of control wires leaving the switchboard shall be provided with terminal blocks with suitable numbering strips. Provide wire markers at each end of all control wiring.

2.02 LOW VOLTAGE AIR POWER CIRCUIT BREAKERS *(NOT IN CONTRACT)*

A. **Main** protective devices shall be fixed mounted low-voltage air power circuit breakers. Frame ratings shall be 800, 1600, 2000, 3200, 4000 or 5000 amperes. All breakers shall be UL listed for application in their intended enclosures for 100% of their continuous ampere rating.

B. Low voltage air power circuit breakers shall be as follows:

1. EATON **MAGNUM DS**
2. Square D **MasterPact**

C. Breakers shall be electrically operated (EO) unless manually operated (MO) is indicated on the drawings.

1. Electrically operated breakers shall be complete with 120 operators, open/close pushbuttons, plus red and green indicating lights to indicate breaker contact position, AC source shall be taken from a control power transformer internal to the switchboard assembly with control power automatic transfer scheme on double ended units.

D. Power circuit breakers shall have a minimum symmetrical interrupting capacity of **[65,000] [85,000] [100,000]** amperes RMS at rated voltage.

2.03 TRIP UNITS AIR POWER CIRCUIT BREAKERS *(NOT IN CONTRACT)*

A. Each low voltage air power circuit breaker shall be equipped with a solid-state tripping system consisting of three current sensors, microprocessor-based trip device and flux-transfer shunt trip. Current sensors shall provide operation and signal function. The trip unit shall use microprocessor-based technology to provide the basic adjustable time-current protection functions. True RMS sensing circuit protection shall be achieved by analyzing the secondary current signals received from the circuit breaker current sensors and initiating trip signals to

the circuit breaker trip actuators when predetermined trip levels and time delay settings are reached. Interchangeable rating plugs shall establish the continuous trip ratings of each circuit breaker.

B. The trip unit shall have an LCD or LED display to indicate mode of trip following an automatic trip operation. The indication of the mode of trip shall be retained after an automatic trip. A trip reset button shall be provided to turn off the display indication after an automatic trip.

C. Complete system selective coordination shall be provided by the addition of the following individually adjustable time/current curve shaping solid-state elements:

1. All breakers shall have adjustments for long delay pick-up and time.

2. All breakers shall have individual adjustments for short delay pick-up and time, and include I^2t settings.

3. All breakers shall have an adjustable instantaneous pick-up.

4. All breakers shall have individually adjustable ground fault current pick-up and time, and include I^2t settings.

D. The trip unit shall contain an integral test panel with a test selector switch and a test pushbutton or a portable full function test set. The test kit shall enable the user to select the values of test currents within a range of available settings. The basic protection functions shall not be affected during test operations. The breaker may be tested in the Trip or No trip test mode.

1. The test kit, when connected to a 120 volt, 50/60 Hz source, shall provide power for testing the trip unit while the breaker is out of the cell or in the disconnect or withdrawn position.

2. Trip unit shall have thermal memory for enhanced circuit protection.

3. The alpha-numeric display shall be provided to indicate the following data:

a. Cause of trip.

b. Instantaneous current on all three phases.

4. The trip unit shall include a power/relay module which shall supply control power to the readout display. Following an automatic trip operation of the circuit breaker, it shall maintain the cause of trip history and the trip target as long as its internal power supply is available.

5. Trip units shall be equipped with Arcflash Reduction Maintenance System Technology capability. The Arcflash Reduction Maintenance System shall allow the operator to enable a maintenance mode which enables a preset accelerated instantaneous override trip to reduce arc flash energy. A blue LED on the trip unit shall indicate the trip unit is in the maintenance mode

6. Metering display accuracy of the complete system including current sensors, auxiliary C.T.'s, and the trip unit shall be +/- 2% of full scale for current values.

7. The trip unit shall include metering capabilities as follows:

a. Volts (per phase)

b. Amperes (per phase)
c. Kilowatt Hours (kWH)
d. Kilowatt demand (kW)
e. Instantaneous demand (kW)
f. Kilovolt-amperes demand (kVA)
g. Instantaneous demand (kVA)
h. Power factor
i. Harmonic distortion (THD Voltage and current)
j. Waveform capture

8. The energy-monitoring parameter values (peak demand, present demand, and energy consumption) shall be indicated in the trip unit alpha-numeric display panel.

9. Metering display accuracy of the complete system of full scale shall be +/- 3% for power values, +/- 4% of full scale for energy values.

10. The trip unit shall be equipped to permit communication via a network twisted pair for remote monitoring and control.

11. The circuit breaker shall be factory wired to the PX Multipoint listed elsewhere in the specifications.

12. The circuit breaker trip unit functionality and performance shall be based on the EATON Digi-Trip 1150+ (520MC) with Arc Flash Reduction technology and remote Arms switch. Square D shall provide 6H trip units with Arch Flash Reduction technology and remote Arms switch. Square D shall meet or exceed the capabilities and functionality of the specified Eaton systems.

2.04 MOLDED CASE CIRCUIT BREAKERS

A. Circuit breakers shall be EATON Series G, with microprocessor-based, true RMS sensing trip units with integral arc flash reduction technology.

1. Each molded case circuit breaker microprocessor-based tripping system shall consist of three current sensors, a microprocessor, and a flux-transfer shunt trip. True RMS sensing circuit protection shall be achieved by analyzing the secondary current signals received from the circuit breaker current sensors and initiating trip signals to the circuit breaker trip actuators when predetermined trip levels and time delay settings are reached.

2. An adjustable trip setting dial mounted on the front of the trip unit shall establish the continuous trip setting of each circuit breaker..

3. The microprocessor-based trip system shall have thermal memory capabilities to prevent the breaker from being reset following an overload condition until after a preset time delay.

a. Molded Case Circuit Breaker Trip Units

1) System coordination shall be provided by the following microprocessor-based time-current curve shaping adjustments:

a) Adjustable long time setting.

b) Adjustable short time setting and delay, with selective curve shaping.

c) Adjustable instantaneous setting.

d) Adjustable ground fault setting and delay.

e) Trip targets indicating the operation of a trip and the function causing it shall be provided via the display

f) Trip units shall be equipped with Arcflash Reduction Maintenance System Technology capability. The Arcflash Reduction Maintenance System shall allow the operator to enable a maintenance mode which enables a preset accelerated instantaneous override trip to reduce arc flash energy. A blue LED on the trip unit shall indicate the trip unit is in the maintenance mode

2) **The circuit breaker trip unit functionality and performance shall be based on the Eaton Digitrip RMS 310+ with CT's, Power Xpert Multipoint Meter and switchboard mounted touch screen display. All other manufacturers shall meet or exceed the capabilities and functionality of the specified unit. Square D shall provide 6H trip units with arc flash reduction switch and touch screen PLC display unit. The Square D components and system functionality shall meet or exceed the performance of the specied Eaton systems.**

B. Provide circuit breakers UL listed for application at 100% of their continuous ampere rating in their intended enclosure as shown on the contract drawings.

C. Provide shunt trips, bell alarms, and auxiliary switches as shown on the contract drawings.

D. Each circuit breaker shall be provided with a factory-installed padlockable handle lock hasp.

2.05 POWER XPERT MULTIPOINT METER *(NOT IN CONTRACT)*

A. Supply a UL listed microprocessor-based Multi-Point Metering System (MPM), Eaton type PX Multipoint Meter or approved equal having the specified features. This system shall consist of current sensors, meter base, and meter module(s) as described below.

B. The MPM shall have the capability to monitor 60 single-phase two-wire ac loads, 30 single-phase three-wire ac loads or 20 three-phase four-wire ac loads or any combination thereof by use of current sensors.

C. All connections to the MPM shall be through removable plugs.

D. The device shall be capable of accepting input from current sensors by connecting with factory installed plug connectors.

E. The device shall automatically sense the rating of the current sensor.

F. The device shall provide a mechanism for detecting tampering with the current sensors. \Tamper detection shall be accessible remotely by computer.

G. The MPM shall be available to accept service type rating from 120-600 Vac voltage rating.

H. The device shall calculate power and energy consumption in accordance with ANSI C12.20 (0.5%) metering specification and stored in non-volatile memory.

I. The device shall store the following per phase and system total for each metering point:

1. Voltage, Current, and Frequency (system total only)
2. Real Power in Watts, Reactive power in Var, Apparent energy in VA, and power factor
3. Real Energy in Watt hours including forward and reverse, Reactive energy in Var hours in Q1-Q4, Apparent energy in VA hours in Q1/Q4, Q2/Q3

J. The MPM shall store energy profile information for each metering point in non-volatile memory. The demand profile time period shall be adjustable from 1, 5, 15, 30 and 60 minutes for fixed method and 1, 5, and 15 minutes for sliding method. The MPM shall have the ability to sync with external input to the on board demand input. The MPM shall be able to save a minimum of 1 year of load profile data for all 60 meter points on a 15 minutes basis.

K. The device shall be suitable for mounting within a panelboard or switchboard. The device may also be mounted in a separate enclosure.

L. The MPM shall have the capability to scale the number of metering points from 6 to 60 in increments of 6.

M. The MPM shall be UL and cUL listed.

N. The MPM shall have LEDs that can be easily viewed when the unit is installed to aid in the installation and operation of the device with the following functionality:

1. Each meter base shall have: an LED to indicate power is applied to the unit; an LED to indicate the proper functioning of the system; an LED to indicate the proper functioning of the system; three LEDs, one per phase, to indicate the voltage is within the range of the set nominal voltage; LEDs to indicate Delta and Wye operation; and LEDs to indicate transmit and receive status on RS 485 link.

2. Each meter module shall have: two programmable LEDs that shall flash in proportion to the amount of energy flowing in the measures circuit with each LED can be assigned to one, two, or three phases; six LEDs that indicate the direction of energy flow per phase; an LED to indicate the proper functioning of the module; and an LED to indicate the proper functioning of communication between the meter base and the meter module.

3. Each pulse input module shall have: eight LEDs, one per input, to indicate the pulse input status; an LED to indicate the proper functioning of the module; an LED to indicate the proper functioning of communication between the meter base and the input module; and eight LEDs, one per output, to indicate the pulse output status.

4. Each pulse output module shall have: an LED to indicate the proper functioning of the module; and an LED to indicate the proper functioning of communication between the meter base and the output module.

O. The MPM shall have rotary address switches that are easily accessible that set the unit address on the communication network.

P. The MPM shall have two Modbus RTU ports. The communication speed at the device level shall be a minimum of 9,600 baud and maximum 57,600 baud. Devices shall communicate at their maximum baud rate regardless of the number of devices on the network.

Q. Meter modules shall be available with support for two three-pole circuits, three two-pole circuits, or six single-pole circuits.

R. Meter modules shall be available to accept 10 mA, 100 mA or 333 mV input signals.

S. Current sensors shall be provided with a toroidal winding over solid core. The winding shall be mounted over the circuit to be monitored by inserting the load conductor through a hole in the center of the current transformers. The current in the load conductor shall be made available to an electronic monitoring device through a four-conductor cable and terminated to a removable plug on the current sensor. The current sensor shall have two LEDs, one red for indicating loss of connection and one blue for verification to connected load. The current sensors shall be suitable for use with circuits rated 125 A through 400 A. Extension cables, with a length of 8 and 16 feet and factory installed connectors shall be available for installations where the standard cable is too short for proper installation. The current sensors shall have 600 V rated cable insulation and shall be UL listed with the MPM.

T. The MPM shall be provided with multiple communications ports and protocols, including the following capability:

1. RS-485 remote display port

2. RS-485 Modbus RTU

3. USB Local Configuration Port

4. HTML web pages

5. File transfer protocol (ftp)

6. RJ-45 10/100Base-T Ethernet network port

7. Modbus TCP

8. BACnet/IP

9. SMTP(Simple Mail Transfer Protocol) for email support

10. SNMP(Simple Network Management Protocol) MIB support

11. Ethernet TCP/IP

12. NTP(Network Time Protocol) support

U. The WEB server shall provide the user with remote WEB access to all the metered and trend information with the optional Energy Portal Module. The WEB server shall include real time monitored information in both numeric and graphical visual formats.

1. Administrators shall have the following capabilities: add, remove and configure the user accounts; view all the energy, demand, power, voltage, current and power factor measurements available in the meter; and ability to map the meters to the accounts and users.

2. User accounts shall have the following capabilities: view the energy and demand measurements specific to their account; and display the event logs, system logs and load profile data.

V. The meter shall have a real-time clock with the added capability to synchronize with a network time server to maintain time accuracy.

W. The MPM shall have a configuration utility installed on a disc or downloadable from the manufacturer's website to install on a PC.

1. The configuration utility shall be able to provide online and offline configuration.

2. The configuration utility shall have a wizard to guide the user in step by step setup.

3. The configuration utility shall be able to load a previously saved configuration, save a configuration, and print a configuration.

4. The configuration utility shall be able to configure the service type, set PT and CT ratios, set demand type and intervals along with reset capability on a specific day, configure inputs and outputs, set time, add admin and users with different authorization levels, assign meters to tenants, set alarms and limits, and set network parameters for optional energy portal module.

2.06 MULTIPOINT METER AND CIRCUIT BREAKER TOUCH SCREEN DISPLAY *(NOT IN CONTRACT)*

A. Provide minimum 6" color touch screen display. The touch screen display shall be capable of providing the following screens and displays for the Multipoint Meter System and all electronic trip circuit breaker trip units with power monitoring functionality.

1. System Meter Screen providing:

   a. Current per phase and average phase for A, B, and C
   b. Volts: L-L and L-N
   c. Power, Power Factor and Frequency
   d. Power per phase
   e. Demand
   f. Peak Demand and Timestamp
   g. Energy

2. Sub Meter Screen providing:

   a. Configuration
   b. Power, Power Factor and Frequency
   c. Demand
   d. Peak Demand and Timestamp
   e. Energy

3. Events Screen providing:

   a. Latest 20 events with date and timestamps

4. System Information Screen providing:

   a. Name
   b. Part Number
   c. Serial Number and Date Code

5. Module Information Screen providing:

    a. Name
    b. Part Number
    c. Serial Number and Date Code

6. Set-up screen providing:

    a. View set-up
    b. Edit set-up
    c. Login
    d. Logout

2.07 MISCELLANEOUS DEVICES *(NOT IN CONTRACT)*

A. Each section of the switchboard shall be provided with a space heater [thermostatically controlled]. Power for the space heaters shall be obtained [from a control power transformer within the switchboard] [from a source as indicated on the drawings]. Supply voltage shall be **[120] [240]** volts AC. Space heaters shall be wired to provide temporary heating during storage.

B. Control power transformers with primary and secondary protection shall be provided as required for proper operation of the equipment. **[Control power transformers shall have adequate capacity to supply power to the transformer cooling fans.]**

2.08 UTILITY METERING

A. Where indicated on the drawings, furnish a separate barriered-off Utility Metering Compartment complete with hinged sealable door. Bus work shall include provisions for mounting utility company current transformers and potential transformers or potential taps as required by the utility company. Provide Service Entrance Label and provide necessary applicable service entrance features per NEC and local code requirements.

2.09 CUSTOMER METERING *(NOT IN CONTRACT)*

A. Provide customer metering devices as specified herein. Provide a separate customer metering compartment with front hinged door. Including associated current transformers and potential instrument transformers.

B. Current transformers shall be wired to shorting type terminal blocks.

C. Provide potential transformers including primary and secondary fuses with disconnecting means or fused potential taps as the potential source for metering as required.

D. Microprocessor-based metering system.

1. Provide a full function electronic meter on the switchboard main fused switch. The meter shall have an imbedded wed server, the features and functions specified below. The meter shall be UL recognized, CSA certified and also meet ANSI Standard C12.20 0.2C and IEC 687 0.2

2. The meter shall provide direct reading metered, calculated values and monitored points of the items listed below and shall auto range between Units, Kilo-units, and Mega-units for all metered values. Accuracy indicated below to be of read or calculated values.

a. Volts: L-L, L-N, Avg. L-L, Avg. L-N, N-G
b. Phase, neutral and ground currents.
c. Power: real, reactive and apparent.
d. Frequency
e. Power Factor: apparent and displacement.
f. Energy
g. Demand
h. % THD
i. Min and Max values
j. Harmonics
k. Flicker
l. Number of 9's of availability
m. Phasors
n. Sequence components
o. Crest factor
p. K-Factor
q. PQ Index.

3. The meter accuracy shall be as indicated below:

a. Currents: 0.05% reading +0.025% FS
b. Voltage: 0.1% reading + 0.025% FS
c. Energy and demand power: 0.2% in accordance with ANSI C12.20
d. Frequency: +/- 0.01 Hertz
e. Power factor: 0.10% at unity PF and 0.3% at 0.5PF.

4. The meter shall have the following communications ports included and shall support the communications protocols:

a. Ports
   1) RS-485 remote display port
   2) RS-485 Modbus RTU slave port
   3) INCOM gateway port.
   4) RJ-45 10/100base-T local configuration port (Local browser connection)
   5) Selectable 100FX or 10/100Base-T Ethernet network port.
   6) RS-485 Modbus selectable Master/slave port
   7) RS-232 Modbus RTU slave port.

b. Protocols
   1) Modbus RTU
   2) Modbus TCP
   3) Ethernet TCP/IP
   4) HTML
   5) FTP
   6) INCOM

5. Provide current transformers as required for each phase and neutral circuit with ratings sized for incoming service or associated feeder. Provide potential transformers as required for proper operation of the meter.

6. The meter control power shall be capable of being supplied from the monitored incoming AC line without the need for a separate AC control circuit unless a separate 120 or 240 volt source is indicated on the drawings.

7. Customer meter shall have the characteristic and performance equal to or exceeding the Eaton Power Expert 6000 meter. Square D shall provide ION7650 Series meter.

8. The meter shall be factory installed and wired to the 1GB Ethernet switch listed elsewhere in the specifications.

2.10 SURGE PROTECTION DEVICE

A. Electrical Requirements

1. Unit Operating Voltage – 480 volt, 3 phase, 4 wire, solid grounded.

2. Maximum Continuous Operating Voltage (MCOV) – The MCOV shall be greater than 115% of the nominal system operating voltage.

3. The suppression system shall incorporate a hybrid designed Metal-Oxide Varistors (MOV) surge suppressor for the service entrance and other distribution level. The system shall not utilize silicon avalanche diodes, selenium cell, air gaps or other components that may crowbar the system voltage leading to system upset or create any environmental hazards.

4. Protection Modes – For a wye configured system, the device must have directly connected suppression elements between line-neutral (L-N), line-ground (L-G), and neutral-ground (N-G). For a delta-configured system, the device must have suppression elements between line to line (L-L) and line to ground (L-G). The device must meet or exceed the following surge current ratings;

MODES	kA Rating
Surge Current Per Phase	250
Surge Current Per Mode (All modes)	125

5. UL 1449 3RD Edition Suppressed Voltage Rating (SVR) – The maximum UL 1449 3RD Edition SVR for the device must not exceed the following:

MODES	208Y/120	480Y/277	600Y/347
L-N; L-G; N-G	400V	800V	1200V
L-L	800V	1800V	1800V

6. ANSI/IEEE Cat. C3 Let Through Voltage – The let through voltage based on IEEE C62.41 and C62.45 recommended procedures for Category C3 surges (20 kV, 10 kA) shall be less than:

Mode	208Y/120	480Y/277	600Y/347
L-N	560V	960V	1840V

7. ANSI/IEEE Cat. B3 Let Through Voltage – Let through voltage based on IEEE C62.41 and C62.45 recommended procedures for the ANSI/IEEE Cat. B3 ringwave (6 kV,

500 amps) shall be less than:

Mode	208Y/120	480Y/277	600Y/347
L-N	160V	165V	168V

B. SPD Design

1. Balanced Suppression Platform – The surge current shall be equally distributed to all MOV components to ensure equal stressing and maximum performance. The surge suppression platform must provide equal impedance paths to each matched MOV. Designs incorporating SPD modules shall not be acceptable.

2. Electrical Noise Filter – Each unit shall include a high-performance EMI/RFI noise rejection filter. Noise attenuation for electric line noise shall be 50 dB at 100 kHz using the MIL-STD-220A insertion loss test method. Products not able to demonstrate noise attenuation of 50 dB @ 100 kHz shall be rejected.

3. Extended Range Filter –The Surge Protective Device shall have a High Frequency Extended Range Tracking filter in each Line to Neutral mode with compliance to UL 1283 and NEMA LS1. The filter shall have published high frequency attenuation rating in the attenuation frequencies.

Attenuation Frequency	50kHz	100kHz	500kHz	1MHz	10MHz	100MHz
Insertion Loss (ratio)	40	316	316	89	200	79
Insertion Loss (dB)	32	50	50	39	46	38

4. Internal Connections – No plug-in component modules or printed circuit boards shall be used as surge current conductors. All internal components shall be hardwired with connections utilizing low impedance conductors and compression fittings.

5. Standard Monitoring Diagnostics – Each SPD shall provide integral monitoring options:

   a. Each unit shall provide a green / red solid state indicator light shall be provided on each phase. The absence of a green light and the presence of a red light, shall indicate which phase(s) have been damaged.

   b. Remote Status Monitor – The SPD device must include form C dry contacts (one NO and one NC) for remote annunciation of unit status. The remote alarm shall change state if any of the three phases detect a fault condition.

   c. Audible Alarm – The SPD shall provide an audible alarm with a reset pushbutton that will be activated under any fault condition.

   d. Event Counter – The SPD shall be equipped with an LCD display system designed to indicate to the user how many surges, sags, swells and outages have occurred at the location. The event counter triggers each time under each respective categories after significant event occurs. A reset pushbutton shall also be standard allowing all counters to be zeroed.

   e. Push to Test – The SPD shall be equipped with push-to-test feature is designed to provide users with real time testing of the suppressor's monitoring

and diagnostic system. By depressing the test button, the diagnostic system initiates a self test procedure. If the system is fully operational, the self test will activate all indicator lights.

f. Voltage Monitoring – The SPD shall display true Root Mean Square (RMS) on three L-N voltage protection mode on Wye configuration and three L-L voltage on delta configuration.

6. Advanced Monitoring Diagnostics:

a. Non Volatile Memory – The SPD shall at least be able to save the last 1000 events.

b. Network Communication – The SPD shall have the ability to communicate via Ethernet 10BaseT port or Modbus to provide information to the network master drive.

c. Security – The SPD monitoring diagnostics shall be password protected.

d. Protection Remaining – The SPD shall indicate the level of protection remaining.

e. Total Harmonic Distortion (%THD) – The SPD shall display Total Harmonic Distortion.

7. Overcurrent Protection Fusing: In order to isolate the SPD under any fault condition, the manufacturer shall provide:

a. Individual Fusing: MOV's shall be individually fused via Copper Fuse Trace. The Copper Fuse shall allow protection during high surge (kA) events.

b. Thermal Protection: MOV's shall be equipped with Thermal Fuse Spring (TFS) Technology which allows disconnection of the suppression component at the overheated stage common during temporary over voltage condition. For small fault currents between 100mA to 30Amp, or if the occurrence is over a longer period of time, the TFS will disconnect first. Manufacturers that utilize fuse trace only shall not be approved since there is no fault current protection between 100mA to 30A.

c. All overcurrent protection components shall be tested in compliance with UL 1449-Limited Current Test and AIC rating test.

C. Minimum Repetitive Surge Current Capability as per ANSI/IEEE C62.41 and ANSI/IEEE C62.45 – 1992

D. Monitored points shall be monitored by an addressable relay. Any monitored point event shall be communicated immediately over a local area network via the monitoring addressable relay over a twisted pair of shielded wires. Each relay shall have a unique address so that it is possible to "call up" and "read" a fuse blown operation for a set of fuses with the communication system. The monitored points shall be factory wired to a factory installed and wired to the 1GB Ethernet switch listed in Item 2.08 above.

E. The suppression filter system shall be repetitive surge tested in every mode utilizing a 1.2 x 50µsec, 20kV open circuit voltage. 8 x 20µsec, 10kA short circuit current Category C3 bi-wave at one minute intervals without suffering either performance degradation or more than

10% deviation of clamping voltage at a specified surge current. The minimum repetitive surge current capability as per ANSI/IEEE C62.41 and ANSI/IEEE C62.45 – 1992 shall be:

1. Switchboard : 12000 impulse per mode.
2. Distribution Panelboard: 10000 impulse per mode.
3. Branch Location Panelboard: 9000 impulse per mode.

2.11 ENCLOSURES

A. The switchboards shall be enclosed in an indoor NEMA 1 Enclosure.

2.12 NAMEPLATES

A. Engraved nameplates, mounted on the face of the assembly, shall be furnished for all main and feeder circuits as indicated on the drawings. Nameplates shall be laminated plastic, black characters on white background, and secured with screws. Characters shall be 3/16 inch high, minimum. Nameplates shall give item designation and circuit number as well as frame ampere size and appropriate trip rating. Furnish Master nameplate giving switchboard designation, voltage ampere rating, short circuit rating, manufacturer's name, general order number and item number.

B. Control components mounted within the assembly, such as fuse blocks, relays, pushbuttons, switches, etc., shall be suitably marked for identification corresponding to appropriate designations on manufacturer's wiring diagrams.

2.13 ARC FLASH REDUCTION MAINTENANCE SWITCH

A. Function

1. The Arc Flash Reduction Maintenance Switch shall reduce the trip system Instantaneous pickup value when activated. The device must not compromise phase protection or defeat its functionality, even when enabled. Once disabled, the recalibration of phase protection must not be required. Include one Arc Flash Reduction Maintenance Switch for each breaker or breaker provision.

2. Activation and deactivation of reduced maintenance trip setting must be accomplished without opening the circuit breaker door and exposing operator to energized parts.

3. Provided for Air-Power Circuit Breakers and Series G Breakers.

B. Features

1. The Arc Flash reduction system will provide a switchboard mounted blue indicating light for visual indication that the Arc Flash reduction system is activated. The light control voltage shall be an independent 9-volt DC or 120 volt AC source. A battery shall be included as backup.

2. The Arc Flash reduction system switch will provide a lockable cover to avoid tampering. The switch must be rated and tested for milli-volt signals in harsh environments. The switch shall include an extra NO/NC contact for remote indication.

3. The reduced maintenance trip setting must be adjustable with a minimum of five settings ranging from 2.5X to 10X of sensor tap value. The switch shall be maintained in the “Normal” and “Maintenance” positions. It shall be momentary in the “Continuity Check” position.

2.14 FINISH

A. All exterior and interior steel surfaces of the switchboard shall be properly cleaned and provided with a rust-inhibiting phosphatized coating. Color and finish of the switchboard shall be ANSI 61 light gray.

2.15 WEB-ENABLED COMMUNICATIONS

A. Provide a separate compartment with a front facing hinged door as a central point of connection for all internally located communicating devices to an external Ethernet network and allow monitoring of the power infrastructure with real-time, web-enabled data.

B. The compartment shall have a lockable, hinged door with a functional through-the-door RJ45 network access port. Power for the components in the compartment shall be supplied by a pre-wired, bus-connected control transformer in the compartment that is fused and has a disconnecting means.

C. Factory provided and wire communications components shall include meter(s), Ethernet Switch(es), Gateway(s), etc., as required for a complete single point of connection system

D. The switchboards metering, monitoring and circuit breaker shall be prewired to a factory provided and installed 1GB Ethernet switch.

E. Provide factory installed and wire gateway and 1GB Ethernet switch.

F. All circuit breaker trip units, meters, gateways, etc., shall be factory wired to the gateway

PART 3 – EXECUTION

3.01 FACTORY TESTING

A. The following standard factory tests shall be performed on the equipment provided under this section. All tests shall be in accordance with the latest version of ANSI and NEMA standards.

1. The switchboard shall be completely assembled, wired, adjusted and tested at the factory. After assembly, the complete switchboard will be tested for operation under simulated service conditions to assure the accuracy of the wiring and the functioning of all equipment. The main circuits shall be given a dielectric test of 2200 volts for one minute between live parts and ground and between opposite polarities. The wiring and control circuits shall be given a dielectric test of 1500 volts for one minute between live parts and ground.

B. Factory tests as outlined above shall be witnessed by the owner's representative.

1. The manufacturer shall notify the owner two (2) weeks prior to the date the tests are to be performed.

2. The manufacturer shall include the cost of transportation and lodging for up to two (2) owner's representatives and the project electrical engineer. The cost of meals and incidental expenses shall be the owner's responsibility.

C. The manufacturer shall provide three (3) certified copies of factory test reports.

3.02 INSTALLATION

A. The Electrical Subcontractor shall install all equipment per the manufacturer's recommendations and the contract drawings.

B. The assembly shall be provided with adequate lifting means and shall be capable of being moved into installation position and bolted directly to the floor without the use of floor sills providing the floor is level to 1/8 inch per 3-foot distance in any direction. All necessary hardware to secure the assembly in place shall be provided by the Electrical Subcontractor.

3.03 MANUFACTURER'S CERTIFICATION

A. A certified test report of all standard production tests shall be available to the Engineer upon request.

3.04 FIELD TESTING AND ACCEPTANCE

A. Perform all tests required by equipment manufacturer and as specified in Section 161198 of these specifications.

B. Final acceptance of the switchboard shall not be given until above referenced training is completed.

C. The Arc Flash Reduction System maximum clearing time must not exceed 0.05 seconds. The System must meet the requirements of ANSI C37.59 and EMI testing.

D. The Electrical Subcontractor shall provide a training session for up to 6 Owner's representative for 2 normal workdays at a jobsite location determined by the Owner.

E. The training session shall be conducted by a manufacturer's qualified representative. The training program shall consist of instruction on operation of the assembly, circuit breakers, fused switches, and major components within the assembly.

****

END OF SECTION

THE LIVESTOCK INSTITUTE

WESTPORT, MA

PROJECT NO. 4730

Specification for

GROUNDING

Section 16450

THE DENNIS GROUP, LLC

PLANNING ▲ ENGINEERING ▲ CONSTRUCTION MANAGEMENT

1537 MAIN STREET
SPRINGFIELD, MASSACHUSETTS 01103
413.787.1785 ▲ FAX 413.787.1786

26 WEST MARKET STREET
SALT LAKE CITY, UTAH 84101
801.531.8585 ▲ FAX 810.531.8586

A	**09.20.2016**	**Review**	**MJJ**		
Issue	**Date**	**Description**	**By**	**Approved**	**Section 16450**

Unless notification and/or comments are received from client within two weeks after issue date, all documentation including drawings, specifications, and studies submitted to client shall be considered approved as released.

PART 1 – GENERAL

1.01 REFERENCES

A. The General Documents, as listed on the Table of Contents and applicable parts of Division 1, General Requirements, and applicable requirements of Section 16010, shall be included in and made part of this Section.

B. Examine all drawings and criteria sheets and all other Sections of the specifications for requirements which affect work under this Section whether or not such work is specifically mentioned in this Section.

C. Coordinate work with that of all other Trades affecting or affected by work of this Section. Cooperate with such Trades to assure the steady progress of all work under the Contract.

D. Provide all material, labor and equipment, to complete the work of this Section in strict accordance with the design Architect's and Engineer's plans and specifications, and with all applicable codes, rules, and standards.

1.02 SCOPE OF WORK

A. The work under this Contract shall include all labor, materials, tools, equipment, transportation, insurance, temporary protection, supervision and incidental items essential for proper installation and operation, even though not specifically mentioned or indicated on the drawings, but which are usually provided or are essential for proper installation and operation of grounding systems as indicated on the drawings and specified herein.

B. The specifications and drawings describe the minimum requirements that must be met by Contractor for the installation of all work as shown on the drawings and as specified herein.

C. As a minimum, the Contractor shall provide grounding as outlined below and as required by the NEC:

1. Ground each separately derived system neutral to local ground bus and structural member of the building.

2. Ground raceways and electrical equipment; use double locknuts at all panels; use bonding jumpers where conduits are installed in concentric knockouts. Ground panels, switches, motor frames, motor starters, fixtures, and outlets with a separate ground conductor within the conduit system.

3. Bond together system neutrals, service entrance enclosures, exposed non-current carrying metal parts of electrical equipment, metal raceway systems, grounding conductor in raceways and cables, receptacle ground terminals, building structural steel and plumbing systems.

1.03 RELATED WORK SPECIFIED ELSEWHERE

A. The following referenced sections are listed as a minimum of additional requirements and/or work not included in this Section which may be required to be performed under other designated Sections:

1. Section 16110: Raceways
2. Section 16120: Conductors (600 Volt)

3. Section 16130: Boxes
4. Section 16140: Wiring Devices and Device Plates
5. Section 16198: Start Up Testing of Electrical Equipment
6. Section 16500: Lighting Fixtures
7. Section 16670: Lightning Protection

1.04 COORDINATION

A. The work of this Section shall be coordinated with other work of the Contractor.

1.05 REFERENCE STANDARDS

A. Applicable provisions of the following Codes and Trade Standard Publications shall apply to the work of this Section, and are hereby incorporated into, and made a part of, the Contract Documents.

1. ANSI/NFPA 70: National Electric Code (NEC)
2. NFPA-99
3. FAC 59A-3

1.06 GUARANTEE

A. In addition to the specific guarantee requirements of the General Conditions, the Contractor shall obtain in the Owner's name the standard written manufacturer's guarantee of all materials furnished under this Section where such guarantees are offered in the manufacturer's published product data. All these guarantees shall be in addition to, and not in lieu of, other liabilities which the Contractor may have by law or other provisions of the Contract Documents.

PART 2 – MATERIALS

2.01 GENERAL

A. All grounding materials required shall be furnished new and undamaged.

2.02 CABLE

A. Insulated Cable

1. Soft drawn copper, Class B stranding with green polyvinyl chloride insulation, UL 83, Type TW and THW.

B. Bare Cable

1. Soft drawn copper. Class AA stranding, ASTMB8.

2.03 BUS AND BARS

A. Soft copper, cross not less than 1/4" thick by 4" wide, ASTM B 187.

2.04 DRIVEN GROUND ROD ELECTRODES

A. Ground rods shall be copper clad steel with minimum size of 3/4" O.D. by 10'-0" length.

2.05 MISCELLANEOUS

A. All clamps, connectors, bolts, washers, nuts, and other hardware used with the grounding system shall be high-strength, high conductivity copper alloy.

B. All conductors shall be insulated unless otherwise indicated.

2.06 MECHANICAL CONNECTORS

A. Manufacturers

1. American Brass Manufacturing Company
2. Thomas & Betts - Blackburn
3. Anderson Electric Corporation

B. Material: Bronze

2.07 EXOTHERMIC CONNECTIONS

A. Manufacturers

1. Erico Products, Inc.
2. American Brass Manufacturing Co.
3. Thomas & Betts - Blackburn

PART 3 – EXECUTION

3.01 INSTALLATION

A. Provide equipment grounding system as shown on the drawings. Equipment grounding system shall be designed so metallic structures, enclosures, raceways, junction boxes, outlet boxes, cabinets, machine frames, portable equipment and other conductive items in proximity to electrical circuits operate continuously at ground potential and provide low impedance path for possible ground fault currents.

B. System shall meet NEC requirements, modified as shown on the drawings and as specified. Bonding jumpers shall be installed at all locations required by NEC.

C. A copper ground bus shall be installed surrounding the electric room. The bus shall be 3" by 1/4" in cross-section and supported off the walls with 3/4" spacers on 2'-0" centers. All electrical equipment in the electric room shall be properly bonded to the ground bus with an adequately sized copper conductor as well as the driven ground rod system external to the building.

D. Provide separate green insulated equipment grounding conductor for each single or three-phase feeder and each branch circuit. Install grounding conductor in common conduit with related phase or neutral conductors, or both. Parallel feeders installed in more than one raceway shall have individual full size green insulated equipment ground conductors in each.

E. Main Grounding Network

1. Provide grounding network for main service equipment consisting of:

a. Ground loop buried around the building, 500 kcmil copper, bare.

b. Down conductors from main electric room grounding system shall be 500 kcmil copper conductors in conduit to the ground loop.

c. Appropriate number of 3/4" diameter, 10'-0" long copper-clad steel ground rod clusters and copper ground wire connections from grounding loop.

d. Ground points shall be driven to achieve 5 ohms maximum resistance to ground. Provide additional rods as required to achieve 5 ohms overall. Where geological conditions dictate, ground wire mesh may be provided or additional rods shall be driven in compacted earth areas as required to meet 5-ohm resistance requirement. Plate electrodes may be used where ground rods cannot be driven to achieve grounding requirements.

2. Connections to ground loop system shall be made with Exothermic process.

F. Determine numbers and sizes of screw terminals for equipment grounding bars in panelboards and other electrical equipment. Provide screw terminals for active circuits, spares and spaces.

G. Provide green, insulated equipment ground conductor in same raceway with associated phase conductors, as follows:

1. From main service ground bus in service entrance equipment to ground bus in all distribution panels, remote panels, motor control centers, etc., size as shown on the drawings.

2. From green equipment ground terminals of receptacles to green 10-32 washer-in-head outlet box machine screw and to panelboard grounding bus. (Receptacles with special cast boxes and factory designed and approved ground path do not require separate ground jumper.)

3. From panelboard ground bus to green 10-32 washer-in-head machine screw in ceiling outlet box or junction box, through flexible metallic conduit to ground terminal on lighting fixture and from green 10-32 washer-in-head machine screw in ceiling outlet box or junction box through flexible metallic conduit to green 10-32 washer-in-head machine screw in switch outlet box.

4. From panelboard ground bus to green 10-32 washer-in-head machine screw in junction box or disconnect switch through flexible metallic conduit to ground terminal in connection box mounted on single phase fractional horsepower motor.

5. From equipment ground bus in motor control center through conduit and flexible metallic conduit to ground terminal in connection box mounted on three-phase motors. Ground conductors for motors with separate starters and disconnect devices shall originate at ground bar in panelboard and shall be bonded to each starter and disconnect device enclosure.

6. From dry type transformer neutrals to the local ground bus and building steel by means of copper wire, as scheduled on the drawings.

H. Grounding system materials shall be installed according to the drawings and the requirements which follow.

I. Conduit Grounding

1. All grounding bushings within all enclosures, including equipment enclosures, shall be bonded together and connected internally to the enclosure grounding lug or grounding bus with a bare copper conductor. Grounding bushings shall be grounded with conductors' sizes in accordance with NEC, but not smaller than #12 AWG.

J. Equipment Grounding

1. All electrical equipment shall be connected to the grounding system with copper grounding conductor. The term “electrical equipment” shall include all enclosures containing electrical connections or bare conductors, except that individual devices such as solenoids, pressure switches, and limit switches shall be exempt from this requirement, unless the device requires grounding for proper operation. Large equipment such as motor control centers will be furnished with a grounding bus, which the Contractor shall connect to the grounding system. Most other equipment will be furnished with grounding pads and/or grounding lugs, which the Contractor shall connect to the grounding system. All ground connection surfaces shall be free of paint and cleaned immediately prior to connection. The Contractor shall furnish all grounding material not furnished with the equipment.

2. The conduit system is not considered to be a grounding conductor. No grounding conductor shall be smaller in size than #12 AWG, unless it is a part of an acceptable cable assembly. A separate grounding conductor shall be run in all conduits.

K. Non-Metallic Raceways

1. Provide green, insulated grounding conductor in non-metallic conduits or ducts unless specified otherwise.

L. Extension Stingers

1. Where grounding system extension stingers are indicated on the drawings to be provided for connection to electrical equipment ground bus, pad or lug. Except where otherwise indicated on the drawings, all equipment ground conductors installed in conduit shall be insulated. Metal siding not attached to grounded structure shall be bonded to the grounding system.

M. Grounding Facilities

1. Suitable grounding facilities acceptable to the Owner's representative shall be furnished on electrical equipment not provided with the equipment. The grounding facilities shall consist of compression type terminal connectors bolted to the equipment frame or enclosure and shall provide a minimum of joint resistance.

N. Equipment Grounding Conductor

1. Provide separate insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus or bushing.

2. Ground all noncurrent carrying components for the electrical system with a separate ground conductor sized per the NEC, and include raceways, enclosures, lighting fixtures, motors, panels, etc. All panels shall have a ground bar distinct from neutral bus. Flexible conduit must have a separate ground wire.

3. The conduit system is not considered to be a grounding conductor. No grounding conductor shall be smaller in size than #12 AWG unless it is a part of an acceptable cable assembly. A separate grounding conductor shall be run in all conduits.

O. Provide separate green insulated equipment grounding conductor for each single or three-phase feeder and each branch circuit. Install grounding conductor in common conduit with related phase or neutral conductors, or both. Parallel feeders installed in more than one raceway shall have individual full size green insulated equipment ground conductors in each.

P. Provide green, insulated equipment ground conductor in all conduits, runs.

Q. If a lightning protection system is to be installed, the building grounding grid system shall be as follows:

1. Three-quarter 3/4" by 10'-0" driven ground rods shall be copper weld type, and 2/3 of the length of the rod shall be in contact with conductive soil. Connections to buried ground rods shall be exothermic weld. Tops of all buried ground rods shall be a minimum of 6" below grade. Where rock is encountered, grounding plates may be used in lieu of grounding rods. Grounding plates shall be copper. Sizes of plates shall be as required.

2. All exposed connections shall be made by means of approved grounding clamps. Exposed connections between different metals shall be sealed with no-oxide paint Grade A. All buried connections shall be made by the Cadweld process.

3. Dry season resistance of the grounding system shall not exceed five (5) ohms. If such resistance cannot be obtained with the grounding system indicated on the drawings, the Contractor shall provide additional grounding as required and as directed by the Engineer, to provide the five (5) ohms resistance value.

4. A test shall be conducted at the completion of the grounding system installation in the presence of the Owner's representative. The Contractor shall pay for all materials and workmanship. Defects appearing under the tests shall be corrected by the Contractor.

5. An exterior buried grounding loop shall connect the building steel and grounding electrode array (Triad).

R. All empty conduit runs shall be provided with insulated and grounding bushing and grounded by a #12 AWG green ground conductor to the nearest panel ground bus.

S. Where motors are connected to conduit system with flexible conduit section, install grounding conductor in flexible section.

T. Grounding Requirements

1. Dry type transformers and separately derived systems shall contain an insulated grounding conductor which shall be used to connect neutral of secondary system to ground.

2. Grounding terminal on receptacles shall be bonded to grounding conductor to establish grounding continuity.

3. Conduit Systems

   a. Ground all metallic conduit systems.

   b. Non-metallic conduit systems shall contain a grounding conductor.

   c. Conduit provided for mechanical protection and containing only a grounding conductor shall be bonded to that conductor at the entrance and exit from the conduit.

   d. *All ground bushing shall have a nylon insert.*

4. Feeders and Branch Circuits

   a. Install green grounding conductors with all feeders and branch circuits as follows:

      1) All feeders.

      2) All receptacle outlets, switches.

      3) All directly connected laboratory equipment.

      4) All motors, motor controllers, disconnect switches, etc.

      5) All fixed equipment and appliances.

      6) All items of equipment where the final connection is made with flexible metal conduit shall have a grounding wire.

      7) All additional locations and systems as shown on the drawings.

      8) All lighting fixtures.

5. Boxes, Cabinets, Enclosures and Panelboards

   a. Bond the grounding wires to each pull box, junction box, outlet box, cabinets, and other enclosures through which the ground wires pass.

   b. Provide lugs in each box and enclosure for ground wire termination.

   c. Provide ground bars in panelboards, bolted to the housing, with sufficient lugs for terminating the ground wires.

6. Motors and Starters

   a. Provide lugs in motor terminal box and starter housing for ground wire termination.

   b. Make ground wire connections to ground bus in motor control centers.

7. Lighting Fixtures

   a. Fixtures shall be grounded by a separate green ground conductor run with branch circuit wiring. Fixtures connected with flexible conduit shall have a green ground wire included with the power wires from the fixture through the flexible conduit to the first outlet box.

U. The Contractor shall provide equipment grounding of all building systems such as fire alarm, telephone, computer, paging, water, etc. Grounding of these systems shall be as shown on the drawings or per equipment manufacturer's recommendations.

V. Provide surge protection devices at locations shown on the drawings and as specified herein.

1. Provide surge protection devices in the following locations:

   a. Service entrance switchboard.

2. See specification section 16421.

3.02 TESTING

A. All grounding systems shall be tested as outlined in specification section 16198.

****

END OF SECTION

THE LIVESTOCK INSTITUTE

WESTPORT, MA

PROJECT NO. 4730

Specification for

DRY TYPE TRANSFORMERS

Section 16460

THE DENNIS GROUP, LLC

PLANNING ▲ ENGINEERING ▲ CONSTRUCTION MANAGEMENT

1537 MAIN STREET
SPRINGFIELD, MASSACHUSETTS 01103
413.787.1785 ▲ FAX 413.787.1786

26 WEST MARKET STREET
SALT LAKE CITY, UTAH 84101
801.531.8585 ▲ FAX 810.531.8586

A	**09.20.2016**	**Review**	**MJJ**		
Issue	**Date**	**Description**	**By**	**Approved**	**Section 16460**

Unless notification and/or comments are received from client within two weeks after issue date, all documentation including drawings, specifications, and studies submitted to client shall be considered approved as released.

PART 1 – GENERAL

1.01 REFERENCES

A. The General Documents, as listed on the Table of Contents and applicable parts of Division 1, General Requirements, and applicable requirements of Section 16010, shall be included in and made part of this Section.

B. Examine all drawings and criteria sheets and all other Sections of the specifications for requirements which affect work under this Section whether or not such work is specifically mentioned in this Section.

C. Coordinate work with that of all other Trades affecting or affected by work of this Section. Cooperate with such Trades to assure the steady progress of all work under the Contract.

D. Provide all material, labor and equipment, to complete the work of this Section in strict accordance with the design Architect's and Engineer's plans and specifications, and with all applicable codes, rules, and standards.

1.02 SCOPE OF WORK

A. The work under this Section shall include furnishing, installing, testing and placing in operation dry type transformers in accordance with these specifications and as indicated on the drawings. Transformer shall include all transformers, supports and accessories required for a complete and operational installation.

B. The work under this Contract shall also include all labor, materials, tools, equipment, transportation, insurance, temporary protection, supervision and incidental items essential for proper installation and operation, even though not specifically mentioned or indicated on the drawings, but which are usually provided or are essential for proper installation and operation of all systems as indicated on the drawings and specified herein.

C. The specifications and drawings describe the minimum requirements that must be met by the Contractor for the installation of all work as shown on the drawings and as specified hereinunder.

1.03 RELATED WORK SPECIFIED ELSEWHERE

A. The following referenced sections are listed as a minimum of additional requirements and/or work not included in this Section which may be required to be performed under other designated Sections:

1. Division 3, Housekeeping Pads
2. Section 16016: Power System and Arc Flash Hazard Analysis Study
3. Section 16120: Conductors (600 Volt)
4. Section 16190: Hangers and Supports
5. Section 16195: Electrical Identification
6. Section 16198: Start-up Testing of Electrical Equipment
7. Section 16450: Grounding

1.04 SUBMITTALS

A. Prepare and submit complete shop drawings of the transformer required on this project to Engineer for approval.

B. Submit samples of each transformer if requested by the Engineer, for approval. Samples shall be in size and form requested by the Engineer, and reasonable to show characteristics, color and finishes of the material.

C. Submit complete manufacturer's product data of all materials and systems to the Engineer for approval, consisting of complete product description and specifications, complete performance test data, and complete preparation and installation instructions.

D. Disposition of shop drawings shall not relieve the Contractor from the responsibility for deviations from drawings or specifications, unless he has submitted in writing a letter itemizing or calling attention to such deviations at time of submission and secured written approval from the Engineer, nor shall such disposition of shop drawings relieve the Contractor from responsibility for errors in shop drawings or schedules.

E. Do not order materials or begin installation until the Architect's and Engineer's approval of submittals has been obtained.

1.05 GUARANTEE

A. In addition to the specific guarantee requirements of the General Conditions, the Contractor shall obtain in the Owner's name the standard written manufacturer's guarantee of all materials furnished under this Section where such guarantees are offered in the manufacturer's published product data. All these guarantees shall be in addition to, and not in lieu of, other liabilities which the Contractor may have by law or other provisions of the Contract Documents.

1.06 COORDINATION

A. The work of this Section shall be coordinated with other work of the Contractor.

1.07 REFERENCE STANDARDS

A. Applicable provisions of the following Codes and Trade Standard Publications shall apply to the work of this Section, and are hereby incorporated into, and made a part of, the Contract Documents.

1. NFPA 70: National Electric Code (NEC)
2. UL: Underwriter's Laboratories
3. NEMA: National Electrical Manufacturers Association
4. ANSI: American National Standards Institute
5. IEEE: Institute of Electronic and Electrical Engineers

1.08 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery of materials shall be made to the project by the materials supplier in accordance with the instructions of the Contractor.

B. The Contractor shall be responsible for the receiving and safe handling of all transformers included in the Contract.

C. The Contractor shall provide adequate locked storage space with shelving for the materials, shall be responsible for all items of materials after receipt from the supplier, and shall replace all materials lost or damaged after delivery and receipt.

PART 2 – MATERIALS

2.01 GENERAL

A. Furnish, assemble, hang and connect all transformers, as indicated on the drawings.

B. Transformers shall be non-explosive and fire resistant and be cooled by natural circulation of air through the windings. Transformers shall be of the continuous wound construction and shall be impregnated with non-hygroscopic, thermosetting varnish. Subject transformers to potential tests in accord with NEMA standards applying to dry type apparatus.

C. Transformers shall be designed, manufactured, and tested in accordance with all the latest applicable ANSI, NEMA, and IEEE Standards. All 600 volt class transformers shall be UL listed and shall bear the UL label.

D. Transformers shall be designed for continuous operation at rated kVA, for 24 hours a day, 365 days a year operation, with normal life expectancy as defined in ANSI C57.96.

2.02 ACCEPTABLE MANUFACTURERS

A. Transformers shall be manufactured by companies listed below:

1. Cutler-Hammer
2. Square D
3. Siemens

2.03 INSULATION SYSTEMS

A. Transformers shall be insulated as follows:

1. 2 kVA and below: Class C insulation for 150°C total temperature, based on 80°C rise.

2. 3 kVA through 15 kVA: Class C insulation for 185°C total temperature, based on 115°C rise.

3. 15 kVA and above: Class C insulation for 220°C total temperature, based on 150°C rise.

B. Required performance shall be obtained without exceeding the above indicated temperature rise in a 40°C maximum ambient, with a 30°C average ambient over 24 hours.

C. All insulation materials shall be flame-retardant and shall not support combustion as defined in ASTM Standard Test Method D635.

2.04 CORE AND COIL ASSEMBLIES

A. Transformer core shall be constructed with high grade, non-aging, grain-oriented silicon steel with high magnetic permeability, and low hysteresis and eddy current losses. Maximum magnetic flux densities shall be substantially below the saturation point. The transformer core volume shall allow efficient transformer operation at 10 percent above the highest tap voltage. The core laminations shall be tightly clamped and compressed.

B. Coils shall be wound of electrical grade **copper** with continuous wound construction. The complete coil and core shall be isolated from the enclosure by means of rubber, vibration absorbing mounts.

C. On units rated below 15 kVA, the core and coil assembly shall be completely encapsulated in a proportioned mixture of resin and aggregate to provide a moisture-proof, shock resistant seal.

D. On units rated 15 kVA and above, the core and coil assembly shall be impregnated with a non-hydroscopic, thermo-setting varnish and cured to reduce hot spots and seal out moisture. The assembly shall be installed on vibration-absorbing pads and securely bolted to the base to minimize sound transmission.

E. Windings shall be totally enclosed and the transformers shall be capable of continuous operation at rated load, voltage and frequency in accord with ANSI C57.96. The coils shall be thoroughly insulated from the bushings and from each other. Bushings shall be built into coils. The complete coil and core assembly shall be impregnated with waterproofing material having high-insulating and good heat-conducting properties, in accord with NEMA ST-20.

2.05 MOTOR DRIVE ISOLATION

A. Where shown on the drawings, provide motor drive isolation transformers.

B. Motor drive isolation transformers shall be designed for use with 3-phase AC adjustable frequency drives 600 volts and below to provide isolation between the incoming line and drive circuitry. These drives minimize the line disturbances caused by SCR firing within the drive unit. Thermoguards shall be included in all motor drive isolation transformers to provide additional protection for the transformer from increased heating due to the non-sinusoidal characteristics of drive currents. The transformer shall provide reduced short circuit currents and voltage line transients. The transformer shall be specifically sized to the drive kVA requirements dictated by the horsepower of the motor, and as such will be mechanically braced to withstand the stress of current reversals and short circuit currents associated with the specific drive kVA rating.

2.06 ENCLOSURES

A. The enclosure shall be made of heavy gauge steel and shall be degreased, cleaned, primed, and finished with ANSI 61 color weather-resistant enamel. All transformers shall be equipped with a wiring compartment suitable for conduit entry from top, bottom and/or sides, and large enough to allow convenient wiring. The maximum temperature of the enclosure shall not exceed 90°C. The core of the transformer shall be visibly grounded to the enclosure.

B. On units rated below 15 kVA, the enclosure construction shall be totally enclosed, non-ventilated, NEMA 3R, with lifting eyes.

C. On units rated 15 kVA and above, the enclosure construction shall be ventilated, NEMA 2, dripproof, with lifting holes. All ventilation openings shall be protected against falling dirt. On outdoor units, provide suitable weathershields over ventilation openings.

2.07 SOUND LEVELS

A. Transformer sound levels shall not exceed the following ANSI and NEMA levels for self-cooled ratings:

1.	Up	to	9 kVA	40 dB
2.	10	to	50 kVA	45 dB
3.	51	to	150 kVA	50 dB
4.	151	to	300 kVA	55 dB
5.	301	to	500 kVA	60 dB
6.	501	to	700 kVA	62 dB
7.	701	to	1000 kVA	64 dB

2.08 RATINGS

A. Transformers shall have voltage and kVA ratings indicated on the drawings, with four 2-1/2% taps – two above and two below rated voltage.

B. **Transformers shall exceed the minimum efficiencies as required by TP-1, 1996**

2.09 WIRING/TERMINATIONS

A. Recommended external cable shall be rated 90 degrees C for encapsulated and 75 degrees C for ventilated designs. Connectors should be selected on the basis of the type and cable size used to wire the specific transformer. Vendor to provide primary and secondary lugs per Dennis Group transformer cable size schedules #SS-03 and SS-04.

2.10 ISOLATION PADS

A. Set transformers on isolation pads of proper size and thickness to prevent transmission of sound into building structure.

1. Acceptable Products:

a. Isomode
b. Keldur
c. Korfund

PART 3 – EXECUTION

3.01 GENERAL

A. Transformers shall be installed in accordance with manufacturer's installation instructions.

B. Dust protection plastic covers shall be maintained during construction.

C. Prior to energizing, transformers shall be tested and vacuumed clean of dust and debris.

D. Protect transformers from moisture.

E. Refer to Specification Section 16198 for testing.

3.02 INSTALLATION

A. Wall mount or floor mount transformers as shown on Drawings. All floor mounted transformers shall be set on a 4" high concrete housekeeping pad.

B. All conduit connections to transformers shall have a minimum of 24 inch length of flexible conduit to minimize vibration transmission. Maximum length shall not exceed sizes allowed by the NEC.

C. Ground secondary of transformer to the ground electrode system in accord with the National Electrical Code.

D. Trapeze or wall mounted transformers shall be provided with the necessary mounting channels and hardware.

E. A minimum 6 inch clearance from walls shall be maintained for proper ventilation.

3.03 TESTS

A. Transformers shall be tested in accord with Specification Section 16198 of this contract and as specified herein. The following tests shall be made on all transformers:

1. Ratio tests on the rated voltage connection and all tap connections.

2. Polarity and phase-relation tests on the rated voltage connection.

3. Applied potential tests.

4. Induced potential test.

B. The following special factory tests shall be performed on ratings above 500 kVA provided under this section. All tests shall be in accordance with the latest revision of ANSI and NEMA standards.

1. Resistance measurements on all windings at the rated voltage connection of each unit and at the tap extremes of the first unit made of a new design.

****

END OF SECTION

THE LIVESTOCK INSTITUTE

WESTPORT, MA

PROJECT NO. 4730

Specification for

PANELBOARDS

Section 16470

THE DENNIS GROUP, LLC

PLANNING ▲ ENGINEERING ▲ CONSTRUCTION MANAGEMENT

1537 MAIN STREET
SPRINGFIELD, MASSACHUSETTS 01103
413.787.1785 ▲ FAX 413.787.1786

26 WEST MARKET STREET
SALT LAKE CITY, UTAH 84101
801.531.8585 ▲ FAX 810.531.8586

A	**09.20.2016**	**Review**	**MJJ**		
Issue	**Date**	**Description**	**By**	**Approved**	**Section 16470**

Unless notification and/or comments are received from client within two weeks after issue date, all documentation including drawings, specifications, and studies submitted to client shall be considered approved as released.

PART 1 – GENERAL

1.01 REFERENCES

A. The General Documents, as listed on the Table of Contents and applicable parts of Division 1, General Requirements, and applicable requirements of Section 16010, shall be included in and made part of this Section.

B. Examine all drawings and criteria sheets and all other Sections of the specifications for requirements which affect work under this Section whether or not such work is specifically mentioned in this Section.

C. Coordinate work with that of all other Trades affecting or affected by work of this Section. Cooperate with such Trades to assure the steady progress of all work under the Contract.

D. Provide all material, labor and equipment, to complete the work of this Section in strict accordance with the design Architect's and Engineer's plans and specifications, and with all applicable codes, rules, and standards.

1.02 SCOPE OF WORK

A. The work under this Section shall include furnishing and installing lighting and power panelboards as shown on the drawings.

B. The work under this Contract shall also include all labor, materials, tools, equipment, transportation, insurance, temporary protection, supervision and incidental items essential for proper installation and operation, even though not specifically mentioned or indicated on the drawings, but which are usually provided or are essential for proper installation and operation of all systems as indicated on the drawings and specified herein.

C. The specifications and drawings describe the minimum requirements that must be met by the Contractor for the installation of all work as shown on the drawings and as specified hereinunder.

1.03 RELATED WORK SPECIFIED ELSEWHERE

A. The following referenced sections are listed as a minimum of additional requirements and/or work not included in this Section which may be required to be performed under other designated Sections:

1. Section 16016: Power System and Arc Flash Hazard Analysis Study
2. Section 16110: Raceways (Non-Process)
3. Section 16120: Conductors (600 Volt)
4. Section 16190: Hangers and Supports
5. Section 16195: Electrical Identification
6. Section 16198: Start-Up Testing of Electrical Equipment
7. Section 16421: Transient Voltage Surge Suppression
8. Section 16450: Grounding
9. Section 16460: Dry Type Transformers

1.04 SUBMITTALS

A. Prepare and submit complete shop drawings of panelboards required on this project to Engineer for approval.

B. Submit samples of each material under this Section requested by the Engineer for approval. Samples shall be in size and form requested by the Engineer, and reasonable to show characteristics, color and finishes of the materials.

C. Submit complete manufacturer's product data of all materials and systems to the Engineer for approval, consisting of complete product description and specifications, complete performance test data, complete preparation and installation instructions, and all other pertinent technical data required for complete product and product use information.

D. All shop drawings shall have clearly marked the appropriate specification number of drawing designation, for identification of the submittal.

E. Disposition of shop drawings shall not relieve the Contractor from the responsibility for deviations from drawing or specifications, unless he has submitted in writing a letter itemizing or calling attention to such deviations at time of submission and secured written approval from the Engineer, nor shall such disposition of shop drawings relieve the Contractor from responsibility for errors in shop drawings or schedules.

F. Do not order materials or begin installation until the Architect's and Engineer's approval of submittals has been obtained.

1.05 GUARANTEE

A. In addition to the specific guarantee requirements of the General Conditions, the Contractor shall obtain in the Owner's name the standard written manufacturer's guarantee of all materials furnished under this Section where such guarantees are offered in the manufacturer's published product data. All these guarantees shall be in addition to, and not in lieu of, other liabilities which the Contractor may have by law or other provisions of the Contract Documents.

1.06 COORDINATION

A. The work of this Section shall be coordinated with other work of the Contractor.

1.07 REFERENCE STANDARDS

A. Applicable provisions of the following Codes and Trade Standard Publications shall apply to the work of this Section, and are hereby incorporated into, and made a part of, the Contract Documents:

1.	NEMA KS 1:	Enclosed Switches
2.	NFPA 70:	National Electrical Code
3.	UL 67-79:	Panelboards
4.	NEMA PB 1-77:	Panelboards
5.	UL 489-80:	Molded Case Circuit Breakers
6.	NEMA AB1:	Molded Case Circuit Breakers and Enclosures

1.08 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery of materials shall be made to the project by the materials supplier in accordance with the instructions of the Contractor.

B. The Contractor shall provide adequate locked storage space with shelving for the materials, shall be responsible for all items of materials after receipt from the supplier, and shall replace all materials lost or damaged after delivery and receipt.

C. The Contractor shall furnish the materials supplier with receipts for all materials and accessory items received, and shall send copies of these receipts to the Architect.

PART 2 – MATERIALS

2.01 GENERAL

A. The Electrical Subcontractor shall furnish and install the panelboards as specified and as scheduled on the contract drawings.

B. The panelboards and all components shall be designed, manufactured, and tested in accordance with the latest applicable standards of NEMA and UL.

C. The manufacturer of the panelboard shall be the manufacturer of the major components within the assembly, including circuit breakers and fusible switches.

D. For the equipment specified herein, the manufacturer shall be ISO 9000, 9001 or 9002 certified.

E. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

F. Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment.

G. Panelboards shall be provided with typewritten directories indicating circuit numbers, equipment served and area served.

H. Each panel shall have an engraved nameplate fastened by rivets or screws for each section, in accordance with this specification and specification Section 16195.

I. Each circuit breaker shall be provided with a factory-installed padlockable handle lock hasp.

2.02 MANUFACTURERS

A. Panelboards, 208/120 volt with mains from 100 amperes to 400 amperes, max 84 branch circuits and no branch breakers over 100 amperes, shall be:

1. Cutler-Hammer, PRL-1
2. Square D, NQOD
3. Siemens, P1
4. General Electric, AQ
5. Panel dimensions shall be 90"H x 28"W x 5.75"D.

B. Panelboards, 480/277 volt or 208/120 volt with mains from 100 amperes to 400 amperes, max 76 branch circuits and no branch breakers over 225 amperes, shall be:

1. Cutler-Hammer, PRL-3
2. Square D, NF or I-Line
3. Siemens, P3
4. General Electric, AD
5. Panel dimensions shall be 90”H x 28”W x 5.75”D.

C. Panelboards, 480/277 volt or 208/120 volt with mains from 400 amperes to 1,200 amperes and/or with branch breakers over 225 amperes, shall be:

1. Cutler-Hammer, PRL-4
2. Square D, I-Line
3. Siemens, P5
4. General Electric, Spectra
5. Panel dimensions shall be 90”H x 44”W x 13”D.

2.03 RATINGS

A. All panels and individually mounted circuit breakers shall have short circuit ratings as follows:

1. 240 Volt Class Panels/Breakers

    a. 10 kAIC where shown fed via 150 kVA transformers or less

    b. 22 kAIC where shown fed via 225 and 300 kVA transformers

    c. 42 kAIC where shown fed via 500 kVA transformers

2. 480 Volt Class Panels/Breakers

    a. 14 kAIC where shown fed via 500 kVA transformers or less

    b. 30 kAIC where shown fed via 750 or 1,000 kVA transformers

    c. 42 kAIC where shown fed via 1,500 kVA transformers

    d. 50 kAIC where shown fed via 2,000 kVA transformers

    e. 65 kAIC where shown fed via 2,500 kVA transformers

3. All panelboards shall be UL listed and labeled. Panels shall have ratings not less than the short circuit ratings available from the power sources.

4. Panelboards shall be labeled with a UL short circuit rating. Panelboards shall be fully rated.

2.04 CONSTRUCTION

A. Interiors shall be completely factory-assembled with bolt-on devices. They shall be designed such that switching and protective devices can be replaced without disturbing adjacent units and without removing the main bus connectors.

B. All panelboards shall be provided with solid neutrals. In addition, grounding bus with lugs shall be provided on all panelboards meeting UL and NEMA standards. Other special features shall be provided as required and as indicated.

C. Where auxiliary gutters are indicated for feed-through lugs, a separate gutter shall be attached to the panelboard, sized as required based on conductor size, with an individual cover.

D. A directory card with a clear plastic cover shall be supplied and mounted on the inside of each door.

2.05 BUS

A. Main bus bars shall be **copper** sized in accordance with UL standards to limit temperature rise on any current carrying part to a maximum of 65 degrees C above an ambient of 40 degrees C maximum.

B. A bolted ground bus shall be included in all panels.

C. In addition to the bolted ground bus, an isolated ground bus shall be included in panels as indicated on the drawings.

D. Bus bar taps for panels with single pole branches shall be arranged for sequence phasing of the branch circuit devices.

E. Neutral Bus

1. Full-size insulated neutral bars shall be included for panelboards shown with neutral.

2. Neutral busing shall have a suitable lug for each outgoing feeder requiring a neutral connection.

3. For panels 600 amperes and below, fed via "K"-factor transformers, neutral bus shall be 200% of phase busses.

4. For panels over 600 amperes, fed by "K"-factor transformers, switchboards shall be provided with 200% neutral bus. Refer to Switchboard section of these specifications.

2.06 BOXES

A. Boxes shall be at least 20" wide and 5-3/4" deep, made from galvanized steel. Provide minimum gutter space of 4" on all sides. Where feeder cables supplying the mains of a panel are carried through its box to supply other electrical equipment, the box shall be sized to include the additional required wiring space. At least four (4) interior mounting studs with adjustable nuts shall be provided.

B. Boxes shall be provided with removable blank ends.

2.07 TRIMS

A. Trims for all lighting and appliance panelboards shall be supplied with a door-in-hinged-door. Interior door shall cover all circuit breaker handles and not uncover any live parts. Outer hinged door shall open to provide access to all wire gutter space on both sides of circuit breakers. Doors shall have a semi-flush cylinder lock and catch assembly. Doors over

48 inches in height shall have auxiliary fasteners. Refer to drawings for surface or recessed mounted.

B. All distribution panelboard trims shall be door-in-hinged-door type. Interior door shall cover all circuit breaker handles and shall not uncover any live parts. The outer hinged door shall open to provide access to all wire gutter space on both sides of circuit breakers. Switching device handles shall be accessible.

C. Surfaces of the trim assembly shall be properly cleaned, primed, and applied with a finish coat of gray ANSI 61 paint.

D. Surface trims shall be same height and width as box. Flush trims shall overlap the box by 3/4 inch on all sides.

E. Two (2) milled type keys shall be provided with each panel and all panel locks shall be keyed alike.

2.08 POWER DISTRIBUTION PANELBOARDS, CIRCUIT BREAKER TYPE

A. Molded case circuit breakers shall provide circuit overcurrent protection with inverse time and instantaneous tripping characteristics. **Ground fault protection shall be provided on breakers where indicated on the drawings and these specifications.**

B. Circuit breakers shall be operated by a toggle-type handle and shall have a quick-make, quick-break over-center switching mechanism that is mechanically trip-free. Automatic tripping of the breaker shall be clearly indicated by the handle position. Contacts shall be nonwelding silver alloy, and arc extinction shall be accomplished by means of arc chutes. A push-to-trip button on the front of the circuit breaker shall provide a local manual means to exercise the trip mechanism.

C. Circuit breakers 600 ampere frame and below shall either be of the thermal-magnetic type with inverse time-current characteristics, or be of the solid state type, as indicated on the contract drawings.

D. Circuit breakers over 600 ampere frame shall be Cutler-Hammer Series C, Square D Micrologic, or Siemens Sentron, with microprocessor-based, true RMS sensing trip units with LSIG adjustments.

1. Each molded case circuit breaker microprocessor-based tripping system shall consist of three current sensors, a microprocessor, and a flux-transfer shunt trip. True RMS sensing circuit protection shall be achieved by analyzing the secondary current signals received from the circuit breaker current sensors and initiating trip signals to the circuit breaker trip actuators when predetermined trip levels and time delay settings are reached.

2. Interchangeable rating plugs shall establish the continuous trip ratings of each circuit breaker. Rating plugs shall be interlocked so that they are not interchangeable between frames, and interlocked such that a breaker cannot be closed and latched with the rating plug removed.

3. The microprocessor-based trip system shall have thermal memory capabilities to prevent the breaker from being reset following an overload condition until after a preset time delay.

4. Molded Case Circuit Breaker Trip Units

   a. System coordination shall be provided by the following microprocessor-based time-current curve shaping adjustments:

      1) Adjustable long time pick-up and delay.

      2) Adjustable short time pick-up and delay, with selective curve shaping.

      3) Adjustable instantaneous pick-up.

      4) Adjustable ground fault pick-up and delay, with selective curve shaping.

5. **Where 100%-rated breakers are indicated in panelboard schedules, provide circuit breakers UL listed for application at 100% of their continuous ampere rating in their intended enclosure.**

6. **Provide shunt trips, bell alarms, and auxiliary switches, as shown on the contract drawings.**

7. Main circuit breakers shall be vertically mounted

8. Each circuit breaker shall be provided with a factory-installed padlockable handle lock hasp.

2.09 BRANCH CIRCUIT PANELBOARDS

A. Bolt-in type, heavy-duty, quick-make, quick-break, single- and multi-pole circuit breakers of the types specified herein, shall be provided for each circuit with toggle handles that indicate when unit has tripped.

B. Circuit breakers shall be thermal magnetic type with common type handle for all multiple pole circuit breakers. Circuit breakers shall be minimum 100 ampere frame, and through 100 ampere trip sizes shall take up the same pole spacing. 20 ampere, single pole circuit breakers shall be UL listed as type SWD for lighting circuits.

C. Main circuit breakers shall be vertically mounted

D. Each circuit breaker shall be provided with a factory-installed padlockable handle lock hasp.

2.10 NAMEPLATES

A. Each panel shall have an engraved nameplate for each section. Engraved nameplate shall include panel designation, voltage, phase, ampere rating of upstream feeder breaker or main circuit breaker, and upstream panel feeder, as follows:

PANEL L42
100 AMPERE, 480/277 VOLT, 3 PHASE, 4 WIRE,
FED FROM PANEL D42

B. Panelboards shall be provided with typewritten directories indicating circuit numbers, equipment served and room number of the area served. All room numbers used for directory cards shall be the room numbers assigned by the Owner and not necessarily room numbers

indicated on the drawings. Coordinate all room numbers with Architect prior to final printing of directory cards.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Panelboards shall be installed in locations as shown on the drawings. Panelboards shall be mounted such that the handle of the highest circuit breaker does not exceed 6'-6" above finished floor. Panelboard cabinets shall be installed flush or surface mounted as indicated by trim type as shown on the drawings. No piping, ductwork, or other mechanical equipment, shall be allowed to pass through the area extending from the floor to the structural ceiling with the width equal to width of the panel plus 6 inches on either side of panel.

B. Surface mounted panelboards shall be mounted independent of the wall and connecting raceways. Furnish steel channel supports mounted on the wall and attach the panelboards to these supports. Recessed panels shall have a spare 1-1/2 inch conduit from panel to 12 inch by 12 inch by 6 inch pull box mounted in accessible ceiling. Conduit and pull box shall be empty at time of completion.

C. Panelboard doors shall contain holders for directory cards with plastic protector. Panelboard directory cards shall be typewritten to indicate areas and/or devices served by each circuit. Directory cards shall be edited and maintained during the course of construction to keep an accurate, up-to-date record of each feeder or branch circuit.

D. Panelboards shall be installed with work space as required by NEC.

E. Panelboards shall be installed in strict accordance with NEC Article 408.13. The Contractor shall coordinate work with all other trades in order to assure compliance to this requirement.

F. Panelboards in finished areas, installed recessed in walls, shall be prime coated only, for finish painting by others.

G. Panelboards located in spaces subject to storage shall have the clear working space per NFPA-70, National Electric Code. "Electrical Access – Not for Storage" shall be permanently marked on the floor and wall about the panel. Panelboards shall not be located in egress corridors.

3.02 CLEANING

A. All panelboards shall be completely cleaned prior to energizing.

B. Cleaning shall consist of vacuuming all buses, enclosures (inside and out), etc. After vacuuming is complete, all equipment shall be wiped down. If equipment is wet or contains moisture, it shall be thoroughly dried before energizing.

3.03 TESTING

A. Perform testing in accordance with Specification Section 16198.

****

END OF SECTION

THE LIVESTOCK INSTITUTE

WESTPORT, MA

PROJECT NO. 4730

Specification for

ADJUSTABLE AND VARIABLE FREQUENCY DRIVES

Section 16483

THE DENNIS GROUP, LLC

PLANNING σ ENGINEERING σ CONSTRUCTION MANAGEMENT

1537 MAIN STREET
SPRINGFIELD, MASSACHUSETTS 01103
413.787.1785 σ FAX 413.787.1786

26 WEST MARKET STREET
SALT LAKE CITY, UTAH 84101
801.531.8585 σ FAX 810.531.8586

A	**09.20.2016**	**Review**	**MJJ**		
Issue	**Date**	**Description**	**By**	**Approved**	**Section 16483**

Unless notification and/or comments are received from client with in two weeks after issue date, all documentation including drawings, specifications, and studies submitted to client shall be considered approved as released.

PART 1 – GENERAL

1.01 PROVISIONS INCLUDED

A. The General Documents, as listed on the Table of Contents and applicable parts of Division 1, General Requirements, and requirements of Section 16010, shall be included in and made part of this Section.

B. Examine all drawings and all other Section of the Specifications for requirements which affect work under this Section whether or not such work is specifically mentioned in this Section.

C. Coordinate work with that of all other Trades affecting or affected by work of this Section. Cooperate with such Trades to ensure the steady progress of all work under the Contract.

D. Provide all material, labor and equipment, to complete the work of this Section in strict accordance with the design Architect and Engineers plans and specifications, with all applicable codes, rules and standards

1.02 SCOPE OF WORK

A. The work under this Section consists of furnishing and installing adjustable frequency drives on motor starters for motors as indicated on the drawings.

B. The work under this Contract shall also include all labor, materials, tools, equipment, transportation, insurance, temporary protection, supervision and incidental items essential for proper installation and operation, even though not specifically mentioned or indicated on the drawings but which are usually provided or are essential for proper installation and operation of all systems as indicated on the drawings and specified herein.

C. The specifications and drawings describe the minimum requirements that must be met by the Contractor for the installation of all work as shown on the drawings and as specified hereinunder.

1.03 RELATED WORK SPECIFIED ELSEWHERE

A. The following referenced sections are listed as a minimum of additional requirements and/or work not included in this Section which may be required to be performed under other designated Sections:

1. Section 16110: Raceways
2. Section 16120: Conductors
3. Section 16170: Motor and Circuit Disconnects
4. Section 16181: Fuses
5. Section 16190: Hangers and Supports
6. Section 16195: Electrical Identification
7. Section 16198: Start-Up Testing of Electrical Equipment
8. Section 16450: Grounding
9. Section 16920: Motor Control Centers

1.04 SUBMITTALS

A. Prepare and submit complete shop drawings of adjustable/variable frequency drives required on this project to Engineer for approval.

B. Submit samples of each material under this Section requested by the Engineer for approval. Samples shall be in size and form requested by the Engineer, and reasonable to show characteristics, color and finishes of the materials.

C. Submit complete manufacturer's product data of all materials and systems to the Engineer for approval, consisting of complete product description and specifications, complete performance test data, complete preparation and installation instructions, and all other pertinent technical data required for complete product and product use information.

D. All shop drawings shall have clearly marked the appropriate specification number of drawing designation for identification of the submittal.

E. Disposition of shop drawings shall not relieve the Contractor from the responsibility for deviations from drawings or specifications unless he has submitted, in writing, a letter itemizing or calling attention to such deviations at time of submission and secured written approval from the Engineer, nor shall such disposition of shop drawings relieve the Contractor from responsibility for errors in shop drawings or schedules.

F. Do not order materials or begin installation until approval of submittals by the Architect and Engineer has been obtained.

G. The AFD/VFD manufacturer shall supply with submittal information, harmonic calculations made in accordance with IEEE 519-1992 Standards showing the THVD, line notching and THCD limits are met. Calculations shall assume worst case system conditions. System 1-line, 480V transformer data, standby generator data, and primary fault current data required to make these calculations are provided in the system short circuit study and can be obtained from the Electrical Contractor. The submittal shall include, as a minimum, the following information:

1. All input data and assumptions.

2. Explanation of method used to perform the analysis.

3. All calculations and computer printouts used in the analysis, including input documentation.

4. A system impedance diagram based on the Electrical one-line diagrams.

5. All calculations shall be in accordance with IEEE 519 with all drives at 90% speed. The point of common coupling shall be the secondary connection of the transformer supplying that group of devices. These calculations shall be done with the transformer loaded to no more than 60% of its nominal capacity. These calculations shall also be done with all 12-pulse or greater drives running as well as the smaller drives running.

6. A detailed description of the tests, procedures and supporting calculations required to substantiate the installed systems compliance with the specified THD limits.

    a. The description shall include information on the proposed test equipment and test conditions.

    b. Include the name and qualifications of the firm which will conduct the field tests.

7. Each point of common coupling shall be defined as the secondary side of the transformer that feeds that group of drives. At the point of common coupling, the following numbers shall meet with the maximum load on the transformer no greater than 60% of its nominal capacity.

    a. Total harmonic voltage distortion is less than 3%

b. Total harmonic current distortion is less than 5% and harmonic table requirements ISC / IL <20.

Note: 6-pulse drives will not be accepted on 50 HP drives or larger, even if this calculation is met.

1.05 GUARANTEE

A. In addition to the specific guarantee requirements of the General Conditions, the Contractor shall obtain, in the Owner's name, the standard written manufacturer's guarantee of all materials furnished under this Section where such guarantees are offered in the manufacturer's published product data. All these guarantees shall be in addition to, and not in lieu of, other liabilities which the Contractor may have by law or other provisions of the Contract Documents.

1.06 COORDINATION

A. The work of this Section shall be coordinated with other work of the Contractor.

1.07 REFERENCE STANDARDS

A. Applicable provisions of the following Codes and Trade Standard Publications shall apply to the work of this Section, and are hereby incorporated into, and made a part of, the Contract Documents.

1. UL 98: Enclosed Switches
2. NEMA ICS-2: Industrial Control Devices, Controllers and assemblies
3. NEMA AB-1: Molded Case Circuit Breakers
4. NFPA-70: National Electrical Code

1.08 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery of materials shall be made to the project by the materials supplier in accordance with the instructions of the Contractor.

B. The Contractor shall provide adequate storage space for the materials, shall be responsible for all items of materials after receipt from the supplier, and shall replace all materials lost or damaged after delivery and receipt.

C. The Contractor shall furnish the materials supplier with receipts for all materials and accessory items received, and shall send copies of these receipts to the Architect.

PART 2 - MATERIALS

2.01 MANUFACTURERS

A. Provide a complete adjustable frequency drive (AFD) of capacity,quantity and characteristics as described in this specification and as shown and scheduled on the drawings. Acceptable manufacturers contingent on compliance with specifications are:

1. 50 HP and Larger (12-Pulse or Greater Units Only)

a. Halmar Robocon Group
b. Toshiba
c. Allen Bradley
d. ABB
e. Westinghouse / Cutler-Hammer

f. Saftek

Note: 6-pulse units will be rejected.

2. 40 HP and Less

a. Halmar Robocon Group
b. Allen Bradley
c. Reliance Electric
d. Toshiba
e. ABB
f. Westinghouse / Cutler-Hammer
g. Saftek

B. All AFDs 50 HP and larger shall be of the same manufacturer.

C. All AFDs 40 HP and less shall be of the same manufacturer.

2.02 VARIABLE FREQUENCY DRIVES (VFD)

A. Provide a complete variable frequency drive (VFD) of capacity,quantity and characteristics as described in this specification and as shown and scheduled on the drawings. Acceptable manufacturers contingent on compliance with specifications are:

1. 50 HP and Larger (12-Pulse or Greater Units Only)

a. Allen Bradley PowerFlex 755 Series
b. Approved Equal

Note: 6-pulse units will be rejected.

2. 30 HP and Less

a. Allen Bradley PowerFlex 525 Series
b. Approved Equal

B. 50 HP and Larger (12-Pulse or Greater Unit Only)

1. VFDs 50 HP and larger shall be 12-pulse (or greater) input. Provide data and calculations showing the drive harmonics do not exceed the following numbers at the power connection to the drive.

a. Total harmonic voltage distortion: Less than 5%.

b. Total harmonic current distortion: Less than 8% and harmonic table requirements for ISC/IL = 20-50.

Note: These are the maximum harmonics that can be generated by each of these drives.

2. The use of the following devices is permitted:

a. Line reactors

b. DC chokes

3. The use of the passive filters is not permitted:

C. VFDs 40 HP and Less

1. VFDs 40 HP and less shall be 6-pulse (or greater) input. Provide data and calculations showing the drive harmonics.

   a. 5% line reactors shall be provided on each drive.

2. The use of passive filters is not permitted:

D. Harmonic Table

ISC / IL	Harmonic Order (Odd Harmonics)					THD	
	h<11	11<h17	17<h23	23<h35	35<h		
<20	4.0	2.0	1.5		0.6	0.3	5.0
20-50	7.0	3.5	2.5	1.0	0.5	8.0	
50-100	10.0	4.5	4.0		1.5	0.7	12.0
100-1000	12.0	5.5	5.0		2.0	1.0	15.0
>1000	15.0	7.0	6.0		2.5	1.4	20.0

E. VFD's All Drives

1. The VFD shall be of the pulse width modulated (PWM) design converting the fixed utility voltage and frequency to a variable voltage and frequency output via a 2-step operation. VFDs utilizing a 3rd power section are not acceptable. Efficiency shall exceed 96% at 100% speed and load. Line side displacement power factor shall exceed (0.95) regardless of speed and load. The VFD shall be rated for 110% current for (1) minute for variable torque loads and 150% current for (1) minute for constant torque loads.

2. Standard operating conditions shall be:

   a. Incoming 3-phase 480 VAC power, +5% or -10%, 60 Hz.

   b. Humidity 0 to 95% (non-condensing and non-corrosive).

   c. Altitude 0'-0" to 3,300'-0" above sea level.

   d. Ambient temperature 0° to 40°C.

3. VFDs shall include the following system interfaces:

   a. Speed reference interface with a differential amplifier, isolated input 0-10 VDC and 4-20 mADC signal.

   b. Run relay with an isolated set of Form C contacts.

   c. Programmable contacts selectable to indicate any of the conditions listed in below (Form C selectable);

      1) Over current.

      2) Over Voltage.

      3) Under voltage.

      4) Over frequency.

5) Phase loss.

6) Over temperature.

7) Groundfault.

8) DC bus undervoltage.

9) DC bus over voltage.

d. Trip contacts (Form C).

e. VFD will accept an external trip contact and indicate so on the display.

f. Dedicated terminal blocks for interface with maintained remote start contacts.

g. Output signal proportional to output frequency (0-10 VDC or 4-20 mADC).

h. Output signal proportional to output current (0-10 VDC or 4-20 mADC).

i. Output signal proportional to output power (0-10 VDC or 4-20 mADC).

j. Output signal proportional to output current (phase selectable) 0-10 VDC or 4-20 mADC).

4. The VFD shall include the following protective features:

a. Over current protection.

b. Over Voltage protection.

c. Under voltage protection.

d. Over frequency protection

e. Phase loss protection

f. Over temperature protection

g. Provide groundfault protection with pick-up of approximately 20% of rating for all motors 3 HP and above.

h. Adjustable current limit

i. Line-to-line and line-to-ground output short-circuit protection.

j. DC bus undervoltage protection.

1) Ability to withstand output line-to-line short circuits without component failure.

k. DC bus over voltage protection.

l. Electronic instantaneous protection.

5. Status indication via an LED display of the following protective functions:

a. DC Bus Undervoltage

b. DC Bus Overvoltage

c. Overcurrent

d. Controller Overtemperature

e. Overload

f. Overload Warning

g. Overfrequency and Phase Loss

h. Overload capability shall be 110% of the inverter rating for (1) minute.

i. Selectable auto restart with adjustable number of tries.

Note: A single light to indicate a VFD trip is not acceptable.

6. VFD will catch a motor spinning in the forward or reverse direction upon starting.

7. Upon loss of the input signal (4-20 mA), the drive will stop or go to preset speed (selectable).

8. Standard adjustments shall include:

a. Minimum frequency (4-60 Hz)

b. Maximum frequency (40-120 Hz)

c. Four (4) preset speeds (4-120 Hz) initiated by contact closures

d. Four (4) acceleration times (2-300 seconds)

e. Four (4) deceleration times (2-300 seconds)

f. Minimum speed dwell time (0-18 seconds)

g. Voltage boost (0-40V) for starting torque control

h. V/Hz linear or reduced for motor noise reduction

i. Carrier frequency 700 Hz -10 KHz for motor noise reduction

j. Current limit (70-120%)

k. Critical frequency avoidance ([3] bands with 10 Hz adjustable widths)

9. Door mounted operator controls and status indication from the LED display shall include:

a. Run/stop selection and LED indication (keypad or remote)

b. Speed control selection and LED indication

c. Forward/Reverse selection

d. Manual speed adjustment

e. Frequency meter

f. Motor RPM

g. Ammeter

h. Output voltage

i. Elapsed time meter

j. The keypad shall have an LED display. The reverse button and the programming functions may be locked out if desired.

10. Optional features to be included in all VFDs:

a. Input breaker rated for 65KAIC or 100KAIC, to provide a disconnect means. Operating handle shall protrude through the AFD door. The disconnect shall not be mounted on the door. Extended operator handles shall not be permitted. The handle position shall indicate ON, OFF or TRIPPED condition. The handle shall have provisions for padlocking in the OFF position with at least three (3) padlocks. Interlocks shall prevent unauthorized opening or closing of the AFD door with disconnect handle in the ON position. This shall be defeatable by maintenance personnel.

b. Bypass which includes an output contactor electrically and mechanically interlocked with a bypass contactor, run relay including control logic, status lights and a motor overcurrent relay. The complete bypass system and Inverter/Off/Bypass selector switch shall be packaged in the VFDs enclosure. The bypass shall include a starter.

c. Output contactor to provide a means for positive disconnection of the drive output from the motor terminals.

d. 5% input line reactor.

e. 120-Vac control to allow VFD to interface with remote dry contacts

f. Motor overcurrent relay to provide motor overcurrent sensing of a given level of load current.

g. RLC output filter combination dv/dt and peak voltage limiter.

h. For all motor starters, provided current transformer and a 4-20 mA current transducer on B phase or output of starter. Wire current transducer to terminal board for remote use by the ATC Contractor. Coordinate characteristics with the Other Work Contractors (OWC).

F. Enclosure

1. Unless specified otherwise, the VFD enclosure shall be NEMA rated in accordance with the NEMA classification of the location. Refer to the NEMA Classification drawings.

2. The VFD shall have complete front accessibility with easily removable assemblies.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

A. All work shall conform to the printed specifications and installations of each of the manufacturers, the approved shop drawings, and to the requirements of the Governing Laws and Building Codes. Refer to drawings to determine locations of fire-resistive, and fire-protective work, and construct this work to conform to the specifications and installation instructions of UL or other testing agencies.

B. Inspect job conditions and related work and report to the Architect/Engineer –any conditions adversely affecting raceway work.

C. Make all changes and adjustments in this work and other work under this Section as needed to accommodate the work of other Trades.

D. All boxes shall be erected, rigidly supported and securely fastened in place in such a manner that plumb, level, and true finished lines and surfaces shall result in the finished work.

E. Furnish overloads based on the nameplate rating of the installed motor to be controlled.

F. Each motor shall be supplied by an individual branch circuit in separate branch conduit.

G. All final connections to motor shall be made with flexible conduit, not less than 18" or more than 36" long. Provide ground wire to motor frame. Conduit shall be adequately supported at each motor.

H. Proper direction of rotation of all motors shall be the responsibility of this Contractor.

I. All disconnects, combination starters, starters, and control devices, etc., shall have nameplates or legends indicating the equipment served and/or the functions of the device. These nameplates or legends shall be sized relative to the device, be made of engraved phenolic compound, and properly secured to the device. Refer to Section 16195.

J. It shall be the responsibility of the Contractor for work under this Section to confer with the Contractors of other trades involved and provide connections of proper capacity at proper locations thereof. This Contractor shall be fully responsible to furnish and install proper fuses, starters, conduit, thermal heaters and conductors to the individual starters, leaving same ready for operation.

K. Where starters and other devices are furnished with the equipment, this Contractor shall receive these starters and other devices in connection with the units and do all necessary power field wiring between equipment and starters. This work is to be done under the supervision of the respective Contractor, or Subcontractor, who shall be fully responsible for providing adequate and correct wiring diagrams and instructions.

3.02 INSTALLATION OF AFD's AND VFD's

A. Install AFD/VFD as follows:

1. Location: Approximately as shown. Choose precise location to provide ample space for operation and maintenance. Confirm with Architect/Engineer.

2. Mounting Method

   a. Wall Mounting: Use expansion anchors and bolts. Install collars around mounting bolts, to provide air space between wall and device enclosure.

   b. Structural Steel Mountings: Bolt to steel or brackets welded to steel. Provide air space between steel and device enclosure.

   c. Angle Iron Framework Mounting: Provide where walls or structural steel not available. Bolt device enclosure or enclosures to angle iron or to steel panel attached to iron as directed.

   d. Floor Mounting: Install on 4" high concrete equipment pad, in plumb and level altitude. Use expansion anchors and bolts as required.

3.03 CLEANING

A. All starters shall be thoroughly cleaned prior to final acceptance by Owner.

3.04 FACTORY TESTING

A. The following standard factory tests shall be performed on the equipment provided under this section. All tests shall be in accordance with the latest version of UL and NEMA standards.

1. All printed circuit boards shall be functionally tested via fault finder bench equipment prior to unit installation.

2. All final assemblies shall be tested at full load with application of line-to-line and line-to-ground bolted faults. The Adjustable Frequency Drive and Variable Frequency Drive shall trip electronically without device failure.

3. After all tests have been performed, each AFD/VFD shall undergo a burn-in test. The drive shall be burned in at 100% inductive or motor load without an unscheduled shutdown.

4. After the burn-in cycle is complete, each AFD/VFD shall be put through a motor load test before inspection and shipping.

5. VFD power semiconductors and diodes shall be 100% inspected and tested, including load testing.

6. Small signal semiconductors, resistors, capacitors and diodes shall be lot sampled. Testing shall include parameter, as well as functional characteristics.

7. All printed circuit boards shall be tested under a temperature cycling (0°C to +65°C) 24-hour load test and then functionally tested via fault finder bench equipment prior to unit installation.

8. All final assemblies shall be tested at full load with application of line-to-line and line-to-ground bolted faults. The VFD shall trip electronically without device failure.

9. After all tests have been performed, each VFD shall undergo a 24-hour burn-in test. The drive shall be burned-in at 100% inductive or motor load for (24) hours without an unscheduled shutdown.

10. After the burn-in cycle is complete, each VFD shall be provided by the manufacturer upon request prior to shipment.

3.05 FIELD TESTING

A. Testing, checkout and start-up of the AFD/VFD equipment shall be performed under the technical direction of the manufacturer's service engineer. Under no circumstances are any portions of the drive system to be energized without authorization from the manufacturer's representative.

B. The AFD/VFD manufacturer shall provide to the Owner a start-up service for all AFD/VFDs provided. The service shall include inspection, final adjustments, operational checks, functional checks of spare parts and a final report for record purpose. The service shall include a (2) year parts warranty from date of written acceptance. The start-up service shall be provided by a factory service engineer. The engineer shall be permanently located within 200 miles of the installation for service after start-up, if required by the Owner.

C. A copy of all tests and checks performed in the field, complete with meter readings and recordings, where applicable, shall be submitted to the Owner for this record.

D. A (1) day training course for Owner's personnel shall be presented by representatives of the manufacturer at the jobsite.

E. Test motors and AFD's/VFD's as specified in Section 16198. Coordinate with other trades.

3.06 SERVICE

A. The AFD/VFD manufacturer shall provide to the Owner a start-up service package for all VFDs provided. Service shall include inspector for final adjustment, operational checks, and a final report for record purposes. The service package shall include a (1) year parts and labor warranty from date of written acceptance and be performed by local factory trained service engineers. The service center must be permanently located within (200) miles of the job site and able to provide 24-hour service.

****

END OF SECTION

THE LIVESTOCK INSTITUTE

WESTPORT, MA

PROJECT NO. 4730

Specification for

AUTOMATIC TRANSFER SWITCHES

Section 16496

THE DENNIS GROUP, LLC

PLANNING σ ENGINEERING σ CONSTRUCTION MANAGEMENT

1537 MAIN STREET
SPRINGFIELD, MASSACHUSETTS 01103
413.787.1785 σ FAX 413.787.1786

26 WEST MARKET STREET
SALT LAKE CITY, UTAH 84101
801.531.8585 σ FAX 810.531.8586

A	**09.20.2016**	**Review**	**MJJ**		
Issue	**Date**	**Description**	**By**	**Approved**	**Section 16496**

Unless notification and/or comments are received from client with in two weeks after issue date, all documentation including drawings, specifications, and studies submitted to client shall be considered approved as released.

PART 1 – GENERAL

1.01 PROVISIONS INCLUDED

A. The General Documents, as listed on the Table of Contents and applicable parts of Division 1, General Requirements, and requirements of Section 16010, shall be included in and made part of this Section.

B. Examine all drawings and all other Section of the Specifications for requirements which affect work under this Section whether or not such work is specifically mentioned in this Section.

C. Coordinate work with that of all other Trades affecting or affected by work of this Section. Cooperate with such Trades to ensure the steady progress of all work under the Contract.

D. Provide all material, labor and equipment, to complete the work of this Section in strict accordance with the design Architect and Engineers plans and specifications, with all applicable codes, rules and standards

1.02 SCOPE OF WORK

A. The work under this Contract shall include all labor, materials, tools, equipment, transportation, insurance, temporary protection, supervision and incidental items essential for proper installation and operation, even though not specifically mentioned or indicated on the drawings but which are usually provided or are essential for proper installation and operation of all systems as indicated on the drawings and specified herein.

B. The specifications and drawings describe the minimum requirements that must be met by the Contractor for the installation of all work as shown on the drawings and as specified hereinunder.

1.03 SEQUENCE OF OPERATION

A. When the voltage on any phase of the normal source drops below 80% or increases to 120%, or frequency drops below 90%, or increase to 110%, or 20% voltage differential between phases occurs, after a programmable time delay period of 0-9,999 seconds factory set at 3 seconds to allow for momentary dips, the engine starting contacts shall close to start the generating plant.

B. The transfer switch shall transfer to the emergency source when the generating plant has reached 90% of rated voltage and frequency on all phases.

C. After restoration of normal power on all phases to a preset value of at least 90% to 110% of rated voltage, and at least 95% to 105% of rated frequency, and voltage differential is below 20%, an adjustable time delay period of 0-9,999 seconds (factory set at 300 seconds) shall delay retransfer to allow stabilization of normal power. If the emergency power source should fail during this time delay period, the switch shall automatically return to the normal source.

D. After retransfer to normal, the engine generator shall be allowed to operate at no load for a programmable period of 0-9,999 seconds, factory set at 300 seconds.

1.04 RELATED WORK SPECIFIED ELSEWHERE

A. The following referenced sections are listed as a minimum of additional requirements and/or work not included in this Section which may be required to be performed under other designated Sections:

1. Section 16016: Power System Studies
2. Section 16110: Raceways
3. Section 16120: Conductors
4. Section 16195: Electrical Identification
5. Section 16198: Start-Up Testing of Electrical Equipment
6. Section 16450: Grounding
7. Section 16109: Hangers and Supports

1.05 SUBMITTALS

A. Prepare and submit complete shop drawings of the automatic transfer switches required on this project to Engineer for approval.

B. Submit complete manufacturer's product data of all materials and systems to the Engineer for approval, consisting of complete product description and specifications, complete performance test data, complete preparation and installation instructions, and all other pertinent technical data required for complete product and product use information.

C. All shop drawings shall have clearly marked the appropriate specification number of drawing designation for identification of the submittal.

D. Disposition of shop drawings shall not relieve the Contractor from the responsibility for deviations from drawings or specifications unless he has submitted, in writing, a letter itemizing or calling attention to such deviations at time of submission and secured written approval from the Engineer, nor shall such disposition of shop drawings relieve the Contractor from responsibility for errors in shop drawings or schedules.

E. Do not order materials or begin installation until approval of submittals by the Architect and Engineer has been obtained.

F. Manufacturer shall submit shop drawings for review, which shall include the following, as a minimum:

1. Descriptive literature

2. Plan, elevation, side, and front view arrangement drawings, including overall dimension, weights and clearances, as well as mounting or anchoring requirements and conduit entrance locations.

3. Schematic diagrams.

4. Wiring diagrams.

5. Accessory list.

G. Submit ten (10) copies of the above information.

1.06 GUARANTEE

A. In addition to the specific guarantee requirements of the General Conditions, the Contractor shall obtain, in the Owner's name, the standard written manufacturer's guarantee of all materials furnished under this Section where such guarantees are offered in the manufacturer's published product data. All these guarantees shall be in addition to, and not in lieu of, other liabilities which the Contractor may have by law or other provisions of the Contract Documents.

1.07 COORDINATION

A. The work of this Section shall be coordinated with other work of the Contractor. The placement of all access panels shall be coordinated with all other Trades and with the Architect.

1.08 REFERENCE STANDARDS

A. Applicable provisions of the following Codes and Trade Standard Publications shall apply to the work of this Section and are hereby incorporated into, and made a part of, the Contract Documents:

1.	NFPA 70:	National Electrical Code.
2.	UL 489:	Molded Case Circuit Breakers
3.	UL 508:	Industrial Control Systems
4.	UL 1008:	Transfer Switches
5.	UL 1087:	Molded Case Switches
6.	NEMA ICS:	Industrial Controls and Systems

1.09 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery of materials shall be made to the project by the materials supplier in accordance with the instructions of the Contractor.

B. The Contractor shall provide adequate storage space for the materials, shall be responsible for all items of materials after receipt from the supplier, and shall replace all materials lost or damaged after delivery and receipt.

C. The Contractor shall furnish the materials supplier with receipts for all materials and accessory items received, and shall send copies of these receipts to the Architect.

PART 2 – PRODUCTS

2.01 GENERAL

A. Furnish the automatic transfer switch(es) to automatically transfer the critical load between the normal and emergency power source.

B. To ensure system compatibility, the automatic transfer switch shall be furnished by the emergency generator set supplier.

C. The automatic transfer switches covered by these specifications shall be designed, tested, and assembled in strict accordance with all applicable standards of ANSI, UL, IEEE and NEMA.

2.02 MANUFACTURERS

A. Automatic transfer switch shall be dual operator automatic transfer switch as manufactured by Russelectric RMTD or equivalent product as manufactured by ASCO.

2.03 CONSTRUCTION

A. The automatic transfer switch shall be furnished as shown on the drawings. Voltage and continuous current ratings and number of poles shall be as shown.

B. Each automatic transfer switch shall have the number of poles as shown on the drawings. Where 4 pole switches are indicated, a true 4 pole switch shall be supplied with all four poles mounted on a common shaft. The continuous current rating and the closing and withstand rating of the fourth pole shall be identical to the rating of the main poles.

C. The transfer switch shall be mounted in a NEMA 1 enclosure, unless otherwise indicated. Enclosures shall be fabricated from 12 gauge steel. The enclosure shall be sized to exceed minimum wire bending space required by UL 1008.

D. The transfer switch shall be equipped with an internal welded steel pocket, housing an operations and maintenance manual.

E. The transfer switch shall have top and bottom cable access.

F. The main contacts shall be capable of being replaced without removing the main power cables.

G. The main contacts shall be visible for inspection without any major disassembly of the transfer switch.

H. All bolted bus connections shall have Belleville compression type washers.

I. When a solid neutral is required, a fully rated bus bar with required AL-CU neutral lugs shall be provided.

J. Control components and wiring shall be front accessible. All control wires shall be multi-conductor 18 gauge, 600 volt SIS switchboard type with point to point harness. All control wire terminations shall be identified with tubular sleeve-type markers.

K. The switch shall be equipped with 90 degrees C rated copper/aluminum solderless **[mechanical compression] [set screw crimp]** type lugs. Lugs shall be sized to accommodate conductor sizes as indicated on the drawings.

L. The complete transfer switch assembly shall be factory tested to ensure proper operation and compliance with the specification requirements. A copy of the factory test report shall be available upon request.

2.04 AUTOMATIC TRANSFER SWITCH

A. Dual operator transfer switch(es) shall be double throw, actuated by two electric motor operators or electric solenoids momentarily energized, and connected to the transfer mechanism by a simple over center type linkage. Minimum transfer time shall be 400 milliseconds. Transfer between two energized sources shall have an adjustable time delay of 0 to 9,999 seconds, factory set at 3 seconds to allow for motor wind-down. Single operator transfer switches with in-phase monitors will be considered in lieu of dual operators provided active synchronizers and electronic isochronous governors are used in conjunction with the in-phase monitor. Passive synchronization is not acceptable.

B. The normal and emergency contacts shall be positively interlocked mechanically and electrically to prevent simultaneous closing. Main contacts shall be mechanically locked in both the normal and emergency positions without the use of hooks, latches, magnets, or springs, and shall be silver-tungsten alloy. Separate arcing contacts with magnetic blowouts shall be provided on all transfer switches. Interlocked, molded case circuit breakers or contactors are not acceptable.

C. The transfer switch shall be equipped with a safe external manual operator, designed to prevent injury to operating personnel. The manual operator shall provide the same contact to contact transfer speed as the electrical operator to prevent a flashover from switching the main contacts slowly. The external manual operator shall be safely operated from outside of the transfer switch enclosure while the enclosure door is closed.

2.05 AUTOMATIC TRANSFER SWITCH CONTROLS

A. The transfer switch shall be equipped with a microprocessor based control system, to provide all the operational functions of the automatic transfer switch. The controller shall have two asynchronous serial ports. The controller shall have a real time clock with Nicad battery back-up.

B. The CPU shall be equipped with self diagnostics which perform periodic checks of the memory I/O and communication circuits, with a watchdog/power fail circuit.

C. The controller shall use industry standard open architecture communication protocol for high speed serial communications via multi-drop connection to other controllers and to a master terminal with up to 4000 feet of cable, or further, with the addition of a communication repeater. The serial communication port shall be RS422/485 compatible.

D. The serial communication port shall allow interface to either the manufacturer's or the Owner's furnished remote supervisory control.

E. The controller shall have password protection required to limit access to qualified and authorized personnel.

F. The controller shall include a 20 character, LCD display, with a keypad, which allows access to the system.

G. The controller shall include three phase over/under voltage, over/under frequency, phase sequence detection and phase differential monitoring on both normal and emergency sources.

H. The controller shall be capable of storing the following records in memory for access either locally or remotely:

1. Number of hours transfer switch is in the emergency position (total since record reset).

2. Number of hours emergency power is available (total since record reset).

3. Total transfer in either direction (total since record reset).

4. Date, time, and description of the last four source failures.

5. Date of the last exercise period.

6. Date of record reset.

2.06 AUTOMATIC TRANSFER SWITCH ACCESSORIES

A. Programmable three phase sensing of the normal source set to pickup at 90% and dropout at 80% of rated voltage and over-voltage to pickup at 120% and dropout out at 110% of rated voltage. Programmable frequency pickup at 95% and dropout at 90% and over frequency to pickup at 110% and dropout at 105% of rated frequency. Programmable voltage differential between phases, set at 20%, and phase sequence monitoring.

B. Time delay for override of momentary normal source power outages (delays engine start signal and transfer switch operation). Programmable 0-9,999 seconds. Factory set at 3 seconds, if not otherwise specified.

C. **Time delay to control contact transition time on transfer to either source shall be provided for dual operator automatic transfer switches. Programmable 0-9,999 seconds, factory set at 3 seconds.**

D. Time delay on retransfer to normal, programmable 0-9,999 seconds, factory set at 300 seconds if not otherwise specified, with overrun to provide programmable 0-9,999 second time delay, factory set at 300 seconds, unloaded engine operation after retransfer to normal.

E. Time delay on transfer to emergency, programmable 0-9,999 seconds, factory set at 3 seconds.

F. A maintained type load test switch shall be included to simulate a normal power failure.

G. A remote type load test switch shall be included to simulate a normal power failure, remote switch initiated.

H. A time delay bypass on retransfer to normal shall be included.

I. Contact, rated 10 amperes, 30 volts DC, to close on failure of normal source to initiate engine starting.

J. Contact, rated 10 amperes, 30 volts DC, to open on failure of normal source for customer functions.

K. Light emitting diodes shall be mounted on the microprocessor panel to indicate: switch is in normal position, switch is in emergency position and controller is running.

L. A plant exerciser shall be provided with ten (10) 7 day events, programmable for any day of the week and twenty-four (24) calendar events, programmable for any month/day, to automatically exercise generating plant programmable in one minute increments. Also include selection of either "no load" (switch will not transfer) or "load" (switch will transfer) exercise period.

M. Provision to select either "no commit" or "commit" to transfer operation in the event of a normal power failure shall be included. In the "no commit position," the load will transfer to the emergency position unless normal power returns before the emergency source has reach 90% of its rated values (switch will remain in normal). In the "commit position" the load will transfer to the emergency position after any normal power failure.

N. Two auxiliary contacts rated 10 ampere, 120 volts AC (for switches 100 to 800 amperes) 15 ampere, 120 volts AC (for switches 1,000 to 4,000 amps), shall be mounted on the main shaft, one closed on normal, the other closed on emergency. Both contacts will be wired to a terminal strip for ease of customer connections.

O. A three phase digital LCD voltage readout, with 1% accuracy shall display all three separate phase to phase voltages for both the normal and emergency source.

P. A digital LCD frequency readout with 1% accuracy shall display frequency for both normal and emergency source.

Q. An LCD readout shall display normal source and emergency source availability.

R. Include two (2) time delay contacts that open simultaneously 10 seconds (adjustable 0-30 seconds) prior to transfer in either direction when transferring between two live sources. These contacts close after a time delay upon transfer. Programmable 0-9,999 seconds after transfer.

2.07 RATINGS AND APPROVAL

A. As a condition of approval, the manufacturer of the automatic transfer switches shall verify that their switches are listed by Underwriters Laboratories, Inc., Standard UL-1008 with 3 cycle short circuit closing and withstand as follows:

1. RMS Symmetrical Amperes at 480 volts AC

Amperes	Closing and Withstand 3 Cycle	Closing and Withstand 30 Cycle
100-400	42,000	30,000
600-800	65,000	42,000
1000-1200	85,000	65,000
1600-3000	100,000	85,000
4000	100,000	*Call Factory

2. During the **3** cycle closing and withstand tests, there shall be no contact welding or damage. The tests shall be performed without the use of current limiting fuses. The test shall verify that contacts separation has not occurred, and there is contact continuity across all phases. Test procedures shall be in accordance with UL 1008, and testing shall be certified by Underwriters' Laboratories, Inc.

3. When conducting temperature rise tests to UL 1008, the manufacture shall include post-endurance temperature rise tests to verify the ability of the transfer switch to carry full rated current after completing the overload and endurance tests.

4. The microprocessor controller shall meet the following requirements:

   a. Storage conditions - 25 degrees C to 85 degrees C

   b. Operation conditions - 20 degrees C to 70 degrees C ambient

   c. Humidity 0 to 99% relative humidity, non-condensing

   d. Capable of withstanding infinite power interruptions

   e. Surge withstand per ANSI/IEEE C-37.90A-1978

   f. Manufacturer shall provide copies of test reports upon request.

2.08 NAMEPLATES

A. Engraved nameplates, mounted on the face of the assembly, shall be furnished. Nameplates shall be laminated plastic, black characters on white background, and secured with screws. Characters shall be 3/16 inch high, minimum. Nameplates shall give item designation, voltage ampere rating, short circuit rating, manufacturer's name, general order number and item number.

B. Control components mounted within the assembly, such as fuse blocks, relays, pushbuttons, switches, etc., shall be suitably marked for identification corresponding to appropriate designations on manufacturer's wiring diagrams.

2.12 FINISH

A. All exterior and interior steel surfaces of the switchboard shall be properly cleaned and provided with a rust-inhibiting phosphatized coating. Color and finish of the switchboard shall be ANSI 61 light gray.

PART 3 – EXECUTION

3.01 FIELD SUPPORT AND FACTORY RECORDS

A. The transfer switch manufacturer shall employ a nationwide factory-direct, field service organization, available on a 24-hour a day, 365 days a year, call basis.

B. The manufacture shall include an 800 telephone number, for field service contact, affixed to each enclosure.

C. The manufacturer shall maintain records of each transfer switch, by serial number, for a minimum 20 years.

3.02 INSTALLATION

A. The Electrical Subcontractor shall install all equipment per the manufacturer's recommendations and the contract drawings.

B. The assembly shall be provided with adequate lifting means and shall be capable of being moved into installation position and bolted directly to the floor or walls without the use of floor sills providing the floor is level to 1/8 inch per 3-foot distance in any direction. All necessary hardware to secure the assembly in place shall be provided by the Electrical Subcontractor.

3.03 FIELD TESTING

A. Provide testing as specified in section 16198.

3.04 FACTORY TESTING

A. Provide manufacturers standard production tests.

3.05 MANUFACTURER'S CERTIFICATION

A. A certified test report of all standard production tests shall be available to the Engineer upon request.

3.06 TRAINING

A. The Electrical Subcontractor shall provide a training session for up to 6 Owner's representative for 2 normal workdays at a jobsite location determined by the Owner.

B. The training session shall be conducted by a manufacturer's qualified representative. The training program shall consist of instruction on operation of the assembly, circuit breakers, fused switches, and major components within the assembly.

3.07 OPERATION INSTRUCTIONS AND MAINTENANCE MANUAL

A. After completion of work and start-up of the equipment at the job site, deliver to the Contracting Officer, copies of operating instructions, maintenance manuals and drawings presenting full details for care and maintenance of each item of equipment furnished and/or installed under this Contract.

B. Each manual shall contain the operating and maintenance information and parts lists furnished by the manufacturer, for all equipment provided in the Contract. When necessary, provide supplemental drawing to show system operation and servicing and maintenance points. For all electrical components, furnish wiring and connection diagrams. Manuals shall include instructions required to accomplish specified operation and functions. Data shall be neat, clean, legible copies. Drawings shall be accordion folded. Non-applicable information shall not be included. Five (5) sets of manuals shall be furnished to the Owner.

C. Switchgear drawings and wiring diagrams shall be furnished complete and up to date at the completion of start-up and system acceptance by the Owner. Drawings and wiring diagrams shall include any field modifications or changes to reflect actual as built conditions.

3.08 SPARE PARTS LIST

A. Provide a complete spare parts list, including recommended quantities and prices.

****

END OF SECTION

THE LIVESTOCK INSTITUTE

WESTPORT, MA

PROJECT NO. 4730

Specification for

LIGHTING FIXTURES

Section 16500

THE DENNIS GROUP, LLC

PLANNING ▲ ENGINEERING ▲ CONSTRUCTION MANAGEMENT

1537 MAIN STREET
SPRINGFIELD, MASSACHUSETTS 01103
413.787.1785 ▲ FAX 413.787.1786

26 WEST MARKET STREET
SALT LAKE CITY, UTAH 84101
801.531.8585 ▲ FAX 810.531.8586

A	**09.20.2016**	**Review**	**MJJ**		
Issue	**Date**	**Description**	**By**	**Approved**	**Section 16500**

Unless notification and/or comments are received from client within two weeks after issue date, all documentation including drawings, specifications, and studies submitted to client shall be considered approved as released.

PART 1 – GENERAL

1.01 PROVISIONS INCLUDED

A. The General Documents, as listed on the Table of Contents and applicable parts of Division 1, General Requirements, and requirements of Section 16010, shall be included in and made part of this Section.

B. Examine all drawings and all other Sections of the Specifications for requirements which affect work under this Section whether or not such work is specifically mentioned in this Section.

C. Coordinate work with that of all other Trades affecting or affected by work of this Section. Cooperate with such Trades to ensure the steady progress of all work under the Contract.

D. Provide all material, labor and equipment, to complete the work of this Section in strict accordance with the design Architect's and Engineer's plans and specifications, and with all applicable codes, rules, and standards.

1.02 SCOPE OF WORK

A. The work under this Section shall include furnishing and installing interior and exterior lighting fixtures.

B. The work under this Contract shall also include all labor, materials, tools, equipment, transportation, insurance, temporary protection, supervision and incidental items essential for proper installation and operation, even though not specifically mentioned or indicated on the drawings, but which are usually provided or are essential for proper installation and operation of all systems as indicated on the drawings and specified herein.

C. The specifications and drawings describe the minimum requirements that must be met by the Contractor for the installation of all work as shown on the drawings and as specified hereinunder.

1.03 RELATED WORK SPECIFIED ELSEWHERE

A. The following referenced sections are listed as a minimum of additional requirements and/or work not included in this Section which may be required to be performed under other designated Sections:

1. Section 16110: Raceways
2. Section 16120: Conductors (600 Volt)
3. Section 16130: Boxes
4. Section 16190: Hangers and Supports
5. Section 16195: Electrical Identification
6. Section 16198: Start-Up Testing of Electrical Equipment
7. Section 16450: Grounding

1.04 SUBMITTALS

A. Prepare and submit complete shop drawings of lighting fixtures required on this project to Architect for approval.

B. Submit samples of each material under this Section requested by the Architect for approval. Samples shall be in size and form requested by the Architect, and reasonable to show characteristics, color and finishes of the materials.

C. Submit complete manufacturer's product data of all materials and systems to the Architect for approval, consisting of complete product description and specifications, complete performance test data, complete preparation and installation instructions, and all other pertinent technical data required for complete product and product use information.

D. All shop drawings shall have clearly marked the appropriate specification number of drawing designation for identification of the submittal.

E. Disposition of shop drawings shall not relieve the Contractor from the responsibility for deviations from drawings or specifications unless he has submitted, in writing, a letter itemizing or calling attention to such deviations at time of submission and secured written approval from the Engineer, nor shall such disposition of shop drawings relieve the Contractor from responsibility for errors in shop drawings or schedules.

F. Shop drawings, samples, test data and certificates shall be submitted for approval in accordance with the requirements of the Contract Documents. Fixtures or other materials shall not be shipped, stored or installed into the work unless prior approval has been received, based upon the submittal of shop drawings, samples, catalog cuts, test data, certificates or other materials submitted for approval. Make modifications to fixtures in accordance with Architect's comments concerning submittals, as a part of the work of this Section.

G. Submittal Schedule

1. Within 30 calendar days after award of General Contract, a List of Intended Manufacturers and estimated fabrication lead times shall be submitted to Architect. “Lead times” shall be measured in weeks, beginning from the manufacturer's receipt of approved shop drawings and release, and ending at shipment. Architect shall approve or disapprove each manufacturer.

2. Within 15 days after Contractor's receipt of Architect's response to the List of Intended Manufacturers, copies of purchase orders and manufacturers' acknowledgements for all fixtures specified, conforming to Architect's responses, shall be forwarded to Architect. The purchase orders and the manufacture acknowledgements need not list prices but shall contain a warranted fabrication lead time, in weeks, as defined above. These fabrication times shall be adequate for the timely completion of the job.

3. Within 30 days after date of manufacturer's acknowledgement of order, Contractor shall forward to Architect complete shop drawings, and/or catalog cuts for all specified fixtures.

4. Within 15 days after receipt of “approved” or “approved as noted” shop drawings, Contractor shall forward to Architect a warranted shipment date for each specified fixture, as well as forwarding samples, texts, or any outstanding data required for approval.

5. Within 15 days after Contractor's receipt of disapproved shop drawings, revised shop drawings shall be resubmitted to the Architect.

6. Contractor shall call to the attention of Architect any submittals that have not been returned to him in a timely manner and that might affect the appropriate delivery of fixtures.

H. Shop Drawings

1. Indicate on shop drawings, materials, finished, metal gauges, overall and detail dimensions, sizes, electrical and mechanical connections, fasteners, welds, joints, end conditions, provisions for the work of others, and similar information. Include pertinent mounting details including hung ceiling construction. Indicate complete details of the fixture, including manufacturer's catalog numbers for sockets, ballasts, light shields, switches and type of wiring, and targeting and locking devices for adjustable fixtures. Indicate type and extent of approved inert insulating materials to prevent electrolytic corrosion at junctions of dissimilar metals shall be supplemented by additional drawings if information or descriptions listed above are not included in the cuts.

2. Shop drawings for each type of lamp as specified on the lighting fixture schedules.

3. Data

   a. Submit independent laboratory photometric data in the directed number of copies and in format as directed by Architect. Photometric data shall be submitted for standard, “off-the-shelf” units, at the time the manufacturer's cuts are submitted. Photometric testing and reporting shall conform to IES procedures.

4. Manufacturer's catalog sheets shall indicate input and load electrical characteristics, ambient temperature rating, noise level rating, mounting methods and UL listing for use with required lamp.

5. Fluorescent fixture manufacturer shall submit (with fixture shop drawing or catalog sheet) thermal test data for the fixture to prove that nuisance tripping of the Class “P” ballast shall not occur when fixture is operating under the following conditions:

   a. Voltage not exceeding 5 percent above nominal 120 or 277 volts.

   b. Room ambient of 77°F (25°C).

   c. Ceiling cavity ambient temperature for recessed installation shall not exceed 113°F (45°C).

1.05 SUBSTITUTIONS

A. No substitutions shall be permitted. The Contractor shall submit the fixtures listed for each fixture type as indicated on the lighting fixture schedule.

1.06 GUARANTEE

A. In addition to the specific guarantee requirements of the General Conditions, the Contractor shall obtain, in the Owner's name, the standard written manufacturer's guarantee of all materials furnished under this Section where such guarantees are offered in the manufacturer's published product data. All these guarantees shall be in addition to, and not in lieu of, other liabilities which the Contractor may have by law or other provisions of the Contract Documents.

1.07 COORDINATION

A. The work of this Section shall be coordinated with other work of the Contractor. The placement of all access panels shall be coordinated with all other Trades and with the Architect.

1.08 REFERENCE STANDARDS

A. Applicable provisions of the following Codes and Trade Standard Publications shall apply to the work of this Section, and are hereby incorporated into, and made a part of, the Contract Documents:

1. NFPA 70: National Electrical Code
2. UL: Underwriters' Laboratories
3. NEC: National Electrical Code
4. CBM: Certified Ballast Manufacturers Association
5. IES: Illuminating Engineering Society
6. ASTM: American Society for Testing and Materials
7. ANSI: American National Standards Institute

1.09 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery of materials shall be made to the project by the materials supplier in accordance with the instructions of the Contractor.

B. The Contractor shall provide adequate storage space for the materials, shall be responsible for all items of materials after receipt from the supplier, and shall replace all materials lost or damaged after delivery and receipt.

C. The Contractor shall furnish the materials supplier with receipts for all materials and accessory items received, and shall send copies of these receipts to the Architect.

PART 2 – MATERIALS

2.01 GENERAL

A. Provide materials, equipment, appurtenances and workmanship for the work of this Section conforming to the highest commercial Standards as specified and indicated on the drawings. Make fixture parts and components not specifically identified or indicated on the drawings, of materials most appropriate to their use or function, and resistant to corrosion and to thermal and mechanical stresses encountered in the normal application and function of the fixtures.

B. Provide recessed fixtures that are constructed to be suitable for and compatible with the ceiling, wall or pavement materials and construction in which they shall be installed.

2.02 MARKING OF FIXTURES

A. Plainly mark fixtures equipped with ballasts for operation of rapid start lamps “Use Rapid Start Lamps Only”. Similarly, mark other fixtures according to proper lamp type. Clearly mark ballasts that have multi-level outputs as such, and indicate proper terminals for the various outputs. Provide markings that are clear and readily visible to service personnel, but invisible from normal viewing angles when lamps are in place.

2.03 MATERIALS AND FABRICATION

A. Provide fixtures, completely factory assembled, wired, and equipped with necessary sockets, ballasts, wiring, shielding, reflectors, channels, lenses and other parts and appurtenances necessary to complete the fixture installation and deliver to project site ready for installation.

2.04 FINISHES

A. Lighting fixture finishes shall be selected by the Architect. The Architect shall select finishes and indicate the color selections on the shop drawing submittals.

2.05 FIXTURE WIRING

A. Provide wiring channels and wireways free from projections and rough or sharp edges throughout. At points or edges over which conductors shall pass and may be subject to injury or wear, round bush to make a smooth contact surface with the conductors.

B. Install insulated bushings at points of entrance and exit of flexible wiring.

2.06 LED FLIGHT FIXTURES, DRIVERS AND MODULES

A. Provide drivers for LED lamps that are suitable for the electrical characteristics of the supply circuits to which they are to be connected, and which are suitable for operating the specified lamps. Provide

B. Provide drivers conforming to UL, ETL and ANSI Specifications and displaying labels or symbols of approval by the UL or ETL and of certification as tested by the UL / ETL. Design, fabricate and assemble component parts of ballasts in accordance with the latest requirements of the NEC. This Driver protection shall be provided by a built-in self-resetting thermally actuated device that shall remove the driver from line when excessive driver temperature is reached.

C. Rigidly mount drivers to the inside of the top of the fixture housing, with driver surfaces and housing in complete contact for efficient conduction of ballast heat, unless specifically indicated to the contrary. Permanently affix driver mounting screws to the fixture housing. Provide only fixtures whose design, fabrication and assembly prevent overheating or cycling of LED’s and drivers under any condition of use.

D. Provide identical drivers within each fixture type unless otherwise noted.

E. Switched fixtures which incorporate battery inverter packs for emergency lighting circuits shall include a second "hot leg" conductor to allow for fixtures to be switched without activating the inverter ballast. Inverter ballasts shall only be activated during loss of normal power.

F. LED light fixtures shall be Reduction of Hazardous Substances (RoHS) – compliant.

G. LED drivers shall include the following features unless otherwise indicated:

1. Minimum efficiency: 85% at full load
2. Minimum Operating Ambient Temperature: -20˚C (-4˚F).
3. Input Voltage: 120/277V (±10%) at 60Hz.
4. Integral short circuit, open circuit, and overload protection
5. Power Factor: ≥ 0.95.
6. Total Harmonic Distortion: ≤ 20%
7. Comply with FCC 47 CFR Part 15
8. Provide 0-10V dimming controls.

H. LED modules shall include the following features unless otherwise indicated:

1. Comply with IES LM-79 and LM-80 requirements.
2. Minimum color rendering index (CRI) 82.
3. Color temperature shall be 4100K unless otherwise specified in Lighting Fixture Schedule. Color temperature shifts shall comply with ANSI C78 377A for LED binning with further sub-binning restrictions of chromatic to be at or below the visual threshold of perceivable color variation not exceeding the 3 step MacAdam Ellipse line that crosses the black body locus as indicated on the LM79 report. Such restrictions documentation compliance shall be submitted as part of the submittal process.
4. Minimum Rated Life: 50,000 hours per IES L70
5. Light output lumens in accordance to the specified manufacturer and catalog number as indicated in the Lighting Fixture Schedule.

2.07 BALLASTS

A. Provide ballasts for fluorescent lamps that are suitable for the electrical characteristics of the supply circuits to which they are to be connected, and which are suitable for operating the specified lamps. Provide ballasts which are high power factor, super low temperature rise of the electronic type, unless specifically indicated to the contrary.

B. Provide ballasts conforming to UL and ANSI Specifications and displaying labels or symbols of approval by the UL, and of certification by the CBM, as tested by the ETL. Design, fabricate and assemble component parts of ballasts in accordance with the latest requirements of the NEC. Mark ballasts “Class P” indicating approved integral ballast protection. This ballast protection shall be provided by a built-in self-resetting thermally actuated device that shall remove the ballast from line when excessive ballast temperature is reached.

C. Rigidly mount ballasts to the inside of the top of the fixture housing, with ballast surfaces and housing in complete contact for efficient conduction of ballast heat, unless specifically indicated to the contrary. Permanently affix ballast mounting screws to the fixture housing. Provide only fixtures whose design, fabrication and assembly prevent overheating or cycling of lamps and ballasts under any condition of use.

D. Provide identical ballasts within each fixture type unless otherwise noted.

E. Switched fixtures which incorporate battery inverter packs for emergency lighting circuits shall include a second “hot leg” conductor to allow for fixtures to be switched without activating the inverter ballast. Inverter ballasts shall only be activated during loss of normal power.

F. Provide ballasts having the lowest sound rating available for the lamps specified and clearly showing their respective sound ratings. Replace ballasts found by Architect or Engineer to be unduly noisy, without charge, prior to acceptance of the job. Inform Architect, in writing, if ballasts with a sound rating other than “A” are to be provided.

G. For outdoor use and wherever ballasts are used outside of a heated environment, provide fluorescent ballasts capable of lamp-starting at any temperature down to 0°F.

H. Fluorescent Ballasts (T8 and above)

1. Ballast shall be instant start.

2. Fluorescent ballasts shall be electronic type and operate lamps at a frequency above 40 kHz with no visible flicker (<5% flicker index).

3. Ballast manufacturer shall have been producing electronic ballasts for at least ten (10) years with a low failure rate.

4. Ballast shall be specifically designed to operate the number and type of lamps for each fixture as indicated on the Lighting Fixture Schedule.

5. Ballasts shall operate at an input frequency of 60 Hz and an input voltage of 108 to 132 (120 volt circuit) or 249 to 305 (277 volt circuit) with no damage to the ballast.

6. Ballasts shall provide transient immunity as specified by ANSI C82.41-1991, Location Category A1.

7. Ballasts shall provide starting sequence consistent with ANSI standard C82.11-1993.

8. Ballasts shall operate as a parallel circuit allowing remaining lamp(s) to maintain full light output if one or more lamps fail.

9. Ballasts shall tolerate sustained open circuit and short circuit output conditions without damage to the ballast.

10. Ballasts shall be UL Listed as Class P, and for use in indoor or Type 1 outdoor applications and shall contain a temperature sensing device that shall switch the ballast off if excessive internal temperature develops.

11. Ballasts shall tolerate operation in ambient temperatures up to 105 degrees F (40 degrees C) without damage.

12. Ballasts shall comply with limits of FCC Part 18, Subpart C Limits for Non-Consumer Equipment for EMI and RFI.

13. Ballasts shall have Power Factor greater than 0.98.

14. Lamp Current Crest Factor (ratio of peak to RMS lamp current) shall be 1.7 or less in accordance with lamp manufacturer's recommendation and ANSI C82.11-1993.

15. Ballast shall have a Ballast Factor between 0.87 and 0.90 per ANSI C82.11-1993.

16. Ballast Efficiency Factor (relative light output per watt consumed) shall be at least 10% greater than CBM certified electromagnetic ballasted system for the same application.

17. Input current Total Harmonic Distortion shall not exceed 10%.

18. Ballasts shall be fully encapsulated (potted) to ensure maximum thermal and structural integrity and shall contain no PCBs.

19. Ballasts shall not be affected by lamp failure and shall deliver normal lamp life.

20. Operating temperature shall not exceed 60°C at any point on the case during normal operation.

21. Ballasts shall be marked with manufacturer's name, part number, supply voltage, power factor, open circuit voltage, current draw for each lamp type and UL listing.

I. Fluorescent Ballasts (T5 and smaller)

1. T5HO, T5 linear, and T4, fluorescent ballasts shall be programmed start.

2. Electronic ballasts operating T5 or smaller diameter lamps (including linear T5, T5HO, compact fluorescent twin tube, triple tube or quad tube or T5 compact fluorescent) shall be high power factor IC type with integral end-of-lamp-life detection circuitry.

3. Fluorescent ballasts shall be electronic type and operate lamps at a frequency above 40 kHz with no visible flicker (<5% flicker index).

4. Ballast manufacturer shall have been producing electronic ballasts for at least ten (10) years with a low failure rate.

5. Ballast shall be specifically designed to operate the number and type of lamps for each fixture as indicated on the Lighting Fixture Schedule.

6. Ballasts shall operate at an input frequency of 60 Hz and an input voltage of 108 to 132 (120 volt circuit) or 249 to 305 (277 volt circuit) with no damage to the ballast.

7. Ballasts shall provide transient immunity as specified by ANSI C82.41-1991, Location Category A1.

8. Ballasts shall provide starting sequence consistent with ANSI standard C82.11-1993.

9. Ballasts shall operate as a parallel circuit allowing remaining lamp(s) to maintain full light output if one or more lamps fail.

10. Ballasts shall tolerate sustained open circuit and short circuit output conditions without damage to the ballast.

11. Ballasts shall be UL Listed as Class P, and for use in indoor or Type 1 outdoor applications and shall contain a temperature sensing device that shall switch the ballast off if excessive internal temperature develops.

12. Ballasts shall tolerate operation in ambient temperatures up to 105 degrees F (40 degrees C) without damage.

13. T5HO Ballasts shall tolerate operation in ambient temperatures up to 131 degrees F (55 degrees C) without damage. The ballast shall have an allowable maximum case temperature of 90 degrees C.

14. Ballasts shall comply with limits of FCC Part 18, Subpart C Limits for Non-Consumer Equipment for EMI and RFI.

15. Ballasts shall have Power Factor greater than 0.98.

16. Lamp Current Crest Factor (ratio of peak to RMS lamp current) shall be 1.7 or less in accordance with lamp manufacturer's recommendation and ANSI C82.11-1993.

17. Ballast shall have a Ballast Factor between 0.87 and 0.90 per ANSI C82.11-1993.

18. Ballast Efficacy Factor (relative light output per watt consumed) shall be at least 10% greater than CBM certified electromagnetic ballasted system for the same application.

19. Input current Total Harmonic Distortion shall not exceed 10%.

20. Ballasts shall be fully encapsulated (potted) to ensure maximum thermal and structural integrity and shall contain no PCBs.

21. Ballasts shall not be affected by lamp failure and shall deliver normal lamp life.

22. Operating temperature shall not exceed 60°C at any point on the case during normal operation.

23. Ballasts shall be marked with manufacturer's name, part number, supply voltage, power factor, open circuit voltage, current draw for each lamp type and UL listing.

24. Ballasts shall be marked with manufacturer's name, part number, supply voltage, power factor, open circuit voltage, current draw for each lamp type and UL listing.

25. 54W T5HO ballasts shall be Sylvania QUICKTRONIC PROStart T5HO Universal High Ambient Temp, Type CC, Programmed Rapid Start, Normal Ballast Factor HT, for 120 volt and 277 volt applications.

26. 54W T5HO ballasts shall be Sylvania QUICKTRONIC PROStart T5HO Universal High Ambient Temp, Type CC, Programmed Rapid Start, Normal Ballast Factor HT, for 347 – 480 volt applications.

27. 28W T5 ballasts shall be Sylvania QUICKTRONIC PROFESSIONAL T5 PROStart Universal High Ambient Temp for 120/277 volt and 3477/480 volt applications.

28. 28W T5 ballast for step-dimming shall be Advanced Optanium for 120/277 volt applications.

J. HID Lamp Ballasts

1. High intensity discharge lamp ballasts shall be core and coil ballasts designed in accordance with all applicable ANSI specifications including ANSI C84.2.

2. The core and coil ballast shall be designed with class “H” (180°C) or higher insulation system and by 100% solid based resin impregnated.

3. All coils shall be precision wound.

4. Core and coil ballasts shall be designed to operate at least 180 cycles of 12 hours on and 12 hours off, with the lamp circuit in an open or short-circuited condition and without undue reduction in ballast life.

5. Core and coil ballast and starter combinations shall be designed to provide reliable lamp starting down to -40 degrees C for high pressure sodium and -20 degrees C for metal halide lamps.

6. High intensity discharge lamp ballasts shall have an operating power factor of 0.90 or higher.

7. Capacitors shall be oil filled with self-contained internal protective device and bleeder resistor.

8. Capacitors shall be housed in corrosion-resistant steel cans and contain 0.25" quick disconnect terminals.

9. Starters shall be epoxy filled with either a plastic or aluminum external housing.

10. Starters shall be designed to provide 6 months of lamp open circuit operation without failure.

11. All high intensity density lamp ballasts shall be UL listed per UL 1029.

12. Pulse start lamps shall utilize Constant Wattage Autotransformer (CWA) Pulse Start ballasts as manufactured by Venture.

13. Ballasts shall have a two (2) year warranty from date of acceptance of the completed installation.

14. All ballasts shall comply with the local utility company requirements and rebate program.

2.08 LAMPHOLDERS

A. Provide incandescent and HID lamp sockets with porcelain housings over copper screw shells, with medium base sockets rated at 660 watt. Plastic or metal sheet sockets are not approved.

B. Provide fluorescent fixture sockets that are white, of heat resistant plastic and rated at 660 watt. Fluorescent lamp sockets operating with an open circuit voltage in excess of 300 volts shall be of the safety type that opens the supply circuit when the lamp is removed from the socket.

C. Rigidly and securely attach lamp holding sockets to the fixture enclosure or husk.

D. Provide sockets suitable for specified lamps, and set to position the lamps in optically correct spacing and relationship to lenses, reflectors, filters, and baffles.

E. **Where fluorescent lamps are to be used "bare" without diffusers or lenses, provide tube guards.**

2.09 LAMPS

A. Provide a complete set of new lamps as specified in the Fixture Schedule on Drawings and/or as described below, in each fixture. Upon completion of the work, leave fixtures and lighting equipment completely lamped and/or in normal operating condition.

B. Fluorescent lamps shall have a color temperature of 4100 Kelvin.

C. T5 and smaller fluorescent lamps shall have a minimum color rendition index (CRI) of 85. Biax fluorescent lamps and T8 fluorescent lamps shall have a minimum CRI of 85.

D. T5HO lamps and ballast shall be by the same manufacturer. T5 Linear and T4 lamps and ballast shall be from the same manufacturer or shall be covered under a joint manufacturers listing / warrantee agreement.

E. For incandescent fixtures provide 130 volt lamps unless otherwise indicated.

F. For other fixtures provide lamps as specified, or if not specified, provide as rated by the manufacturer. If specification is not complete contact Architect for clarification.

G. All lamps shall be as manufactured by Venture, Osram Sylvania, General Electric, or Phillips Lighting.

H. 54W T5HO lamps shall be Sylvania No. 21043 with ballast as specified previously in this document.

I. 28W T5HO lamps shall be Sylvania No. 20902 with ballast as specified previously in this document.

J. Pulse Start Metal Halide lamps shall be **Venture only** as listed below. Provide correct lamps socket and ballast in all fixtures.

1.	1000W Vertical Lamp	MS 1000W/BU/BT37/PS	Product Number: 71722
2.	400W Vertical Lamp	MS 400W/V/ED28/PS	Product Number: 85260
3.	400W Vertical Open Rated	MP 400W/V/UVS/ED37/PS/740	Product Number: 71642
4.	400W Horizontal Lamp	MS 400W/H75/ED28/PS	Product Number: 40124
5.	320W Vertical Lamp	MS 320W/V/PS	Product Number: 59194
6.	320W Horizontal Lamp	MS 320W/H75/PS	Product Number: 47549
7.	250W Vertical Lamp	MS 250W/V/PS	Product Number: 49621
8.	250W Vertical Open Rated	MP250W/BU/UVS/PS/ED28	Product Number: 19523
9.	250W Horizontal Lamp	MS 250W/H75/PS	Product Number: 81054
10.	175W Vertical Lamp	MS 175W/BU/PS	Product Number: 68475
11.	175W Horizontal Lamp	MS 175W/H75/PS/740	Product Number: 99585
12.	150W Vertical Lamp	MS 150W/U/ED28/PS	Product Number: 13556
13.	100W Universal Lamp	MS 100W/U/ED17/PS	Product Number: 27266
14.	70W Universal Lamp	MS 70W/U/ED17/PS	Product Number: 78138

2.10 LENSES/FACEPLATES/TRIM

A. Where plastic lenses are indicated provide lenses of virgin methyl methacrylate, unless otherwise indicated.

B. Make lenses, louvers, or other light diffusing elements contained in frames removable, but positively held within the frames so that hinging or other motion of the frame shall not cause the diffusing element to drop out.

C. Provide faceplates of incandescent recessed fixtures which open for access to the interior of the fixture, serve as a ceiling trim, and are positively held to the fixture body by adjustable means that permit the faceplate to be drawn up to the ceiling as tight as necessary to ensure complete contact of faceplate with ceiling surrounding the fixture.

2.11 EXTERIOR FIXTURES

A. Provide fixtures designed and manufactured specifically for outdoor service. Make components, including nuts, bolts, rivets, springs, and similar parts, of materials of effective corrosion resistance, or of materials which have been subjected to finishing treatment which shall ensure such resistance.

B. Provide fixtures for use outdoors or in areas designated as damp locations, which are suitably and effectively gasketed to prevent access of moisture into electrical components or enclosing diffusers, lenses or globes.

C. Provide metal parts of fixtures for use in outdoor or damp locations which are specified as requiring painting with suitable weather and moisture resisting qualities equal to epoxy-based coatings.

D. Provide anodized aluminum for aluminum parts of exterior fixtures which are not specified as requiring a painted finish.

2.12 FIXTURE DESCRIPTIONS

A. Provide fixtures which conform to the above Standards and to the criteria as indicated on the drawings.

PART 3 – EXECUTION

3.01 INSTALLATION

A. The electrical contractor shall be responsible for the coordination of light fixtures locations in all areas of the facility with other trades. This shall include the marking of the locations of the light fixtures that are recessed in the metal panel ceilings. The openings in the metal panel ceiling shall be provided by the metal panel contractor.

B. Furnish, assemble, hang and connect all lighting fixtures. Lighting fixtures shall be as indicated on the drawings.

C. Install each fixture properly and safely. Provide hangers, rods, mounting brackets, supports, frames, yokes, support bars and any other equipment required for a complete installation.

D. Lay-in recessed fixtures in grid type ceiling shall be supported from the underside of roof or floor slab, and utilize adequate hangers with attachments to building construction independent of other systems. All fluorescent fixtures shall have a minimum of two (2) hanger supports and all incandescent fixtures shall have at least one (1) hanger support. Greenfield shall be supported and not allowed to lie on accessible ceiling tiles.

E. All lighting fixtures shall be supported from the slab above and shall not be suspended from ducts, piping, equipment, ceiling support system, etc.

F. Where continuous rows of lighting fixtures are installed (pendant mounted), the Contractor shall furnish and install appropriate mounting channels to properly align fixtures. Use Kindorf or Unistrut channels.

G. Before ordering fixtures, the Contractor shall verify with the Architect the type of ceilings which shall be used in the various spaces.

H. Coordinate fixture locations and mounting heights with Architectural plans, reflected ceiling plans and other reference data prior to installation.

I. Check for adequate headroom and non-interference with other equipment, such as ducts, pipes or openings.

J. Do not scale electrical drawings for exact location of the lighting fixtures. Consult the architectural reflected ceiling plans for the proper locations of lighting fixtures.

K. Prior to fabrication and submittal of shop drawings, check for adequate headroom and non-interference with other equipment such as ducts, pipes or openings.

L. Pendant or surface mounted fixtures shall be provided with required mounting devices and accessories, including hickeys, stud extensions, ball aligners, canopies and stems. Locations of fixtures in mechanical areas shall be coordinated with the Contractor. Mounting stems of pendant fixtures shall be of the correct length to uniformly maintain the fixture heights shown

on the drawings. Variation in mounting individual fixtures shall not exceed 1/4 inch. Height shall not vary more than 1/2 inch from the floor mounting height shown on the drawings. Fixtures hung in continuous runs shall be installed absolutely level and in line with each other. Hanging devices shall comply with Code requirements. Use single stem hangers (double stem hangers shall not be acceptable). Threaded rods shall be used to support lighting fixtures in those spaces where no other means of support is attainable, and only if fixtures are installed absolutely level with no looseness for movement, and only if approved by Code.

M. Rigidly align continuous rows of lighting fixtures for true in-line appearance, subject to Architect's approval.

N. Install pendant lighting fixtures plumb and at a height from the floor as specified or indicated on the drawings. In cases where conditions make this impractical, refer to the Architect and install as directed. Use ball aligners and canopies on pendant fixtures unless noted otherwise.

O. Do not install fixtures and/or parts such as finishing plates and trims for recessed fixtures until all plastering and painting that may mar fittings finish has been completed.

P. Housings shall be rigidly installed and adjusted to a neat flush fit with the ceiling or other finished mounting surface.

Q. The housings of recessed lighting fixtures shall be adequately protected during installation.

R. Install reflector cones, baffles, aperture plates, light controlling element for air handling fixtures, and decorative elements after completion of ceiling tiles, painting and general cleanup.

S. Replace blemished, damaged or unsatisfactory fixtures as directed.

T. Exterior poles, bases and any other fixture or fixture components with scratched or damaged finish shall be repainted to match specified color. Pole mounted fixtures shall be provided with inline fuses located in base.

U. Any lamps, ballasts, reflectors, lens, diffusers, side panels or other parts damaged prior to the final inspection shall be replaced at no expense to the Owner.

V. At time of final inspection, all fixtures and equipment shall be fully lamped, and shall be complete with required lenses or diffusers, reflectors, side panels, louvers or other components necessary.

W. All recessed incandescent lighting fixtures shall be provided with thermal cutoff devices which shall conform to the requirements rated for control of incandescent lamps, as indicated by the NEC Article 410.65(c) and as specified by UL.

X. Each lighting fixture shall be packaged with complete instructions and illustrations showing how to install. Install lighting fixtures in strict conformance with manufacturer's recommendation and instructions.

Y. Provide fixtures constructed, wired and installed in compliance with the current edition of applicable City, State and National Codes. Provide fixtures conforming to Underwriters' Laboratories Standards, and to provisions of applicable Codes which exceed those Standards. In addition, provide fixtures which conform to additional Regulations necessary to obtain approval for use of specified fixtures in locations shown. Use only electrical components listed by Underwriters' Laboratories.

Z. Particular attention is called to Article 410 of the National Electrical Code. Provide only fixtures that meet these requirements, as interpreted by local agencies. As manufacturers' catalog numbers may not include thermal protection devices, it is Contractor's responsibility to coordinate the fixture provided with the ceiling construction in accordance with Local Code enforcement practice.

****

END OF SECTION

THE LIVESTOCK INSTITUTE

WESTPORT, MA

PROJECT NO. 4730

Specification for

LIGHTNING PROTECTION SYSTEM

Section 16670

THE DENNIS GROUP, LLC

PLANNING ▲ ENGINEERING ▲ CONSTRUCTION MANAGEMENT

1537 MAIN STREET
SPRINGFIELD, MASSACHUSETTS 01103
413.787.1785 ▲ FAX 413.787.1786

26 WEST MARKET STREET
SALT LAKE CITY, UTAH 84101
801.531.8585 ▲ FAX 810.531.8586

A	**09.30.2016**	**Review**	**MJJ**		
Issue	**Date**	**Description**	**By**	**Approved**	**Section 16670**

Unless notification and/or comments are received from client within two weeks after issue date, all documentation including drawings, specifications, and studies submitted to client shall be considered approved as released.

PART 1 – GENERAL

1.01 REFERENCES

A. The General Documents, as listed on the Table of Contents and applicable parts of Division 1, General Requirements, and applicable requirements of Section 16010, shall be included in and made part of this Section.

B. Examine all drawings and criteria sheets and all other Sections of the specifications for requirements which affect work under this Section whether or not such work is specifically mentioned in this Section.

C. Coordinate work with that of all other Trades affecting or affected by work of this Section. Cooperate with such Trades to assure the steady progress of all work under the Contract.

D. Provide all material, labor and equipment, to complete the work of this Section in strict accordance with the design Architect's and Engineer's plans and specifications, and with all applicable codes, rules, and standards.

1.02 SCOPE OF WORK

A. The work under this Section specifies the furnishing and installation of a complete lightning protection system in accordance with NFPA 780 including, but not limited to the following:

1. Air terminals.
2. Bonding plates.
3. Conductors.
4. Connectors.
5. Grounding rods.
6. Rod clamps.
7. Splicers.
8. Counterpoise ground loop.
9. Mounting hardware.
10. Bonding of building services.

1.03 SUBMITTALS

A. Submit shop drawings and product data.

B. Submit shop drawings showing layout of air terminals, grounding electrodes, and bonding connections to structure, other metal objects and building services. Include terminal, electrode and conductor sizes, and connection and termination details.

C. Submit product data showing dimensions and materials of each component, and include indication of listing in accordance with ANSI/UL 96.

D. The manufacturer/installer shall submit for approval installation drawings indicating all work required including ground rod locations, air terminal locations and cable locations. Catalog cuts of all components shall also be submitted for approval to the Architect.

E. Submit manufacturer's installation instructions.

F. Certified test report stating the measured resistance to ground of the grounding system.

1.04 PROJECT RECORD DOCUMENTS

A. Submit project record document, indicating actual locations of air terminals, grounding electrodes, bonding connections, and routing of system conductors.

B. Contractor shall provide the Owner with a UL master label lightning protection system certificate.

1.05 REFERENCE STANDARDS

A. Conform to the applicable requirements of the following codes:

1. ANSI/NFPA 780 – Lightning Protection Code
2. ANSI/UL 96 – Lightning Protection Components
3. UL 96A – Installation Requirements for Lightning Protection

1.06 QUALIFICATIONS

A. Manufacturer shall be a company specializing in lightning protection equipment, with minimum of ten (10) years documented experience and listed in Underwriters' Laboratories Electrical Construction Materials Directory or supplement under Lightning Protection – Lightning conductor, Air Terminals and Fittings.

B. Installer shall be authorized installer of manufacturer with minimum of ten (10) years of documented experience and UL listed in Electrical Construction Materials Directory or Supplement under Lightning Protection – Lightning Protection Installation.

1.07 COORDINATION

A. Coordinate the work of this section with roofing, exterior and interior finishes installations.

1.08 RELATED WORK SPECIFIED ELSEWHERE

A. The following referenced sections are listed as a minimum of additional requirements and/or work not included in this Section which may be required to be performed under other designated Sections:

1. Section 16110: Raceways
2. Section 16130: Boxes
3. Section 16195: Electrical Identification
4. Section 16450: Grounding

PART 2 – PRODUCTS

2.01 GENERAL

A. Materials shall be new and first quality commercial products. Standard fittings shall be used where practicable, in preference to special fittings.

B. Materials shall comply in weight, size and composition with the requirements of ANSI/UL 96 and the NFPA Code relating to this type of structure.

C. Lightning rod equipment and fittings shall bear the UL label.

2.02 MANUFACTURERS

A. Subject to compliance with requirements, provide products by one of the following manufacturers:

1. Heary Brothers
2. Thompson Lightning Protection, Inc.
3. A.C. Lightning Protection.
4. Harger Lightning Protection, Inc.
5. Engineer-approved equal

2.03 LIGHTNING PROTECTION SYSTEM COMPONENTS

A. Provide lightning protection system materials and components that comply with manufacturer's standard design, in accordance with published information. Provide air terminals, bonding plates, conductors, connectors, conductor straps, fasteners, grounding plates, grounding rods, rod clamps, splicers and other components required for a complete system that meets UL 96A and NFPA standards.

B. Air Terminals

1. Air terminals shall be one-piece, solid copper.

C. Air Terminal Bases

1. Air terminal bases shall provide a secure attachment to the structure, the air terminal and the conductor cable. The base shall be compatible with all (3) items in contact with it.

D. Conductors

1. Ground and bonding conductors shall be copper and as required for Class I structure.

2. Copper conductors shall be soft drawn copper with a conductivity of at least 95 percent of pure copper.

E. Connector Fittings

1. A connector fitting shall be constructed so that a minimum of 1-1/2" of each conductor can be secured within the connector. Connectors shall be compatible with the material being secured.

2. Water pipe connectors shall be constructed so as to provide at least 1-1/2" contact with the water pipe and conductor. It shall be compatible with the water pipe and conductor materials.

3. Connectors and disconnectors shall be compression type designed to withstand 200 lbs. pull or exothermic welding type.

F. Clips

1. Clips for securing copper conductors shall be not less than 0.032" thick and not less than 3/8" wide. Clips shall be placed not more than 3'-0" apart along a conductor.

G. Ground Rod Clamps

1. Ground rod clamps shall be not less than 3/32" thick, contact the ground rod and conductor not less than 1-1/2" and be secured with at least (2) bolts.

H. Ground electrodes

1. Ground electrodes shall be copperclad 3/4" diameter by not less than 10'-0" long.

I. Fasteners

1. Fasteners shall be compatible with the materials being secured.

PART 3 – EXECUTION

3.01 INSTALLATION OF LIGHTNING PROTECTION SYSTEMS

A. Examination

1. Verify that surfaces are ready to receive work.

2. Verify that field measurements are as shown on the drawings.

3. Beginning of installation shall mean installer accepts existing conditions.

B. Protection of Surrounding Elements

1. Protect elements surrounding work of this Section from damage or disfiguration.

C. Installation

1. General

a. The system shall be installed in accordance with the current edition of UL 96A "Installation Requirements for Master Labeled Lightning Protection Systems" by the Underwriters' Laboratories, Inc.

1) No ferrous fasteners (except stainless steel), nor ferrous holding devices of any kind shall be employed as permanent fasteners.

2) Individual anchor bolts employed in this installation shall each have a pull-out resistance as determined and documented by a Registered Engineer, as required to meet current wind loading criteria.

3) The installation shall be made in a most conspicuous manner. Conductors shall be coursed on the back side of Architectural construction to conceal equipment as much as possible.

2. Air Terminal Installation

a. Air terminals shall be installed as required by UL.

b. Air terminals shall have their points aligned vertically, and their bases shall be bolted to the building.

3. Conductor Installation

a. Down conductors shall be installed on buildings at intervals of 100'-0" on center maximum.

b. Conductors shall be connected to the ground rods with ground clamps allowing a reasonable amount of slack conductor to allow for expansion and contraction. Steel surfaces shall be clean and bright before applying connector plates or Cadwelding. Bends in these conductors shall have no angle more than 90°. Bends shall have a radius of not less than 8". Connectors shall, when fixed to conductors, be capable of withstanding a pull of 200 lbs.

c. Bonding conductors shall be connected to the bonding clamps allowing a reasonable amount of slack for expansion and contraction, and the conductor bonds shall be limited as stated above.

d. All metal fascia, television masts, metal fan housings, ventilators, vents, etc., shall be grounded.

e. Grounding conductors shall be pulled and coiled in pullboxes which shall be provided 2'-0" above slab on grade for final connection to down conductors. Coordination with the Construction Manager for the placement of pullboxes which house grounding conductors shall be conducted in a manner to avoid coring the slab on grade after it has been poured.

4. Ground Installation

a. Ground terminal installation shall be made at all other locations indicated on the drawings and at such other points as may be found necessary to properly ground the system.

b. All grounds shall be made by means of rods driven into the soil which shall penetrate vertically not less than 10'-0" below the finished surface of the ground and passing approximately 2'-0" away from the building foundations. Provide minimum of (2) rods at each ground point.

c. The Electrical Contractor shall add to the ground system in case the measured resistance exceeds 5 ohms per electrode, at the direction of the Architect/Engineer and at an additional contractual agreement.

d. As-built drawings shall indicate the exact location and configuration of each ground location. As-built documents shall also include record of resistance values for each ground.

5. Where cables penetrate the roofing membrane, penetrations shall be permanently sealed per roof manufacturer's recommended methods.

6. Counter poise loop

a. Furnish and install a complete ground level potential equalization loop in accordance with current NFPA-780 criteria.

3.02 BONDING OF METAL BODIES

A. All grounded interior and exterior metal bodies, including ladders, elevators, piping and conduit, roof drainage, water services, gas services, telephone services, electric services, etc., shall be interconnected to the lightning protection system.

3.03 FIELD QUALITY CONTROL

A. Ground Resistance Testing:

1. Measure ground resistance with bridge type meter designed for testing grounds.

2. Record readings, conditions of soil, model of meter and name of tester.

3. Conductor test in presence of Owner or his Representative.

B. Obtain the services of UL to provide inspection and certification of the lightning protection system under provisions of UL 96A.

C. Obtain UL Master Label and attach to building at the location prescribed by UL 96A.

****

END OF SECTION

THE LIVESTOCK INSTITUTE

WESTPORT, MA

PROJECT NO. 4730

Specification for

FIRE ALARM SYSTEM

Section 16721A – Non-Voice

THE DENNIS GROUP, LLC

PLANNING ▲ ENGINEERING ▲ CONSTRUCTION MANAGEMENT

1537 MAIN STREET
SPRINGFIELD, MASSACHUSETTS 01103
413.787.1785 ▲ FAX 413.787.1786

26 WEST MARKET STREET
SALT LAKE CITY, UTAH 84101
801.531.8585 ▲ FAX 810.531.8586

A	**09.20.2016**	**Review**	**MJJ**		
Issue	**Date**	**Description**	**By**	**Approved**	**Section 16721**

Unless notification and/or comments are received from client within two weeks after issue date, all documentation including drawings, specifications, and studies submitted to client shall be considered approved as released.

PART 1 – GENERAL

1.01 REFERENCES

A. The General Documents, as listed on the Table of Contents and applicable parts of Division 1, General Requirements, and applicable requirements of Section 16010, shall be included in and made part of this Section.

B. Examine all drawings and criteria sheets and all other Sections of the specifications for requirements which affect work under this Section whether or not such work is specifically mentioned in this Section.

C. Coordinate work with that of all other Trades affecting or affected by work of this Section. Cooperate with such Trades to assure the steady progress of all work under the Contract.

D. Provide all material, labor and equipment, to complete the work of this Section in strict accordance with the design Architect's and Engineer's plans and specifications, and with all applicable codes, rules, and standards.

1.02 FIRE ALARM MONITORING AND CONTROL SYSTEM

A. General

1. Furnish and install a full microprocessor-based addressable, fire alarm temporal code evacuation and firefighter's phone system according to the following specifications and as indicated on the drawings.

2. The equipment and completed installation shall meet the approval of the City Fire Department, the State Fire Marshall, and other Authorities having jurisdiction, and shall be in accordance with applicable sections of the latest edition of NFPA 72 National Fire Codes.

3. Furnish and install a full microprocessor based addressable, fire alarm and audio evacuation system with networking capabilities according to the following specifications.

4. The system shall consist of fire alarm control panels configured for network operations. One LED graphical system status display shall be provided in the main lobby. The graphic system shall meet the local AHJ requirements. The contractor shall submit obtain written approval of the final graphic display from the AHJ and submit for record to DGL the approved drawing prior to fabrication and installation.

5. Each and all items of the fire alarm system shall be listed as a product of a single fire alarm system manufacturer under the appropriate category by Underwriters' Laboratories, Inc. (UL), and shall bear the UL label. All control equipment shall be listed under UL category UOJZ as a single control unit. Partial listing shall NOT be acceptable.

6. All control equipment must have transient protection to comply with UL 864 requirements. Where fire alarm circuits leave the building, additional transient protection must be provided for each circuit. Devices must be UL listed under Standard 497B (Isolated Loop Circuit Protectors).

7. In addition to the UL-UOJZ requirement mentioned above, the system controls shall be UL listed for Power Limited Applications and all circuits must be marked in accordance with **NEC Article 760.**

8. The system shall permit maximum system expansion and Owner flexibility with a minimum of additional field wiring. The system shall be wired, connected, tested and left in first class operating condition.

9. The system shall have the capability of recalling alarms and trouble conditions in chronological order for the purpose of recreating an event history.

10. Provide the services of a factory certified fire alarm representative/technician for all technical support required for a complete and operational system.

11. Installation and testing of water flow and tamper switches provided under Division 13. Flow and tamper switches shall be provided under the Division 13. Coordinate exact location of flow and tamper switches with Division 13.

12. The work under this Contract shall also include all labor, materials, tools, equipment, transportation, insurance, temporary protection, supervision and incidental items essential for proper installation and operation, even though not specifically mentioned or indicated on the drawings, but which are usually provided or are essential for proper installation and operation of all systems as indicated on the drawings and specified herein.

13. The specifications and drawings describe the minimum requirements that must be met by the Electrical Contractor for the installation of all work as shown on the drawings and as specified hereinunder.

14. Provide all devices, remote interface units, components, wiring, programming and related work necessary for a complete “network/integrated” system.

B. System Requirements

1. The following equipment specifications are based on EST-3, to indicate system configuration and performance.

2. The fire alarm monitoring and control system shall consist of all necessary hardware and software equipment to perform the following functions:

   a. Fire alarm and detection operations.

   b. Evacuation signaling system.

   c. Automatic control of elevator recall, egress door release under fire alarm conditions, remote monitoring of sprinkler, fire pump and emergency power systems.

   d. Remote control of door release.

   e. Interface with building HVAC/engineered smoke control system.

   f. Fire fighter's communication.

3. Nodes as defined for this specification shall be intelligent, microprocessor based fire alarm control panels that connect to, and handle network communications in a peer-to-peer manner. In order to maintain network integrity, systems using a single master with remote slave units will not be acceptable. Decisions pertinent to the network shall be distributed among the nodes such that there is no need for a central controller.

4. By programmable selection at each node:

    a. The specific detail information of any point connected to any node in the network may be made accessible to the network.

    b. Any point information may be incorporated into the custom control program of any node and operated upon as though that point was physically connected to that node.

    c. Points within each node shall be able to be grouped by area, type of device, type of function, or any other user selectable category, and custom labeled as a point list. A point list shall be acted upon as though it was a point for purposes of interaction with the node custom control program.

5. Network operations shall be via communication links that connect all network nodes and include primary data transfer, an audio signaling bus serving all remote primary and backup amplifiers. All communications trunk wiring shall be electrically supervised, Style 4, Class "B".

6. The network shall operate using half-duplex, digital RS-485 communication techniques. Communication shall be via twisted #16 AWG wire or single/multi-mode fiber optic cables where otherwise shown and required.

7. Each system control panel shall be a specially configured control panel with a network interface card and custom network programming capabilities. Each fire alarm panel shall have stand-alone capabilities. As required panels shall be provided with dedicated amplifiers for speaker circuits.

8. All points monitored and controlled by each control panel shall be capable of being made available to the network. Such points shall include initiating circuit devices such as analog sensors, including sensor type and sensor values; conventional addressable or zone connected smoke and heat detectors; addressable manual fire alarm pull stations; supervisory operation, such as for sprinkler flow and tamper monitoring; control circuits such as for notification appliances, fan control, elevator control, and other similar operations.

9. Each point made public to the network may be programmed to be operated by any other control panel connected to the network.

10. Network communications shall be capable of supporting zones that can be handled as though they were a single point.

    a. When any point in the zone enters into an off/normal condition, the zone is annunciated as in that condition.

    b. The network message shall include the zone name and zone status.

c. The network message shall not be burdened with detail information on each point in the zone.

d. Individual point information shall be available by accessing the point details.

C. Network Operation

1. Network communication details shall be per the following:

a. The system shall utilize node to node, direct wired multi-priority peer-to-peer network operations. The system shall utilize independently addressed, smoke detectors, heat detectors and input/output modules as described in this specification.

b. The peer-to-peer network shall contain multiple nodes consisting of the command center, main controller, remote control panels, LCD/LED annunciation nodes, and workstations. Each node is an equal, active functional node of the network, which is capable of making all local decisions and generating network tasks to other nodes in the event of node failure or communications failure between nodes.

c. When a network is wired in a Class B configuration, a single break or short on the network wiring isolates the system into two groups of panels. Each group continues to function as a peer-to-peer network working with their combined databases.

d. In the event that the network path to the next node has experienced a communications failure, the node shall attempt to reach the next node by going around the network in the opposite direction. At the same time, the status of the non-communicating node shall be made known to all nodes.

e. The communication method shall be NFPA 72, Style 4 (Class B).

f. If a group of nodes becomes isolated from the rest of the network, that group shall form a sub-network with all common interaction of monitoring and control remaining intact. The network shall be notified with the exact details of the lost communications.

g. In the event that a single node becomes unable to communicate, the network shall continue communications to the rest of the network. The off-line node shall be reported as such to the network and shall be periodically interrogated to determine if it is ready to be brought back on-line with the rest of the network.

2. Network operation for any manual or automatic fire alarm initiating device activation shall be as follows:

a. The node connected to the alarmed device shall operate in accordance with its programmed response.

b. When the network token message reaches that node, it shall be updated with the alarm condition to include:

1) The red ALARM LED shall flash on the monitoring node, and on all connected network nodes programmed to recognize that alarm, until the alarm has been manually acknowledged. When the alarm has been acknowledged, this same LED shall latch on. A subsequent alarm received after any acknowledgment shall again flash the same LEDs.

2) The source of alarm shall be annunciated via English language description on the alphanumeric display at the monitoring node and all other nodes programmed to respond to that alarm.

3) All nodes shall respond to alarm information in accordance with their individually programmed response which may include operation of control functions both connected to that node and on all other nodes.

4) All fire alarm conditions shall be visually indicated at the main node and at all remote annunciators as programmed.

5) All alarms shall be recorded with the time and date at the main fire command center.

6) Any alarm verification timing shall be performed by the node in accordance with that node's pre-programmed operation.

7) The network operation shall be such that the alarm operation of any initiating device shall not prevent the subsequent alarm operation of any other initiating device due to wiring or power limitations.

c. Audio Annunciation and Communications

1) The network communications shall be capable of controlling speaker circuits by appropriately programming control points throughout the network.

2) Audio wiring shall be routed with the network data communications wiring in accordance with specifications found in the Voice Section.

3. Time Keeping

a. Network time synchronization with seconds resolution accuracy shall be provided by designating (1) node as the network timekeeper. This node shall notify the network of authorized time and date changes. During periods without any time or date changes, the network timekeeper shall maintain network time synchronization by network communication once every 24 hours. In the event that the network timekeeper is unable to communicate the correct time, each node shall maintain its own local time and date reference using an internal, crystal controlled oscillator.

4. Refrigeration Systems

a. Provide monitoring of the building ammonia refrigeration system. Monitor two points; alarm and supervisory.

5. Building HVAC Systems

a. Duct smoke detectors for specific air handling units shall initiate alarm conditions and shall shut down the associated fan and a discrete signal shall be sent to the building automation system to indicate the fan has been shut down. Wiring from the duct detector aux contact to the building automation system shall be by the HVAC contractor.

D. Fire Alarm System Operation

1. The first activation of any manual fire alarm pull station, or the automatic actuation of any thermal detector, smoke detector, duct detector, sprinkler system water flow switch, or any other approved alarm initiating device shall immediately result in the following:

a. Report alarm to the Municipal Fire Station via **approved means**.

b. Notify the Owner's monitoring service.

c. Activate the evacuation signal throughout the building on all floors. The evacuation signal should be Temporal Code 3 in all areas and shall sound until signal silence is activated at the control panel.

d. All ADA visible alarm indicating appliances shall flash at a synchronized rate continuously until the system is reset.

e. Any subsequent zone alarm shall reactivate the alarm indicating appliances.

f. All doors normally held open by door control devices shall release. Electrically operated egress doors equipped with security access shall be overridden to allow passage.

g. The alarm shall be displayed on the main fire alarm control panel 168-character LCD display and shall include a 40-character custom message. The system alarm LED shall flash on the control panel until the alarm has been acknowledged. Once acknowledged, this same LED shall latch on. A subsequent alarm received from another zone shall flash the system alarm LED on the control panel. The LCD display shall show the new alarm information.

h. The alarm shall be displayed on the main fire command panel's 168 character LCD display. The system alarm LED shall flash on the control panel until the alarm has been acknowledged. Once acknowledged, this same LED shall latch on. A subsequent alarm received from another zone shall flash the system alarm LED on the control panel. The LCD display shall show the new alarm information.

i. Sound the alarm signal at all FACPs and FCCs, and illuminate the system alarm LED. The alarm signal shall pulse until the appropriate “acknowledge” switch is depressed which shall cause it to be silenced. The system alarm LED shall remain illuminated until the alarm condition has been corrected.

j. All events shall be entered and stored in a software memory log.

2. The activation of any standpipe or sprinkler valve supervisory (tamper) switch shall activate the system supervisory service audible signal and illuminate the LED at the

network fire alarm control panels. Differentiation between valve tamper activation and opens and/or grounds on the initiation circuit wiring shall be provided.

a. Pressing the “Supervisory Acknowledge” key will silence the supervisory audible signal while maintaining the supervisory service LED “on” indicating the off/normal condition.

b. Restoring the valve to the normal position shall cause the supervisory LED to extinguish, indicating restoration to normal.

c. Restoring the valve to the normal position shall cause the supervisory audible signal to pulse indicating the restoration to normal position. The supervisory acknowledge key shall silence the audible signal.

1.03 RELATED WORK SPECIFIED ELSEWHERE

A. The following referenced sections are listed as a minimum of additional requirements and/or work not included in this Section which may be required to be performed under other designated Sections:

1. Section 16110: Raceways
2. Section 16120: Conductors
3. Section 16130: Boxes
4. Section 16190: Hangers and Supports
5. Section 16195: Electrical Identification

1.04 COORDINATION

A. The work of this Section shall be coordinated with other work of the Contract. The placement of all raceways shall be coordinated with other trades prior to installation.

1.05 REFERENCE STANDARDS

A. Applicable provisions of the following Codes and Trade Standard Publications shall apply to the work of this Section, and are hereby incorporated into, and made a part of, the Contract Documents:

1. NFPA 70: National Electrical Code
2. FAC 4A-47: Uniform Fire Safety Code For Elevators
3. ASME A17.1: Safety Code for Elevators
4. NFPA: National Fire Protection Association
   a. 72: Protective Signaling Systems
   b. 90A: Installation of Air conditioning and Ventilating Systems
   c. 101: Life Safety Code
   d. ADA: American Disability Act

1.06 GUARANTEE

A. In addition to the specific guarantee requirements of the General Conditions, the Contractor shall obtain in the Owner's name the standard written manufacturer's guarantee of all materials furnished under this Section where such guarantees are offered in the manufacturer's published product data. All these guarantees shall be in addition to, and not in lieu of, other liabilities which the Contractor may have by law or other provisions of the Contract Documents.

B. Furnish the Owner a written two year warranty (material and labor) from the approved certificate of completion, signed by manufacturer/vendor against defects in materials and workmanship.

C. The equipment manufacturer shall make available to the Owner a maintenance contract proposal to provide a minimum of four (4) inspections and tests per year in compliance with NFPA-72 guidelines.

1.07 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery of materials shall be made to the project by the materials supplier in accordance with the instructions of the Contractor.

B. The Contractor shall provide adequate locked storage space with shelving for the materials, shall be responsible for all items of materials after receipt from the supplier, and shall replace all materials lost or damaged after delivery and receipt.

C. The Contractor shall furnish the materials supplier with receipts for all materials and accessory items received, and shall send copies of these receipts to the Architect.

1.08 ACCEPTABLE MANUFACTURERS

A. Manufacturer's name and equipment model numbers by EST are listed herein to establish minimum level of quality and performance requirements. Simplex, Notifier, and Siemens Cerberus shall be considered equals.

B. Contractor shall base his bid on the equipment specified.

1.09 QUALITY ASSURANCE

A. Each and all items of the Fire Alarm System shall be listed as a product of a SINGLE fire alarm system manufacturer under the appropriate category by Underwriters' Laboratories, Inc. (UL), and shall bear the UL label. Partial listing shall NOT be acceptable.

B. All control equipment must have transient protection devices to comply with UL 864 requirements.

1. All external surge protectors shall comply with UL #497B requirements.

C. The Contractor quoting the Fire Alarm System Installation shall be the Owner's single point of contact for all issues that may arise during the project associated with the fire alarm system. The contractor shall be responsible for all coordination of materials, labor, installation, startup, testing, and warranty.

1.10 PARTS LIST AND INSTRUCTIONS FOR OPERATION AND MAINTENANCE MANUALS

A. The Contractor shall thoroughly instruct the representative of the Owner, to the complete satisfaction of the Architect, in the proper operation of all systems and equipment provided by him. The Contractor shall make arrangements, via the Architect, as to whom the instructions are to be given in the operation of the basic and auxiliary systems and the period of time in which they are to be given. The Architect shall be completely satisfied that the representative of the Owner has been thoroughly and completely instructed in the proper operation of all systems and equipment before final payment is made. If the Architect determines that complete and thorough instructions have not been given by the Contractor to the Owner's

representative, then the Contractor shall be directed by the Architect to provide whatever instructions are necessary until the intent of this paragraph of the specification has been fulfilled.

B. The Contractor shall submit to the Architect for approval, the required typed sets (see Division 1; General and Supplementary General Requirements), bound neatly in loose-leaf binders, of all instructions for the installation, operation, care and maintenance of all equipment and systems (including instructions for the ordering and stocking of spare parts for all equipment installed under this Contract). The lists shall include part numbers and suggested supplier. Each set shall also include an itemized list of component parts that should be kept on hand and where such parts can be purchased.

C. Information shall indicate possible problems with equipment and suggested corrective action. The manuals shall be indexed for each type of equipment. Each section shall be clearly divided from the other sections. A sub-index for each section shall also be provided. The methodology of setting-up the manuals shall be submitted to the Architect and Owner for review prior to final submission of manuals.

D. The instructions shall contain information deemed necessary by the Architect and include but not limited to the following:

1. Introduction

    a. Explanation of Manual and its use.

    b. Summary description of the Electrical systems.

    c. Purpose of systems.

2. System

    a. Detailed description of all systems.

    b. Illustrations, block diagrams, catalog cuts, and other exhibits.

3. Operations

    a. Complete detailed, step-by-step, sequential description of all phases of operation for all portions of the systems, including start-up, shutdown, adjusting. Include all posted instruction charts.

4. Maintenance

    a. Parts list and part numbers.

    b. Maintenance, and replacement charts and Electrical Contractor's recommendations for preventive maintenance.

    c. Troubleshooting charts for systems and components.

    d. Instructions for testing each type of part.

    e. Recommended list of on-hand spare parts.

f. General or miscellaneous maintenance notes.

5. Manufacturer's Literature

a. Complete listing for all parts with names, addresses and telephone numbers.

b. Care and operation.

c. All and only pertinent brochures, illustrations, drawings, cuts, bulletins, technical data, certified performance charts and other literature with the model actually furnished to be clearly and conspicuously identified.

d. Internal wiring diagrams and engineering data sheets for all items and/or equipment to be furnished.

e. Guarantee and warranty data.

1.11 MANUFACTURER'S REPRESENTATIVE

A. The Contractor shall provide the on-site services of a competent factory trained Project Manager, Construction Manager, and field technicians. Provide a minimum of three technicians on site simultaneously. No additional compensation will be allowed for such services. Manufacturer's project manager and construction manager shall be identified in the bid package. Provide resume for each individual with bid package. The Owner reserves the right to reject the project manager and construction manager without cause.

B. Manufacturer's project managers shall attend weekly job meetings. Provide a minimum eight hours per week on site management.

C. Manufacturer's construction managers shall attend weekly job meetings. Provide a minimum 16 hours per week (two days) on site supervision from conduit rough in through cable pulling complete. Provide a minimum 24 hours per week (three days) on site supervision during device installation, wire termination, testing and commissioning.

D. Manufacturer's field service technicians shall be onsite a minimum 8 hours per week (two half days) from conduit rough in through cable pulling complete. Provide a minimum 16 hours per week (two days) on site supervision during device installation, wire termination, testing and commissioning. The hours listed above shall be per technician.

1.12 SHOP DRAWINGS

A. The following minimum shop drawings shall be submitted as part of the fire alarm system:

1. Detailed component and equipment list with model numbers.

2. Manufacturer's specification sheets for each item of equipment.

3. Description of how specified system functions.

4. Confirmation that manufacturer's representative will provide job site supervision during system installation, perform final testing and instruct operating personnel on system operation.

5. Standby battery calculations showing system power requirements and formulas used to compute the 24 hours of standby power, and 5 minutes full alarm condition.

6. Detailed one-line schematic wiring diagrams of specified system and interconnection wiring.

7. Device specific wiring and termination diagrams.

8. Cable Schedule and types, including outside diameter of cables for sizing conduits.

9. Building riser diagram.

10. List of all node addresses (to be submitted as part of operations manual).

11. Points programmed.

B. Shop drawings submitted for approval without this information will not be considered for approval.

C. In addition to the shop drawing, the installation contractor shall be responsible for reading and understanding manufacturer's product inserts to ensure proper installation and operation of the device.

PART 2 – PRODUCTS

2.01 FIRE ALARM MONITORING AND CONTROL PANELS

A. Furnish and install EST-3 series solid state, microprocessor based, networked fire alarm monitoring control panels, distributed throughout the Building. The system shall be modular to allow future additions without the need to replace the entire control. It shall display only those and displays essential to operation during a fire alarm condition. Keyboards or keypads shall not be required to operate the system during fire alarm conditions.

1. A local audible device shall sound during “Alarm”, “Trouble”, “Monitor”, or “Supervisory” conditions. This audible device shall sound differently during each condition to distinguish one condition from another without having to view the panel. This audible feedback shall also sound during each key press to ensure that the key has been pressed properly.

2. Each panel shall have a 168-character LCD which shall be backlit for enhanced readability. So as to conserve battery standby power, it shall not be lit during an AC power failure unless an alarm condition occurs or there is keypad activity.

B. The following primary controls shall be visible through a front panel of the FACPs:

1. 168-Character LCD

2. Individual red system alarm LED

3. Individual yellow supervisory LED

4. Individual yellow trouble LED

5. Green “power on” LED

6. Alarm acknowledge key

7. Supervisory acknowledge key

8. Trouble acknowledge key

9. Alarm silence key

10. System reset key

C. The control panel shall provide the following:

1. Setting of time and date

2. LED test switch

3. Alarm, trouble, and abnormal condition listing

4. Enabling and disabling of each monitor point individually

5. Activation and deactivation of each control point separately

6. Changing operator access levels

7. Walk test enable

8. Running diagnostic functions (RUN INTERNALLY)

9. Displaying software revision level

10. Displaying system event logs

11. Point listing

12. Lamp test

D. For maintenance purposes, the following reports shall be available from the status lists menu:

1. All active points

2. Alarm points

3. Supervisory points

4. Trouble points

5. Monitor points

6. Test points

7. Disabled points

8. Output points

E. Separate, life safety supervised indication shall be provided to annunciate status, at the fire command center, via necessary auxiliary relays with dry contacts at the equipment and monitor ZAMs connected to the MAPNET II loop for the following status points:

1. Valve tamper at fire pump
2. Fire pump “running”
3. Fire pump “power loss”
4. Fire pump “phase reversal” each pump
5. Emergency generator “over crank”, each generator
6. Emergency generator “low water temperature”, each generator
7. Emergency generator “high engine temperature pre-alarm”, each generator
8. Emergency generator “high engine temperature”, each generator
9. Emergency generator “low lube oil pressure”, each generator
10. Emergency generator “over speed”, each generator
11. Emergency generator “low fuel main tank”, each generator
12. Emergency generator “low coolant level”, each generator
13. Emergency generator “control switch not in automatic position”, each generator
14. Emergency generator “low cranking voltage”, each generator
15. Emergency generator “contacts for local and remote common alarm”, each generator
16. Emergency generator “audible alarm silencing switch”, each generator
17. Emergency generator “air shutdown damper when used”, each generator
18. Sprinkler valve tampers by device
19. Standpipe valve tampers by device
20. Each stairwell pressurization fan that is running
21. Each smoke removal fan that is running

F. Two-Way Firefighter Communication **(NIC)**

1. Provide a 2-way voice communication system between the central control and emergency phones located at each stair on each level, elevator lobby, and other locations as indicated on the drawings. All wires between the central control and remote unit shall be continuously supervised. Any fault which occurs shall be reported visually and audibly at the central control.

2. Provide 1-line (talk) circuit for each elevator bank, stairwells, and elevator lobby. Line (talk) circuit modules shall be furnished to electrically supervise for shorts, opens and grounds of circuit wiring. Each line module shall contain a “call” and “trouble” indication and a 2-position switch to enable 2-way voice communication between remote and master phones.

3. The Fire Department communication system shall be capable of handling single or simultaneous conversations with all phones connected into the system. The phone system circuits shall be so designed to prevent static, hum or other interference for clear, intelligible 2-way conversation between all phones of the system.

4. The systems shall indicate to the person attempting to use a remote phone, by beeping busy signal, that the signal is being received at the central control and that the lines are intact. As many as (6) phones shall be able to be connected into the active conversation at the discretion of the person at the central control.

5. Operation shall be as follows:

    a. The act of removing a phone from its normal hook position shall cause the appropriate phone location LED to flash and a distinctive audible device to sound at the control panel. The subsequent picking up of the master phone and acknowledgment of the proper phone circuit shall silence the pulsing tone and cause the phone location LED to stop flashing and remain on. This action shall couple the remote phone to the master phone to provide direct and private communications.

    b. Attempting to use a subsequent phone on the same circuit shall not cause the pulsing tone to activate if any 2-way communications are already established; however, any new circuits activated shall cause their discrete phone circuit LED's to flash until acknowledged.

    c. The 2-way communications system shall provide the capacity to handle simultaneous use of multiple remote phones.

    d. The act of replacement of all remote phones to their normal hook position and returning all the related circuit acknowledgment switches to the normal position shall cause the restoration of all normal supervisory functions. If any remote phone is not hung up, then the appropriate phone zone indicator LED shall flash and the pulsing tone shall resume at the control panel.

    e. At the discretion of the person at the control panel, the system shall allow for remote paging from any Firefighter's remote phone location via the system speakers as manually selected at the main controls.

6. Emergency Phone Stations

    a. Provide remote phones in break-rod cabinets for installation where shown on the drawings.

G. System Front Panel Operation and Capabilities

1. Under normal condition the front panel shall display a “System is Normal” message and the current time and date.

2. Should an abnormal condition be detected the appropriate LED (Alarm, Supervisory, monitor, or Trouble) shall flash. The panel audible signal shall pulse for alarm conditions and sound steady for trouble and supervisory conditions.

3. The LCD shall display the following information relative to the abnormal condition of a point in the system.

    a. 40-Character custom location label

    b. Point status (i.e., alarm, trouble)

4. Acknowledging Points – Pressing the appropriate acknowledge button shall display the first unacknowledged condition, and require another acknowledge action to acknowledge the next point displayed. After all points have been acknowledged, the LEDs shall glow steady and the sounder will be silenced. The total number of alarm, supervisory, monitor, and trouble conditions shall be displayed along with a prompt to review each list chronologically.

5. Alarm Silencing

    a. When the “Alarm Silence” button is activated at the network panel all audible alarm signals shall cease operation, visual signals shall be extinguished unless otherwise directed by the AHJ.

6. System Reset

    a. The System Reset button shall be used to return the entire fire alarm system (the existing and new) to its normal state after an alarm condition has been remedied. This shall be programmed as a high level function.

7. Auxiliary Functions

    a. A manual evacuation (drill) switch shall be provided to operate the alarm indicating appliances without causing other control circuits to be activated. However, should a true alarm occur, all alarm functions would occur as described previously.

    b. Activation of an auxiliary bypass switch shall override the selected automatic functions.

    c. All doors normally held open by door control devices shall release upon AC power failure.

    d. The actuation of the Service Group test program at the control panel shall activate the “Walk Test” mode of the system which shall cause the following to occur:

        1) The City circuit connection shall be bypassed.

        2) Control relay functions shall be bypassed.

        3) The control panel shall show a trouble condition.

4) The activation of any alarm initiation device shall cause the audible signals activate.

5) The system shall have the capacity of (128) distinctive service test groups. Such that only a portion of the system need be disabled during testing.

8. Service Groups

a. The system shall be capable of being tested by one person. The control panel shall be capable of supporting up to (128) separate service test groups whereby one group of points may be in a testing mode and the other (non-testing) groups may be active and operate as programmed per normal system operation. While in testing mode, the alarm activation of an initiating device circuit shall be silently logged as an alarm condition in the log. The panel shall automatically reset the device after logging of the alarm.

b. Should the walk test feature be on for an inappropriate amount of time, it shall revert to the normal mode automatically.

c. After testing is considered complete, testing data may be retrieved from the system in chronological order to ensure device/circuit activation.

d. Should an alarm condition occur from an active point, not in service group test mode, it shall perform operations described under operation.

9. History Logging

a. The system shall be capable of logging and storing 1000 events in a system event log. These events shall be stored in non-volatile memory. Each recorded event shall include the time and date of that event's occurrence.

b. The following events shall be stored:

1) Alarms and acknowledgements

2) Alarm Restorations

3) Alarm Silence

4) System Reset

5) Alarm historical log cleared

c. The following Trouble events shall be stored:

1) Trouble Conditions and acknowledgements

2) Supervisory Alarms and acknowledgements

3) Trouble Restorations

4) Supervisory Restorations

5) Service Group Test Results

6) Trouble historical log cleared

d. Systems which do not feature logging shall be required to furnish a system printer to provide a hard copy of system events.

10. System Programming

a. The fire alarm system shall allow for loading and editing special instructions and operating sequences as required. The system shall be capable of on-site programming to accommodate system expansion and facilitate changes in operation. All software operations shall be stored in a non-volatile programmable memory within the fire alarm control panel. Loss of primary and secondary power shall not erase the instructions stored in memory.

b. Full flexibility for selective input/output control functions based on AND, OR, NOT, timing, and special coded operations shall also be incorporated in the resident software programming of the system.

c. Resident software shall allow for full configuration of initiating circuits so that additional hardware shall not be necessary to accommodate changes.

11. LED Supervision

a. System shall be capable of lamp test function to automatically test the status of LCD/LED burnout.

12. System Trouble Reminder

a. Should a trouble condition be present within the system and the audible trouble signal silenced, the trouble signal shall resound at preprogrammed time intervals to act as reminder that the fire alarm system is not 100% operational. Both the time interval and the trouble reminder signal shall be programmable to suit the Owner's application.

13. Access Levels

a. There shall be (4) access levels with Level 4 being the highest level. Level 1 actions shall not require a pass code. Pass codes shall consist of up to (4) digits. Changes to pass codes shall only be made by authorized personnel.

b. Access shall be in effect until the operator manually logs out or the keypad has been inactive for 10 minutes.

c. The following keys/switches shall have access levels associated with them:

1) Alarm Silence

2) System Reset

3) Set Time/Date

4) Manual Control

5) Disable/Enable

6) Clear Log

7) Service Groups

d. “Acknowledge” keys shall also require privileged access to acknowledge points. If the operator presses an “acknowledge” key with insufficient access, an error message will be displayed.

14. RS-232-C Output

a. System Fire alarm control panels shall be provided with two (2) RS-232 output ports.

b. Each RS-232-C port shall be capable of supporting and supervising remote CRT displays or printers. Each node shall provide up to (2) RS-232-C ports. The network shall be capable of up to (128) RS-232-C ports.

15. Communicating Device Module

a. All devices indicated on the electrical drawings shall be addressable. These devices will report to an addressable interface card module integral to each system control panel. Each module will communicate with the microprocessor to continually communicate with the remote devices for normal, abnormal, shorted, and open line conditions. Various alarm/status inputs and control/signal outputs shall communicate via zone addressable modules with the module over the multiple addressable peripheral network interface card.

16. Operation

a. The module will continuously “listen” for each of the addressable devices on its communications channel for status changes and/or trouble conditions.

b. Initiating circuits from the communicating device module shall be Class "B" (Style 4) supervised to provide an indication of sensing circuit faults. Supervision points shall not reduce available system alarm points. Control points shall be capable of initiating remote alarm signals or systems, and providing a momentary pulse to allow reset of remotely located fire or other types of local controls.

17. Equipment Enclosures

a. Provide cabinets of sufficient size to accommodate all equipment. Cabinet shall be equipped with locks and transparent door panel providing freedom from tampering yet allowing full view of the various lights and controls. Color of cabinets shall be per Fire Department Regulations.

H. Remote Annunciator Panels

1. Provide remote 168-character LCD annunciator as shown on the plans. Provide complete redundant information of the main fire alarm control panel display.

I. Multiple Addressable Peripheral Network

1. Communication with addressable devices. The system must provide communication with initiating and control devices individually via addressable loop interface modules. All of these devices shall be individually annunciated at the control panel LCD. Annunciation shall include the following conditions for each point:

    a. Alarm

    b. Trouble

    c. Open

    d. Short

    e. Device missing/failed

2. All addressable devices shall have the capability of being disabled or enabled individually.

3. Addressable module shall be capable of addressing 500 devices.

4. Format

    a. The communication format must be a completely digital “report by exception” protocol. A high degree of communication reliability must be obtained by using parity data bit error checking routines for address codes and check sum routines for the data transmission portion of the protocol. Systems utilizing a polling/response protocol will not be considered as equal.

5. Identification of Addressable Devices

    a. Each addressable device must be uniquely identified by an address code entered on each device at time of installation. The use of jumpers to set address will not be acceptable due to the potential of vibration and poor contact. Device identification schemes that do not use uniquely set addresses but rely on electrical position along the communication channel or requires special programming tools are unacceptable. Any system that cannot accommodate the addition of an addressable device between existing devices and requires reprogramming all existing electrically further devices will not be acceptable. The system must verify that the proper type device is in place and matches the desired software configuration.

J. Wiring Type, Distances, Survivability and Configurations

1. Wiring types shall be approved by the equipment manufacturer. Class B (Style 4) communications shall be provided on all risers. Wire will be so routed to maintain sufficient distance between the feed and return loop as called for by the Authority having jurisdiction.

2. All cables shall be UL listed for fire protective signaling systems and meet the requirements of NEC 760.15 for non-power limited. All fire alarm cables shall be installed in conduit and cable types per manufacturer's recommendations.

3. Cable Types

a. #18 TP for addressable loop signaling line circuits.

b. #14 TP audio speaker cables.

c. #14 AWG for ADA visual light circuits, power circuits, door holders, security devices, etc.

d. #16 TP data communication between network panels.

4. All wiring shall be installed in minimum 3/4" C or shall be Fire Alarm MC Cable. See Part 3 Execution for additional information. Conduit and MC cable shall b red.

5. “T” tapping of conductors shall be **prohibited**.

6. Auxiliary manual controls shall be supervised so that an “off/normal” position of any switch shall cause an “off/normal” system trouble.

7. Each independently supervised circuit shall display a message on the LCD readout to indicate disarrangement conditions per circuit. Systems with common trouble lamps or readouts for multiple indications will not be accepted.

8. The incoming power to the system shall be supervised so that any power failure must be audibly and visually indicated at the control panel. A green “power on” LED shall be displayed continuously while incoming power is present.

9. The system batteries shall be supervised so that a low battery condition or disconnection of the battery shall be audibly and visually indicated at the control panel.

10. The system modules shall be electrically supervised for module placement. Should a module become disconnected, the system trouble indicator shall illuminate and the audible trouble signal shall sound.

11. The system shall have provisions for disabling and enabling all circuits individually for maintenance or testing purposes.

K. Power Requirements

1. Each control panel shall receive 120 volt AC power via dedicated circuits. The electrical contractor shall provide power as required per the manufacturer's requirements. The contractor shall provide circuit breakers, conduits, and wire from the closest appropriate voltage panelboard. Provide breaker locks for all branch circuits. Obtain power from the closest 120 volt panelboard. Record on as-built drawings the branch circuits used for fire alarm system power.

2. The system shall be provided with sufficient battery capacity to operate the entire system upon loss of normal 120 volt AC power in a normal supervisory mode and alarm condition for a period of 24 hours and 5 minutes of alarm. The system shall automatically transfer to the standby batteries upon power failure. All battery charging and recharging operations shall be automatic. Power cable size from remote battery location to fire control center shall be determined from the battery backup calculations, and voltage drop.

3. All external circuits requiring system operating power shall be 24 volt DC power limited and shall be individually protected at the control panel.

4. Provide standby battery calculations showing system power requirements and formulas used to compute the 24 hours of standby power, and 5 minutes full alarm condition.

L. Addressable Device Types

1. Addressable smoke detectors

a. The addressable smoke detectors shall be of the photoelectric type and shall make the alarm decision. Sensors that send an analog value to the panel to make the alarm decision shall not be considered equal.

b. The detectors shall be listed to UL, ULC and CSFM and shall be documented compatible with the control equipment to which they are connected. The detector shall be listed for both ceiling and wall mount applications.

c. Each detector shall contain an LED that lights when in alarm.

d. Each detector shall notify the control panel of its type identification to prevent inadvertent substitution of another sensor type. The control panel shall operate with the installed device but shall initiate a trouble condition until the proper type is installed or the programmed sensor type is changed.

e. The detector's electronics shall be immune from false alarms caused by EMI or RFI.

f. Cover all smoke detection devices with dust covers immediately after installation to maintain cleanliness. If detectors are contaminated with dirt or dust during the construction period, it shall be the responsibility of the Electrical Contractor, at his cost, to clean or replace each device as directed by the Owner's representative.

2. Addressable Thermal Detectors

a. Thermal detector heads must be UL listed. They will be a combination rate-of-use and fixed temperature (135°F) type, automatically restorable.

3. Addressable Pull Stations

a. Addressable pull stations will be UL listed and contain electronics that communicate the station's status (alarm, normal) to the control panel over (2) wires. The address will be set in the station. They will be manufactured from high impact red Lexan. Station will mechanically latch upon operation and remain so until manually reset. Pull stations shall be single action pull type.

b. The front of the station is to be hinged to a backplate assembly and must be opened with a key to reset the station. The key shall be common with the control panels. Stations which use Allen wrenches or special tools to reset will not be accepted.

c. The addressable manual station shall be capable of field programming of its “address” location on an addressable initiating circuit. The manual station shall be fitted with screw terminals for field wire attachment, the use of wire type pigtail connections will not be considered.

d. Pull station shall be mounted on the appropriate back box. The back box shall be capable of holding in addition to the pull station a monitor module, where required.

e. All process areas pull stations shall be rated NEMA 4X. Provide Wheelock Series MPS-400X or approved equal.

f. Pull stations shall be UL listed to operated in the temperature of the space they are installed. Refer to the architectural drawings for room temperatures.

4. Addressable Photoelectric Duct Detector and Test Station

a. The detector and test station shall be a UL, ULC and CSFM listed device which shall be compatible with the fire alarm panel and shall obtain its operating power from the fire alarm detection loop.

b. Detectors shall be of the solid state photoelectric type and shall operate on the light scattering, photodiode principle. To minimize nuisance alarms, detectors shall have an insect screen and shall be designed to ignore invisible airborne particles or smoke densities that are below the factory set alarm point. No radioactive material shall be used.

c. The detector may be reset by actuating the control panel reset switch.

d. It shall be possible to alarm the duct housing by using a test switch. The test switch shall be located at an accessible level to permit testing without a ladder.

e. For maintenance purposes, it shall be possible to clean the duct housing sampling tubes by accessing them through the duct housing's front cover.

f. To minimize false alarms, voltage and RF transient suppression techniques shall be employed as well as smoke signal verification circuit and an insect screen.

g. Provide with sampling tubes of required length from duct in which it is installed.

h. Duct smoke detector installation shall be done by the ATC Contractor and furnished and wired by the Electrical Contractor.

i. Duct detectors shall have one (1) common alarm relay Type Form C, rated 2 A at 30 VDC for local fan shutdown during alarm conditions.

j. Duct detectors shall be UL listed to operated in the temperature of the space they are installed. Refer to the architectural drawings for room temperatures.

k. Duct detector shall have an operating temperature range of -4°F to 158°F.

l. Duct detectors located exterior to the building envelope shall be mounted in NEMA 3R or 4X enclosures. The electrical contractor shall provide the enclosure for installation by the HVAC contractor.

m. Remote test stations shall provide alarm test, trouble indication and reset capability from a remote location. They shall include a single gang plate, momentary SPST switch, red alarm LED and shall be key operated. Wiring from the duct detector to the remote test station shall be conventional two-wire.

n. Provide EST SIGA-SD series or System Sensor D4120W (NEMA 4) intelligent duct smoke detector and test station.

5. Addressable Modules

a. Addressable interface modules shall be used for monitoring and control of remote devices.

b. Addressable interface modules will be capable of mounting in a standard electric outlet box and will include cover plates to allow surface or flush mounting. They will communicate over the same circuits as the other addressable devices.

c. Individual addressable modules shall be used to provide addresses to sprinkler supervisory and water flow devices (mount within a 4" square outlet box).

d. Addressable modules shall be UL listed to operated in the temperature of the space they are installed. Refer to the architectural drawings for room temperatures.

6. Addressable Device Supervision

a. All modules shall be supervised and uniquely identified by the control panel. Device identification shall be transmitted to the control panel for processing according to the program instructions. Should the module become non-operational, tampered with, or removed, a discrete trouble signal, unique to the device, shall be transmitted to, and annunciated at, the control panel. The system control panel will be capable of displaying the type of trouble condition (open, short, device missing/failed).

b. Should a device fail it will not hinder the operation of other system devices.

c. There shall be no limit to the number of detectors, stations, or modules, which may be activated or “in alarm” simultaneously.

d. The use of circuits which are hardwired to the fire alarm control panel will not be considered as meeting the intent of these specifications and will not be considered.

M. Sprinkler System

1. All of the sprinkler flow switches, tamper switches, etc., are furnished under Fire Protection Section and all installation and wiring of the devices shall be done by the Electrical Contractor.

a. Sprinkler alarm water flow detectors (that sound the building alarm signals).

b. Sprinkler OS&Y valve supervisory switches (that causes supervisory signals to sound when not in the normally open and ready condition).

c. A module shall be provided for each detector to individually annunciate the source of alarm.

N. Audio and Visual Alarm Notification Devices – Process and Non-Process Areas

1. Audio/Visual Alarm Signals Horns

a. Furnish and install combination horn-ADA visual alarm assemblies with red impact resistant and flame retardant thermoplastic injection molded frame and ADA compliant strobe lamp. Visual notification appliance output signal shall be 15, 30, 75, 95, 110, 115, 135, 150, 177, or 185 candela, and applied per room size guidelines in accordance with NFPA 72 guidelines. All visual strobes in the facility shall be 1 Hz synchronized flash and shall comply with ADA Standards.

b. Horn/Strobe shall provide field selectable low, medium or high dB output. The entire assembly shall be listed to UL 1971 and 464.

c. Horn/Strobe shall be 24 VDC.

d. Surface mounted devices shall have manufacturer's wall/ceiling mounted weatherproof back box and shall have a NEMA 4X rating.

e. Provide System Sensor SpectraAlert Advance selectable-output horns, strobes and horn/strobe assemblies, with an operating range of -40°F to 151°F.

2. Horns and Strobes shall be UL listed to operated in the temperature of the space they are installed. Refer to the architectural drawings for room temperatures.

3. When installing in High Bay storage areas the device shall be centered between the aisles and face down.

a. The strobe shall be set to 150, 177, or 185 candela, and applied per room size guidelines in accordance with NFPA 72 guidelines. All visual strobes in the facility shall be 1 Hz synchronized flash and shall comply with ADA Standards.

b. The horns shall be set to the “HIGH” dB level.

O. Audio and Visual Alarm Notification Devices – Hazardous Locations

1. Furnish and install explosion proof surface mounted horns.

2. Horn shall be 24 VDC, 100 dB at ten feet. Edward Signal 889D-AW.

3. The assembly shall UL listed for fire alarm use and shall be Red.

4. The device shall have the following classifications:

a. Class I, Division 2, Groups A, B, C, & D.

b. Class II, Division 2, Groups F & G.

c. Class III.

5. Each horn shall be installed along with a strobe warning light. The strobe shall be wall mounted below the horn.

a. Warning strobe shall have the following ratings:

1) Class I, Division 2, Groups A, B, C, & D.

2) Class II, Division 2, Groups F & G.

3) Class III.

P. Rotating Beacons

1. Furnish and install rotating beacons on the exterior of the building as indicated on the drawings. The unit shall have a red lens and 50 watt lamp. The unit shall be wall mounted and shall be weatherproof.

Q. Remote Annunciators

1. Furnish and install a remote annunciators panels consisting of an LCD display unit that duplicates the functions of the LCD display in the FACP. The LCD display shall be an 80-character ([2] lines of [40]) LCD which shall be backlit for enhanced readability.

R. Knox Box

1. Provide fire department approved Knox Box. Coordinate box requirements and location with fire department and project architect.

S. Keying

1. All control panels, annunciators, battery boxes, and manual pull stations, shall be common keyed.

T. Installation

1. All devices shall be capable of operating in the ambient temperatures of the spaces in which they are being installed. Refer to the architectural drawings for room temperatures.

2. Provide and install the system in accordance with the plans and specifications, all applicable Codes and the manufacturer's recommendations. All wiring shall be installed in strict compliance with all the provisions of NEC Article 760 Parts I and III, Power-Limited Fire Protective Signaling Circuits or if required may be reclassified as non-power limited and wired in accordance with NEC Article 760 Parts I and II. Upon completion, the Electrical Contractor shall so certify in writing to the Owner and Construction Manager.

3. All junction boxes shall be red and labeled “Fire Alarm”. Wiring color code shall be maintained throughout the installation. Where the cable is run in pipe or tubing all pull

boxes shall be painted red, EMT shall be red, rigid conduits within the process space shall not be painted. Rigid conduit outside the process space shall have a red stripe 4" wide shall be painted on tubing at regular intervals, maximum 10'-0" on center.

4. The fire alarm system wiring shall be Fire Alarm MC Cable in all joist space, above the walk on ceiling, above LAT or JWB ceilings and within stud construction. In all other areas the wiring shall be installed in conduit. The conduit shall be as required per NEMA Classification drawings and the Division 16 specifications.

5. Installation of equipment and devices that pertain to other work in the contract shall be closely coordinated with the appropriate Contractors.

6. The Electrical Contractor shall clean all dirt and debris from the inside and the outside of the fire alarm equipment after completion of the installation.

7. The manufacturer's authorized representative shall provide on-site supervision of installation.

8. Refer to Part 3 of these specifications for additional requirements.

PART 3 – EXECUTION

3.01 WARRANTY

A. The Electrical Contractor shall warrant the completed fire alarm system wiring and equipment to be free from inherent mechanical and electrical defects for a period of (2) years from the date of the completed and certified test and acceptance by the owner and his agents.

B. The contractor shall provide 4-hour response to emergency requests. For non-emergency service requests the contractor shall respond within 24 hours.

C. The equipment manufacturer shall make available to the Owner a maintenance contract proposal to provide a minimum of (4) inspections and tests per year in compliance with NFPA 72 Guidelines.

3.02 TRAINING

A. Provide two separate training sessions. One after the system is operational and turned over to the owner and a second 6 to 9 months later.

B. Each session shall be an 8-hour training program. Each program shall be presented by a fully qualified, trained representative of the equipment manufacturer who is thoroughly knowledgeable of the specific installation. It should be given to personnel responsible for operating the system and representatives of the Fire Department. The training sessions shall be for a maximum 20 owner employees per session.

C. The training program shall be a classroom type environment and shall include complete printed OEM manuals, OEM manual on CD, and any additional documentation as required for each participant.

3.03 QUALITY CONTROL, TESTING, GUARANTEE, SERVICE

A. Prior to installation of any equipment, the Electrical Contractor shall provide the Engineer with copies of submittals for approval. Submittals shall include one-line riser diagrams of entire system and equipment specification sheets.

B. The Electrical Contractor shall be responsible for assuring that conduit size and wire quantity, size and type are suitable for the equipment supplied. The Electrical Contractor shall review the proper installation of each type of device with the equipment supplier. Final connections between the wiring and equipment shall be made under the supervision of the equipment supplier's representative.

C. Upon completion, the Electrical Contractor shall conduct a functional test of the system for the Owner and Engineer.

1. To ensure that wire size, power supply, number of devices on a circuit, etc., are suitable to support 100% of devices being in alarm or operated simultaneously, this test shall include the following:

   a. Place all detectors and monitor modules in alarm. Each shall display its address and alarm condition. At least the first (10) devices on each circuit shall also have their alarm LEDs lighted.

   b. Operate all control modules for the alarm or operated condition. Each module shall display its address and condition.

   c. Reset all alarmed and operated devices. The panel shall display the address of any off/normal devices.

2. Test each detector so programmed for alarm verification by momentarily testing for alarm. The detector shall not initiate an alarm. Then, test by placing the detector in alarm such that it remains in alarm for the selected verification time. The detector shall initiate an alarm.

3. Test each detector for trouble by removing the detector from its base. The address and trouble condition for each shall be displayed. Insert a different type of detector into the base. The address and trouble condition shall be displayed. The detector will return to normal only when the proper detector type is reinserted in the base.

4. Print out the English language descriptor and status of each module in the system. The printout shall also include the date and time.

5. Audible sound level measurements shall be conducted throughout the entire building and all spaces with the evacuation system sounding. These measurements shall be done to certify that all areas conform to the Fire Department sound level requirements for evacuation alarm signals. Measurements shall be recorded in the following format for each space:

"Room/Area"	"Ambient Sound Level" (dB)	"Ambient and Evacuation Sound Level" (dB)

6. All components, parts and assemblies supplied by the manufacturer shall be guaranteed against defects in materials and workmanship for a period of 24 months after final acceptance.

7. The equipment manufacturer shall have an office staffed with trained, full-time employees who are capable of performing testing, inspection, repair, and maintenance services for the life of the system.

3.04 COORDINATION OF MONITORING

A. Provide a 5-year monitoring and reporting (to local fire department) contract with a guaranteed price to extend the contract an additional five years after the initial monitoring contract expires.

3.05 ACCEPTANCE TESTS – GENERAL REQUIREMENTS

A. Provide four separate verifications tests. Two shall be provided for temporary occupancy permits, one for the state elevator inspection and the other shall be for permanent occupancy. All tests shall comply with Paragraphs B and C below.

B. Before final approval and acceptance by Building Owner, fire protection and life safety systems shall be subjected to tests specified in any applicable NFPA Codes and Standards. Tests shall be witnessed by the representative of the Fire Department and by the representatives of the Owner's Building Construction Department, Risk Management Division and Security Department. At least 48 hours notice shall be given to aforementioned representatives before test.

C. Test shall comprise activating and verifying the operations of each and every device (input and output) and auxiliary functions. No exceptions to this requirement will be accepted. A written test log of this complete test shall be submitted prior to acceptance of the system by the Owner.

D. The permanent occupancy test shall be comprehensive to ensure that the system meets NFPA and local AHJ requirements. The system shall be turned over to the Owner, and warranty shall start from the date of final acceptance.

3.06 MANUAL AND AUTOMATIC FIRE ALARM SYSTEMS

A. Upon completion of system or part as determined by the Owner, satisfactory acceptance test of entire installation shall be made. Test shall include central control station and manual and automatic fire alarm systems. Test(s) shall include but shall not be limited to the following: Manual pull stations, evacuation signals/lights, thermal and/or smoke detectors, automatic door release devices, waterflow and supervisory alarm devices, elevator recall, fan shutdown, etc.

B. Test shall meet requirements of the following:

1. NFPA 72: Supervised Receiving Stations

2. NFPA 13A: Care and Maintenance of Sprinkler Systems

3.07 ADDITIONAL DEVICE INSTALLATION REQUIREMENTS

A. The Electrical Contractor shall carry within his bid the cost of materials and labor required for installing additional devices which may be required by the Fire Department during final inspection. This shall be carried as a separate line item and unit cost associated for each item, as listed below. Carry 75'-0" of conduit and wire for each additional device.

1. Ten (10) Speaker/light units (evacuation signals), ADA type.

2. Two (2) Manual pull stations.

3. Two (2) Monitor ZAMs. (2) Control zones.

4. Five (5) Area smoke detectors.

B. Devices that are not required to be installed at the final sign-off of the fire alarm system by the Fire Department shall be issued to the Owner for credit.

C. System programming cost shall also be included to program the new devices.

****

END OF SECTION

THE LIVESTOCK INSTITUTE

WESTPORT, MA

PROJECT NO. 4730

Specification for

CABLE TRAY SYSTEMS

Section 16921

THE DENNIS GROUP, LLC

PLANNING ▲ ENGINEERING ▲ CONSTRUCTION MANAGEMENT

1537 MAIN STREET
SPRINGFIELD, MASSACHUSETTS 01103
413.787.1785 ▲ FAX 413.787.1786

26 WEST MARKET STREET
SALT LAKE CITY, UTAH 84101
801.531.8585 ▲ FAX 810.531.8586

A	**09.20.2016**	**Review**	**MJJ**		
Issue	**Date**	**Description**	**By**	**Approved**	**Section 16921**

Unless notification and/or comments are received from client within two weeks after issue date, all documentation including drawings, specifications, and studies submitted to client shall be considered approved as released.

PART 1 – GENERAL

1.01 REFERENCES

A. The General Documents, as listed on the Table of Contents and applicable parts of Division 1, General Requirements, and applicable requirements of Section 16010, shall be included in and made part of this Section.

B. Examine all drawings and criteria sheets and all other Sections of the specifications for requirements which affect work under this Section whether or not such work is specifically mentioned in this Section.

C. Coordinate work with that of all other Trades affecting or affected by work of this Section. Cooperate with such Trades to assure the steady progress of all work under the Contract.

D. Provide all material, labor and equipment, to complete the work of this Section in strict accordance with the design Architect's and Engineer's plans and specifications, and with all applicable codes, rules, and standards.

1.02 SCOPE OF WORK

A. The work under this Section consists of furnishing and installing a cable management and cable tray system.

B. The work under this Contract shall also include all labor, materials, tools, equipment, transportation, insurance, temporary protection, supervision and incidental items essential for proper installation and operation, even though not specifically mentioned or indicated on the drawings, but which are usually provided or are essential for proper installation and operation of all systems as indicated on the drawings and specified herein.

C. The specifications and drawings describe the minimum requirements that must be met by the Contractor for the installation of all work as shown on the drawings and as specified hereinunder.

D. Supporting devices and materials shall be defined to include, but not be limited to, the following items:

1. Hanger rods.
2. Conduit clamps.
3. Support channels.
4. Bracket supports.
5. Pipe clamps.
6. Miscellaneous support channel fittings.
7. Bolts and associated hardware.
8. Concrete anchors.
9. Vibration mounts.

1.03 REFERENCES

A. ANSI/NFPA 70 – National Electrical Code.

B. ASTM A123 – Specification for Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars, and Strip.

C. ASTM A653 SS – Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality.

D. ASTM A607 – Specification for Steel Sheet and Strip, Hot-Rolled and Cold-Rolled, High Strength, Low-Alloy Columbium and/or Vanadium.

E. ASTM B633 – Specification for Electrodeposited Coatings of Zinc on Iron and Steel.

F. NEMA VE 1-1998 – Metallic Cable Tray Systems.

G. NEMA VE 2 1995 – Metal Cable Tray Installation Guidelines.

1.04 RELATED WORK SPECIFIED ELSEWHERE

A. The following referenced sections are listed as a minimum of additional requirements and/or work not included in this Section which may be required to be performed under other designated Sections:

1. Section 16010: General Provisions
2. Section 16110: Raceways (Non-Process)
3. Section 16190: Hangers and Supports
4. Section 16195: Electrical Identification
5. Section 16741: Empty Raceway Systems

1.05 SUBMITTALS

A. Prepare and submit complete shop drawings of all work of this Section to the Engineer for approval.

B. Submit samples of each material under this Section requested by the Engineer, for approval. Samples shall be in size and form requested by the Engineer, and reasonable to show characteristics, color and finishes of the materials.

C. Submit complete manufacturer's product data of all materials and systems to the Engineer for approval, consisting of complete product description and specifications, complete performance test data, complete preparation and installation instructions, and all other pertinent technical data required for complete product and product use information.

D. All shop drawings shall have clearly marked the appropriate specification number of drawing designation, for identification of the submittal.

E. Disposition of shop drawings shall not relieve the Contractor from the responsibility for deviations from drawing or specifications, unless he has submitted in writing a letter itemizing or calling attention to such deviations at time of submission and secured written approval from the Engineer, nor shall such disposition of shop drawings relieve the Contractor from responsibility for errors in shop drawings or schedules.

F. Do not order materials or begin installation until the Architect's and Engineer's approval of submittals has been obtained.

1.06 GUARANTEE

A. In addition to the specific guarantee requirements of the General Conditions, the Contractor shall obtain in the Owner's name the standard written manufacturer's guarantee of all

materials furnished under this Section where such guarantees are offered in the manufacturer's published product data. All these guarantees shall be in addition to, and not in lieu of, other liabilities which the Contractor may have by law or other provisions of the Contract Documents.

1.07 COORDINATION

A. The work of this Section shall be coordinated with other work of the Contractor.

1.08 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery of materials shall be made to the project by the materials supplier in accordance with the instructions of the Contractor.

B. The Contractor shall provide adequate locked storage space with shelving for the materials, shall be responsible for all items of materials after receipt from the supplier, and shall replace all materials lost or damaged after delivery and receipt.

C. The Contractor shall furnish the materials supplier with receipts for all materials and accessory items received, and shall send copies of these receipts to the Engineer.

PART 2 – MATERIALS

2.01 ACCEPTABLE MANUFACTURERS

A. Cable Tray Manufacturer: Subject to compliance with these specifications, cable tray and cable channel systems shall be as manufactured by Cooper B-Line or equal pending approval of product sample by the Engineer.

1. Aluminum Tray shall be B-Line 4* series.
2. Steel Tray shall be B-Line 4** series
3. Stainless Steel Tray shall be B-line 4**SS series

2.02 CABLE TRAY SYSTEM

A. Provide complete cable tray systems for specific wiring as indicated on the drawings.

B. Furnish and install a complete cable tray system as specified herein and as shown on the drawings, including, but not limited to, cable fasteners, tray or pieces, fittings, hangers, supports, accessories and associated hardware.

C. Cable tray systems are defined to include, but are not limited to, straight sections of cable trays (ladder type, trough type, solid bottom type, and wire mesh type), bends, tees, elbows, drop-outs, supports and accessories.

D. Material and finish specifications for each tray type are as follows:

1. Aluminum: Straight section and fitting side rails and rungs shall be extruded from Aluminum Association Alloy 6063. All fabricated parts shall be made from Aluminum Association Alloy 5052.

2. Hot-dip Galvanized Steel: Straight section and fitting side rails and rungs shall be made from steel meeting the minimum mechanical properties of ASTM A570, Grade

33 for 14 gauge and heavier, ASTM A611, Grade C for 16 gauge and lighter, and shall be hot-dip galvanized after fabrication in accordance with ASTM A123. All covers and splice plates must also be hot-dip galvanized after fabrication; mill galvanized covers are not acceptable for hot-dip galvanized cable tray. All hot-dip galvanized after fabrication steel cable trays must be returned to point of manufacture after coating for inspection and removal of all icicles and excess zinc. Failure to do so can cause damage to cables and/or injury to installers.

3. Stainless Steel: Straight section and fitting side rails and rungs shall be made of AISI Type 304 or Type 316 stainless steel. Transverse members (rungs) or corrugated bottoms shall be welded to the side rails with Type 316 stainless steel welding wire.

E. Tray Systems

1. Ladder type trays shall consist of two longitudinal members (side rails) with transverse members (rungs) welded to the side rails. Rungs shall be spaced **9** inches on center. Spacing in radiused fittings shall be 9 inches and measured at the center of the tray's width. Rungs shall have a minimum cable-bearing surface of 7/8 inch with radiused edges. No portion of the rungs shall protrude below the bottom plane of the side rails. Each rung must be capable of supporting the maximum cable load, with a safety factor of 1.5 and a 200 pound concentrated load when tested in accordance with NEMA VE-1, section 5.4.

2. Ventilated trough type trays shall consist of two longitudinal members (side rails) with a corrugated bottom welded to the side rails. The peaks of the corrugated bottom shall have a minimum flat cable-bearing surface of 2-3/4 inches and shall be spaced 6 inches on center. To provide ventilation in the tray, the valleys of the corrugated bottom shall have 2-1/4 inch by 4 inch rectangular holes punched along the width of the bottom.

3. Solid bottom trough type trays shall consist of two longitudinal members (side rails) with a corrugated bottom welded to the side rails. The peaks of the corrugated bottom shall have a minimum flat cable-bearing surface of 2-3/4 inch and shall be spaced 6 inches on center.

4. Straight tray sections shall have side rails fabricated as I-Beams. All straight sections shall be supplied in standard **10 or 20** foot lengths of all welded construction to ensure easy fault current paths during the intended life of the system.

5. Cable trays shall be a minimum 12 inches interior width, unless indicated otherwise on the drawings, by a minimum **6** inches interior usable loading depth.

6. All fittings shall have a bend radius of not less than **36** inches.

7. Splice plates shall be the bolted type made as indicated below for each tray type. The resistance of fixed splice connections between adjacent sections of tray shall not exceed .00033 ohms. Splice plate construction shall be such that a splice may be located anywhere within the support span without diminishing rated loading capacity of the cable tray.

8. Aluminum Tray – Splice plates shall be made of 6063-T6 aluminum, using four square neck carriage bolts and serrated flange locknuts. Hardware shall be zinc plated in accordance with ASTM B633, SC1. If aluminum cable tray is to be used outdoors then hardware shall be Type 316 stainless.

9. Steel (including Hot-dip galvanized) – Splice plates shall be manufactured of high strength steel, meeting the minimum mechanical properties of ASTM A607, Grade 50. Each splice plate shall be attached with four ribbed neck carriage bolts with serrated flange locknuts. Hardware shall be zinc plated in accordance with ASTM B633 SC1 for pre-galvanized cable trays, or Chromium Zinc in accordance with ASTM F-1136-88 for hot-dip galvanized cable trays.

10. Splice plates shall be furnished with straight sections and fittings.

11. Expansion connectors shall be used at building expansion joints.

12. Connectors shall be plate or channel type, using 3/8" diameter ribbed neck bolts and free-spinning serrated face locknuts.

13. Hold-down clips shall be used at each support on both sides of tray. Where movement during expansion takes place, tray shall be contained by expansion guides.

14. Where there is insufficient elevation or lateral change in direction to accommodate fittings directly connected, adjustable vertical connectors or adjustable horizontal connectors with straight sections in between may be used. Avoid slopes that would cause cables to bend on smaller radius than that allowed by cable manufacturer.

15. Care shall be taken to note temperature when positioning connector plates to allow proper operation of plates. Plates shall be spaced according to NEMA VE-1 AEI-1-13-1965.

16. Cable tray shall not pierce fire rated partitions. Provide an adequate number of 4" conduit sleeves in all fire rated partitions.

17. Cable trays shall be supported and secured independently to the building structure. All equipment shall be manufactured by B-Line.

18. Accessories – special accessories shall be furnished as required to protect, support, and install a cable tray system. Accessories shall consist of but are not limited to; section splice plates, expansion plates, blind-end plates, specially designed ladder dropouts, barriers, etc.

19. Loading Capacities

    a. Ladder, ventilated trough, and solid bottom cable trays shall meet NEMA class designation 20C.

PART 3 – EXECUTION

3.01 WIRING RESTRICTIONS AND TRAY SIZING REQUIREMENTS

A. Panelboard feeders, MCC feeders and any branch circuit that requires cable equal to or greater than #4/0 AWG shall not be installed in cable tray and shall be installed in a traditional conduits and wire system.

B. Lighting branch circuits shall not be installed in cable tray and shall be installed in a traditional conduits and wire system.

C. The cable tray sizes shown on the drawings are the minimum recommended size for bidding purposes. The contractor shall be responsible to count cable tray conductors quantities and size cable trays such that the installed cables does not exceed the maximum cable fill area in Column 1 of Table 392.9 for the appropriate cable tray width.

D. Refer to NEC Article 392 for addition cable fill restrictions and tray cable conductor derating requirements.

3.02 INSTALLATION OF HANGERS AND SUPPORTS

A. Install cable trays as indicated: Installation shall be in accordance with equipment manufacturer's instructions, and with recognized industry practices to ensure that cable tray equipment comply with requirements of NEC and applicable portions of NFPA 70B. Reference NEMA VE-2 for general cable tray installation guidelines.

B. Coordinate cable tray with other electrical work as necessary to properly integrate installation of cable tray work with other work.

C. Provide sufficient space encompassing cable trays to permit access for installing and maintaining cables.

D. Cable tray fitting supports shall be located such that they meet the strength requirements of straight sections. Install fitting supports per NEMA VE-2 guidelines, or in accordance with manufacturer's instructions.

E. Provide all required hangers, supports, sleeves, clamps, etc., as required for all equipment indicated on the drawings.

F. All horizontal runs shall be properly grouped, aligned, using substantial hangers, straps, etc. Hangers and supports shall be installed at intervals not exceeding NEC recommendations.

G. Supporting rods shall be threaded at ends with allowance for adjustments. Wire and strap hangers will not be permitted. All conduit and fittings shall be supported by hangers, channels, etc., using bolts and/or lead expansion sleeves.

H. Structural Support Interface

1. All system components which are supported by roof joists shall be hung from the top chord or bottom chord panel point or a panel point shall be provided by applying a vertical web member. The maximum load shall not exceed 250 pounds.

2. All equipment, etc., which are supported by roof/floor beams shall be hung from the beams with clamp attachments which engage both edges of the beam flange. The hanger shall be located directly below the web of the beam and the hanger load shall be limited to 1000 pounds in area above process areas, production areas and mechanical room and 250 pounds in remaining areas, unless otherwise approved by the Engineer.

3. All additional supports, clamps, web members, etc., required to comply with the above requirements shall be provided by the Electrical Contractor, as applicable, for the work furnished and installed under this Contract.

I. Where stainless steel cable tray is specified all hangers, supports, etc. shall be stainless steel.

3.03 CABLE TRAY SUPPORTS

A. Cable tray shall be supported as follows:

1. From building steel; 10'-0" maximum spacing; support straight sections and fittings in accordance with NEMA VE-1 requirements.

2. Double strut channel trapeze hangers shall be used to support cable tray. Strut supports shall be constructed from 12 gauge steel, 1-5/8 inch wide minimum, double strut B-Line series B22A or heavier as required. All necessary hardware such as Heavy Duty Trapeze Support Kits (9G-55XX-22SHA) as manufactured by Cooper B-Line or Engineer approved equal. Cable trays installed adjacent to walls shall be supported on wall mounted brackets such as B297 double channel as manufactured by Cooper B-Line or engineer approved equal.

3. Center-hung supports shall be manufactured of 12 gauge B-Line B22 steel strut, 1-5/8 inch by 1-5/8 inch, with a pipe welded at the middle of the support to provide eccentric loading stability. Support shall withstand 700 pounds in a 60 percent vs. 40 percent eccentric loading condition with a safety factor of 3.

4. Trapeze hangers and center-hung supports shall be supported by 5/8 inch (minimum) diameter rods.

5. Where stainless steel cable tray is specified, all supports and hardware listed above shall be stainless steel.

3.04 INSTALLATION OF MECHANICAL SUSPENSION CHANNEL

A. Mechanical suspension channel shall be furnished and installed to support electrical equipment independent of walls (panelboards, disconnect switches, starters, transfer switches, transformers, etc.).

B. All fasteners and fittings shall be supplied to provide a complete installation as required. Channel shall be sized and mounted to allow for future conduits.

C. Where stainless steel cable tray is specified, mechanical suspension channel shall be stainless steel.

3.05 MISCELLANEOUS IRON AND STEEL

A. The Electrical Contractor shall provide all steel supports and hangers as shown on the drawings or required to support all equipment, systems or materials provided under this Contract.

B. All supports shall be cut, assembled, welded and finished by skilled mechanics. Welds shall be ground smooth. Stands, brackets and framework shall be properly sized and strongly constructed.

C. Measurements shall be taken on the job and worked out to suit adjoining and connecting work. All work shall be done by experienced metal-working mechanics. Members shall be straight, true and accurately fitted.

D. Welded joints shall be ground smooth where exposed. Drilling, cutting and fitting shall be done as required to properly install the work and accommodate the work of other Trades as directed by them.

E. Members shall be generally welded except that bolting may be used for field assembly where welding would be impractical. Welders shall be skilled and certified.

F. All shop fabricated iron and steel work shall be cleaned and dried and given a shop coat of rust-inhibiting paint on all surfaces and in all openings and crevices.

G. Where stainless steel cable tray is specified, all miscellaneous iron and steel shall be stainless steel.

3.06 INSTALLATION OF JUNCTION BOXES ON CABLE TRAY

A. The contractor shall be allowed to install junction boxes in the exterior side wall of the cable tray. The box shall be attached to the tray using two nuts, two bolts and four fender washers. The head side of the nut shall be on the inside of the tray.

B. The junction boxes shall have a minimum 24" clear space from any other junction box. No conduits shall travel over the top of the box except for the conduit associated with the box.

3.07 GROUNDING

A. Ground the cable tray system at each 150'-0" minimum length with #10 AWG green insulated copper conductor to the building structural system.

3.08 TESTING

A. Field Testing

1. Test cable trays to ensure electrical continuity of bonding and grounding connections, and to demonstrate compliance with specified maximum grounding resistance. See NFPA 70B, Chapter 18, for testing and test methods.

B. Manufacturer Test Reports

1. Manufacturer shall provide test reports witnessed by an independent testing laboratory of the “worst case” loading conditions outlined in this specification and performed in accordance with the latest revision of NEMA VE-1; including test reports verifying rung load capacity in accordance with NEMA VE-1 Section 5.4.

****

END OF SECTION

THE LIVESTOCK INSTITUTE

WESTPORT, MA

PROJECT NO. 4730

Specification for

CABLE RING SYSTEMS

Section 16922

THE DENNIS GROUP, LLC

PLANNING ▲ ENGINEERING ▲ CONSTRUCTION MANAGEMENT

1537 MAIN STREET
SPRINGFIELD, MASSACHUSETTS 01103
413.787.1785 ▲ FAX 413.787.1786

26 WEST MARKET STREET
SALT LAKE CITY, UTAH 84101
801.531.8585 ▲ FAX 810.531.8586

A	**09.20.2016**	**Review**	**MJJ**		
Issue	**Date**	**Description**	**By**	**Approved**	**Section 16922**

Unless notification and/or comments are received from client within two weeks after issue date, all documentation including drawings, specifications, and studies submitted to client shall be considered approved as released.

PART 1 – GENERAL

1.01 REFERENCES

A. The General Documents, as listed on the Table of Contents and applicable parts of Division 1, General Requirements, and applicable requirements of Section 16010, shall be included in and made part of this Section.

B. Examine all drawings and criteria sheets and all other Sections of the specifications for requirements which affect work under this Section whether or not such work is specifically mentioned in this Section.

C. Coordinate work with that of all other Trades affecting or affected by work of this Section. Cooperate with such Trades to assure the steady progress of all work under the Contract.

D. Provide all material, labor and equipment, to complete the work of this Section in strict accordance with the design Architect's and Engineer's plans and specifications, and with all applicable codes, rules, and standards.

1.02 SCOPE OF WORK

A. The work covered under this section consists of the furnishing of all necessary labor, supervision, materials, equipment, and services to completely execute the cable hook system as described in this specification.

B. The work under this Contract shall also include all labor, materials, tools, equipment, transportation, insurance, temporary protection, supervision and incidental items essential for proper installation and operation, even though not specifically mentioned or indicated on the drawings, but which are usually provided or are essential for proper installation and operation of all systems as indicated on the drawings and specified herein.

C. The specifications and drawings describe the minimum requirements that must be met by the Contractor for the installation of all work as shown on the drawings and as specified hereinunder.

D. Supporting devices and materials shall be defined to include, but not be limited to, the following items:

1. Hanger rods.
2. Conduit clamps.
3. Support channels.
4. Bracket supports.
5. Pipe clamps.
6. Miscellaneous support channel fittings.
7. Bolts and associated hardware.
8. Concrete anchors.
9. Vibration mounts.

1.03 REFERENCES

A. ASTM B633 – Specification for Electro-deposited Coatings of Zinc on Iron and Steel.

B. ASTM A653 G90 – Specification for Steel Sheet, Zinc-Coated by the Hot-Dip Process.

C. ANSI/TIA/EIA 568A – Commercial Building Telecommunications Cabling Standard.

D. ANSI/TIA/EIA 569 – Commercial Building Standard for Telecommunications Pathways and Spaces.

E. NFPA 70 – National Electrical Code.

1.04 RELATED WORK SPECIFIED ELSEWHERE

A. The following referenced sections are listed as a minimum of additional requirements and/or work not included in this Section which may be required to be performed under other designated Sections:

1. Section 16010: General Provisions
2. Section 16110: Raceways
3. Section 16190: Hangers and Supports
4. Section 16195: Electrical Identification
5. Section 16741: Empty Raceway Systems

1.05 QUALITY ASSURANCE

A. Cable hooks shall be listed and labeled by Underwriter's Laboratories (UL) and by UL to Canadian standards (cUL) as required.

B. Cable hooks shall have the manufacturer's name and part number stamped in the part itself for identification.

1.06 SUBMITTALS

A. Prepare and submit complete shop drawings of all work of this Section to the Engineer for approval.

B. Submit samples of each material under this Section requested by the Engineer, for approval. Samples shall be in size and form requested by the Engineer, and reasonable to show characteristics, color and finishes of the materials.

C. Submit complete manufacturer's product data of all materials and systems to the Engineer for approval, consisting of complete product description and specifications, complete performance test data, complete preparation and installation instructions, and all other pertinent technical data required for complete product and product use information.

D. All shop drawings shall have clearly marked the appropriate specification number of drawing designation, for identification of the submittal.

E. Disposition of shop drawings shall not relieve the Contractor from the responsibility for deviations from drawing or specifications, unless he has submitted in writing a letter itemizing or calling attention to such deviations at time of submission and secured written approval from the Engineer, nor shall such disposition of shop drawings relieve the Contractor from responsibility for errors in shop drawings or schedules.

F. Do not order materials or begin installation until the Architect's and Engineer's approval of submittals has been obtained.

1.07 GUARANTEE

A. In addition to the specific guarantee requirements of the General Conditions, the Contractor shall obtain in the Owner's name the standard written manufacturer's guarantee of all materials furnished under this Section where such guarantees are offered in the manufacturer's published product data. All these guarantees shall be in addition to, and not in lieu of, other liabilities which the Contractor may have by law or other provisions of the Contract Documents.

1.08 COORDINATION

A. The work of this Section shall be coordinated with other work of the Contractor.

1.09 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery of materials shall be made to the project by the materials supplier in accordance with the instructions of the Contractor.

B. The Contractor shall provide adequate locked storage space with shelving for the materials, shall be responsible for all items of materials after receipt from the supplier, and shall replace all materials lost or damaged after delivery and receipt.

C. The Contractor shall furnish the materials supplier with receipts for all materials and accessory items received, and shall send copies of these receipts to the Engineer.

PART 2 – MATERIALS

2.01 ACCEPTABLE MANUFACTURERS

A. Cable Ring Manufacturer: Subject to compliance with these specifications, cable ring systems shall be as manufactured by Cooper B-Line, or equal pending approval of product sample by the Engineer.

2.02 CABLE MANAGEMENT SYSTEM

A. Cable hooks shall be B-Line BCH series factory painted or engineer approved equal.

B. Provide a system of cable supports ("rings") above accessible corridor suspended ceilings on 4'-0" centers for all low voltage system cabling such as telephone, paging, intercom system, security systems, A/V systems.

C. Provide a minimum of two (2) 4" cable support rings for telephone and data (color coded) and a minimum of one (1) 4" cable support ring for each of the remaining low voltage systems mentioned above on 4'-0" centers.

D. Where corridors have non-accessible ceilings, provide 4" conduit sleeves with insulated ground bushings as a minimum, (2) for telephone and data and (1) for remaining systems covering the entire length of non-accessible ceiling cavity. Number and size of conduit/sleeves shall be per equipment manufacturer's cabling requirements.

E. Coordinate with the equipment vendors for exact size and quantities of cable rings required for each low voltage system.

F. Provide cable management system in all corridors that do not have cable tray.

G. Provide pull strings with all cable ring systems.

H. Cable hooks shall have a flat bottom and provide a minimum of 1-5/8 inch cable bearing surface.

I. Cable hooks shall have 90° radiused edges to prevent damage while installing cables.

J. Cable hooks shall be designed so the mounting hardware is recessed to prevent cable damage.

K. Cable hooks shall have a stainless steel cable latch retainer to provide containment of cables within the hook. The retainer shall be removable and reusable.

L. Cable hooks shall be factory assembled for direct attachment to walls, hanger rods, beam flanges, purlins, strut, floor posts, etc. to meet job conditions.

2.03 FINISH

A. Cable hooks shall be factory painted with a power coat paint. Colors as indicated below:

1. Building Tel/Data – Gray
2. Process Data – Blue
3. CCTV and Secutity Systems – Brown
4. TV, intercom and paging systems – White

2.04 MATERIALS

A. Cable hooks for non-corrosive areas shall be pre-galvanized steel, ASTM A653 G90. Where additional strength is required, cable hooks shall be spring steel with a zinc-plated finish, ASTM B633, SC3.

B. Cable hooks shall not be used in corrosive areas.

2.05 CAPACITY AND LOAD RATING

A. Cable hooks shall be capable of supporting a minimum of 30 pounds with a safety factor of 3.

B. Spring steel cable hooks shall be capable of supporting a minimum of 100 pounds with a safety factor of 3 where extra strength is required.

C. Follow manufacturer's recommendations for allowable fill capacity for each size of cable hook.

PART 3 – EXECUTION

3.01 INSTALLATION OF HANGERS AND SUPPORTS

A. Coordinate cable ring with other electrical work as necessary to properly integrate installation of cable tray work with other work.

B. Provide sufficient space encompassing cable trays to permit access for installing and maintaining cables.

C. Provide all required hangers, supports, sleeves, clamps, etc., as required for all equipment indicated on the drawings.

D. Installation and configuration shall conform to the requirements of the ANSI/ EIA/TIA Standards 568A & 569, NFPA 70 (National Electrical Code), and applicable local codes.

3.02 MISCELLANEOUS IRON AND STEEL

A. The Electrical Contractor shall provide all steel supports and hangers as shown on the drawings or required to support all equipment, systems and materials provided under this Contract.

B. Measurements shall be taken on the job and worked out to suit adjoining and connecting work.

C. Drilling, cutting and fitting shall be done as required to properly install the work and accommodate the work of other Trades as directed by them.

****

END OF SECTION

THE LIVESTOCK INSTITUTE

WESTPORT, MA

PROJECT NO. 4730

Specification for

LAN AND PHONE

COMMUNICATIONS

Section 17100

THE DENNIS GROUP, LLC

PLANNING ▲ ENGINEERING ▲ CONSTRUCTION MANAGEMENT

1537 MAIN STREET
SPRINGFIELD, MASSACHUSETTS 01103
413.787.1785 ▲ FAX 413.787.1786

26 WEST MARKET STREET
SALT LAKE CITY, UTAH 84101
801.531.8585 ▲ FAX 810.531.8586

A	**09.20.2016**	**Review**	**MJJ**		
Issue	**Date**	**Description**	**By**	**Approved**	**Section 17100**

Unless notification and/or comments are received from client within two weeks after issue date, all documentation including drawings, specifications, and studies submitted to client shall be considered approved as released.

PART 1 – GENERAL

1.01 REFERENCES

A. The General Documents, as listed on the Table of Contents and applicable parts of Division 1, General Requirements, and applicable requirements of Section 16010, shall be included in and made part of this Section.

B. Coordinate work with that of all other Trades affecting or affected by work of this Section. Cooperate with such Trades to assure the steady progress of all work under the Contract.

C. Provide all material, labor and equipment, to complete the work of this Section in strict accordance with the design Architect's and Engineer's plans and specifications, and with all applicable codes, rules, and standards.

1.02 DEFINITIONS

A. The term “horizontal cabling” shall mean all cabling that extends between and includes the horizontal cross-connect, and telecommunications outlet.

B. The term “horizontal cross-connect” shall mean all cabling that forms a connection scheme between each horizontal and backbone cabling subsystem, using patch cords that attach to connecting hardware on each end.

C. The term “Main Distribution Frame” or “MDF” shall mean the front main building office area I.T. Room and the telecommunications equipment located within it that create and house multiple horizontal cross-connect.

D. The term “Intermediate Distribution Frame” or “IDF” shall mean a cross-connect cabinet used to create and house multiple horizontal cross-connect.

E. The term “intrabuilding backbone” or “backbone” shall mean all cabling used to connect the telecommunications rooms, IDF cabinets, cross-connects, entrance facilities and equipment rooms, creating a backbone communication system within a building.

F. The term “interbuilding backbone” shall mean all cabling used to connect the new facility/expansion MDF, IDF Cabinets and/or distribution service outlets and other existing building cross-connects, entrance facilities and equipment, that extend between more than one building and create a backbone communication system between buildings.

1.03 SCOPE OF WORK

A. These specifications and drawings describe the minimum requirements that must be met by the Contractor for all work as specified herein for the furnishing and installation of the communications cabling and associated hardware. Upon award of a contract for the work as described herein, the Contractor assumes all liability for a complete structured cabling system, including all quantities, materials, labor, project management, documentation, labeling and warranty of the work.

1. The Contractor shall provide all work area outlet termination materials required for a complete structured cabling system for the new facility.

2. The Contractor is to furnish and install the horizontal distribution cabling system from each work area outlet and port location to within the Intermediate Distribution Frame (IDF) locations and as required herein and on the Contract Documents.

    a. The Contractor will ensure that the work area faceplates and ports are properly labeled and the labeling identification correlates exactly with the patch panel and panel position labeling identification within the MDF and each IDF.

    b. The Contractor shall provide cabling to and slack cable at locations shown on the Contract Drawings for equipment to be provided and installed by the Owner.

3. The Contractor is to furnish and install intrabuilding backbone cabling links from the MDF to the IDF cabinets in the new facility as required herein and on the Contract Documents.

    a. The Contractor will ensure that the wiring blocks and wiring block positions are properly labeled and the labeling identification correlates exactly with the wiring blocks and wiring block positions at each end and as specified herein and on the Contract Documents.

4. The Contractor is responsible for labeling all cables at both ends of cables.

5. The Contractor is responsible for labeling all faceplates, cabinets, panels, wiring blocks and pathway systems (conduit) as required for a complete administration system.

B. The Contractor shall test all copper cable and all fiber optic cable strands in accordance with ANSI/EIA/TIA-568-C and as specified herein.

C. The Contractor will furnish, install, terminate and test the telephone and data backbone and horizontal distribution cabling and associated terminations, connection blocks, patch panels, crosswire, racks, brackets and all other hardware necessary to effect a workable cable plant fully compliant with that as described in these specifications and in the drawings, and to the satisfaction of the Owner.

D. The Contractor will furnish and install conduit, backboxes, pullboxes, raceways, cable tray, cable runway, and associated fittings and mounting hardware, in accordance with the drawings and specifications as required in this and all other relevant Sections.

E. The specifications and drawings describe the minimum requirements that must be met by the Contractor for the installation of all work.

F. The work under this Contract shall include all labor, materials, tools, equipment, transportation, insurance, temporary protection, supervision and incidental items essential for proper installation and operation, even though not specifically mentioned or indicated on the drawings, but which are usually provided or are essential for proper installation and operation, of all systems as indicated on the drawings and specified herein.

G. The specifications and drawings describe the minimum requirements that must be met by the Contractor for the installation of all work as shown on the drawings and as specified herein under.

H. The following general systems and equipment shall be provided by the Low Voltage Contractor, as a minimum, for the new building expansion area as noted on the drawings:

1. Fiber backbone cabling system for LAN

2. Horizontal distribution cabling system and jacks for LAN

3. Analog telephone cabling and jacks.

4. Power as identified on plans and details and as needed for contractor furnished equipment.

5. Grounding and bonding

6. Cable management hardware

7. Cable ties

8. Nameplates and labeling

9. Fire seal and fire stopping

10. Testing of all cabling systems

11. Supervision and approval

12. Shop drawings

13. Record documentation

1.04 CODES, STANDARDS AND REFERENCES

A. All materials and workmanship shall comply with all applicable Codes, Specifications, Local and State Ordinances, Industry Standards, and Utility Company regulations, and the latest editions thereof.

B. In case of difference between Building Codes, State Laws, Local Ordinances, and the Contract Documents, the Contractor shall promptly notify the Architect in writing of any such difference.

C. In case of conflict between the Contract Documents and the requirements of any Code or Authorities having jurisdiction, the most stringent requirements of the aforementioned shall govern.

D. Should the Contractor perform any work that does not comply with the requirements of the applicable Building Codes, State Laws, Local Ordinances, Industry Standards, and Utility Company regulations, he shall bear all costs arising in correcting the deficiencies, as approved by the Architect/Owner.

E. Applicable provisions of the latest editions of the following Codes and Trade Standard Publications shall apply to the work of this Section and are hereby incorporated into, and made part of, the Contract Documents:

1. General Building Codes:

   a. NFPA 70: National Electrical Code
   b. Occupational Safety and Health Standards
   c. National Fire Protection Association
   d. Accessibility Requirements Code

2. UL Listing of Communications Cabling and Hardware

3. BICSI Telecommunications Distribution Methods Manual

4. ANSI/TIA/EIA-568-C – "Commercial Building Telecommunication Standard"

5. ANSI/TIA/EIA-569-B – "Commercial Building Standard for Telecommunications Pathways and Spaces"

6. ANSI/EIA/TIA-526-14A – "Method B: Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant"

7. ANSI/EIA/TIA-526-7 – "Method 1: Optical Power Loss Measurements of Installed Single-mode Fiber Cable Plant"

8. ANSI/TIA/EIA-606-A – "Administration Standard for the Telecommunications Infrastructure of Commercial Buildings"

9. ANSI/J-STD-607-A – "Commercial Building Grounding and Bonding Requirements for Telecommunications"

10. FCC – Part 67, for Communications Interconnection Devices

1.05 GUARANTEE

A. Attention is directed to provisions of the General Requirements and Supplementary General Requirements regarding guarantees and warranties for work under this Contract.

B. In addition to the specific guarantee requirements of the General Conditions, the Contractor shall obtain, in the Owner's name, the standard written manufacturer's guarantee of all materials furnished under this Section where such guarantees are offered in the manufacturer's published product data. All these guarantees shall be in addition to, and not in lieu of, other liabilities which the Contractor may have by law or other provisions of the Contract Documents.

C. The Contractor shall warranty all work for a period of one year, commencing upon the date of final acceptance as determined by the Owner.

D. The Contractor shall be thoroughly familiar with the cabling methods set forth in the latest release of the BICSI TDMM (Building Industry Consulting Services International, Telecommunications Distribution Methods Manual) and shall be recognized by BICSI as being a certified installer of structured cabling systems.

E. The Contractor shall be a certified installer as registered with the structured cabling system product manufacturer, and shall submit, in writing, proof of such membership as an up-to-date status with mentioned manufacturer, and shall offer the manufacturer's standard warranty of the structured cabling system.

F. The structured cabling system shall at minimum guarantee functionality for the following applications:

1. **1000 Megabits per second (Mb/s) or 1Gigabit per second (Gb/s) Ethernet applications – ALL COPPER LAN CABLING.**

2. **10,000 Megabits per second (Mb/s) or 10 Gigabit per second (Gb/s) Ethernet applications – ALL FIBER.**

G. The Contractor will leave the entire installed wiring system in proper working order and shall, without additional charge, replace any work, materials or equipment furnished and/or installed by him under this contract which develops defects, except from ordinary wear and tear, within one year from the date of acceptance by the Owner.

H. Manufacturers shall provide their standard guarantees for work under the Trades. However, such guarantees shall be in addition to, and not in lieu of, all other liabilities which the manufacturer and Contractor may have by law or by other provisions of the Contract Documents.

I. The Contractor shall guarantee that all elements of the systems which are to be provided under his Contract, are of sufficient capacity to meet the specified performance requirements as set forth herein or as indicated.

J. Upon receipt of notice from the Owner's representative or Architect of failure of any part of the systems or equipment during the guarantee period, the affected part or parts shall be replaced by the Contractor for his work or any other work affected by the failure(s).

K. The Contractor shall furnish, before the final payment is made, a written guarantee covering the above requirements.

1.06 COORDINATION OF WORK

A. The Contractor shall compare his drawings and specifications with those of other Trades as well as the Architectural drawings and specifications, and report any discrepancies between them to the Architect and obtain from the Architect written instructions for changes necessary in the work.

B. The Contractor shall coordinate work of this Section with the work of other Sections.

C. The placement of all cabling and equipment required to support all systems as indicated on the drawings and specified shall be coordinated by the Contractor with all other Trades, and with the Architect.

D. The Contractor must include in his bid sufficient dollar amounts to coordinate the work of this Contract. This project is complex and will require additional time to coordinate all Trades and allow implementation of the Owner's representatives Standards and maintenance serviceability requirements. This requirement shall include, but not be limited to, producing the coordination drawings, as many times and as many drawings as required, to ensure serviceability of equipment, as approved by the Architect.

E. Locations of conduits, boxes distribution equipment, systems, etc. shall be adjusted to accommodate the work with interferences anticipated to be encountered. The Contractor shall determine the exact routing and locations of his systems prior to fabrication or installation of any system component. It is the Contractor's responsibility to ensure that cabling and cabling

pathways are installed such that each cable link from the zoned Distribution Frame rooms (MDF/IDF) to each work area outlet will not exceed a total electrical length of 300 feet, including all cable slack requirements as specified in the contract documents. If a cable length is an issue, the Contractor shall notify the Architect prior to installation.

F. Accurate measurements and coordination drawings shall be completed to verify dimensions and characteristics of the various systems installations.

G. All work shall be installed in a way to permit removal without damage to other parts, of pull and junction box covers, cabling, and all other system components provided under this Contract requiring periodic replacement or maintenance. All pull and junction boxes shall be arranged in a manner to enable unobstructed openings of swinging overhead access doors and ceiling tiles. All work shall be done to allow easy access for maintaining equipment. The Owner's representative and Engineer will require proof via the preparation of large-scale sections and part plans that pull and junction boxes, etc. are accessible after the work is completed. Any items in the field discovered to be in non-compliance shall be removed and relocated, as required, and as directed by the Architect.

H. The Contract Drawings are diagrammatic only intending to show general runs and locations of conduits and distribution equipment and not necessarily showing all required offsets, details and accessories to be connected. All work shall be accurately laid out with other Trades to avoid conflicts and to obtain a neat and workmanlike installation, which will afford maximum accessibility for operations and maintenance and observe the critical distance limitations of the horizontal distribution cable.

1.07 EQUIPMENT AND MATERIALS

A. Equipment and materials shall be delivered to the site and stored in original sealed containers, suitably sheltered from the elements, yet readily accessible for inspection by the Architect, until installed. All items subject to moisture damage such as controls shall be stored in dry, heated spaces.

B. Equipment shall be tightly covered and protected against dirt, water, and chemical or mechanical injury and theft. At the completion of the work, equipment and materials shall be cleaned and polished thoroughly and turned over to the Owner's representative in a condition satisfactory to the Architect. Damage or defects that develop before acceptance of the work shall be made good at the Contractor's expense.

C. The Contractor shall make necessary field measurements to ascertain space requirements, for equipment and connections to be provided under his respective Trade and shall furnish and install such sizes and shapes of equipment to allow for the final installation to conform to the drawings and specifications.

D. The Contractor shall furnish and install all equipment, accessories, connections and incidental items necessary to fully complete the work under his Contract for use, occupancy and operation by the Owner's representative.

E. Where equipment of a substitute manufacturer differ from that specified and require different arrangement or connections from those shown, it shall be the responsibility of the Contractor responsible for the substitution to modify the installation of the equipment to operate properly and in harmony with the original intent of the drawings and specifications. When directed by the Architect, the Contractor shall submit drawings showing the proposed, substitute installation. If the proposed installation is approved, the Contractor shall make all necessary changes in all affected related work provided under his and other Sections including location

of roughing-in connections by other Trades, conduit, supports, etc. All changes shall be made at no increase in the Contract amount or additional cost to the Owner's representative. The General Contractor shall be responsible to assure that the Contractor responsible for the substitution bears the cost arising to all other Trades as a result of the substitution.

F. Unless specifically indicated otherwise, all equipment and materials required for installation under these specifications shall be new, and without blemish or defect. Equipment and materials shall be products which will meet with the acceptance of the Authorities having jurisdiction over the work and as specified hereinbefore. Where such acceptance is contingent upon having the products listed and/or labeled by FM or UL or another testing laboratory, the products shall be so listed and/or labeled. Where no specific indication as to the type or quality of material or equipment is indicated, a first class standard article shall be provided.

G. **Equipment purchased by the Construction Manager on behalf of the Owner or by the Owner himself, if assigned to the Contractor, shall be received, stored, installed, etc., as if the equipment were purchased by the Contractor. All guarantees, service contracts, warranties, etc., shall be assigned to the Contractor and shall be the same as for all other equipment provided under this Contract. The Contractor shall be responsible for replacing any defective equipment or components as covered by warranties, including coordination with the equipment manufacturer for procurement of replacement parts under warranty. In no case shall the replacement of the assigned equipment under warranty incur any additional cost to the Owner.**

1.08 RELATED WORK SPECIFIED ELSEWHERE

A. The following referenced Sections are listed as a minimum of additional requirements and/or work not included in this Section which may be required to be performed under other designated Sections:

1. 16010 General Provisions
2. 16110 Raceways
3. 16120 Conductors
4. 16130 Boxes
5. 16140 Wiring Devices and Device Plates
6. 16181 Fuses
7. 16190 Hangers and Supports
8. 16195 Electrical Identification
9. 16198 Startup Testing of Electrical Equipment
10. 16441 Safety Switches
11. 16450 Grounding

1.09 SUBMITTALS

A. Prepare and submit shop drawings on all types of products provided on this project to the Engineer for approval, prior to installation.

B. Submit samples of each material under this Section requested by the Engineer, for approval. Samples shall be in size and form requested by the Engineer, and reasonable to show characteristics, color and finishes of the materials.

C. Submit complete manufacturers' product data of all materials and systems to the Engineer for approval, consisting of complete product description and specifications, complete performance test data, complete preparation and installation instructions, and all other pertinent technical data required for complete product and use information.

D. All shop drawings shall have clearly marked the appropriate specification number or drawing designation for identification of the submittal.

E. Submit shop drawings showing the complete layout of all raceway products that identify the installed system and all components with device type, color, installation criteria and Owner furnished devices, for approval by the Engineer.

F. Disposition of shop drawings shall not relieve the Contractor from the responsibility for deviations from drawings or specifications unless he has submitted in writing, a letter itemizing or calling attention to such deviation at the time of submission and secured written approval from the Engineer, nor shall such disposition of shop drawings relieve the Contractor from responsibility for errors in shop drawings or schedules.

G. The Contractor shall show proof of having a sufficient number of trained personnel on staff for all telephone and data systems, cabling, and connector installation as required by the specific manufacturer of equipment being provided for by the Contractor.

H. The Contractor shall show proof of membership in a certified cabling installation program and must warrant the cabling system specified herein, for a minimum of 20 years.

I. Do not order materials or begin installation until written approval of submittals by the Architect and Engineer has been obtained.

J. Submittals shall contain information specific to systems, equipment and materials required by Contract Documents for this project only. Do not submit catalogs that describe products, models, options or accessories other than those required, unless irrelevant information is marked out or unless relevant information is highlighted clearly.

K. Intent of Submittal review is to check for capacity, rating and certain construction features. Contractor shall ensure that work meets requirements of Contract Documents regarding information that pertains to fabrication processes or means, methods, techniques, sequences and procedures of construction and for coordination of work of this and other Sections. Work shall comply with submittals marked “REVIEWED” to extent that they agree with Contract Documents. Submittal review shall not diminish responsibility under this Contract for dimensional coordination, quantities, installation, wiring, supports and access for service, nor the shop drawing errors or deviations from requirements of Contract Documents. The Engineer's noting of some errors while overlooking others will not excuse the contractor from proceeding in error. Contract Documents requirements are not limited, waived nor superseded in any way by review.

PART 2 – PRODUCTS

2.01 GENERAL

A. All products shall meet applicable NEMA, ANSI and UL, FCC and IEEE Standards

B. Refer to Drawings for outlet locations and service types required.

C. All products shall be new unless specifically indicated otherwise. Material shall be without blemish or defect.

2.02 CABLING DISTRIBUTION

A. Manufacturer's cable markings shall consist of manufacturer's name, cable type/catalog No., 1987 NFPA type code compliance, and the National Electrical Code (NEC) rating and classification compliance.

B. All cable shall be listed for its use per NEC Article 800.

C. All cables shall meet performance specifications as required herein, and in accordance with the following:

1. ANSI/TIA/EIA-568-C.1 – General Cabling System Requirements.

2. ANSI/TIA/EIA-568-C.2 – Balanced Twisted Pair Copper Cabling Systems

3. ANSI/TIA/EIA-568-C.3 – Optical Fiber Cabling Components

2.03 TELECOMMUNICATIONS CABLING TYPE

A. LAN Fiber Backbone

1. Fiber optic data backbone from the Main Distribution Frame to each IDF Cabinet.

2. Multimode fiber optic data backbone shall be a 12 or 24-strand Laser Optimized (OM-3) 50-micron OFNR rated, tight buffered cable, manufactured by Panduit or approved equal.

a. Multimode fiber optic cable shall meet or exceed 10 Gigabit Ethernet (10GbE) performance requirements in accordance with IEEE specifications for 10GbE systems operating at 850 nm and 1300nm.

b. Shielded fiber optic cable in low voltage cable trays matching existing conditions is acceptable.

3. Splices to be fusion type.

4. Connectors to be LC Duplex.

B. LAN Horizontal Distribution

1. Horizontal distribution cable shall be ANSI/EIA/TIA Category 6 (Cat 6) compliant, manufactured by Belden Datatwist or approved equal. The cable sheath shall be **Blue** in color.

a. CMP Plenum rated cable is required for any wiring exposed in office area plenum spaces.

b. CMR non-plenum rated cable is acceptable for all other areas.

2. Horizontal Distribution cabling shall be four (4) pair, solid 23 or 24 AWG, Unshielded Twisted Pair (UTP) cables and shall be terminated using the ANSI/TIA/EIA-568-B, **T568B wiring scheme** and pin-out configuration.

C. LAN Patch Cables

1. Patch cords shall have factory molded connectors (not site-crimped) and shall match or exceed LAN cable specification above.

D. Analog Telephone Horizontal Cabling

1. Horizontal distribution cable shall be ANSI/EIA/TIA Category 6 (Cat 6) compliant, manufactured by Belden Datatwist or approved equal. The cable sheath shall be **Green** in color.

a. CMR non-plenum rated cable is acceptable for the process expansion area.

E. Analog Telephone backbone

1. Cable shall be 25 pair, #24 AWG, CMR riser rated type cable, manufactured by General Cable or approved equal.

2.04 TELECOMMUNICATION OUTLETS

A. General

1. Each faceplate shall be the same color and height above the floor as the electrical faceplate unless otherwise specified.

2. In process and utility spaces, outlets shall be Panduit # IAEBHC6 and have stainless steel faceplates.

3. In non-process areas; outlets shall have white plastic faceplate with sloped face for up to four Panduit mini-coms, **Panduit #UICFPSE4WH** or approved equal.

a. Provide 8-position, 8-contact **Panduit mini-com modular jacks** at each cable as indicated on the drawings, color to match cable.

b. Provide modular blank adapter at unused port position.

c. Refer to floor plan drawings for voice and data service configurations required within each work area outlet faceplate.

B. Wall Mounted Voice Only Outlet

1. Each Voice only outlet used for wall mounted telephone locations shall consist of one (1) single gang, single port, stainless steel faceplate with RJ11 port.

2.05 PATCH PANELS

A. All Horizontal Distribution cables and cable pairs designated as data are to be terminated to IDFs on rack mount patch panels. Contractor to provide IDF's as indicated with patch panels.

2.06 WALL MOUNTED TERMINATION BLOCKS

A. Punchdown blocks shall be 66-style with plywood adequately sized for a wall mount backboard system.

2.07 INNERDUCT

A. Where not installed in conduit, all fibers are to be run in continuous, high density, corrugated, flexible, riser-rated innerduct. The innerduct shall be orange in color, and shall contain a 3/8-inch Polypropylene pull rope (Carlon P/N CF4X1).

B. Radial sweeps required to achieve bends or change in direction shall be no less than 20 times the diameter of the fiber optic cable diameter.

C. Innerduct splicing is prohibited.

D. Provide conduit innerduct plugs around the innerduct openings, Hilti filler foam series CF124 or approved equivalent.

2.08 WIRE MARKERS

A. Each wire and cable shall be permanently identified at both ends with pre-printed Heat Shrink flattened Polyolefin Type wire markers manufactured by Panduit, Thomas & Betts, Brady, or approved equal.

PART 3 – EXECUTION

3.01 COOPERATION AND WORK PROGRESS

A. The work shall be carried on under the usual construction conditions, in conjunction with all other work at the site. The Contractor shall cooperate with the Architect and all other Subcontractors and equipment suppliers working at the site. The Contractor shall coordinate the work and proceed in a manner so as not to delay the progress of the project.

B. The Contractor shall coordinate his work with the progress of the work and other Trades so that he will complete his work as soon as conditions permit and such that interruptions of the building functions will be at a minimum. Any overtime hours worked or additional costs incurred due to lack of or improper coordination with other Trades, the Architect or the Owner's representative by the Contractor shall be assumed by him without any additional cost to the Owner's representative.

C. The Contractor shall provide information on all equipment that is furnished under this Section but installed under another Section to the installing Subcontractor as specified herein.

D. The Contractor shall furnish all materials, equipment and workmanship to provide for adequate protection of all equipment during the course of construction of the project. This shall also include protection from moisture and all foreign matter. The Contractor shall also be responsible for damage which he causes to the work of other Trades, and he shall remedy such injury at his own expense.

E. Waste materials shall be removed promptly from the premises. All material and equipment stored on the premises shall be kept in a neat and orderly fashion. Material or equipment shall not be stored where exposed to the weather. The Contractor shall be responsible for the security, safekeeping and any damages, including acts of vandalism, of all material and equipment stored at the job site.

F. The Contractor shall be responsible for unloading all materials delivered to the site. This shall also include all large and heavy items or which require hoisting. Consult with the General Contractor for hoisting/crane requirements.

G. It shall be the responsibility of the Contractor to coordinate the delivery of the materials for the project prior to the time installation of such materials will be required.

H. The Contractor shall erect and maintain, at all times, necessary safeguards for the protection of life and property of the Owner's representative(s), Personnel and the Public.

I. Prior to installation, the Contractor has the responsibility to coordinate the exact mounting arrangement and location of equipment to allow proper space requirements as indicated in the NEC. If it is questionable that sufficient space, architectural or structural obstructions, or a conflict with the work of other Subcontractors will result in an arrangement which will prevent proper access, operation or maintenance of the indicated equipment, the Contractor shall immediately notify the General Contractor and shall not proceed with this part of the work until definite instructions have been given to him by the Architect.

J. The Contractor shall not allow any equipment or piping foreign to the telecommunications installation to be installed or pass through any telecommunication rooms in which communication systems and equipment are located, such as computer equipment, PBX and distribution frames. The Contractor shall notify the General Contractor of such violations and request immediate removal.

K. The Contractor shall obtain from the other Trades, copies of all shop drawing prints showing ductwork and piping installations as they will be put in place on the project. These drawings shall be thoroughly checked by the Contractor and used for the routing of all cable runway, conduits and innerduct installations.

L. Location of all outlets shall be verified with the Architect prior to roughing in conduits, raceway, cable tray or routing of cables. Refer to details and wall elevations on the Architectural drawings. Mounting heights indicated on these drawings and/or specific dimensional information given to the Contractor by the Architect shall take precedence over such information indicated on the Telecommunication drawings.

M. The Contractor shall not allow any equipment or piping foreign to the telecommunications installation to be installed or pass through any room in which telecommunications system or equipment are located such as Distribution Frames, Telecommunication Rooms or Telecommunications Entrance Facilities. The Contractor shall notify the General Contractor of such violations and request immediate removal.

3.02 INSTALLATION

A. The Contractor shall be licensed in the State with the low voltage certification if required.

B. The Contractor shall furnish and install in accordance with manufacturers' instructions, all wiring, conduit, raceway, outlet boxes, pull boxes, etc., as required for the installation of a complete telecommunications system as described herein and as indicated on the drawings.

C. LAN –

1. The Contractor shall provide one (1) 4-pair Category 6 cable to connect each LAN outlet port location to the associated IDF-Patch Panel as indicated on the Drawings by ID name and as specified herein. All eight conductors shall be terminated at both ends.

D. **All low voltage cabling in process areas to be run in conduit or in "low-voltage" cable tray.** Conduits shall be sized in accordance with the following unless otherwise specified;

1. Horizontal Distribution (4-pair UTP) Cable

a.	0–4 cables	1" Trade Size Conduit
b.	5–10 cables	1-1/4" Trade Size Conduit
c.	11–14 cables	1-1/2" Trade Size Conduit
d.	15–20 cables	2" Trade Size Conduit
e.	21–30 cables	2-1/2" Trade Size Conduit
f.	31–50 cables	3" Trade Size Conduit
g.	51–65 cables	3-1/2" Trade Size Conduit
h.	66–80 cables	4" Trade Size Conduit

E. Where corridors or necessary cable access pathway routes cross smoke partitions or fire-rated partitions, provide conduit sleeves, minimum one (1) per system extending 6" beyond partition in both directions, and firestop per other specification sections.

3.03 TELECOMMUNICATIONS CABLING PRACTICE

A. All cable installation and termination shall adhere to the provisions in ANSI/TIA/EIA-568 standards. LAN Cables shall be terminated using the ANSI/TIA/EIA-568-B, **T568B wiring scheme** and pin-out configuration

B. The physical length of each horizontal LAN cable run (length of cable sheathing) shall not exceed 300 linear feet. Each Horizontal cable shall be a continuous run with no splices, bridges, or other discontinuities. Length of cords is responsibility of installing EC. Length shall closely match needed length with slack greater than 2' but less than 4'.

C. All cables shall be clearly labeled at each end, with the location number machine-labeled at 4" to 6" from the points of termination.

D. Each fiber optic backbone cable strand shall be terminated at both ends, using "LC" type connectors at new IDF and match existing connectors at MDF.

E. Verify exact location of backbone cabling terminations with the Owner before installation.

F. In Distribution Frame (DF) locations where cables originate from different floors, the cables are to be separately bundled so that each bundle contains cable from the originating floor only.

G. Maintain cable twist-rate at all termination points. The amount of cable untwist shall be no more than 1/2". Do not strip back the cable jacket any more than is necessary to terminate the individual conductors.

H. All 66 connections shall be installed using a single 66 punch down tool and all terminations shall be trimmed flush with connector blocks.

I. Provide minimum 12-inches of cable slack at the work area outlet and a 5-foot minimum service loop at the Distribution Frame cabinets for all cables. NOTE: Do not store slack in back boxes.

J. Provide a 10-foot minimum service loop at the equipment rack, within the overhead runway, for all fiber optic cables.

K. The Cabling Contractor must provide protective covering for any horizontal cables (4-Pair) left exposed in occupied areas using 1/2" Panduit Spiral-wrap (P/N# T50R-C) or 3/4" Panduit Spiral-wrap (P/N# T75F-C) as required, for the entire length of the exposed cabling. Exposed cable (with Spiral-wrap) in such areas shall not exceed 30". Use of an approved equal method will be considered.

L. Conduit bends must have a radius of not less than 6 times the internal diameter of conduits 2 inches or smaller; or 10 times the internal diameter of conduits larger than 2 inches.

M. **For concealed Non-process spaces, cables may be supported on J-hooks every 4'**.

1. Cables shall not be tie wrapped to other utilities such as electrical conduit or sprinkler pipes.

2. Cable shall not lie on ceiling tiles, plumbing or steam pipes, high voltage conduits or trays, fluorescent lights or any other known source of heat, moisture or electrical magnetic interference (EMI).

3. Cable cannot be strapped or tied to any electrical conduits, raceways, plumbing or any type of incorrectly supported loose wiring.

N. Cabling to be sleeved in stud walls with conduit from outlet to above lay-in ceiling.

O. A 6-inch clearance and/or separation must be maintained between any communications and electrical conduits.

P. Provide a minimum of 5-feet cable slack, to neatly route the horizontal cable through the D-rings to the appropriate 66-type block.

Q. No communication or data circuit shall be run in the same conduit or raceway with power conductor except where the raceway is separated by a full height, integral divider.

R. Installation of the cable shall be in accordance with the marked floor plan. All deviations to the cable route shall be approved by the Owner prior to installation.

S. Cable routing shall follow physical separation guidelines and shall avoid locations of high RFI/EMI radiation or adverse environmental conditions. Cable shall be a minimum of 4 feet from any electric motor or light ballast.

T. Do not install copper cabling within 5 feet of a welding outlet/receptacle or station.

U. The telecommunications cable plant shall be grounded and bonded in accordance with ANSI/TIA/EIA-607-A and NEC Article 250.

3.04 TELECOMMUNICATION ACCEPTANCE TESTING

A. Each copper cable terminating in a communication outlet jack connector shall be tested from the MDF/IDF cabinet cross-connect location with a 4-pair wire tester. The tester shall verify continuity, faults, reversals, swaps, wiremap, autotest and pairing.

B. Each optical fiber strand will be tested end-to-end in both directions and at multiple wavelengths.

C. 100% of all cables, pairs, connected strands, connected jacks and panel connections shall be tested.

D. Any failed test links or segments will require remedial action until the failed link or segment passes the performance test.

E. Test results shall be submitted in hard copy and electronic formats within 7 days of completion of the testing.

F. Category 6 UTP

1. The Permanent Link test configuration shall be used to verify the performance of the installed cabling.

2. Each cable terminating in a Telecommunication Outlet shall be tested from the Telecommunications Room with a 4-pair wire tester. The baseline accuracy of the test equipment shall exceed TIA Level IV, as indicated by independent laboratory testing.

3. The test equipment shall be capable of certifying Category 6 links in accordance with ANSI/TIA/EIA-568-C Category 6 parameters.

4. Each Category 6 cable link (Permanent Link) shall be tested for near-end and far-end crosstalk and attenuation and shall be verified for acceptable length. The Contractor shall warrant performance based on Category 6 referenced standards for Permanent Link performance and provide patch cords that meet channel performance.

5. All cabling not tested strictly in accordance with these specifications shall be re-tested at no additional cost to the Owner.

6. 100% of the installed cabling must be tested and all tests must pass the acceptance criteria as defined herein.

7. All test reports shall include the following information for each cabling element tested:

   a. Wiremap results that indicate the cabling has no shorts, opens, miswires, split, reversed, or crossed pairs and end-to-end connectivity is achieved.

   b. Tests shall be performed in a swept frequency manner from 1 to 250 MHz. Information shall be provided for all pairs or pair combinations and in both directions. Any individual test that fails the relevant performance specifications shall be marked as “FAIL”.

c. For Category 6 cabling, Attenuation, NEXT, PSNEXT, Insertion and Return Loss, ELFEXT, and PSELFEXT data that include the worst case result, the frequency at which it occurs, the limit at that point, and the margin. These tests shall be performed in a swept frequency manner from 1MHz to highest relevant frequency, using a swept frequency interval that is in accordance with TIA and ISO requirements. Information shall be provided for all pairs or pair combinations and in both directions. Any individual test that fails the relevant performance specification shall be marked as a FAIL.

d. Length, propagation delay, and delay skew relative to the relevant limit. Any individual test that fails the relevant performance specification shall be marked as a FAIL.

e. Cable manufacturer, cable model number/type, and Nominal Velocity of Propagation (NVP).

f. Tester manufacturer, model, serial number, hardware version, and software version.

g. Circuit ID number and Project name.

h. Autotest specification used.

i. Overall “PASS/FAIL” indication.

j. Date of test.

G. All Category 3 Backbone Distribution cables shall be tested for:

1. Wiremap

2. Length

3. Loop Resistance

H. All fiber cables shall be tested after termination of both ends and tests shall be conducted in both directions. Each Multimode fiber shall be tested at the 850 nm and 1300 nm wavelengths, and each Singlemode cable shall be tested at the 1310 nm and 1550 nm wavelength for decibel loss utilizing a stabilized lightsource and optical power meter. Fiber testing must conform to ANSI/TIA/EIA-526, Optical Power Loss Measurements. The maximum loss of each strand shall not exceed 2.0 dB. The Owner shall be supplied documentation with the following test results:

1. End to end attenuation testing for each fiber.

2. Insertion and Return Loss.

3. OTDR (Optical Time Domain Reflectometer) Signature traces of fiber runs in excess of 300 feet.

4. Certificate of Compliance for Connector and Splice Loss.

5. The length of each fiber shall be measured using an Optical Time Domain Reflectometer (OTDR). A hard copy of the OTDR screen and the OTDR setting shall be provided to the Owner. Hand written test results will not be accepted.

I. Test reports shall be submitted within 7 business days of completion of testing.

3.05 GROUNDING, BONDING AND ELECTRICAL PROTECTION

A. A suitable telecommunications ground (for equipment) is required. Approved grounding points shall include:

1. All Intermediate Distribution Frame cabinet (IDF) locations must be bonded to nearest building steel with #4 copper exothermic weld at building column and mechanical lug at Rack.

3.06 WIRELESS ACCESS POINT INSTALLATION

A. Owner shall provide wireless access point hardware. Contractor shall surface mount antennas high at wall locations indicated per notes and details.

B. Contractor shall install the indicated LAN cabling to the wireless access point hardware.

C. Contractor shall work with Owner's Ethernet Programmer to verify proper operation and if necessary use a lift to adjust antenna's as directed.

3.07 RECORD DRAWINGS AND WALK-THROUGH

A. Provide detailed and accurate documentation of the distribution system upon completion of the installation in order to facilitate system administration, system maintenance, and future system changes.

B. Maintain a clean set of Contract Documents on site at all times and note any deviations in installation on a day-to-day basis. The markup set shall serve as the basis for the Contractor to provide an AutoCAD file of all Record Drawings, which shall be turned over to the Owner at final inspection.

C. Contractor shall provide all necessary testing equipment to test all cables, maintain a complete set of test records on site at all times, and note any deviations in installation on a day-to-day basis. The tests shall indicate results in accordance with ANSI/TIA/EIA-568-C Standards for every cable and port installed per the terms and conditions as set forth herein. These test records shall serve as the basis for the Contractor to provide final test results which shall be turned over to the Owner at final inspection.

D. Both a hard copy and a CD-ROM disk electronic file (*.csv formatted) of the test results for each cable run shall be provided to the Owner. The Owner and Contractor shall agree upon acceptable test results prior to testing. It is the Contractor's responsibility to replace, repair, or modify any cable run which tests outside the agreed-upon ranges, in such a manner as to be acceptable to the Owner.

E. Before the system is accepted by the Owner, the Contractor will be required to "walk-through" the installation with the Owner and verify proper installation and conformance to specifications, Drawings, and other agreed upon, written details.

3.08 LABELING

A. General

1. All faceplate and modular jack labeling shall be approved in writing by the Owner prior to installation.

2. All labels shall be clearly printed on clear or opaque labels and meet the following requirements:

   a. The font shall be approximately 1/8 inch in height with block type characters, and shall be clearly legible.

   b. Handwritten labels will not be accepted.

   c. The text color shall contrast with the label background color (e.g., black text on a white background).

   d. Provide nameplates in or on the faceplate and/or wiring blocks. Wiring block(s) labeling shall exhibit all station numbers in sequential order.

   e. Nameplates shall be securely attached to the equipment.

   f. Each Horizontal and Backbone cables shall be clearly labeled at each end.

   g. Label all cables that are left un-terminated in walls or other pathways and/or spaces in accordance with ANSI/TIA/EIA-606-A or approved alternate.

B. Telecommunications Outlets

1. Each telecommunication outlet shall be labeled with LAN or Voice cable numbers per the plan.

2. The labeling scheme will be sequential and shall coincide with the floor plan communication outlet locations.

C. Distribution Frames

1. Each wiring block and patch panel shall be labeled with its own unique identification number.

3.09 CLEANING

A. General

1. This Section of the specifications shall include the cleaning materials on a day-to-day basis and final cleaning of all equipment and materials prior to turning building over to the Owner's representative. All necessary cleaning referred to herein shall be performed to the satisfaction of the Architect.

2. Ensure timely cleanup of all facilities and buildings related to this project, during construction and at completion.

3. Upon completion of cleaning work areas as described in above, but before energizing equipment, the entire room shall be swept clean and all garbage shall be removed from the site.

B. Final Cleaning

1. All Telecommunication devices, device plates, etc., shall be cleaned and left in “like new” condition to the satisfaction of the Architect, prior to occupancy.

2. All rubbish and discarded materials shall be disposed of and removed from the site on a day-to-day basis.

****

END OF SECTION

THE LIVESTOCK INSTITUTE

WESTPORT, MA

PROJECT NO. 4730

Specification for

Security –

Surveillance Systems

Section 17500

THE DENNIS GROUP, LLC

PLANNING ▲ ENGINEERING ▲ CONSTRUCTION MANAGEMENT

1537 MAIN STREET
SPRINGFIELD, MASSACHUSETTS 01103
413.787.1785 ▲ FAX 413.787.1786

26 WEST MARKET STREET
SALT LAKE CITY, UTAH 84101
801.531.8585 ▲ FAX 810.531.8586

A	**09.20.2016**	**Review**	**MJJ**		
Issue	**Date**	**Description**	**By**	**Approved**	**Section 17500**

Unless notification and/or comments are received from client within two weeks after issue date, all documentation including drawings, specifications, and studies submitted to client shall be considered approved as released.

PART 1 – GENERAL

1.01 REFERENCES

A. The General Documents, as listed on the Table of Contents and applicable parts of Division 1, General Requirements, and applicable requirements of Section 16010, shall be included in and made part of this Section.

B. Coordinate work with that of all other Trades affecting or affected by work of this Section. Cooperate with such Trades to assure the steady progress of all work under the Contract.

C. Provide all material, labor and equipment, to complete the work of this Section in strict accordance with the design Architect's and Engineer's plans and specifications, and with all applicable codes, rules, and standards.

1.02 SCOPE OF WORK

A. These specifications and drawings describe the minimum requirements that must be met by the Contractor for all work as specified herein for the furnishing and installation of the communications cabling and associated hardware. Upon award of a contract for the work as described herein, the Contractor assumes all liability for a complete structured cabling system, including all quantities, materials, labor, project management, documentation, labeling and warranty of the work.

1. The Contractor shall furnish and install a complete and functional surveillance system with components described in this spec and as indicated on plans and details.

2. The Contractor is to provide a wiring diagram of system and O&M manuals upon completion. Provide training in the software.

3. The Contractor is responsible for labeling all cables at both ends of cables.

4. The Contractor is responsible for labeling all faceplates, cabinets, panels, wiring blocks and pathway systems (conduit) as required for a complete administration system.

B. **The contractor shall provide a complete and functional video surveillance system.**

1. **The system shall utilize video cameras powered from owner-furnished IDF switches with POE from the nearest IDF/MDF.**

2. **Locate cameras as indicated on plans and specifications. Provide pan-tilt-zoom cameras where indicated.**

3. **Provide NVR and mount in owner-furnished rack in MDF. Connect to LAN.**

4. **Provide and startup Milestone XProtect Express software or equal and work with Client IT department for installation on owner furnished server. Program software for min 7day storage (with 40%motion allowed) and sending text and email alerts for various alarm or trouble conditions in the system. Provide training and time for re-customizing the software based on IT staff input.**

C. The Contractor shall test all copper cable and all fiber optic cable strands in accordance with ANSI/EIA/TIA-568-C and as specified herein.

D. The Contractor will furnish, install, terminate and test all cabling required for a complete and functional system.

E. The Contractor will furnish and install conduit, backboxes, pullboxes, raceways, cable tray, cable runway, and associated fittings and mounting hardware, in accordance with the drawings and specifications as required in this and all other relevant Sections.

F. The specifications and drawings describe the minimum requirements that must be met by the Contractor for the installation of all work.

G. The work under this Contract shall include all labor, materials, tools, equipment, transportation, insurance, temporary protection, supervision and incidental items essential for proper installation and operation, even though not specifically mentioned or indicated on the drawings, but which are usually provided or are essential for proper installation and operation, of all systems as indicated on the drawings and specified herein.

H. The specifications and drawings describe the minimum requirements that must be met by the Contractor for the installation of all work as shown on the drawings and as specified herein under.

I. The following general systems and equipment shall be provided, as a minimum, for the new building expansion area as noted on the drawings:

1. LAN and power connections as required for the system to function and comply with codes.

2. Grounding and bonding

3. Cable management hardware

4. Cable ties

5. Nameplates and labeling

6. Fire seal and fire stopping

7. Testing of all cabling systems

8. Supervision and approval

9. Shop drawings

10. Record documentation

1.03 CODES, STANDARDS AND REFERENCES

A. All materials and workmanship shall comply with all applicable Codes, Specifications, Local and State Ordinances, Industry Standards, and Utility Company regulations, and the latest editions thereof.

B. In case of difference between Building Codes, State Laws, Local Ordinances, and the Contract Documents, the Contractor shall promptly notify the Architect in writing of any such difference.

C. In case of conflict between the Contract Documents and the requirements of any Code or Authorities having jurisdiction, the most stringent requirements of the aforementioned shall govern.

D. Should the Contractor perform any work that does not comply with the requirements of the applicable Building Codes, State Laws, Local Ordinances, Industry Standards, and Utility Company regulations, he shall bear all costs arising in correcting the deficiencies, as approved by the Architect/Owner.

E. Applicable provisions of the latest editions of the following Codes and Trade Standard Publications shall apply to the work of this Section and are hereby incorporated into, and made part of, the Contract Documents:

1. General Building Codes:

a. NFPA 70: National Electrical Code
b. Occupational Safety and Health Standards
c. National Fire Protection Association
d. International Building Code
e. BICSI Telecommunications
f. UL
g. Accessibility Requirements Code

1.04 GUARANTEE

A. Attention is directed to provisions of the General Requirements and Supplementary General Requirements regarding guarantees and warranties for work under this Contract.

B. In addition to the specific guarantee requirements of the General Conditions, the Contractor shall obtain, in the Owner's name, the standard written manufacturer's guarantee of all materials furnished under this Section where such guarantees are offered in the manufacturer's published product data. All these guarantees shall be in addition to, and not in lieu of, other liabilities which the Contractor may have by law or other provisions of the Contract Documents.

C. The Contractor shall warranty all work for a period of one year, commencing upon the date of final acceptance as determined by the Owner.

D. The Contractor shall be a certified installer as registered with the structured cabling system product manufacturer, and shall submit, in writing, proof of such membership as an up-to-date status with mentioned manufacturer, and shall offer the manufacturer's standard warranty of the structured cabling system.

E. The Contractor will leave the entire installed wiring system in proper working order and shall, without additional charge, replace any work, materials or equipment furnished and/or installed by him under this contract which develops defects, except from ordinary wear and tear, within one year from the date of acceptance by the Owner.

F. Manufacturers shall provide their standard guarantees for work under the Trades. However, such guarantees shall be in addition to, and not in lieu of, all other liabilities which the manufacturer and Contractor may have by law or by other provisions of the Contract Documents.

G. The Contractor shall guarantee that all elements of the systems which are to be provided under his Contract, are of sufficient capacity to meet the specified performance requirements as set forth herein or as indicated.

H. Upon receipt of notice from the Owner's representative or Architect of failure of any part of the systems or equipment during the guarantee period, the affected part or parts shall be replaced by the Contractor for his work or any other work affected by the failure(s).

I. The Contractor shall furnish, before the final payment is made, a written guarantee covering the above requirements.

1.05 COORDINATION OF WORK

A. The Contractor shall compare his drawings and specifications with those of other Trades as well as the Architectural drawings and specifications, and report any discrepancies between them to the Architect and obtain from the Architect written instructions for changes necessary in the work.

B. The Contractor shall coordinate work of this Section with the work of other Sections.

C. The placement of all cabling and equipment required to support all systems as indicated on the drawings and specified shall be coordinated by the Contractor with all other Trades, and with the Architect.

D. The Contractor must include in his bid sufficient dollar amounts to coordinate the work of this Contract. This project is complex and will require additional time to coordinate all Trades and allow implementation of the Owner's representatives Standards and maintenance serviceability requirements. This requirement shall include, but not be limited to, producing the coordination drawings, as many times and as many drawings as required, to ensure serviceability of equipment, as approved by the Architect.

E. Accurate measurements and coordination drawings shall be completed to verify dimensions and characteristics of the various systems installations.

F. All work shall be installed in a way to permit removal without damage to other parts, of pull and junction box covers, cabling, and all other system components provided under this Contract requiring periodic replacement or maintenance. All pull and junction boxes shall be arranged in a manner to enable unobstructed openings of swinging overhead access doors and ceiling tiles. All work shall be done to allow easy access for maintaining equipment. The Owner's representative and Engineer will require proof via the preparation of large-scale sections and part plans that pull and junction boxes, etc. are accessible after the work is completed. Any items in the field discovered to be in non-compliance shall be removed and relocated, as required, and as directed by the Architect.

G. The Contract Drawings are diagrammatic only intending to show general runs and locations of conduits and distribution equipment and not necessarily showing all required offsets, details and accessories to be connected. All work shall be accurately laid out with other Trades to avoid conflicts and to obtain a neat and workmanlike installation, which will afford maximum accessibility for operations and maintenance and observe the critical distance limitations of the horizontal distribution cable.

1.06 EQUIPMENT AND MATERIALS

A. Equipment and materials shall be delivered to the site and stored in original sealed containers, suitably sheltered from the elements, yet readily accessible for inspection by the Architect, until installed. All items subject to moisture damage such as controls shall be stored in dry, heated spaces.

B. Equipment shall be tightly covered and protected against dirt, water, and chemical or mechanical injury and theft. At the completion of the work, equipment and materials shall be cleaned and polished thoroughly and turned over to the Owner's representative in a condition satisfactory to the Architect. Damage or defects that develop before acceptance of the work shall be made good at the Contractor's expense.

C. The Contractor shall make necessary field measurements to ascertain space requirements, for equipment and connections to be provided under his respective Trade and shall furnish and install such sizes and shapes of equipment to allow for the final installation to conform to the drawings and specifications.

D. The Contractor shall furnish and install all equipment, accessories, connections and incidental items necessary to fully complete the work under his Contract for use, occupancy and operation by the Owner's representative.

E. Where equipment of a substitute manufacturer differ from that specified and require different arrangement or connections from those shown, it shall be the responsibility of the Contractor responsible for the substitution to modify the installation of the equipment to operate properly and in harmony with the original intent of the drawings and specifications. When directed by the Architect, the Contractor shall submit drawings showing the proposed, substitute installation. If the proposed installation is approved, the Contractor shall make all necessary changes in all affected related work provided under his and other Sections including location of roughing-in connections by other Trades, conduit, supports, etc. All changes shall be made at no increase in the Contract amount or additional cost to the Owner's representative. The General Contractor shall be responsible to assure that the Contractor responsible for the substitution bears the cost arising to all other Trades as a result of the substitution.

F. Unless specifically indicated otherwise, all equipment and materials required for installation under these specifications shall be new, and without blemish or defect. Equipment and materials shall be products which will meet with the acceptance of the Authorities having jurisdiction over the work and as specified hereinbefore. Where such acceptance is contingent upon having the products listed and/or labeled by FM or UL or another testing laboratory, the products shall be so listed and/or labeled. Where no specific indication as to the type or quality of material or equipment is indicated, a first class standard article shall be provided.

G. **Equipment purchased by the Construction Manager on behalf of the Owner or by the Owner himself, if assigned to the Contractor, shall be received, stored, installed, etc., as if the equipment were purchased by the Contractor. All guarantees, service contracts, warranties, etc., shall be assigned to the Contractor and shall be the same as for all other equipment provided under this Contract. The Contractor shall be responsible for replacing any defective equipment or components as covered by warranties, including coordination with the equipment manufacturer for procurement of replacement parts under warranty. In no case shall the replacement of the assigned equipment under warranty incur any additional cost to the Owner.**

1.07 RELATED WORK SPECIFIED ELSEWHERE

A. The following referenced Sections are listed as a minimum of additional requirements and/or work not included in this Section which may be required to be performed under other designated Sections:

1. 16010 General Provisions
2. 16050 Process Electrical
3. 16110 Raceways
4. 16120 Conductors
5. 16130 Boxes
6. 16140 Wiring Devices and Device Plates
7. 16190 Hangers and Supports
8. 16195 Electrical Identification

B. **The Low Voltage Contractor shall procure the services of a licensed electrician of the state to install any needed 120v power from the nearest panel and to install any raceways for low voltage cabling**.

1.08 SUBMITTALS

A. Prepare and submit shop drawings on all types of products provided on this project to the Engineer for approval, prior to installation.

B. Submit samples of each material under this Section requested by the Engineer, for approval. Samples shall be in size and form requested by the Engineer, and reasonable to show characteristics, color and finishes of the materials.

C. Submit complete manufacturers' product data of all materials and systems to the Engineer for approval, consisting of complete product description and specifications, complete performance test data, complete preparation and installation instructions, and all other pertinent technical data required for complete product and use information.

D. All shop drawings shall have clearly marked the appropriate specification number or drawing designation for identification of the submittal.

E. Submit shop drawings showing the complete layout of all raceway products that identify the installed system and all components with device type, color, installation criteria and Owner furnished devices, for approval by the Engineer.

F. Disposition of shop drawings shall not relieve the Contractor from the responsibility for deviations from drawings or specifications unless he has submitted in writing, a letter itemizing or calling attention to such deviation at the time of submission and secured written approval from the Engineer, nor shall such disposition of shop drawings relieve the Contractor from responsibility for errors in shop drawings or schedules.

G. The Contractor shall show proof of having a sufficient number of trained personnel on staff for all telephone and data systems, cabling, and connector installation as required by the specific manufacturer of equipment being provided for by the Contractor.

H. The Contractor shall show proof of membership in a certified cabling installation program and must warrant the cabling system specified herein, for a minimum of 20 years.

I. Do not order materials or begin installation until written approval of submittals by the Architect and Engineer has been obtained.

J. Submittals shall contain information specific to systems, equipment and materials required by Contract Documents for this project only. Do not submit catalogs that describe products, models, options or accessories other than those required, unless irrelevant information is marked out or unless relevant information is highlighted clearly.

K. Intent of Submittal review is to check for capacity, rating and certain construction features. Contractor shall ensure that work meets requirements of Contract Documents regarding information that pertains to fabrication processes or means, methods, techniques, sequences and procedures of construction and for coordination of work of this and other Sections. Work shall comply with submittals marked “REVIEWED” to extent that they agree with Contract Documents. Submittal review shall not diminish responsibility under this Contract for dimensional coordination, quantities, installation, wiring, supports and access for service, nor the shop drawing errors or deviations from requirements of Contract Documents. The Engineer's noting of some errors while overlooking others will not excuse the contractor from proceeding in error. Contract Documents requirements are not limited, waived nor superseded in any way by review.

PART 2 – PRODUCTS

2.01 GENERAL

A. All products shall meet applicable NEMA, ANSI and UL, FCC and IEEE Standards

B. Refer to Drawings for outlet locations and service types required.

C. All products shall be new unless specifically indicated otherwise. Material shall be without blemish or defect.

2.02 CABLING DISTRIBUTION

A. Manufacturer's cable markings shall consist of manufacturer's name, cable type/catalog No., 1987 NFPA type code compliance, and the National Electrical Code (NEC) rating and classification compliance.

B. All cable shall be listed for its use per NEC Article 800.

C. All cables shall meet performance specifications as required herein, and in accordance with the following:

1. ANSI/TIA/EIA-568-C.1 – General Cabling System Requirements.

2. ANSI/TIA/EIA-568-C.2 – Balanced Twisted Pair Copper Cabling Systems

2.03 CAMERAS

A. **Cameras are to be selected by the bidder to meet the design requirements identified on the plans. Provide description with proposal of intended camera and NVR make.**

1. **Pan-Tilt-Zoom exterior camera – Hikvision DS-2DF5286-AEL or equal**

2. **Fixed mounted exterior camera – Hikvision DS-2CD8254FWD-EI or equal**

3. **Fixed mounted interior camera – Hikvision DS-2CD8254FWD-EI or equal**

B. **Exterior mounting shall have outdoor rated housing.**

C. **Cameras to utilize Power Over Ethernet (POE) and be wired to nearest LAN system IDF or MDF. Furnish and install LAN cabling per LAN specification. Install additional transformer, cable, or power supply as needed for cameras and voltage drop.**

D. **NVR - Milestone Husky M50 or equal with;**

1. **40 camera capability**

2. **16TB Storage**

2.04 WIRE MARKERS

A. Each wire and cable shall be permanently identified at both ends with pre-printed Heat Shrink flattened Polyolefin Type wire markers manufactured by Panduit, Thomas & Betts, Brady, or approved equal.

PART 3 – EXECUTION

3.01 COOPERATION AND WORK PROGRESS

A. The work shall be carried on under the usual construction conditions, in conjunction with all other work at the site. The Contractor shall cooperate with the Architect and all other Subcontractors and equipment suppliers working at the site. The Contractor shall coordinate the work and proceed in a manner so as not to delay the progress of the project.

B. The Contractor shall coordinate his work with the progress of the work and other Trades so that he will complete his work as soon as conditions permit and such that interruptions of the building functions will be at a minimum. Any overtime hours worked or additional costs incurred due to lack of or improper coordination with other Trades, the Architect or the Owner's representative by the Contractor shall be assumed by him without any additional cost to the Owner's representative.

C. The Contractor shall provide information on all equipment that is furnished under this Section but installed under another Section to the installing Subcontractor as specified herein.

D. The Contractor shall furnish all materials, equipment and workmanship to provide for adequate protection of all equipment during the course of construction of the project. This shall also include protection from moisture and all foreign matter. The Contractor shall also be responsible for damage which he causes to the work of other Trades, and he shall remedy such injury at his own expense.

E. Waste materials shall be removed promptly from the premises. All material and equipment stored on the premises shall be kept in a neat and orderly fashion. Material or equipment shall

not be stored where exposed to the weather. The Contractor shall be responsible for the security, safekeeping and any damages, including acts of vandalism, of all material and equipment stored at the job site.

F. The Contractor shall be responsible for unloading all materials delivered to the site. This shall also include all large and heavy items or which require hoisting. Consult with the General Contractor for hoisting/crane requirements.

G. It shall be the responsibility of the Contractor to coordinate the delivery of the materials for the project prior to the time installation of such materials will be required.

H. The Contractor shall erect and maintain, at all times, necessary safeguards for the protection of life and property of the Owner's representative(s), Personnel and the Public.

I. Prior to installation, the Contractor has the responsibility to coordinate the exact mounting arrangement and location of equipment to allow proper space requirements as indicated in the NEC. If it is questionable that sufficient space, architectural or structural obstructions, or a conflict with the work of other Subcontractors will result in an arrangement which will prevent proper access, operation or maintenance of the indicated equipment, the Contractor shall immediately notify the General Contractor and shall not proceed with this part of the work until definite instructions have been given to him by the Architect.

J. The Contractor shall not allow any equipment or piping foreign to the telecommunications installation to be installed or pass through any telecommunication rooms in which communication systems and equipment are located, such as computer equipment, PBX and distribution frames. The Contractor shall notify the General Contractor of such violations and request immediate removal.

K. The Contractor shall obtain from the other Trades, copies of all shop drawing prints showing ductwork and piping installations as they will be put in place on the project. These drawings shall be thoroughly checked by the Contractor and used for the routing of all cable runway, conduits and innerduct installations.

L. Location of all outlets shall be verified with the Architect prior to roughing in conduits, raceway, cable tray or routing of cables. Refer to details and wall elevations on the Architectural drawings. Mounting heights indicated on these drawings and/or specific dimensional information given to the Contractor by the Architect shall take precedence over such information indicated on the Telecommunication drawings.

M. The Contractor shall not allow any equipment or piping foreign to the telecommunications installation to be installed or pass through any room in which telecommunications system or equipment are located such as Distribution Frames, Telecommunication Rooms or Telecommunications Entrance Facilities. The Contractor shall notify the General Contractor of such violations and request immediate removal.

3.02 INSTALLATION

A. The Contractor shall be licensed in the State with the low voltage certification if required.

B. The Contractor shall furnish and install in accordance with manufacturers' instructions, all wiring, conduit, raceway, outlet boxes, pull boxes, etc., as required for the installation of a complete telecommunications system as described herein and as indicated on the drawings.

C. Conduits shall be sized in accordance with LAN cabling specification.

D. Where corridors or necessary cable access pathway routes cross smoke partitions or fire-rated partitions, firestop per other specification sections.

3.03 TELECOMMUNICATIONS CABLING PRACTICE

A. All cable installation and termination shall adhere to the provisions in ANSI/TIA/EIA-568-C standards.

B. The physical length of each horizontal LAN cable run (length of cable sheathing) shall not exceed 300 linear feet. Each Horizontal cable shall be a continuous run with no splices, bridges, or other discontinuities.

C. All cables shall be clearly labeled at each end, with the location number machine-labeled at 4" to 6" from the points of termination.

D. Verify exact location of backbone cabling terminations with the Owner before installation.

E. In Distribution Frame (DF) locations where cables originate from different floors, the cables are to be separately bundled so that each bundle contains cable from the originating floor only.

F. Maintain cable twist-rate at all termination points. The amount of cable untwist shall be no more than 1/2". Do not strip back the cable jacket any more than is necessary to terminate the individual conductors.

G. Provide minimum 12-inches of cable slack at the work area outlet and a 5-foot minimum service loop at the Distribution Frame cabinets for all cables.

H. Conduit bends must have a radius of not less than 6 times the internal diameter of conduits 2 inches or smaller; or 10 times the internal diameter of conduits larger than 2 inches.

I. **For concealed Non-process spaces, cables may be supported on J-hooks every 4'**.

1. Cables shall not be tie wrapped to other utilities such as electrical conduit or sprinkler pipes.

2. Cable shall not lie on ceiling tiles, plumbing or steam pipes, high voltage conduits or trays, fluorescent lights or any other known source of heat, moisture or electrical magnetic interference (EMI).

3. Cable cannot be strapped or tied to any electrical conduits, raceways, plumbing or any type of incorrectly supported loose wiring.

J. A 6-inch clearance and/or separation must be maintained between any communications and electrical conduits.

K. Provide a minimum of 5-feet cable slack, to neatly route the horizontal cable through the D-rings to the appropriate 66-type block.

L. No communication or data circuit shall be run in the same conduit or raceway with power conductor except where the raceway is separated by a full height, integral divider.

M. Installation of the cable shall be in accordance with the marked floor plan. All deviations to the cable route shall be approved by the Owner prior to installation.

N. Cable routing shall follow physical separation guidelines and shall avoid locations of high RFI/EMI radiation or adverse environmental conditions. Cable shall be a minimum of 4 feet from any electric motor or light ballast.

O. Do not install copper cabling within 5 feet of a welding outlet/receptacle or station.

P. The telecommunications cable plant shall be grounded and bonded in accordance with ANSI/TIA/EIA-607-A and NEC Article 250.

3.04 TELECOMMUNICATION ACCEPTANCE TESTING

A. Each copper cable terminating in a communication outlet jack connector shall be tested per LAN specification.

B. Test reports shall be submitted within 7 business days of completion of testing.

3.05 GROUNDING, BONDING AND ELECTRICAL PROTECTION

A. A suitable telecommunications ground (for equipment) is required. Approved grounding points shall include:

1. All Intermediate Distribution Frame cabinet (IDF) locations must be bonded to nearest building steel with #4 copper exothermic weld at building column and mechanical lug at Rack.

3.06 CAMERA INSTALLATION

A. **Contractor shall mount and aim cameras as indicated on plans. Mount cameras at the following;**

1. **Interior Office – in ceiling at approx. 9'AFF**

2. **Factory Areas – on walls at approx. 15'AFF.**

3. **Exterior – on wall at approx. 25' above interior slab.**

B. **Contractor shall verify with owner acceptable focus and view of the camera video feed back at the head-end, and will re-aim/re-focus as requested. Aim cameras initially as indicated on drawing E7.100 to match viewing window indicated on the plan.**

C. **Contractor will verify storage of camera feeds, and train owner in operating the camera software.**

3.07 RECORD DRAWINGS AND WALK-THROUGH

A. Provide detailed and accurate documentation of the distribution system upon completion of the installation in order to facilitate system administration, system maintenance, and future system changes.

B. Maintain a clean set of Contract Documents on site at all times and note any deviations in installation on a day-to-day basis. The markup set shall serve as the basis for the Contractor to provide an AutoCAD file of all Record Drawings, which shall be turned over to the Owner at final inspection.

C. Contractor shall provide all necessary testing equipment to test all cables, maintain a complete set of test records on site at all times, and note any deviations in installation on a day-to-day basis. The tests shall indicate results in accordance with ANSI/TIA/EIA-568-C Standards for every cable and port installed per the terms and conditions as set forth herein. These test records shall serve as the basis for the Contractor to provide final test results which shall be turned over to the Owner at final inspection.

D. Both a hard copy and a CD-ROM disk electronic file (*.csv formatted) of the test results for each cable run shall be provided to the Owner. The Owner and Contractor shall agree upon acceptable test results prior to testing. It is the Contractor's responsibility to replace, repair, or modify any cable run which tests outside the agreed-upon ranges, in such a manner as to be acceptable to the Owner.

E. Before the system is accepted by the Owner, the Contractor will be required to “walk-through” the installation with the Owner and verify proper installation and conformance to specifications, Drawings, and other agreed upon, written details.

3.08 LABELING

A. General

1. All faceplate and modular jack labeling shall be approved in writing by the Owner prior to installation.

2. All labels shall be clearly printed on clear or opaque labels and meet the following requirements:

   a. The font shall be approximately 1/8 inch in height with block type characters, and shall be clearly legible.

   b. Handwritten labels will not be accepted.

   c. The text color shall contrast with the label background color (e.g., black text on a white background).

   d. Provide nameplates in or on the faceplate and/or wiring blocks. Wiring block(s) labeling shall exhibit all station numbers in sequential order.

   e. Nameplates shall be securely attached to the equipment.

   f. Each Horizontal and Backbone cables shall be clearly labeled at each end.

   g. Label all cables that are left un-terminated in walls or other pathways and/or spaces in accordance with ANSI/TIA/EIA-606-A or approved alternate.

B. Telecommunications Outlets

1. Each telecommunication outlet shall be labeled with LAN or Voice cable numbers per the plan.

2. The labeling scheme will be sequential and shall coincide with the floor plan communication outlet locations.

3.09 CLEANING

A. General

1. This Section of the specifications shall include the cleaning materials on a day-to-day basis and final cleaning of all equipment and materials prior to turning building over to the Owner's representative. All necessary cleaning referred to herein shall be performed to the satisfaction of the Architect.

2. Ensure timely cleanup of all facilities and buildings related to this project, during construction and at completion.

3. Upon completion of cleaning work areas as described in above, but before energizing equipment, the entire room shall be swept clean and all garbage shall be removed from the site.

B. Final Cleaning

1. All Telecommunication devices, device plates, etc., shall be cleaned and left in “like new” condition to the satisfaction of the Architect, prior to occupancy.

2. All rubbish and discarded materials shall be disposed of and removed from the site on a day-to-day basis.

****

END OF SECTION

SECTION 22 00 01
PLUMBING GENERAL PROVISIONS

PART 1: GENERAL

1.1 SUMMARY

A. THE WORK AS SHOWN, INDICATED, AND SPECIFIED IN THE PROJECT PLUMBING CONSTRUCTION DRAWINGS, DIVISION 22 AND 31 SPECIFICATIONS, AND AS SPECIFIED WITHIN THE BID DOCUMENTS INCORPORATES THIS SECTION BY REFERENCE AND IS INCOMPLETE WITHOUT THE PROVISIONS STATED HEREIN.

B. EXAMINE ALL DRAWINGS AND CRITERIA SHEETS AND ALL OTHER SECTIONS OF THE SPECIFICATIONS FOR REQUIREMENTS WHICH AFFECT WORK UNDER THIS SECTION WHETHER OR NOT SUCH WORK IS SPECIFICALLY MENTIONED IN THIS SECTION.

C. REFER TO ELECTRICAL NEMA CLASSIFICATION DRAWINGS FOR CLASSIFICATIONS OF EACH SPACE. ALL EQUIPMENT AND DEVICES SHALL COMPLY WITH THE NEMA DRAWINGS. IT SHALL BE THE RESPONSIBILITY OF THIS CONTRACTOR TO OBTAIN THE LATEST VERSION OF THE NEMA DRAWINGS FROM THE CM, ARCHITECT OR ENGINEER.

D. COORDINATE WORK WITH THAT OF ALL OTHER TRADES AFFECTING OR AFFECTED BY WORK OF THIS SECTION. COOPERATE WITH SUCH TRADES TO ASSURE THE STEADY PROGRESS OF ALL WORK UNDER THE CONTRACT.

E. PROVIDE ALL MATERIAL, LABOR, AND EQUIPMENT TO COMPLETE THE WORK OF THIS SECTION IN STRICT ACCORDANCE WITH THE DESIGN ARCHITECT AND ENGINEER'S PLANS AND SPECIFICATIONS, AND WITH ALL APPLICABLE CODES, RULES, AND STANDARDS.

F. THE WORK SHALL BE COMPLETED IN ACCORDANCE WITH THE CONTRACT SCHEDULE ESTABLISHED BY THE CONSTRUCTION MANAGER AND THE GENERAL CONTRACTOR.

1.2 DEFINITIONS

A. CONTRACTOR: REFERS TO THE PLUMBING CONTRACTOR RESPONSIBLE FOR FURNISHING AND INSTALLATION OF ALL WORK INDICATED ON THE PLUMBING DRAWINGS AND IN THE PLUMBING SPECIFICATIONS.

B. SUBCONTRACTOR: REFERS TO THE PLUMBING CONTRACTOR RESPONSIBLE FOR FURNISHING AND INSTALLATION OF ALL WORK INDICATED ON THE PLUMBING DRAWINGS AND IN THE PLUMBING SPECIFICATIONS.

C. ARCHITECT: SHALL REFER TO "THE DENNIS GROUP, LLC (DGL)".

D. ENGINEER: SHALL REFER TO "THE DENNIS GROUP, LLC (DGL)".

E. OWNER: SHALL REFER TO THE OWNER, "THE LIVESTOCK INSTITUTE (TLI)", OR HIS DESIGNATED REPRESENTATIVE.

F. CONSTRUCTION MANAGER: OR "CM" SHALL BE DESIGNTATED BY OWNER

G. PROVIDE: IS UNDERSTOOD TO MEAN "THE CONTRACTOR SHALL FURNISH AND INSTALL" THE EQUIPMENT, TESTS, INSPECTIONS, ETC. REFERENCED.

H. RELATED WORK: SECTIONS REFERENCED UNDER THE PARAGRAPH "RELATED WORK SPECIFIED ELSEWHERE" ARE UNDERSTOOD TO INCLUDE PROVISIONS WHICH DIRECTLY AFFECT THE WORK BEING SPECIFIED IN THE SECTION WHERE THE RELATED WORK PARAGRAPH OCCURS.

I. CONCEALED: IS USED IN CONJUNCTION WITH PIPING, EQUIPMENT AND THE LIKE. THE WORD CONCEALED IS UNDERSTOOD TO MEAN HIDDEN FROM SIGHT, SUCH AS INSIDE CHASES, FURRED SPACES ABOVE SUSPENDED CEILINGS, WALLS, AND CABINETS. ALL PIPING, HANGERS, EQUIPMENT, ETC. THAT IS LOCATED ABOVE A WALK-ON CEILING SHALL BE CONSIDERED EXPOSED.

J. EXPOSED: IS UNDERSTOOD TO MEAN OPEN TO VIEW.

K. PROCESS AREAS: SHALL INCLUDE ALL AREAS INVOLVED IN THE PROCESSING, PRODUCTION, PACKAGING AND STORAGE OF FOOD PRODUCTS OR AREAS SUBJECTED TO WET WASH DOWN PROCESSES. THE FOLLOWING ROOMS ARE DEFINED AS PROCESS AREAS:

1. P100 KILL FLOOR HIDE ON
2. P101 KILL FLOOR CLEANING
3. P102 PLANT CORRIDOR
4. P103 PLANT CORRIDOR
5. P104 PLANT CORRIDOR

6. P105 BREAKING & FABRICATION
7. P106 CURING COOLER
8. P107 SMOKE HOUSE
9. P108 HOT PRODUCT
10. P109 PACKAGING ROOM
11. S100 INEDIBLES / HIDE DOCK
12. S101 CHEMICAL STORAGE
13. S102 CHILL COOLER
14. S103 SALES COOLER
15. S105 CHILLED BOXED COOLER
16. S106 INGREDIENT STORAGE
17. S107 FROZEN BOXED FREEZER
18. S108 DRY STORAGE / DOCK

L. NON-PROCESS AREAS: SHALL INCLUDE ALL AREAS OUTSIDE OF THE "PROCESS AREAS" INCLUDING OFFICE AREAS, UTILITY ROOMS, ELECTRICAL ROOMS, ETC.

M. REFER TO THE CONTRACT CONDITIONS FOR ANY ADDITIONAL DEFINITIONS.

1.3 CODES, STANDARDS, AND PERMITS

A. PERFORM WORK IN ACCORDANCE WITH THE ACCEPTED EDITION, REVISION, AMENDMENT OR SUPPLEMENT OF APPLICABLE STATUTES, ORDINANCES, CODES OR REGULATIONS OF NATIONAL, STATE, COUNTRY AND LOCAL AUTHORITIES HAVING JURISDICTION IN EFFECT ON THE DATE BIDS ARE RECEIVED. REFER TO THE ARCHITECTURAL CODE COMPLIANCE SHEET FOR APPLICABLE CODES.

B. WHERE APPROVAL STANDARDS HAVE BEEN ESTABLISHED BY OHSA, UNDERWRITER'S LABORATORIES, THE MASSACHUSETTS PLUMBING REGULATIONS (248 CMR), ASME, AGA, AMCA, ANSI, ASA, ASHRAE, ARI, ASSE, CSA, ETL, FM, NEC, NFPA, NSF AND THE STATE OF MASSACHUSETTS, THESE STANDARDS SHALL BE FOLLOWED WHETHER OR NOT INDICATED ON THE CONTRACT DRAWINGS AND SPECIFICATIONS. INCLUDE THE COST OF ALL WORK REQUIRED TO COMPLY WITH THE REQUIREMENTS OF THESE AUTHORITIES IN THE ORIGINAL PROPOSAL.

C. REQUIREMENTS IN REFERENCE SPECIFICATIONS AND STANDARDS ARE A MINIMUM FOR ALL EQUIPMENT, MATERIAL, AND WORK. IN INSTANCES WHERE CAPACITIES, SIZE, OR OTHER FEATURES OF EQUIPMENT, DEVICES, OR MATERIALS EXCEED THESE MINIMUMS, MEET LISTED OR SPECIFIED CRITERIA.

D. ALL POTABLE WATER SYSTEMS SHALL BE LEAD FREE IN COMPLIANCE WITH NSF STANDARDS.

E. RESOLVE ANY CODE VIOLATIONS DISCOVERED IN CONTRACT DOCUMENTS WITH THE CONTRACTOR AND ENGINEER. CONTRACTOR SHALL MAKE ANY CORRECTION OR ADDITION NECESSARY FOR COMPLIANCE WITH APPLICABLE CODES AT NO ADDITIONAL COMPENSATION.

F. PERMITS: THE CONSTRUCTION MANAGER SHALL OBTAIN A GENERAL BUILDING PERMIT FOR THE WORK. THE SUBCONTRACTOR SHALL OBTAIN ALL OTHER NECESSARY PERMITS AS REQUIRED BY THE LOCAL AUTHORITY HAVING JURISDICTION. THE SUBCONTRACTOR SHALL PAY ALL NECESSARY FEES AND CHARGES ISSUED BY THE AUTHORITY. THE SUBCONTRACTOR SHALL BE RESPONSIBLE FOR MAKING ARRANGEMENTS FOR ALL REQUIRED INSPECTIONS.

1.4 SUBMITTALS

A. SUBMITTALS SHALL BE SUBMITTED IN CONFORMANCE WITH THE REQUIREMENTS OF SECTION *01300 – ADMINISTRATIVE REQUIREMENTS*, SECTION *01600 – PRODUCT REQUIREMENTS*, AND THE FOLLOWING:

1. MANUFACTURERS
    a. THE LISTED MANUFACTURERS WILL BE ACCEPTABLE AS LONG AS THEY COMPLY WITH THE SPECIFICATIONS AND SCHEDULES.
    b. MANUFACTURERS WHO ARE NOT LISTED AS "ACCEPTABLE MANUFACTURERS" BEAR THE BURDEN OF PROOF TO THE CONTRACTOR AND ENGINEER THAT THEIR PRODUCTS COMPLY WITH THE DRAWINGS AND SPECIFICATIONS. ALTERNATE MANUFACTURERS WILL NOT BE ACCEPTED UNTIL SHOP DRAWING

SUBMITTAL. THE SUBCONTRACTOR BEARS THE RESPONSIBILITY IF ALTERNATE MANUFACTURERS ARE USED FOR PREPARING BID PROPOSALS.

2. CONTRACTOR'S CERTIFICATION
    a. SUBMITTALS SHALL BE SUBMITTED ONLY BY THE CONTRACTOR. INDICATE BY SIGNED STAMP THAT THE CONTRACT DOCUMENTS HAVE BEEN CHECKED, THAT THE WORK SHOWN IN THE SUBMITTALS IS IN ACCORDANCE WITH CONTRACT REQUIREMENTS, AND THAT DIMENSIONS AND RELATIONSHIP WITH WORK OF OTHER TRADES HAVE BEEN CHECKED.
    b. SUBMITTALS SENT TO THE CM DIRECT FROM THE EQUIPMENT VENDOR WILL NOT BE ACCEPTED.
    c. SUBMITTALS SHALL BE SENT VIA EMAIL OR MAIL.
3. PREPARATION
    a. WHERE PRODUCT DATA PUBLISHED BY THE MANUFACTURER IS PART OF A SUBMITTAL, INCLUDE ONLY INFORMATION RELEVANT TO THE PARTICULAR EQUIPMENT OR MATERIALS TO BE FURNISHED. STRIKE ALL NON-RELEVANT PRODUCTS AND PAGES. SUBMITTALS INCLUDING PRODUCTS NOT USED ON THE PROJECT WILL BE RETURNED FOR RESUBMISSION.
    b. IN ALL CASES WHERE COMPLIANCE WITH UL, ETL, FM, IRI, ASME, ASSE, NSF OR OTHER SIMILAR ORGANIZATIONS' STANDARDS ARE REQUIRED, PROVIDE PROPER DOCUMENTATION OF THIS COMPLIANCE WITH THE MANUFACTURER'S PUBLISHED LITERATURE OR DRAWINGS OR BY A LETTER SIGNED BY AN OFFICER OF THE COMPANY. FOR ALL EQUIPMENT, FURNISH THE MANUFACTURER'S REPRESENTATIVE NAME, CURRENT ADDRESS, AND TELEPHONE NUMBER WITH AREA CODE.
    c. INCLUDE IDENTIFYING SYMBOLS AND EQUIPMENT NUMBERS USED IN THE CONTRACT DOCUMENTS FOR ALL EQUIPMENT AND MATERIAL SUBMITTED.
    d. CROSS REFERENCE SHEET NUMBERS ON CONTRACT DRAWINGS FOR SHOP DRAWINGS. PROVIDE SHOP DRAWINGS CONSISTING OF PLANS DRAWN TO SCALE, WITH ELEVATIONS AND SECTIONS, TO SHOW CLEARLY THE LOCATION OF MAJOR ITEMS OF EQUIPMENT AND CLEARANCES FOR MAINTENANCE AND CODE REQUIREMENTS. PROVIDE CAD DRAWINGS WHEN REQUESTED.
    e. SUBMIT ONLY THE REQUESTED SUBMITTALS COMPLETE BY TYPES OF EQUIPMENT (I.E. FLOOR DRAINS, HUB DRAINS, CLEANOUTS, ETC.) LABELED WITH APPLICABLE SPECIFICATION SECTION(S) INCLUDED. EACH SUBMITTAL WILL BE HANDLED SEPARATELY. SHOULD ANY ITEM NOT BE ACCEPTABLE, THE ENTIRE SUBMITTAL WILL BE RETURNED TO THE CONTRACTOR FOR CORRECTION AND RESUBMISSION. PARTIAL SUBMITTALS ARE UNACCEPTABLE. THE INTENT OF THIS REQUIREMENT IS THAT ALL APPROVED BOUND SETS OF DATA WILL BE IDENTICAL AND WILL CONTAIN ONLY ACCEPTABLE INFORMATION.
    f. SUBMIT A COMPLIANCE SHEET FOR EACH SUBMITTAL INDICATING THE SUBMITTAL IS IN FULL COMPLIANCE WITH THE DRAWINGS AND SPECIFICATIONS. INDICATE BY DRAWING NUMBER OR SPECIFICATION SECTION NUMBER AND PARAGRAPH NUMBERS ALL EXCEPTIONS TAKEN AND INCLUDE AN EXPLANATION.
    g. BY PREPARING, APPROVING, AND SUBMITTING SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, THE CONTRACTOR REPRESENTS THAT THE CONTRACTOR HAS DETERMINED AND VERIFIED ALL MATERIAL, FIELD MEASUREMENTS AND FIELD CONSTRUCTION CRITERIA RELATED THERETO, OR WILL DO SO WITH REASONABLE PROMPTNESS. IN ADDITION, THE CONTRACTOR HAS CHECKED AND COORDINATED THE INFORMATION CONTAINED WITHIN SUCH SUBMITTALS WITH THE REQUIREMENTS OF THE WORK, THE PROJECT, AND THE CONTRACT DOCUMENTS.

h. THE REVIEW OF SUBMITTALS BY THE CONTRACTOR AND ENGINEER DOES NOT RELIEVE OR MODIFY THE SUBCONTRACTOR'S RESPONSIBILITY FOR COMPLIANCE WITH THE CONTRACT DOCUMENTS. THE REQUIREMENTS OF THE CONTRACT DOCUMENTS SHALL SUPERCEDE ANY DIMENSION, QUALITY, OR QUANTITY DISCREPANCIES FOUND IN THE SUBMITTALS. IT IS CLEARLY UNDERSTOOD THAT, IN THE REVIEW PROCESS, NOTING OF SOME DISCREPANCIES BUT OVERLOOKING OTHERS DOES NOT GRANT THE SUBCONTRACTOR PERMISSION TO PROCEED IN ERROR. REGARDLESS OF ANY INFORMATION CONTAINED IN THE SUBMITTALS, THE CONTRACT DOCUMENTS GOVERN THE WORK, AND ARE NEITHER WAIVED NOR SUSPENDED IN ANY WAY BY THE REVIEW OF THE SUBMITTALS.

i. INCLUDE IN SUBMITTALS SUFFICIENT PLANS, ELEVATIONS, SECTIONS, PERFORMANCE DATA, ELECTRICAL REQUIREMENTS, DIMENSIONS, BOLT LOCATIONS, RATINGS, SOUND DATA, WEIGHTS, AND SCHEMATICS TO CLEARLY DESCRIBE THE EQUIPMENT AND TO SHOW COMPLIANCE WITH APPLICABLE SPECIFICATIONS AND SCHEDULES.

j. PROVIDE A COVER OR TITLE SHEET FOR THE SUBMITTAL CONTAINING THE FOLLOWING:
   1) NAME OF SUBCONTRACTOR ORIGINATING THE SUBMITTAL.
   2) NAME OF PROJECT FOR WHICH THE SUBMITTAL IS CREATED.
   3) AN INDEX OF ALL ITEMS SUBMITTED INCLUDING:
      a) MARK OF EQUIPMENT ON DRAWINGS
      b) MANUFACTURER
      c) CATALOG NUMBER
      d) SPECIFICATION SECTION NUMBER
   4) DATE OF SUBMITTAL AND DATE OF EACH REVISION
   5) CONTRACTOR'S CERTIFICATION OF REVIEW
   6) CONTRACTOR'S CERTIFICATION OF COMPLIANCE

4. SHOP DRAWINGS AND PRODUCT DATA THAT DO NOT COMPLY WITH THE REQUIREMENTS HEREIN WILL BE RETURNED FOR RESUBMISSION.
5. REFER TO THE CONTRACT GENERAL CONDITIONS AND/OR SUPPLEMENTAL GENERAL CONDITIONS FOR ANY ADDITIONAL OR SUPERSEDING REQUIREMENTS.

1.5 MATERIALS AND WORKMANSHIP

A. THE WORK SHALL BE COMPLETED IN A MANNER CONSISTENT WITH GOOD PLUMBING PRACTICE AND THE REQUIREMENTS OF THE PLUMBING CODE. ANY WORK NOT ACCEPTABLE TO THE OWNER SHALL BE REMOVED AND REPLACED AS NECESSARY, AT NO COST TO THE OWNER.

B. PROVIDE NEW MATERIALS AND EQUIPMENT BY THOSE REGULARLY ENGAGED IN THE PRODUCTION AND MANUFACTURE OF SPECIFIED MATERIALS AND EQUIPMENT. THE COMMERCIALLY STANDARD ITEMS OF EQUIPMENT AND THE SPECIFIC NAMES MENTIONED HEREIN ARE INTENDED TO IDENTIFY STANDARDS OF QUALITY AND PERFORMANCE NECESSARY FOR THE PROPER FUNCTIONING OF THE WORK. USE UL LISTED AND LABELED EQUIPMENT AND MATERIALS WHERE REQUIRED BY THE LOCAL BUILDING CODE.

C. PERFORM WORK BY WORKMEN SKILLED IN THE TRADE REQUIRED FOR THE WORK. INSTALL ALL MATERIALS AND EQUIPMENT TO PRESENT A NEAT APPEARANCE WHEN COMPLETED AND IN ACCORDANCE WITH THE APPROVED RECOMMENDATIONS OF THE MANUFACTURER AND THE BEST PRACTICES OF THE TRADE AND IN CONFORMANCE WITH THE CONTRACT DOCUMENTS.

D. PROVIDE ALL LABOR, MATERIALS, TOOLS, EQUIPMENT, APPARATUSES, AND APPLIANCES ESSENTIAL TO THE COMPLETE FUNCTIONING OF THE SYSTEMS DESCRIBED OR INDICATED HEREIN, OR WHICH MAY BE REASONABLY IMPLIED AS ESSENTIAL WHETHER MENTIONED IN THE CONTRACT DOCUMENTS OR NOT.

E. ALL MATERIALS, WHERE REQUIRED BY LOCAL CODE, SHALL BE MARKED AND LABELED WITH THE NAME OF THE APPROPRIATE STANDARDS AGENCY AND THE SPECIFIC STANDARD.

F. ALL TOOLS AND EQUIPMENT TAGS SHALL BE LEGIBLE. TOOLS AND EQUIPMENT SHALL BE KEPT CLEAN AND IN GOOD REPAIR. TOOLS AND EQUIPMENT WHICH ARE NOT IN COMPLIANCE WITH RELEVANT SITE AND OSHA STANDARDS AND GUIDELINES WILL BE PROMPTLY REMOVED FROM SITE AND REPLACED BY THE CONTRACTOR. CM RESERVES THE RIGHT TO REMOVE AN ITEM OR EQUIPMENT WHICH IS OUT OF COMPLIANCE.

G. DURING THE BID PROCESS THE CONTRACTOR WILL REVIEW THE SITE SPECIFIC OWNER AND CM SAFETY REQUIREMENTS IN ORDER TO ENSURE COMPLIANCE THROUGH THE EXECUTION OF THE SCOPE OF WORK.

H. ALL CONTRACTOR TOOLS AND EQUIPMENT INCLUDING CORDS AND HARNESSES WILL BE LABELED IDENTIFYING THE OWNER OR RESPONSIBLE CONTRACTOR. TOOLS, EQUIPMENT, CORDS, HARNESSES, AND GANG BOXES NOT PROPERLY IDENTIFIED WILL BE REMOVED FROM SITE.

1.6 CONTRACT DRAWINGS

A. THE CONTRACT DRAWINGS ARE GENERALLY DIAGRAMMATIC AND ARE INTENDED TO ENCOMPASS A SYSTEM THAT WILL NOT INTERFERE WITH THE STRUCTURAL AND ARCHITECTURAL DESIGN OF THE BUILDING. COORDINATE THE WORK TO AVOID INTERFERENCE BETWEEN PIPING, EQUIPMENT, ARCHITECTURAL, AND STRUCTURAL WORK.

B. COORDINATE WITH ARCHITECTURAL FEATURES, TRIM AND MILLWORK DETAILS, AND INSTALL EQUIPMENT IN CABINETS OR OTHER SPECIAL AREAS AS SHOWN ON THE DRAWINGS.

C. PIPE SIZES MAY BE SHOWN FOR THE SAME PIPING ON MORE THAN ONE PLAN. IN CASE OF PIPE SIZE DISCREPANCY, THE LARGER PIPE SIZE SHALL BE CONSIDERED CORRECT DURING THE BIDDING PROCESS. PRIOR TO CONSTRUCTION, PIPE SIZE DISCREPANCIES MUST BE FORWARDED TO THE ENGINEER FOR CORRECTION.

D. IN CASE OF EQUIPMENT OR SPECIFICATION DISCREPANCY, THE HIGHER OF THE TWO COST ITEMS SHALL BE CONSIDERED CORRECT DURING THE BIDDING. PRIOR TO CONSTRUCTION, THE DISCREPANCY MUST BE BROUGHT TO THE ATTENTION OF THE ENGINEER AND INTENT CONFIRMED BY THE ENGINEER.

1.7 RECORD DRAWINGS (I.E. AS-BUILT DRAWINGS)

A. THE PLUMBING SUBCONTRACTOR SHALL MAINTAIN CURRENT AT THE SITE A SET OF DRAWINGS ON WHICH HE/SHE SHALL ACCURATELY SHOW THE ACTUAL INSTALLATION OF ALL WORK PROVIDED UNDER HIS/HER CONTRACT INDICATING HEREON ANY VARIATION FROM THE CONTRACT DRAWINGS, IN ACCORDANCE WITH THE GENERAL CONDITIONS AND DIVISION 1. CHANGES, WHETHER RESULTING FROM FORMAL CHANGE ORDERS OR OTHER INSTRUCTIONS ISSUED BY THE ENGINEER OR CONSTRUCTION MANAGER, SHALL BE RECORDED. INCLUDE CHANGES IN PIPE SIZES, LOCATION, DIMENSIONS, ETC.

B. THE PLUMBING SUBCONTRACTOR SHALL INDICATE PROGRESS BY COLORING-IN PIPING, EQUIPMENT, AND ASSOCIATED APPURTENANCES EXACTLY AS THEY ARE ERECTED. THIS PROCESS SHALL INCORPORATE BOTH THE CHANGES NOTED ABOVE AND ALL OTHER DEVIATIONS FROM THE ORIGINAL DRAWINGS WHETHER RESULTING FROM JOB CONDITIONS ENCOUNTERED OR FROM ANY OTHER CAUSES.

C. THE MARKED-UP AND COLORED-UP PRINTS WILL BE USED AS A GUIDE FOR DETERMINING THE PROGRESS OF THE WORK INSTALLED. THEY SHALL BE INSPECTED PERIODICALLY BY THE CM, ENGINEER, AND OWNER AND THEY SHALL BE CORRECTED IMMEDIATELY IF FOUND EITHER INACCURATE OR INCOMPLETE. THIS PROCEDURE IS MANDATORY.

D. AT COMPLETION OF THE JOB, THESE PRINTS SHALL BE SUBMITTED TO THE CM AND ENGINEER FOR FINAL REVIEW AND COMMENT. THE PRINTS WILL BE RETURNED WITH APPROPRIATE COMMENTS AND RESUBMISSION REQUIREMENTS IF FOUND TO BE UNSATISFACTORY.

E. PLUMBING CONTRACTOR'S RECORD DRAWINGS, TOGETHER WITH FORMAL CONSTRUCTION REVISIONS, ADDITIONS, AND DELETIONS OF WORK, SHALL FORM THE BASIS FOR PREPARING A COMPLETE SET OF PLUMBING AS-BUILT RECORD DRAWINGS.

1.8 OPERATION & MAINTENANCE (O&M) MANUALS

A. FURNISH COPIES OF COMPLETE OPERATION AND MAINTENANCE INSTRUCTIONS, SERVICE MANUALS, AND PARTS LIST APPLICABLE TO EACH MANUFACTURED ITEM OF EQUIPMENT

FURNISHED. BIND OPERATION AND MAINTENANCE INFORMATION IN HEAVY-DUTY LOOSE-LEAF BINDERS.

1. REQUIRED MINIMUMS: 3 HARDCOPY SETS AND 3 ELECTRONIC SETS ON CD, DVD, OR EXTERNAL STORAGE DEVICE.

B. ORGANIZE BINDERS TO CONTAIN LIKE EQUIPMENT SUCH AS FIXTURES, SPECIALTIES, EQUIPMENT, PIPING, VALVES, ETC., IN SEPARATE DIVISIONS. PROVIDE A COMPLETE DOUBLE INDEX FOR EACH BINDER TO INCLUDE:

1. AN ALPHABETIZED LIST OF THE PRODUCTS BY NAME.
2. AN ALPHABETIZED LIST OF MANUFACTURERS WHOSE PRODUCTS HAVE BEEN INCORPORATED IN THE WORK, TOGETHER WITH THEIR ADDRESSES AND THE NAME, ADDRESSES, AND TELEPHONE NUMBERS OF THE LOCAL SALES REPRESENTATIVE OR SUPPLIER.

C. SUBMIT TO ENGINEER ONE PRELIMINARY O&M MANUAL PER THE INSTRUCTIONS IN THIS SECTION FOR REVIEW AND COMMENT PRIOR TO SUBMITTING THE REMAINING ELECTRONIC AND HARD COPIES.

D. FOR EACH SECTION OF PRODUCT, EQUIPMENT, OR SYSTEM, ORGANIZE THE DATA AS FOLLOWS:

1. FURNISH A GENERAL DESCRIPTION OF THE EQUIPMENT OR SYSTEM LISTING THE MAJOR COMPONENTS, INTENDED SERVICE, AND OTHER GENERAL DATA.
2. FURNISH TECHNICAL DATA INCLUDING NAMEPLATE DATA, DESIGN PARAMETERS, RATINGS, CAPACITY, PERFORMANCE DATA, OPERATING CURVES, CHARACTERISTICS AND THE LIKE. CLEARLY DISTINGUISH BETWEEN INFORMATION WHICH DOES AND DOES NOT APPLY.
3. LIST WARNINGS AND CAUTIONS TO BE OBSERVED DURING BOTH INSTALLATION AND OPERATIONS.
4. FURNISH FULLY DETAILED INSTALLATION AND OPERATION INSTRUCTIONS INCLUDING SPECIAL TOOLS REQUIRED, ALIGNMENT INSTRUCTIONS, START-UP, AND SHUT-DOWN SEQUENCES.
5. FURNISH MAINTENANCE, SERVICE, AND REPAIR INSTRUCTIONS INCLUDING MAINTENANCE AND SERVICE SCHEDULES, MATERIALS, AND METHODS FOR PERFORMING ROUTINE AND ANNUAL SERVICE.
6. FURNISH A TROUBLESHOOTING GUIDE AND CHECKLIST INDICATING COMMON FAILURES AND TEST METHODS AND PROCEDURES FOR DETERMINING COMPONENT FAULT OR FAILURE.
7. FURNISH A SPARE PARTS LIST INDICATING PART AND ORDER NUMBER WITH NAME, ADDRESS, AND TELEPHONE NUMBER OF SUPPLIER. INCLUDE CURRENT PRICES OF REPLACEMENT PARTS AND SUPPLIES.
8. FURNISH COPIES OF ALL APPROVED SUBMITTALS.
9. FURNISH COPIES OF ALL TEST REPORTS.

1.9 GUARANTEE

A. REFER TO THE GENERAL CONDITIONS AND SPECIAL CONDITIONS OF THE CONTRACT DOCUMENTS.

1.10 ALTERNATES

A. SEE BID DOCUMENTS FOR ALTERNATES.

PART 2: PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. UNLESS OTHERWISE SPECIFIED, MATERIALS AND EQUIPMENT SHALL BE NEW AND IN GOOD, CLEAN, SOUND CONDITION.

B. CONTRACT DRAWINGS ARE BASED ON THE EQUIPMENT SPECIFIED. MAKE REQUIRED ADJUSTMENTS, MODIFICATIONS, OR CHANGES DUE TO USE OF ALTERNATE EQUIPMENT AND COMPONENTS WITH NO ADDITIONAL COMPENSATION FOR, OR DEMANDED BY, THIS SUBCONTRACTOR OR ANY OTHER SUBCONTRACTOR OR TRADE. ANY ADDITIONAL COMPENSATION AS A RESULT OF CHANGES IN EQUIPMENT, STRUCTURAL FRAMING, CONCRETE

FOUNDATION, OR OTHER PHYSICAL CHANGES SHALL BE BORNE BY THIS SUBCONTRACTOR WITH NO ADDITIONAL EXPENSE. FURTHERMORE, ANY ENGINEERING REQUIRED AS A RESULT OF SUBSTITUTIONS OF ONE MANUFACTURER OVER ANOTHER, THE SUBCONTRACTOR SHALL, AT NO COST TO OTHERS, BE RESPONSIBLE FOR THE COST OF RE-ENGINEERING ANY STRUCTURAL, ELECTRICAL, OR OTHER ENGINEERING ASPECT DUE TO THIS SUBSTITUTION.

C. EQUIPMENT AND MATERIALS INDICATED OR REQUIRED TO BE INSTALLED OUTDOORS SHALL BE OF THE TYPE THAT IS DESIGNED, MANUFACTURED, LISTED OR APPROVED BY AUTHORITIES HAVING JURISDICTION FOR OUTDOOR INSTALLATION BY BEING RESISTANT TO THE ADVERSE EFFECTS OF WEATHER. ALL ADDITIONAL PROTECTIVE MEASURES AGAINST OUTDOOR WEATHER REQUIRED BY THE MANUFACTURERS' INSTALLATION INSTRUCTIONS AND PREVALENT PRACTICE SHALL BE PROVIDED.

PART 3: EXECUTION

3.1 GENERAL

A. THE WORK UNDER THIS CONTRACT SHALL ALSO INCLUDE ALL LABOR, MATERIALS, TOOLS, EQUIPMENT, TRANSPORTATION, INSURANCE, TEMPORARY PROTECTION, SUPERVISION AND INCIDENTAL ITEMS ESSENTIAL FOR PROPER INSTALLATION AND OPERATION, EVEN THOUGH NOT SPECIFICALLY MENTIONED OR INDICATED ON THE DRAWINGS BUT WHICH ARE USUALLY PROVIDED OR ARE ESSENTIAL FOR PROPER INSTALLATION AND OPERATION OF ALL SYSTEMS AS INDICATED ON THE DRAWINGS AND SPECIFIED IN THE CONTRACT DOCUMENTS.

B. THE SPECIFICATIONS AND DRAWINGS DESCRIBE THE MINIMUM REQUIREMENTS THAT MUST BE MET BY CONTRACTOR FOR THE INSTALLATION OF ALL WORK AS SHOWN ON THE DRAWINGS AND AS SPECIFIED ON DRAWINGS, SCHEDULES, SPECIFICATIONS AND RFQ SCOPES OF WORK.

3.2 PROJECT / SITE CONDITIONS

A. VISIT THE SITE OF THE PROPOSED CONSTRUCTION TO THOROUGHLY BECOME FAMILIAR WITH ALL DETAILS OF THE WORK AND WORKING CONDITIONS, VERIFY ALL DIMENSIONS IN THE FIELD, AND ADVISE THE CONTRACTOR AND ENGINEER OF ANY DISCREPANCY BEFORE PERFORMING ANY WORK.

B. SAFETY MEETINGS

1. CONTRACTOR AND SUBCONTRACTOR SHALL BE RESPONSIBLE FOR ATTENDING ALL SAFETY AND CM MEETINGS AS REQUESTED BY THE CM. THE SUBCONTRACTOR SHALL BE REQUIRED TO ATTEND MEETINGS AS REQUESTED BY CM.

C. SPACE REQUIREMENTS

1. CONSIDER SPACE LIMITATIONS IMPOSED BY CONTIGUOUS WORK IN SELECTION AND LOCATION OF EQUIPMENT AND MATERIAL. DO NOT PROVIDE EQUIPMENT OR MATERIAL THAT IS NOT SUITABLE IN THIS RESPECT.
2. CHANGES IN EQUIPMENT LOCATION OF UP TO 5 FT TO ALLOW FOR FIELD CONDITIONS SHALL BE MADE BY THE SUBCONTRACTOR AT NO ADDITIONAL COMPENSATION, AS DIRECTED BY THE CM.
3. INSTALL ALL EQUIPMENT REQUIRING SERVICE SO THAT IT IS EASILY ACCESSIBLE.
4. COMPARE THE EQUIPMENT SIZES WITH THE SPACE ALLOTTED FOR INSTALLATION BEFORE INSTALLATION AND MAKE WRITTEN NOTICE OF POSSIBLE CONFLICT. DISASSEMBLE LARGE EQUIPMENT TO PERMIT INSTALLATION THROUGH NORMAL ROOM OPENINGS WHEN REQUIRED. SHOULD WRITTEN NOTICE NOT BE MADE IN A TIMELY MANNER, MAKE ADJUSTMENTS AND MODIFICATIONS NECESSARY WITHOUT ADDITIONAL COMPENSATION.
5. TIMELY PLACE ALL EQUIPMENT TOO LARGE TO FIT THROUGH FINISHED OPENINGS, STAIRWAYS, ETC.

D. SITE OBSTRUCTIONS

1. THE DRAWINGS INDICATE CERTAIN INFORMATION PERTAINING TO OBSTRUCTIONS WHICH HAS BEEN TAKEN FROM AVAILABLE DRAWINGS. SUCH INFORMATION IS NOT GUARANTEED; HOWEVER, AS TO THE ACCURACY OF LOCATION OR THE COMPLETENESS OF THE INFORMATION.

2. BEFORE ANY CUTTING OR TRENCHING OPERATION IS BEGUN, VERIFY WITH THE CM, UTILITY COMPANIES, MUNICIPALITIES, AND OTHER INTERESTED PARTIES THAT ALL AVAILABLE INFORMATION HAS BEEN PROVIDED. VERIFY LOCATIONS GIVEN. THE SUBCONTRACTOR SHALL NOTIFY THE LOCAL UNDERGROUND SUPERVISORY AGENCY BEFORE ANY EXCAVATIONS AS REQUIRED BY LOCAL CODES AND ORDINANCES.
3. SHOULD BURIED OBSTRUCTION BE ENCOUNTERED, THE SUBCONTRACTOR SHALL STOP ALL WORK ON THE EXCAVATION AND NOTIFY THE CM AND SHALL NOT PROCEED UNTIL RECEIVING WRITTEN NOTIFICATION TO DO SO.
4. ANY UNDERGROUND UTILITIES THAT ARE KNOWN TO EXIST AS SHOWN ON THE DRAWINGS OR SHOWN TO EXIST BY THE BURIED SUPERVISORY AGENCY WHICH ARE DAMAGED SHALL BE REPAIRED TO THE SATISFACTION OF THE APPROPRIATE UTILITY COMPANY AND THE CM.
5. REFER TO THE CM GENERAL CONDITIONS AND SUPPLEMENTAL GENERAL CONDITIONS FOR PRICING ADJUSTMENT REQUIREMENTS.

E. CUTTING AND PATCHING
1. SUBMIT A WRITTEN NOTIFICATION TO CM IN ADVANCE OF CUTTING OR ALTERATIONS.
2. EXECUTE CUTTING AND DEMOLITION BY METHODS THAT WILL PREVENT DAMAGES TO OTHER WORK AND WILL PROVIDE PROPER SURFACES TO RECEIVE INSTALLATION OF REPAIRS.
3. RESTORE WORK THAT HAS BEEN CUT OR REMOVED; INSTALL NEW PRODUCTS COMPLYING WITH SPECIFIED PRODUCTS, FUNCTIONS, TOLERANCES, AND FINISHES AS STATED IN THE CONTRACT DOCUMENTS.

3.3 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. FOLLOW THE MANUFACTURER'S DIRECTIONS COMPLETELY IN THE DELIVERY, STORAGE, AND HANDLING OF EQUIPMENT AND MATERIALS.
B. STORE EQUIPMENT IN A CLEAR, DRY PLACE PROTECTED FROM OTHER CONSTRUCTION AND THE ELEMENTS. WHILE STORED, MAINTAIN FACTORY WRAPPING OR TIGHTLY COVER AND PROTECT EQUIPMENT AGAINST DIRT, WATER, CONSTRUCTION DEBRIS, CHEMICAL, PHYSICAL, OR WEATHER DAMAGE, TRAFFIC, AND THEFT.
C. ADEQUATELY BRACE AND PACKAGE EQUIPMENT TO PREVENT BREAKAGE AND DISTORTION WHILE IN TRANSIT.
D. ALL PRODUCTS SHALL BE SUPPLIED WITH A MSDS SHEET.

3.4 OPERATING INSTRUCTIONS

A. PROVIDE THE SERVICES OF COMPETENT REPRESENTATIVES OF THE MANUFACTURER CAPABLE OF CERTIFYING THAT THE EQUIPMENT IS INSTALLED ACCORDING TO THE MANUFACTURER'S RECOMMENDATIONS, IS OPERATING PROPERLY, AND TO INSTRUCT OPERATING PERSONNEL DURING START-UP AND OPERATING TESTS OF THE COMPLETE PLUMBING SYSTEMS. PROVE THE OPERATION OF EQUIPMENT TO THE SATISFACTION OF THE CM AND OWNER. GIVE AT LEAST SEVEN DAYS NOTICE TO THE CM AND OWNER PRIOR TO BEGINNING EQUIPMENT START-UP.
B. CERTIFY THAT THESE SERVICES HAVE BEEN PERFORMED BY INCLUDING A PROPERLY EXECUTED INVOICE FOR THESE SERVICES OR A LETTER FROM THE MANUFACTURER.

3.5 ADDITIONAL WORK

A. ALL ADDITIONAL WORK AND CHANGES TO THE ORIGINAL CONTRACT MUST BE SUBMITTED IN WRITING TO THE CM/ENGINEER AND APPROVED IN WRITING BY THE CM/PM AND/OR THE OWNER PRIOR TO EXECUTION. ANY CHANGE WORK PERFORMED WITHOUT APPROVAL IS AT THE CONTRACTORS' RISK.

3.6 CLEANING

A. INSTALL ALL PLUMBING SYSTEMS IN COMPLETE WORKING ORDER AND CLEAN AND POLISH ALL FIXTURES, EQUIPMENT, DRAIN SPECIALTIES, VALVES, INSTRUMENTS, AND MATERIALS THOROUGHLY RETURNING THEM TO "AS NEW" CONDITION PRIOR TO REQUEST FOR FINAL REVIEW.
B. REMOVE ALL EXCESS MATERIAL AND DEBRIS. CLEAN OUT ALL LINES AND FITTINGS. LEAVE ALL AREAS "BROOM CLEAN".

END OF SECTION

SECTION 22 05 01
SUPPLEMENTARY COMPONENTS FOR PLUMBING WORK

PART 1: GENERAL

1.1 SUMMARY

A. THE WORK OF THIS SECTION SHALL INCLUDE:
   1. ACCESS DOORS
   2. FIRE-STOPPING MATERIALS (COMPOUND, PACKING, PREFABRICATED FIRESTOP COLLARS)
   3. PAINTING
   4. SEALANT

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. THE FOLLOWING REFERENCED SECTIONS ARE LISTED AS A MINIMUM OF ADDITIONAL REQUIREMENTS AND/OR WORK NOT INCLUDED IN THIS SECTION WHICH MAY BE REQUIRED TO BE PERFORMED UNDER OTHER DESIGNATED SECTIONS:
   1. *22 05 23 – GENERAL DUTY VALVES FOR PLUMBING PIPING*
   2. *22 05 53 – IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT*
   3. *22 10 00 – PLUMBING PIPING*
   4. *22 13 19 – PLUMBING SPECIALTIES*
   5. *22 30 00 – PLUMBING EQUIPMENT*
   6. *22 40 00 – PLUMBING FIXTURES*

1.3 REFERENCE STANDARDS

A. ASME (AMERICAN SOCIETY OF MECHANICAL ENGINEERS)
   1. E119 FIRE TESTS OF BUILDING CONSTRUCTION AND MATERIALS

B. ASTM (ASTM INTERNATIONAL)
   1. C719 STANDARD METHOD FOR THE ADHESION AND COHESION OF ELASTOMERIC JOINT SEALANTS UNDER CYCLIC MOVEMENT
   2. D3730 STANDARD GUIDE FOR TESTING HIGH-PERFORMANCE INTERIOR ARCHITECTURAL WALL COATINGS
   3. G21 STANDARD PRACTICE FOR DETERMINING RESISTANCE OF SYNTHETIC POLYMERIC MATERIALS TO FUNGI

C. FDA (FOOD AND DRUG ADMINISTRATION)

D. SSPC (THE SOCIETY FOR PROTECTIVE COATINGS)

E. UL (UNDERWRITER'S LABORATORIES)

F. USDA (UNITED STATES DEPARTMENT OF AGRICULTURE)

1.4 SUBMITTALS

A. SUBMITTALS SHALL BE SUBMITTED IN CONFORMANCE WITH THE REQUIREMENTS OF SECTION *22 00 01 – PLUMBING GENERAL PROVISIONS*.

B. SUBMITTALS ARE REQUIRED FOR:
   1. ACCESS DOORS
   2. FIRE-STOPPING MATERIALS
   3. PAINT
   4. SEALANT

PART 2: PRODUCTS

2.1 ACCESS DOORS

A. FURNISH ACCESS PANELS FOR ACCESS TO CONCEALED PLUMBING EQUIPMENT, VALVES, CLEANOUTS, OR ANY OTHER SERVICEABLE DEVICES. ACCESS PANELS SHALL NOT BE REQUIRED IN REMOVABLE TILE CEILINGS.

B. THE SIZE OF ACCESS PANELS SHALL BE 12" x 12" MINIMUM OR AS REQUIRED. PANELS SHALL BE FACTORY FABRICATED COMPLETELY FLUSH WITH HEAVY METAL DOOR AND FRAME. FRAMES SHALL BE WELDED CONSTRUCTION OF NOT LESS THAN 14 Ga. STEEL, WITH HEAVY PIANO TYPE HINGES SET FLUSH WITH FRAME, AND SHALL BE SECURED IN THE CLOSED POSITION. IN NO CASE SHALL OPENING OF THE DOOR REQUIRE REMOVAL OF NUTS, BOLTS, SCREWS, WING NUTS, WEDGES OR ANY OTHER SCREWED OR LOOSE DEVICE. ACCESS PANELS SHALL HAVE UL RATING, CONFORMING TO REQUIREMENTS OF AREA IN WHICH IT IS INSTALLED.

C. MANUFACTURERS: MILCOR, JAY R. SMITH, OR EQUAL.

2.2 FIRE-STOPPING MATERIALS

A. FIRESTOP COMPOUND
1. DESCRIPTION: ASME E119 AND UL 263 COMPLIANT FIRESTOP, RED COLOR, UL 1479 LISTED FOR UP TO 4 HOUR FIRE RATING.
2. MANUFACTURER / MODEL: NELSON CMP FIRESTOP COMPOUND OR EQUAL.

B. FIRE RATED PACKING MATERIALS
1. FOAM FIRESTOP
a. DESCRIPTION: INTUMESCENT FIRE BARRIER FOAM, UL LISTED FOR USE IN THROUGH-PENETRATION FIRESTOP SYSTEMS, MAROON COLOR, LOW VOC LEED COMPLIANT, UL 1479 LISTED FOR UP TO 2 HOUR FIRE RATING.
b. MANUFACTURER / MODEL: 3M FIRE BARRIER RATED FOAM 1-STEP OR EQUAL.
2. MINERAL WOOL
a. DESCRIPTION: MINERAL WOOL FIRESTOP PACKING MATERIAL, UL LISTED FOR USE IN THROUGH-PENETRATION FIRESTOP SYSTEMS, GRAY COLOR, 8 PCF, UL 1479 LISTED FOR UP TO 4 HOUR FIRE RATING.
b. MANUFACTURER / MODEL: NELSON FIRESTOP MINERAL WOOL OR EQUAL.
3. WRAP STRIPS
a. DESCRIPTION: TUCK-IN INTUMESCENT WRAP STRIP, UL LISTED FOR USE IN PLASTIC PIPE THROUGH-PENETRATION FIRESTOP SYSTEMS, UL 1479 LISTED FOR UP TO 3 HOUR FIRE RATING.
b. MANUFACTURER / MODEL: 3M FIRE BARRIER TUCK-IN WRAP STRIPS (NOT TO BE USED FOR CPVC), 3M FIRE BARRIER WRAP ULTRA GS, OR EQUAL.
4. ALTERNATE PACKING MATERIAL
a. DESCRIPTION: INORGANIC WOVEN PACKING MATERIAL TO BE USED IN LIEU OF MINERAL WOOL, UL LISTED FOR USE IN THROUGH-PENETRATION FIRESTOP SYSTEMS, OFF-WHITE COLOR, 8 PCF, UL 1479 LISTED FOR UP TO 4 HOUR FIRE RATING.
b. MANUFACTURER / MODEL: 3M FIRE BARRIER PACKING MATERIAL PM4 OR EQUAL.

C. PREFABRICATED FIRESTOP COLLAR ASSEMBLIES
1. DESCRIPTION: FACTORY FABRICATED FIRE WRAP AND COLLAR ASSEMBLY, GALVANIZED STEEL HOUSING, INTUMESCENT FIRE WRAP, UL LISTED FOR PLASTIC PIPE THROUGH-PENETRATION FIRESTOP SYSTEMS, LOW VOC LEED COMPLIANT, UL 1479 LISTED FOR UP TO 3 HOUR FIRE RATING.
2. MANUFACTURER / MODEL: HILTI CP 643 OR CP 644, 3M PPD, OR EQUAL.

D. FIRE RATED SEALANT
1. SEE SEALANT PRODUCTS SECTION BELOW.

2.3 PAINT

A. CARBON STEEL NATURAL GAS PIPING
1. DESCRIPTION: ASTM D3730 COMPLIANT WATER BASED CATALYZED EPOXY PAINT, SAFETY YELLOW COLOR, SEMI-GLOSS FINISH, FDA AND USDA APPROVED, LOW VOC LEED COMPLIANT.
2. MANUFACTURER / MODEL: SHERWIN WILLIAMS WATER BASED CATALYZED EPOXY PAINT OR EQUAL.

2.4 SEALANT

A. FIRE RATED SILICONE SEALANT
1. DESCRIPTION: FIRE BARRIER WATER TIGHT INTUMESCENT SILICONE SEALANT, RED OR LIGHT GRAY COLOR, ASTM G21 FUNGI RESISTANCE, LOW VOC LEED COMPLIANT, UL 1479 LISTED FOR UP TO 4 HOUR FIRE RATING.
2. MANUFACTURER / MODEL: 3M FB-3000 WT, HILTI FS ONE MAX, OR EQUAL.

B. SILICONE SEALANT (NON-FIRE RATED)

1. DESCRIPTION: ASTM C719 JOINT MOVEMENT, WHITE COLOR, USDA AND FDA APPROVED, LOW VOC LEED COMPLIANT.
2. MANUFACTURER / MODEL: GE SCS1000 OR EQUAL.

PART 3: EXECUTION

3.1 GENERAL REQUIREMENTS

A. REFER TO MANUFACTURER INSTALLATION DOCUMENTATION FOR ADDITIONAL INFORMATION ON EACH OF THE PRODUCTS SPECIFIED HEREUNDER.

B. PRE-CLEAN: BEFORE APPLYING FIRE-STOPPING MATERIALS, SEALANTS, AND PAINT, SURFACE MUST BE CLEAN, DRY, AND IN SOUND CONDITION. REMOVE ALL OIL, DUST, GREASE, DIRT, LOOSE RUST, AND OTHER FOREIGN MATERIAL TO ENSURE ADEQUATE ADHESION.

C. ONLY APPLY FIRE-STOPPING MATERIALS, SEALANTS, AND PAINT WHEN TEMPERATURE AND HUMIDITY CONDITIONS ARE WITHIN RANGES SPECIFIED BY THE PRODUCT MANUFACTURER.

3.2 ACCESS DOORS

A. REFER TO MANUFACTURER INSTALLATION DOCUMENTS AND DETAILS PROVIDED ON DRAWINGS.

3.3 FIRE-STOPPING MATERIALS

A. APPLY FIRE-STOPPING FOR FIRE-RATED PENETRATIONS AS SPECIFIED IN PART 3 OF SECTION *22 10 00 – PLUMBING PIPING* AND AS SHOWN ON DETAILS.

B. SURFACE PREPARATION

1. PRE-CLEAN: SEE 3.1 GENERAL REQUIREMENTS.

C. APPLICATION

1. FILL FIRE-RATED PENETRATION VOIDS AS SPECIFIED IN PART 3 OF SECTION *22 10 00 – PLUMBING PIPING* AND AS SHOWN ON DETAILS.

3.4 PAINTING

A. APPLY PAINT WHERE SPECIFIED IN OTHER SECTIONS AND AS SPECIFIED ON DRAWINGS.

B. APPLICATION EQUIPMENT

1. NYLON/POLYESTER BRUSH

C. SURFACE PREPARATION

1. DO NOT USE HYDROCARBON SOLVENT FOR CLEANING.
2. PRE-CLEAN: SEE 3.1 GENERAL REQUIREMENTS.
3. SOLVENT CLEAN: PER SSPC-SP1
4. POWER TOOL CLEAN: PER SSPC-SP3

D. PRIMING

1. APPLY PRIMER ON CLEANED BARE EXTERIOR PIPE SURFACES AT RECOMMENDED FILM THICKNESS AND SPREADING RATE AS INDICATED BY PRIMER MANUFACTURER.

E. FINISH COATING

1. APPLY FINISH COATING ON EXPOSED SURFACES AT RECOMMENDED FILM THICKNESS AND SPREADING RATE AS INDICATED BY PAINT MANUFACTURER.

3.5 SEALANT

A. APPLY SEALANT WHERE SPECIFIED IN OTHER SECTIONS AND AS SHOWN ON DETAILS.

B. SURFACE PREPARATION

1. PRE-CLEAN: SEE 3.1 GENERAL REQUIREMENTS.
2. SOLVENT CLEAN: ISOPROPYL DAMPENED LINT-FREE CLEANING RAG.

C. MASKING

1. MASK SURFACES TO ELIMINATE OVERSPREAD. REMOVE MASKING TAPE IMMEDIATELY AFTER TOOLING SEALANT.

D. APPLICATION

1. APPLY SEALANT IN A CONTINUOUS OPERATION TO PROPERLY FILL THE SEAM, CAVITY, OR JOINT.
2. TOOL SEALANT TO SPREAD EVENLY AND NEATLY.

END OF SECTION

SECTION 22 05 19
METERS AND GAUGES FOR PLUMBING PIPING

PART 1: GENERAL

1.1 SUMMARY

A. THE WORK OF THIS SECTION SHALL INCLUDE:

1. THERMOMETERS
2. PRESSURE GAUGES

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. THE FOLLOWING REFERENCED SECTIONS ARE LISTED AS A MINIMUM OF ADDITIONAL REQUIREMENTS AND/OR WORK NOT INCLUDED IN THIS SECTION WHICH MAY BE REQUIRED TO BE PERFORMED UNDER OTHER DESIGNATED SECTIONS:

1. *22 05 23 – GENERAL DUTY VALVES FOR PLUMBING PIPING*
2. *22 07 00 – PLUMBING INSULATION*
3. *22 10 00 – PLUMBING PIPING*
4. *22 30 00 – PLUMBING EQUIPMENT*

1.3 REFERENCE STANDARDS

A. ASME (AMERICAN SOCIETY OF MECHANICAL ENGINEERS)

1. B40.100 PRESSURE GAUGES AND GAUGE ATTACHMENTS
2. B40.200 THERMOMETERS, DIRECT READING AND REMOTE READING

B. ASTM (ASTM INTERNATIONAL)

1. E1-03A STANDARD SPECIFICATION FOR ASTM THERMOMETERS

1.4 SUBMITTALS

A. SUBMITTALS SHALL BE SUBMITTED IN CONFORMANCE WITH THE REQUIREMENTS OF SECTION *22 00 01 – PLUMBING GENERAL PROVISIONS*.

B. SUBMITTALS ARE REQUIRED FOR:

1. THERMOMETERS
2. PRESSURE GAUGES

PART 2: PRODUCTS

2.1 MANUFACTURERS

A. ALL GAUGES SHALL BE AS MANUFACTURED BY ASHCROFT, MARSH BELLOFRAM, WEISS INSTRUMENTS, OR APPROVED EQUAL.

2.2 THERMOMETERS

A. WATER SYSTEMS

1. OFFICE AND RESIDENTIAL AREAS
    a. ASME B40.200 BI-METALLIC TYPE, ALUMINUM CASE AND STEM, CENTER BACK 1/2" NPT CONNECTION.
    b. DIAL: 2 1/2" DIAMETER, WHITE BACKGROUND WITH BLACK AND RED MARKINGS, ALUMINUM BLACK PAINTED POINTER.
    c. STEM LENGTH: SIZE ACCORDING TO MANUFACTURER INSTALLATION INSTRUCTIONS AND PIPE SIZE WHERE INSTALLED.
    d. ACCURACY: 1% FULL SCALE.
    e. RANGE: 30°F – 250°F
    f. MANUFACTURER / MODEL: MARSH BELLOFRAM L8004-1 OR EQUAL.
2. INDUSTRIAL AREAS (FOOD PRODUCTION, UTILITY AREAS, EXTERIOR, ETC.)
    a. ASME B40.200 304 S.S. HERMETICALLY SEALED IP66 CASE AND STEM, .25” STEM DIAMETER, 1/2" MALE NPT CONNECTION.
    b. DIAL: 3” DIAMETER, ADJUSTABLE, POLYCARBONATE WINDOW, BLACK POINTER AND BLACK FIGURES ON WHITE BACKGROUND.
    c. STEM LENGTH: SIZE ACCORDING TO MANUFACTURER INSTALLATION INSTRUCTIONS AND PIPE SIZE WHERE INSTALLED.
    d. ACCURACY: 1% FULL SCALE, ASME GRADE 1.
    e. RANGE: 30°F – 250°F
    f. MANUFACTURER / MODEL: ASHCROFT EL SERIES OR EQUAL.

2.3 THERMOMETER FITTINGS

A. WATER SYSTEMS
1. COPPER PIPE INSTALLATION
a. THERMOWELL: 1/2" MALE NPT PIPE CONNECTION DESIGNED FOR STEM DIAMETER AND STEM LENGTH OF THERMOMETER WHERE THERMOWELL IS INSTALLED. MATCH THERMOWELL MATERIAL WITH THERMOMETER STEM MATERIAL.
b. CONNECTION TO PIPE
1) 2" PIPE AND SMALLER: LINE SIZE x 1/2" COPPER FEMALE NPT REDUCING TEE (C x F x C).
2) 2 1/2" – 3" PIPE: LINE SIZE x 3/4" COPPER REDUCING TEE (C x C x F) AND 3/4" TO 1/2" FEMALE NPT ADAPTER TRANSITION FITTING.
2. STEEL PIPE INSTALLATION
a. THERMOWELL: 1/2" MALE NPT PIPE CONNECTION, [STRAIGHT, STEPPED, OR TAPERED] TYPE, 304 S.S. CONSTRUCTION. BORE, LENGTH, AND INSTRUMENT CONNECTION SIZED FOR CORROSPONDING THERMOMETER AT LOCATION WHERE INSTALLED.
b. CONNECTION TO PIPE
1) 2" PIPE AND SMALLER: 3"LONG x THERMOWELL THREAD SIZED ELBOLET.
2) 2 1/2" PIPE AND LARGER: 1/2" S.S. NPT THREADED FEMALE OUTLET FITTING WELDED TO PIPE. THREAD LENGTH SIZED SO NO THREADS ARE EXPOSED WHEN THERMOWELL IS INSTALLED.
3. DISSIMILAR PIPE CONNECTIONS
a. PROVIDE DIELECTRIC UNIONS WHERE THERMOWELL AND PIPE CONNECTION FITTINGS ARE DISSIMILAR METALS THAT COULD CAUSE ELECTROLYTIC CORROSION. INCLUDE LENGTH OF DIELECTRIC UNION WHEN SELECTING THERMOMETER STEM SIZE.
4. INSULATED PIPES
a. PROVIDE EXTENSION PIECE OR THERMOWELL LAG LENGTH AS REQUIRED FOR THERMOMETERS TO BE COMPLETELY EXPOSED AND SERVICEABLE WITHOUT MODIFICATION TO THE INSULATION SYSTEM.

2.4 PRESSURE GAUGES
A. WATER SYSTEMS
1. OFFICE AND RESIDENTIAL AREAS
a. ASME B40.100 BRONZE BOURDON TUBE TYPE, BLACK PAINTED ALUMINUM CASE, BRASS 1/4" NPT BOTTOM CONNECTION.
b. DIAL: 4 1/2" DIAMETER, ADJUSTABLE BLACK ALUMINUM POINTER, BLACK FIGURES ON WHITE ALUMINUM BACKGROUND, PLASTIC WINDOW.
c. ACCURACY: 2%-1%-2%, ASME GRADE A.
d. RANGE: 0 PSI – 160 PSI
e. MANUFACTURER / MODEL: ASHCROFT TYPE 2071A OR EQUAL.
2. INDUSTRIAL AREAS (FOOD PRODUCTION, UTILITY AREAS, EXTERIOR, ETC.)
a. ASME B40.100 316L S.S. BOURDON TUBE TYPE WITH 304 S.S. CASE AND RING, 316L S.S. 1/2" BOTTOM MALE NPT CONNECTION, GLYCERIN LIQUID FILLED.
b. DIAL: 3 1/2" DIAMETER, FRICTION ADJUST BLACK POINTER, BLACK FIGURES ON WHITE BACKGROUND, POLYCARBONATE WINDOW.
c. ACCURACY: 1% FULL SCALE, ASME GRADE 1A.
d. RANGE: 0 PSI – 160 PSI
e. MANUFACTURER / MODEL: ASHCROFT TYPE 1009SW SERIES OR EQUAL.
B. NATURAL GAS SYSTEMS
1. OFFICE AND RESIDENTIAL AREAS
a. USE GAUGE FROM INDUSTRIAL AREAS SECTION BELOW.
2. INDUSTRIAL AREAS (FOOD PRODUCTION, UTILITY AREAS, EXTERIOR, ETC.)

a. ASME B40.100 BELLOWS TYPE WITH IP54 BLACK PHENOLIC CASE, POLYPROPYLENE RING, BRASS 1/4" BOTTOM MALE NPT SOCKET CONNECTION.
b. DIAL: 4 1/2" DIAMETER, MICROMETER ADJUSTABLE POINTER, WHITE ALUMINUM BACKGROUND WITH BLACK MARKINGS, ACRYLIC WINDOW.
c. ACCURACY: 2%-1%-2%, ASME GRADE A.
d. RANGE: 0 – 2x OPERATING PRESSURE WHERE GAUGE IS INSTALLED. GAUGE SHALL READ IN INCHES W.C. FOR LOW PRESSURE SYSTEMS AND PSI FOR MEDIUM AND HIGH PRESSURE SYSTEMS.
e. MANUFACTURER / MODEL: ASHCROST TYPE 1188 OR EQUAL.

2.5 PRESSURE GAUGE FITTINGS

A. WATER SYSTEMS

1. COPPER PIPE INSTALLATION
   a. SNUBBERS: EXTENDED STEM BRASS BUSHING DISC TYPE, NPT THREADS TO MATCH THREAD SIZE OF PRESSURE GAUGE.
   b. VALVES: 1/2" BALL VALVE.
   c. PROVIDE TRANSITION FITTING BETWEEN VALVE AND SNUBBER WHEN DISSIMILAR THREAD SIZES/TYPES ARE USED.
   d. CONNECTION TO PIPE
      1) 2” PIPE AND SMALLER: LINE SIZE x 1/2" COPPER FEMALE NPT REDUCING TEE (C x C x F) AND NIPPLE EXTENSION.
      2) 2 1/2" – 3" PIPE: LINE SIZE x 3/4" COPPER REDUCING TEE (C x C x F) AND 3/4" TO 1/2" NPT ADAPTER TRANSITION FITTING.
2. STEEL PIPE INSTALLATION
   a. SNUBBERS: 316 S.S. FILTER DISK, 304 S.S. HOUSING, NPT THREADS TO MATCH THREAD SIZE OF PRESSURE GAUGE. ASHCROFT 1112 SERIES OR EQUAL.
   b. PROVIDE S.S. TRANSITION FITTING BETWEEN VALVE AND SNUBBER WHEN DISSIMILAR THREAD SIZES/TYPES ARE USED.
   c. VALVES: 1/2" S.S. BALL VALVE.
   d. CONNECTION TO PIPE
      1) 2” PIPE AND SMALLER: LINE SIZE x 1/2" S.S. REDUCING TEE. 1/2" S.S. NIPPLE ADAPTER FITTING WELDED TO REDUCING TEE WITH THREAD LENGTH SIZED SO NO THREADS ARE EXPOSED WHEN VALVE IS INSTALLED.
      2) 2 1/2" PIPE AND LARGER: 1/2" S.S. FEMALE NPT THREADED OUTLET FITTING WELDED TO PIPE. THREAD LENGTH SIZED SO NO THREADS ARE EXPOSED WHEN VALVE IS INSTALLED.
3. DISSIMILAR PIPE CONNECTIONS
   a. PROVIDE DIELECTRIC UNIONS WHERE PRESSURE GAUGE AND PIPE CONNECTION FITTINGS ARE DISSIMILAR METALS THAT COULD CAUSE ELECTROLYTIC CORROSION.
4. INSULATED PIPES
   a. PROVIDE EXTENSION PIECE AS REQUIRED FOR PRESSURE GAUGES AND SERVICE VALVES TO BE COMPLETELY EXPOSED AND SERVICEABLE WITHOUT MODIFICATION TO THE INSULATION SYSTEM.

B. NATURAL GAS SYSTEMS

1. STEEL PIPE INSTALLATION
   a. VALVES: 1/4" BALL VALVE.
   b. CONNECTION TO PIPE: 1/4" WELDED PRESSURE GAUGE PORT WITH THREADED END FOR CONNECTION TO SERVICING VALVE.
   c. IN LOCATIONS WHERE THE PRESSURE GAUGE PORT AND SERVICING VALVE IS INSTALLED BUT THE PRESSURE GAUGE IS NOT PERMANENTLY INSTALLED, PROVIDE 1/4" FEMALE NPT COUPLING AND THREADED PLUG (SUCH THAT THE

PLUG CAN BE REMOVED AND A GAUGE CAN BE INSERTED EASILY IN THE FUTURE).

PART 3: EXECUTION

3.1 GENERAL REQUIREMENTS

A. INSTALL GAUGES AND ACCESSORIES IN ACCORDANCE WITH MANUFACTURERS' WRITTEN INSTRUCTIONS AND AS SHOWN ON DRAWINGS.

B. ENSURE FITTINGS, GAUGES, AND ACCESSORIES ARE CLEAN AND FREE FROM DEBRIS BEFORE INSTALLATION.

C. UPON COMPLETION OF WORK, TURN OVER TO OWNER TWO (2) ADDITIONAL NATURAL GAS PRESSURE GAUGES OVER THE AMOUNT USED ON THE PROJECT.

3.2 ADJUSTING

A. ADJUST POSITION AND TILT OF GAUGES FOR EASE OF OBSERVATION, SERVICING, AND REPLACEMENT. WHERE GAUGES SERVE EQUIPMENT, FIXTURES, ETC., PLACE GAUGES AT THE SAME FLOOR LEVEL AS THE EQUIPMENT, FIXTURES, ETC. IN A VISIBLE AND EASILY ACCESSIBLE LOCATION.

3.3 CALIBRATION AND TESTING

A. CALIBRATE GAUGES REQUIRING CALIBRATION.

B. TEST GAUGES AND ACCESSORIES IN ACCORDANCE WITH MANUFACTURERS' PROCEDURES AND CONFIRM GAUGE READING IS WITHIN MANUFACTURER SPECIFIED TOLERANCES.

C. TROUBLESHOOT TESTING ISSUES DISCOVERED. REPLACE FAULTY GAUGES AND ACCESSORIES AS REQUIRED. RE-TEST TO CONFIRM ISSUES HAVE BEEN RESOLVED. REPEAT AS REQUIRED UNTIL ALL GAUGES AND ACCESSORIES ARE OPERATING AS INTENDED AND TO THE SATISFACTION OF THE OWNER.

3.4 CLEANING

A. CLEAN GAUGE WINDOWS AND EXPOSED SURFACES AFTER INSTALLATION.

B. REPLACE GAUGES WITH SCRATCHED OR BROKEN WINDOWS, CASES, OR OTHER DAMAGED PARTS, EVEN IF SUCH PARTS ONLY SERVE AESTHETIC PURPOSES.

END OF SECTION

SECTION 22 05 23
GENERAL DUTY VALVES FOR PLUMBING PIPING

PART 1: GENERAL

1.1 SUMMARY

A. THE WORK OF THIS SECTION SHALL INCLUDE:

1. NEEDLE VALVES
2. BACKWATER VALVES
3. BALANCING VALVES
4. BALL VALVES
5. BUTTERFLY VALVES
6. CHECK VALVES
7. GATE VALVES
8. GLOBE VALVES
9. PLUG VALVES

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. THE FOLLOWING REFERENCED SECTIONS ARE LISTED AS A MINIMUM OF ADDITIONAL REQUIREMENTS AND/OR WORK NOT INCLUDED IN THIS SECTION WHICH MAY BE REQUIRED TO BE PERFORMED UNDER OTHER DESIGNATED SECTIONS:

1. *22 05 19 – METERS AND GAUGES FOR PLUMBING PIPING*
2. *22 07 00 – PLUMBING INSULATION*
3. *22 10 00 – PLUMBING PIPING*
4. *22 30 00 – PLUMBING EQUIPMENT*
5. *22 40 00 – PLUMBING FIXTURES*

1.3 REFERENCE STANDARDS

A. AGA (AMERICAN GAS ASSOCIATION)

B. ANSI (AMERICAN NATIONAL STANDARDS INSTITUTE)

1. Z21.15 MANUALLY OPERATED GAS VALVES FOR APPLIANCES, APPLIANCE CONNECTOR VALVES AND HOSE END VALVES
2. Z21.21 AUTOMATIC VALVES FOR GAS APPLIANCES
3. Z21.70 EARTHQUAKE ACTUATED AUTOMATIC GAS SHUTOFF SYSTEMS

C. ASME (AMERICAN SOCIETY OF MECHANICAL ENGINEERS)

1. A112.14.1 BACKWATER VALVES
2. A112.4.14 MANUALLY OPERATED, QUARTER-TURN SHUTOFF VALVES FOR USE IN PLUMBING SYSTEMS
3. A112.18.1 PLUMBING SUPPLY FITTINGS
4. B1.20.1 PIPE THREADS, GENERAL PURPOSE, INCH
5. B16.1 GRAY IRON PIPE FLANGES AND FLANGED FITTINGS
6. B16.5 PIPE FLANGES AND FLANGED FITTINGS
7. B16.33 MANUALLY OPERATED METALLIC GAS VALVES FOR USE IN GAS PIPING SYSTEMS UP TO 125 PSI (SIZES NPS 1/2" THROUGH NPS 2")
8. B16.34 VALVES FLANGED, THREADED AND WELDING END
9. B16.38 LARGE METALLIC VALVES FOR GAS DISTRIBUTION (MANUALLY OPERATED NPS-2 1/2 TO 12, 125 PSIG MAX)
10. B31.1 POWER PIPING
11. B31.9 BUILDING SERVICES PIPING

D. CSA (COMPLIANCE SAFETY ACCOUNTABILITY)

E. FM GLOBAL (FACTORY MUTUAL INSURANCE COMPANY)

1. 1-11 FIRE FOLLOWING EARTHQUAKES
2. 7-54 NATURAL GAS AND GAS PIPING

F. NFPA (NATIONAL FIRE PROTECTION ASSOCIATION)

1. NFPA 54 NATIONAL FUEL GAS CODE

G. NSF (NSF INTERNATIONAL)

1. 14 PLASTICS PIPING SYSTEM COMPONENTS AND RELATED MATERIALS
2. 61 DRINKING WATER SYSTEM COMPONENTS – HEALTH EFFECTS

3. 372 LEAD CONTENT CERTIFICATION

H. UL (UNDERWRITER'S LABORATORIES)

1.4 SUBMITTALS

A. SUBMITTALS SHALL BE SUBMITTED IN CONFORMANCE WITH THE REQUIREMENTS OF SECTION *22 00 01 – PLUMBING GENERAL PROVISIONS*.

B. SUBMITTALS ARE REQUIRED FOR:

1. NEEDLE VALVES
2. BACKWATER VALVES
3. BALANCING VALVES
4. BALL VALVES
5. BUTTERFLY VALVES
6. CHECK VALVES
7. GATE VALVES
8. GLOBE VALVES
9. PLUG VALVES

PART 2: PRODUCTS

2.1 MANUFACTURERS

A. METALLIC VALVES SHALL BE AS MANUFACTURED BY ALOYCO, APOLLO, BELL & GOSSETT, BRAY, CRANE, JENKINS, NIBCO, NORDSTROM, STOCKHAM, WATTS, WORCESTER, OR APPROVED EQUAL.

B. PLASTIC VALVES SHALL BE AS MANUFACTURED BY GEORG FISCHER, IPEX, SPEARS, OR APPROVED EQUAL.

2.2 GENERAL REQUIREMENTS

A. WHERE VALVES ARE INSTALLED ON INSULATED PIPING SYSTEMS, PROVIDE STEM EXTENSION SUCH THAT THE VALVE STEM AND HANDLE CAN BE OPERATED FREELY WITHOUT INTERFERENCE WITH THE INSULATION SYSTEM. PROVIDE A PROTECTIVE SLEEVE THAT ALLOWS OPERATION OF THE VALVE WITHOUT BREAKING THE VAPOR SEAL OR DISTURBING THE INSULATION.

2.3 NEEDLE VALVES

A. CARBON STEEL PIPE

1. 3/4" PIPE AND SMALLER: CLASS 200 BRONZE BODY, UNION BONNET, RISING STEM, NON-ASBESTOS PACKING, THREADED END CONNECTIONS AND BRASS HANDWHEEL. STOCKHAM B-64 OR EQUAL.

2.4 BACKWATER VALVES

A. PVC PIPE (DWV)

1. 6" PIPE AND SMALLER: ASME/ANSI A112.14.1 PVC BODY INTERNAL FLAPPER ASSEMBLY TYPE WITH EPDM SEAT AND SOCKET END CONNECTIONS. PROVIDE WITH EXTENSION KIT. SPEARS S275P SERIES OR EQUAL.

2.5 BALANCING VALVES

A. COPPER TUBING

1. 3" PIPE AND SMALLER: LEAD FREE BRASS BODY, TYPE 304 S.S. BELL, TFE SEAT RINGS, EPDM STEM SEAL AND SOLDER JOINT OR THREADED NPT END CONNECTIONS. BELL & GOSSETT CIRCUIT SETTER PLUS SERIES OR EQUAL.

B. STAINLESS STEEL PIPE

1. 3" PIPE AND SMALLER: USE SAME BALANCING VALVE FOR COPPER TUBING ABOVE. PROVIDE DIELECTRIC CONNECTIONS FOR TRANSITION FROM BALANCING VALVE MATERIAL TO STAINLESS STEEL PIPE.

2.6 BALL VALVES

A. CARBON STEEL PIPE

1. 1 1/2" PIPE AND SMALLER: TWO PIECE CARBON STEEL BODY, TYPE 304 S.S. FULL PORT BALL, 1000 PSIG WOG, COLD NON-SHOCK, REINFORCED PTFE SEATS, THREADED END CONNECTIONS, LEVER OPERATED. APOLLO 89-100 SERIES OR EQUAL.

2. 1 1/2" PIPE AND SMALLER: TWO PIECE BRONZE BODY, 600 PSIG WOG, CHROME-PLATED BRASS BALL, TEFLON SEAT, THREADED END CONNECTIONS, LEVER OPERATED. APOLLO 70-100 SERIES OR EQUAL.
3. 2" – 4" PIPE: CARBON STEEL BODY, TYPE 316 S.S. BALL AND STEM, FIRESAFE (API 607), TEFLON SEAT AND SEALS, ANSI CLASS 150 FLANGED END CONNECTIONS, LEVER OPERATED. WORCESTER AF51 OR EQUAL.

B. COPPER TUBING
1. 3" PIPE AND SMALLER: LEAD FREE COPPER SILICON ALLOY BODY, TYPE 316 S.S. BALL, PTFE SEALS AND SEATS, RATED FOR 600 PSIG WOG, THREADED OR SOLDERED END CONNECTIONS. WATTS SERIES LFB6000 AND LFB6001 OR EQUAL.

C. CPVC PIPE
1. CPVC BODY, BALL, STEM, AND SEAL CARRIER. POLYPROPYLENE STEM BEARING, HANDLE AND HANDLE LOCK. EPDM SEAL RINGS. PTFE SEAT. SOCKET END CONNECTIONS WITH INTEGRAL UNION NUT. SPEARS TRUE UNION 2000 INDUSTRIAL BALL VALVE OR EQUAL.

D. POLYPROPYLENE PIPE
1. 6" PIPE AND SMALLER: POLYPROPYLENE CONSTRUCTION, PTFE SEAT, EPDM SEAL, THREADED, FLANGED, OR FUSION SOCKET END CONNECTIONS, LEVER OPERATED. GEORG FISCHER TYPE 546 BALL VALVE OR EQUAL.

E. PVC PIPE
1. PVC BODY, BALL, STEM, AND SEAL CARRIER. POLYPROPYLENE STEM BEARING, HANDLE AND HANDLE LOCK. EPDM SEAL RINGS. PTFE SEAT. SOCKET END CONNECTIONS WITH INTEGRAL UNION NUT. SPEARS TRUE UNION 2000 INDUSTRIAL BALL VALVE OR EQUAL.

F. STAINLESS STEEL PIPE
1. 1 1/2" PIPE AND SMALLER: TYPE 316 S.S. TWO PIECE BODY, BALL, AND STEM, TEFLON SEATS AND SEALS, THREADED END CONNECTIONS, LEVER ACTUATED. APOLLO 76-100 SERIES OR EQUAL.
2. 2 " – 3" PIPE: TYPE 316 S.S. BODY, BALL, AND STEM, PTFE SEATS AND SEALS, ASME CLASS 150 FLANGED END CONNECTIONS, LEVER OPERATED. APOLLO 87A-200 SERIES OR EQUAL.

2.7 BUTTERFLY VALVES

A. CPVC PIPE
1. 8" PIPE AND SMALLER: CPVC BODY, EPDM SEAT AND SEALS, ISOLATED TYPE 316 S.S. STEM, POLYPROPYLENE LEVER HANDLE, S.S. LUG INSERTS, ANSI B16.5 CLASS 150 BOLT PATTERN. SPEARS LUG INSERT BUTTERFLY VALVE OR EQUAL.
2. 10" PIPE AND LARGER: CPVC BODY, EPDM SEAT AND SEALS, ISOLATED TYPE 316 S.S. STEM, GEAR OPERATOR WITH CAST ALUMINUM HOUSING, POLYPROPYLENE HANDWHEEL, S.S. LUG INSERTS, ANSI B16.5 CLASS 150 BOLT PATTERN. SPEARS LUG INSERT BUTTERFLY VALVE OR EQUAL.

B. POLYPROPYLENE PIPE
1. 8" PIPE AND SMALLER: UV STABILIZED POLYPROPYLENE BODY, EPDM SEAT AND SEALS, ISOLATED TYPE 316 S.S. STEM, POLYPROPYLENE LEVER HANDLE, ANSI B16.5 CLASS 150 BOLT PATTERN. SPEARS POLYPROPYLENE BUTTERFLY VALVE OR EQUAL.
2. 10" PIPE AND LARGER: UV STABILIZED POLYPROPYLENE BODY, EPDM SEAT AND SEALS, ISOLATED TYPE 316 S.S. STEM, GEAR OPERATOR WITH CAST ALUMINUM HOUSING, POLYPROPYLENE HANDWHEEL, ANSI B16.5 CLASS 150 BOLT PATTERN. SPEARS POLYPROPYLENE BUTTERFLY VALVE OR EQUAL.

C. PVC PIPE
1. 8" PIPE AND SMALLER: PVC BODY, EPDM SEAT AND SEALS, ISOLATED TYPE 316 S.S. STEM, POLYPROPYLENE LEVER HANDLE, S.S. LUG INSERTS, ANSI B16.5 CLASS 150 BOLT PATTERN. SPEARS LUG INSERT BUTTERFLY VALVE OR EQUAL.
2. 10" PIPE AND LARGER: PVC BODY, EPDM SEAT AND SEALS, ISOLATED TYPE 316 S.S. STEM, GEAR OPERATOR WITH CAST ALUMINUM HOUSING, POLYPROPYLENE HANDWHEEL, S.S.

LUG INSERTS, ANSI B16.5 CLASS 150 BOLT PATTERN. SPEARS LUG INSERT BUTTERFLY VALVE OR EQUAL.

D. STAINLESS STEEL PIPE
   1. 6" PIPE AND SMALLER: WAFER OR LUG TYPE, HIGH PERFORMANCE, ANSI B16.5 CLASS 150 BOLT PATTERN, TYPE 316 CAST S.S. BODY, FORGED TYPE 316 S.S. SHAFT AND DISC, REINFORCED PTFE SEAT AND SEALS, LEVER OPERATED. BRAY SERIES 20/21 OR EQUAL.
   2. 8" PIPE AND LARGER: WAFER OR LUG TYPE, HIGH PERFORMANCE, ANSI B16.5 CLASS 150 BOLT PATTERN, TYPE 316 CAST S.S. BODY, FORGED TYPE 316 S.S. SHAFT AND DISC, REINFORCED PTFE SEAT AND SEALS, GEAR OPERATED. BRAY SERIES 20/21 OR EQUAL.

2.8 CHECK VALVES

A. CARBON STEEL PIPE
   1. 1 1/2" PIPE AND SMALLER: BALL CONE CHECK TYPE, 316 S.S. CONSTRUCTION, S.S. SPRING, RPTFE BALL CHECK, 400 PSIG WOG, THREADED END CONNECTIONS. APOLLO 62-100 SERIES OR EQUAL.
   2. 2" PIPE AND LARGER: SWING CHECK TYPE, 316 S.S. BODY AND TRIM, BOLTED BONNET, PTFE SEALS AND GASKETS, ANSI CLASS 150 FLANGED END CONNECTIONS. ALOYCO 377 SERIES OR EQUAL.

B. COPPER TUBING
   1. 1 1/2" PIPE AND SMALLER: SWING CHECK TYPE, LEAD FREE BRONZE SILICONE ALLOY CONSTRUCTION, PTFE DISC, 200 PSI NON-SHOCK COLD WORKING PRESSURE AND CLASS 125 THREADED END CONNECTIONS OR SOLDER END CONNECTIONS. NIBCO T-413-Y-LF AND S-413-Y-LF SERIES OR EQUAL.
   2. 1 1/2" PIPE AND SMALLER: IN-LINE LIFT TYPE, LEAD FREE BRONZE SILICONE ALLOY CONSTRUCTION, PTFE DISC, 250 PSI NON-SHOCK COLD WORKING PRESSURE AND CLASS 125 THREADED END CONNECTIONS OR SOLDER END CONNECTIONS. NIBCO T-480-Y-LF AND S-480-Y-LF SERIES OR EQUAL.
   3. 2" – 3" PIPE: BALL CONE CHECK TYPE, LEAD FREE BRONZE AND BRASS CONSTRUCTION, RPTFE BALL CHECK, STAINLESS STEEL SPRING, 400 PSIG NON-SHOCK COLD WORKING PRESSURE, THREADED END CONNECTIONS. APOLLO 61LF SERIES OR EQUAL.

C. CPVC PIPE
   1. BALL TYPE CHECK VALVES: CHEMICAL AND CORROSION RESISTANT WHITE CPVC, EPDM SEAT, SOCKET END CONNECTIONS WITH INTEGRAL UNION NUT. SPEARS TRUE UNION BALL CHECK VALVE OR EQUAL.
   2. SWING TYPE CHECK VALVES: CHEMICAL AND CORROSION RESISTANT WHITE CPVC, NO METAL PARTS, HIGH GRADE EPDM SEAT WITH WEIGHTED DISC, SOCKET END CONNECTIONS WITH INTEGRAL UNION NUT. SPEARS TRUE UNION UTILITY SWING CHECK VALVE OR EQUAL.
   3. SPRING TYPE CHECK VALVES: CHEMICAL AND CORROSION RESISTANT WHITE CPVC, TYPE 316 S.S. SPRING, HIGH GRADE EPDM SEAT WITH WEIGHTED DISC, SOCKET END CONNECTIONS WITH INTEGRAL UNION NUT. SPEARS TRUE UNION UTILITY SPRING CHECK VALVE OR EQUAL.

D. POLYPROPYLENE PIPE
   1. 4" PIPE AND SMALLER: BALL TYPE CHECK VALVE, POLYPROPYLENE CONSTRUCTION, EPDM SEALS, THREADED, FLANGED, OR FUSION SOCKET END CONNECTIONS. GEORG FISCHER TYPE 561 AND 562 SERIES OR EQUAL.

E. PVC PIPE
   1. BALL TYPE CHECK VALVES: CHEMICAL AND CORROSION RESISTANT WHITE PVC, EPDM SEAT, SOCKET END CONNECTIONS WITH INTEGRAL UNION NUT. SPEARS TRUE UNION BALL CHECK VALVE OR EQUAL.
   2. SWING TYPE CHECK VALVES: CHEMICAL AND CORROSION RESISTANT WHITE PVC, NO METAL PARTS, HIGH GRADE EPDM SEAT WITH WEIGHTED DISC, SOCKET END

CONNECTIONS WITH INTEGRAL UNION NUT. SPEARS TRUE UNION UTILITY SWING CHECK VALVE OR EQUAL.

3. SPRING TYPE CHECK VALVES: CHEMICAL AND CORROSION RESISTANT WHITE PVC, TYPE 316 S.S. SPRING, HIGH GRADE EPDM SEAT WITH WEIGHTED DISC, SOCKET END CONNECTIONS WITH INTEGRAL UNION NUT. SPEARS TRUE UNION UTILITY SPRING CHECK VALVE OR EQUAL.

F. STAINLESS STEEL PIPE

1. 1 1/2" PIPE AND SMALLER: BALL CONE CHECK TYPE, 316 S.S. CONSTRUCTION, S.S. SPRING, RPTFE BALL CHECK, 400 PSIG WOG, THREADED END CONNECTIONS. APOLLO 62-100 SERIES OR EQUAL.
2. 2" PIPE AND LARGER: SWING CHECK TYPE, 316 S.S. BODY AND TRIM, BOLTED BONNET, PTFE SEALS AND GASKETS, ANSI CLASS 150 FLANGED END CONNECTIONS. ALOYCO 377 SERIES OR EQUAL.

2.9 GATE VALVES

A. CARBON STEEL PIPE

1. 1 1/2" PIPE AND SMALLER: CAST IRON BODY, RISING STEM, 200 PSIG CWP, ANSI CLASS 125 FLANGED END CONNECTIONS, HANDWHEEL OPERATED. JENKINS FIGURE 454J OR EQUAL.
2. 2" PIPE AND LARGER: BRONZE BODY, RISING STEM, 200 PSIG CWP, THREADED END CONNECTIONS, HANDWHEEL OPERATED. CRANE FIGURE 428 OR EQUAL.

B. STAINLESS STEEL PIPE

1. 1 1/2" PIPE AND SMALLER: TYPE 316 S.S. BODY, SOLID WEDGE, TEFLON STEM PACKING, ANSI CLASS 150 THREADED END CONNECTIONS, HANDWHEEL OPERATED. ALOYCO 110 OR EQUAL.
2. 2" PIPE AND LARGER: TYPE 316 S.S. BODY, SOLID WEDGE, TEFLON STEM PACKING, ANSI CLASS 150 FLANGED END CONNECTIONS, HANDWHEEL OPERATED. ALOYCO 117 OR EQUAL.

2.10 GLOBE VALVES

A. CARBON STEEL PIPE

1. 1 1/2" PIPE AND SMALLER: BRONZE AND BRASS CONSTRUCTION, PTFE DISC, ASBESTOS FREE PACKING, UNION BONNET, THREADED END CONNECTIONS. STOCKHAM B-22T SERIES OR EQUAL.
2. 2" PIPE AND LARGER: CAST STEEL CONSTRUCTION, BOLTED BONNET, OUTSIDE SCREW & YOKE HANDWHEEL, ANSI CLASS 150 FLANGED END CONNECTIONS. CRANE 143XU SERIES OR EQUAL.

B. STAINLESS STEEL PIPE

1. 1 1/2" PIPE AND SMALLER: TYPE 316 S.S. CONSTRUCTION, PLUG TYPE DISC, PTFE PACKING AND GASKETS, OUTSIDE SCREW & YOKE ALUMINUM HANDWHEEL, CLASS 150 THREADED END CONNECTIONS. ALOYCO 310 SERIES OR EQUAL.
2. 2" PIPE AND LARGER: TYPE 316 S.S. CONSTRUCTION, PLUG TYPE DISC, PTFE PACKING AND GASKETS, OUTSIDE SCREW & YOKE ALUMINUM HANDWHEEL, ANSI CLASS 150 FLANGED END CONNECTIONS. ALOYCO 317 SERIES OR EQUAL.

2.11 PLUG VALVES

A. CARBON STEEL PIPE

1. 1 1/2" PIPE AND SMALLER: TWO-BOLT COVER-TYPE IRON PLUG VALVE, 200 PSIG CWP, WRENCH OPERATED, THREADED END CONNECTIONS. NORDSTROM FIGURE 114 OR EQUAL.
2. 2" – 4" PIPE: TWO-BOLT COVER-TYPE IRON PLUG VALVE, 200 PSIG CWP, WRENCH OPERATED, ASME CLASS 125 FLANGED END CONNECTIONS. NORDSTROM FIGURE 115 OR EQUAL.

3. 6" PIPE AND LARGER: TWO-BOLT COVER-TYPE IRON PLUG VALVE, 200 PSIG CWP, GEAR OPERATED, ASME CLASS 125 FLANGED END CONNECTIONS. NORDSTROM FIGURE 149 OR EQUAL.

PART 3: EXECUTION

3.1 GENERAL REQUIREMENTS

A. INSTALL VALVES IN ACCORDANCE WITH MANUFACTURER INSTALLATION INSTRUCTIONS. WHERE PLUMBING DRAWINGS ARE SCHEMATICALLY DEPICTED, VALVE ORIENTATION (HORIZONTAL VS. VERTICAL) SHALL BE AS DIRECTED BY MANUFACTURER INSTALLATION DOCUMENTATION AND CONFIRMED BY THE PLUMBING CONTRACTOR IN THE FIELD.

B. ALL PIPING SYSTEMS SHALL BE PROVIDED WITH VALVES LOCATED SO THAT THEY CAN EASILY BE OPERATED, REPLACED, AND REPAIRED.

C. EACH FIXTURE, APPLIANCE, OR PIECE OF EQUIPMENT SHALL HAVE A SEPARATE SHUT OFF VALVE, FURNISHED AND INSTALLED, OF APPROVED TYPE FOR SERVICE TO BE CONNECTED TO.

D. LOCATE VALVES ON SUPPLY AND RETURN, AT EACH SIDE OF REGULATING VALVES, EACH SIDE OF PUMPS, EACH SIDE OF METERS, AND ON MAIN BRANCHES.

E. DRAIN VALVES ON SYSTEMS CONTAINING WATER SHALL BE INSTALLED AT THE BASE OF EACH RISER (AFTER THE SHUT OFF VALVE), ON DOWN-FED FIXTURES, AT EQUIPMENT, AND AT SUCH LOCATIONS AS REQUIRED TO ALLOW FOR COMPLETE DRAINAGE OF THE SYSTEM.

F. VALVES SHALL BE LOCATED AS SHOWN ON THE DRAWINGS AND AS HERE-IN-BEFORE SPECIFIED.

3.2 ADJUSTING

A. ADJUST BALANCING VALVES AS REQUIRED TO DISTRIBUTE A CONSISTENT WATER TEMPERATURE THROUGHOUT EACH SEPARATE LOOP.

3.3 TESTING

A. TESTING OF PIPING SYSTEMS IS SPECIFIED IN SECTION *22 10 00 – PLUMBING PIPING*.

B. CONFIRM VALVES HOLD A TIGHT SEAL WHEN SHUTOFF AND OPERATE AS INTENDED FOR THE APPLICATION WHERE INSTALLED. REPLACE FAULTY VALVES WHERE REQUIRED. RE-TEST TO CONFIRM ISSUES HAVE BEEN RESOLVED. REPEAT AS REQUIRED UNTIL ALL VALVES ARE OPERATING AS INTENDED AND TO THE SATISFACTION OF THE OWNER.

END OF SECTION

SECTION 22 05 29
HANGERS AND SUPPORTS FOR PLUMBING PIPING

PART 1: GENERAL

1.1 SUMMARY

A. THE WORK OF THIS SECTION SHALL INCLUDE:

1. PIPE HANGERS
2. PIPE RACKS
3. HANGER RODS
4. HORIZONTAL PIPE WALL SUPPORTS
5. VERTICAL PIPE WALL SUPPORTS
6. FLOOR SUPPORTS
7. ROOF SUPPORTS
8. BUILDING ATTACHMENTS
9. PIPE SHIELDS, SADDLES, AND INSULATED INSERTS

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. THE FOLLOWING REFERENCED SECTIONS ARE LISTED AS A MINIMUM OF ADDITIONAL REQUIREMENTS AND/OR WORK NOT INCLUDED IN THIS SECTION WHICH MAY BE REQUIRED TO BE PERFORMED UNDER OTHER DESIGNATED SECTIONS:

1. *22 07 00 – PLUMBING INSULATION*
2. *22 10 00 – PLUMBING PIPING*

1.3 REFERENCE STANDARDS

A. ASME (AMERICAN SOCIETY OF MECHANICAL ENGINEERS)

1. B31.1 POWER PIPING
2. B31.8 GAS TRANSPORTATION AND DISTRIBUTION PIPING SYSTEMS
3. B31.9 BUILDING SERVICES PIPING

B. AWS (AMERICAN WELDING SOCIETY)

1. D1.1 STRUCTURAL WELDING CODE – STEEL

C. FM GLOBAL (FACTORY MUTUAL INSURANCE COMPANY)

1. 1-11 FIRE FOLLOWING EARTHQUAKES
2. 7-54 NATURAL GAS AND GAS PIPING

D. MSS (MANUFACTURERS STANDARDIZATION SOCIETY)

1. SP-58 PIPE HANGERS AND SUPPORTS – MATERIAL, DESIGN, MANUFACTURE, SELECTION, APPLICATION, AND INSTALLATION
2. SP-69 PIPE HANGERS AND SUPPORTS – SELECTION AND APPLICATION
3. SP-89 PIPE HANGERS AND SUPPORTS – FABRICATION AND INSTALLATION PRACTICES
4. SP-90 GUIDELINES ON TERMINOLOGY FOR PIPE HANGERS AND SUPPORTS

1.4 SUBMITTALS

A. SUBMITTALS SHALL BE SUBMITTED IN CONFORMANCE WITH THE REQUIREMENTS OF SECTION *22 00 01 – PLUMBING GENERAL PROVISIONS*.

B. SUBMITTALS ARE REQUIRED FOR:

1. PIPE HANGERS
2. PIPE RACKS
3. HANGER RODS
4. HORIZONTAL PIPE WALL SUPPORTS
5. VERTICAL PIPE WALL SUPPORTS
6. FLOOR SUPPORTS
7. ROOF SUPPORTS
8. BUILDING ATTACHMENTS
9. PIPE SHIELDS, SADDLES, AND INSULATED INSERTS

C. WHERE HANGERS AND SUPPORT SYSTEMS ARE LOCATED IN FOOD PRODUCTION AREAS, INCLUDE COPY OF USDA LETTER OF APPROVAL FOR INCIDENTAL FOOD CONTRACT.

1.5 SEISMIC DESIGN

A. ALL PIPING SHALL BE HUNG AND SUPPORTED TO ACCOMMODATE THE MAXIMUM RELATIVE STRUCTURAL MOVEMENT AND SEISMIC FORCES AS DEFINED IN THE MASSACHUSETTS PLUMBING REGULATIONS (248 CMR).

B. ALL PIPING SHALL BE PROVIDED WITH SEISMIC RESTRAINTS IN ACCORDANCE WITH THE APPROPRIATE SEISMIC HAZARD LEVEL (SHL) OF THE SEISMIC RESTRAINT MANUAL – GUIDELINES FOR MECHANICAL SYSTEMS, LATEST EDITION, AS PUBLISHED BY SMACNA.

PART 2: PRODUCTS

2.1 MANUFACTURERS

A. HANGERS AND SUPPORTS SHALL BE AS MANUFACTURED BY ANVIL, AWI, BERRINGER, COOPER B-LINE, DIXON, FAB-LOK, GRINNELL, HILTI, OR APPROVED EQUAL (SEE ADDITIONAL MANUFACTURER INFORMATION IN SPECIFIC PRODUCT GROUPS SPECIFIED HEREUNDER).

B. THE USE OF PRE-ENGINEERED METAL SUPPORT SYSTEMS SUCH AS B-LINE, KINDORF, OR UNISTRUT IS NOT ALLOWED IN FOOD PRODUCTION AREAS DUE TO ROLLED EDGES AND SPACED SUPPORT HOLES.

2.2 PRODUCT FINISHES

A. NON-PROCESS AREAS

1. EXPOSED HANGERS AND SUPPORTS SHALL BE PROVIDED WITH A GALVANIZED FINISH.
2. CONCEALED HANGERS AND SUPPORTS SHALL NOT REQUIRE ADDITIONAL COATINGS OR FINISHES.

B. PROCESS AREAS

1. EXPOSED HANGERS AND SUPPORTS SHALL BE CONSTRUCTED OF TYPE 304 STAINLESS STEEL.

C. ELECTROLYTIC CORROSION PREVENTION

1. HANGERS AND SUPPORTS IN DIRECT CONTACT WITH COPPER PIPE AND TUBING SHALL BE PROVIDED WITH A COPPER PLATED FINISH.

2.3 PIPE HANGERS

A. NON-PROCESS AREAS

1. INSULATED PIPING

ALL HANGERS FOR INSULATED PIPES IN NON-PROCESS AREAS SHALL BE SIZED FOR THE TOTAL DIAMETER OF THE PIPE PLUS INSULATION, JACKET, AND PROTECTION SHIELD THICKNESS (I.E. HANGERS SHALL BE INSTALLED AROUND THE PIPE INSULATION SYSTEM).

a. CAST IRON, COPPER, AND PLASTIC PIPE
   1) HOT & COLD SERVICE, 1 1/2" FINISH COVER AND SMALLER: MALLEABLE IRON OR CARBON STEEL ADJUSTABLE SWIVEL, SPLIT RING TYPE. ANVIL FIGURE 104 OR EQUAL.
   2) HOT & COLD SERVICE, OVER 1 1/2" FINISH COVER: CARBON STEEL ADJUSTABLE CLEVIS. ANVIL FIGURE 260 OR EQUAL.

b. STEEL PIPE
   1) COLD SERVICE, 1 1/2" FINISH COVER AND SMALLER: MALLEABLE IRON OR CARBON STEEL ADJUSTABLE SWIVEL, SPLIT RING TYPE. ANVIL FIGURE 104 OR EQUAL.
   2) COLD SERVICE, OVER 1 1/2" FINISH COVER.: CARBON STEEL ADJUSTABLE CLEVIS. ANVIL FIGURE 260 OR EQUAL.
   3) HOT SERVICE, 4" PIPE AND SMALLER: CARBON STEEL ADJUSTABLE CLEVIS. ANVIL FIGURE 260 OR EQUAL.
   4) HOT SERVICE, 6" PIPE AND LARGER: ADJUSTABLE CARBON STEEL YOKE, CAST IRON ROLL. ANVIL FIGURE 181 OR EQUAL.

2. NON-INSULATED PIPING

a. CAST IRON PIPE
   1) 1 1/2" PIPE AND SMALLER: MALLEABLE IRON OR CARBON STEEL ADJUSTABLE SWIVEL, SPLIT RING TYPE. ANVIL FIGURE 104 OR EQUAL.

2) 2" PIPE AND LARGER: CARBON STEEL ADJUSTABLE CLEVIS. ANVIL FIGURE 590 OR EQUAL.

b. COPPER PIPE (DWV)
1) 4" PIPE AND SMALLER: CARBON STEEL COPPER-PLATED LIGHT WEIGHT ADJUSTABLE CLEVIS. ANVIL FIGURE CT-65 OR EQUAL.

c. PLASTIC AND STEEL PIPE
1) 1 1/2" PIPE AND SMALLER: MALLEABLE IRON OR CARBON STEEL ADJUSTABLE SWIVEL, SPLIT RING TYPE. ANVIL FIGURE 104 OR EQUAL.
2) 2" PIPE AND LARGER: CARBON STEEL ADJUSTABLE CLEVIS. ANVIL FIGURE 260 OR EQUAL.

B. PROCESS AREAS
1. REFER TO DETAILS PROVIDED ON THE DRAWINGS.

2.4 PIPE RACKS

A. NON-PROCESS AREAS
1. 1,000 LB LOAD TRAPEZE HANGER
a. SUPPORT STRUT: 1 5/8" 12 Ga. CHANNEL OR 2"x2"x1/4" ANGLE, GALVANIZED STEEL.
b. HANGER RODS: 1/2" ROD DIAMETER, SEE HANGER RODS SECTION FOR ADDITIONAL REQUIREMENTS. PROVIDE WASHER AND NUT ON TOP OF SUPPORT STRUT, LOCK NUTS AND WASHER ON BOTTOM OF SUPPORT STRUT. NYLOK OR EQUAL.
c. U-BOLTS: GALVANIZED STEEL, ANVIL FIGURE 137 OR EQUAL.

B. PROCESS AREAS
1. UTILIZE PROCESS AREA PIPE RACKS PROVIDED BY OTHERS FOR USE BY THE PLUMBING CONTRACTOR ONLY WHERE SHOWN ON DRAWINGS.

2.5 HANGER RODS

A. NON-PROCESS AREAS
1. HANGER RODS SHALL BE CARBON STEEL END-THREADED ONLY AND NOT ALL-THREADED DESIGN. ANVIL FIGURE 140 OR EQUAL.

B. PROCESS AREAS
1. HANGER RODS SHALL BE TYPE 304 STAINLESS STEEL END-THREADED ONLY AND NOT ALL-THREADED DESIGN. MAXIMUM OF 2 THREADS OR 0.25" OF THREADS SHALL BE EXPOSED.

2.6 HORIZONTAL PIPE WALL SUPPORTS

A. NON-PROCESS AREAS
1. COLD SERVICE, 2 1/2" FINISH COVER AND SMALLER: STEEL OFFSET J-HOOK. B-LINE B3190 OR EQUAL.
2. COLD SERVICE, OVER 2 1/2" FINISH COVER: WELDED STEEL BRACKET ANVIL FIGURE 195 OR 199, GALVANIZED U-BOLT ANVIL FIGURE 137, WASHER PLATES ANVIL FIGURE 60, OR EQUAL.
3. HOT SERVICE, 4" PIPE AND SMALLER: WELDED STEEL BRACKET ANVIL FIGURE 195 OR 199, GALVANIZED U-BOLT ANVIL FIGURE 137, WASHER PLATES ANVIL FIGURE 60, OR EQUAL.
4. HOT SERVICE, 6" PIPE AND LARGER: WELDED STEEL BRACKET ANVIL FIGURE 195 OR 199, STEEL YOKE AND CAST IRON ROLL ANVIL FIGURE 177, WASHER PLATES ANVIL FIGURE 60, OR EQUAL.

B. PROCESS AREAS
1. REFER TO DETAILS PROVIDED ON THE DRAWINGS.

2.7 VERTICAL PIPE WALL SUPPORTS

A. NON-PROCESS AREAS
1. INSULATED PIPING

ALL HANGERS FOR INSULATED PIPES IN NON-PROCESS AREAS SHALL BE SIZED FOR THE TOTAL DIAMETER OF THE PIPE PLUS INSULATION, JACKET, AND PROTECTION SHIELD THICKNESS (I.E. HANGERS SHALL BE INSTALLED AROUND THE PIPE INSULATION SYSTEM).

a. CAST IRON, COPPER TUBE, PLASTIC, AND STEEL PIPING
   1) 3" FINISH COVER AND SMALLER: SPLIT RING HANGER ANVIL 138R ATTACHED TO END-THREAEDED STEEL HANGER ROD.
   2) OVER 3" FINISH COVER: STEEL PIPE CLAMP ANVIL 212 ATTACHED TO (2) THREADED STEEL HANGER RODS.

2. NON-INSULATED PIPING
   a. CAST IRON, PLASTIC, AND STEEL PIPING
      1) 3" PIPE AND SMALLER: SPLIT RING HANGER ANVIL 138R OR EQUAL ATTACHED TO END-THREAEDED STEEL HANGER ROD.
      2) 3 1/2" PIPE AND LARGER: STEEL PIPE CLAMP ANVIL 212 ATTACHED TO (2) THREADED STEEL HANGER RODS.
   b. COPPER PIPE (DWV)
      1) 2" PIPE AND SMALLER: COPPER PLATED SPLIT RING HANGER ANVIL CT-138R OR EQUAL ATTACHED TO THREADED STEEL HANGER ROD.
      2) 2 1/2" – 4" PIPE: COPPER TUBE RISER CLAMP ANVIL CT-121 OR EQUAL ATTACHED TO (2) THREADED STEEL HANGER RODS.

B. PROCESS AREAS
   1. INSULATED PIPING
      a. S.S. EXTENSION SPLIT RING PIPE CLAMP, FULLY BURIED IN INSULATION, WITH ½" SOLID S.S. ROD WELDED TO S.S. WALL PLATE, SECURED TO IMP WALL BY TEXTRON FASTENING SYSTEMS S.S. FAB-LOK FASTENER, PART # EZJ230. REFER TO DETAILS ON PLUMBING DRAWINGS.
   2. NON-INSULATED PIPING
      a. S.S. HEX CLAMP, DIXON MODEL B24PS FOR TUBING AND MODEL B24PV FOR PIPING OR EQUAL. 1/2" SOLID 304 S.S. ROD WELDED TO HEX CLAMP TO PROVIDE REQUIRED SPACE BETWEEN PIPE OUTSIDE DIAMETER AND SUPPORTING STRUCTURE. WELD 1/2" SOLID 304 S.S. ROD TO 304 S.S. BASE PLATE AND FASTEN BASE PLATE TO WALL WITH INSERTS AND S.S. BOLTING HARDWARE FOR MASONRY INSTALLATIONS, OR S.S. FASTENING SYSTEM FOR IMP INSTALLATIONS. SEE BUILDING ATTACHMENTS SECTION AND DETAILS PROVIDED ON DRAWINGS.

2.8 FLOOR SUPPORTS

A. NON-PROCESS AREAS
   1. COLD SERVICE, 3" FINISH COVER AND SMALLER
      a. ADJUSTABLE SADDLE: CARBON STEEL SADDLE AND INTEGRAL THREADED ROD, B-LINE B3096 OR EQUAL, CARBON STEEL STANCHION AND BASE PLATE.
   2. COLD SERVICE, OVER 3" FINISH COVER
      a. BOLT ON FLANGE: CARBON STEEL FLANGE SUPPORT, B-LINE B3094 OR EQUAL, CARBON STEEL STANCHION AND BASE PLATE.
      b. ADJUSTABLE SADDLE WITH U-BOLT: CARBON STEEL SADDLE, INTEGRAL THREADED ROD AND U-BOLT, B-LINE B3098 OR EQUAL, CARBON STEEL STANCHION AND BASE PLATE.
   3. HOT SERVICE, 4" PIPE AND SMALLER
      a. BOLT ON FLANGE: CARBON STEEL FLANGE SUPPORT, B-LINE B3094 OR EQUAL, CARBON STEEL STANCHION AND BASE PLATE.
      b. ADJUSTABLE SADDLE WITH U-BOLT: CARBON STEEL SADDLE, INTEGRAL THREADED ROD AND U-BOLT, B-LINE B3098 OR EQUAL, CARBON STEEL STANCHION AND BASE PLATE.
   4. HOT SERVICE, 6" PIPE AND LARGER

a. ROLLER CHAIR: CAST IRON ROLL AND CHAIR, STEEL SCREWS, ANVIL FIGURE 175 OR EQUAL, MOUNTED ON CARBON STEEL ANGLE IRON "T" SUPPORT STANCHION AND BASE PLATE.

B. PROCESS AREAS
1. REFER TO DETAILS PROVIDED ON THE DRAWINGS.

2.9 ROOF SUPPORTS
A. 100% RUBBER UV RESISTANT SUPPORT BASE WITH 12 Ga. 2 7/16" HIGH GALVANIZED CHANNEL AND GALVANIZED STEEL PIPE STRAP.
1. 3" PIPE AND SMALLER: B-LINE DB610 WITH B2400 PIPE STRAP OR EQUAL.
2. 3 1/2" – 4" PIPE: B-LINE DB620 WITH B2400 PIPE STRAP OR EQUAL.
3. 6" PIPE AND LARGER: B-LINE DB648 WITH B2400 PIPE STRAP OR EQUAL.

2.10 BUILDING ATTACHMENTS
A. BEAM HANGERS
1. BEAM CLAMPS: PLAIN OR ZINC-PLATED, ANVIL FIGURE 133, ANVIL FIGURE 14, OR EQUAL.
2. "C" CLAMPS: PLAIN OR ZINC-PLATED, ANVIL FIGURE 92 THROUGH 94, ANVIL FIGURE 89 OR 89X RETAINING CLIP, OR EQUAL.
3. WELDED: WELDED BEAM ATTACHMENT, ANVIL FIGURE 66 OR EQUAL.

B. INSERTS
1. HOLLOW-CORE MASONRY INSTALLATION
a. PLASTIC MESH SLEEVE: HILTI HIT-S OR EQUAL.
b. MASONRY INJECTABLE MORTAR: HILTI HIT-HY 70 OR EQUAL.
c. MALLEABLE IRON OR STEEL INTERNALLY THREADED INSERTS: HILTI HIT-I OR EQUAL.
2. SOLID MASONRY INSTALLATION
a. FOIL CAPSULE ADHESIVE ANCHOR: HILTI HVU OR EQUAL.
b. MALLEABLE IRON OR STEEL INTERNALLY THREADED INSERTS: HILTI HIS-N OR EQUAL.

C. INSULATED METAL PANEL FASTENERS
1. 304 S.S. CUSTOM MOUNTING BRACKET WITH EZJ230 S.S. FAB-LOK FASTENING SYSTEM, THROUGH BOLTS WITH BACKER PLATE, OR APPROVED EQUAL. SEE DETAILS ON DRAWINGS.

2.11 PIPE SHIELDS, SADDLES, AND INSULATED INSERTS
A. PROTECTION SHIELDS
1. NON-PROCESS AREAS
a. PRE-GALVANIZED CARBON STEEL, 180 DEGREE WRAP, ANVIL FIGURE 167 OR EQUAL.
1) 2" PIPE AND SMALLER: 18 Ga. METAL, 12" SHIELD LENGTH.
2) 2 1/2" – 4" PIPE: 16 Ga. METAL, 12" SHIELD LENGTH.
3) 6" – 10" PIPE: 14 Ga. METAL, 24" SHIELD LENGTH.
4) 12" PIPE AND LARGER: 12 Ga. METAL, 24" SHIELD LENGTH.
2. PROCESS AREAS
a. TYPE 304 S.S., 180 DEGREE WRAP.
1) 2" PIPE AND SMALLER: 18 Ga. METAL, 12" SHIELD LENGTH.
2) 21/2" – 4" PIPE: 16 Ga. METAL, 12" SHIELD LENGTH.
3) 6" – 10" PIPE: 14 Ga. METAL, 24" SHIELD LENGTH.
4) 12" PIPE AND LARGER: 12 Ga. METAL, 24" SHIELD LENGTH.

B. SADDLES
1. PLAIN CARBON STEEL PIPE SADDLE, 12" SADDLE LENGTH, ANVIL FIGURE 160 THROUGH 165 SERIES OR EQUAL. SIZE SADDLE FOR REQUIRED PIPE DIAMETER AND INSULATION THICKNESS. SADDLE SHALL BE COMPLETELY COVERED BY INSULATION JACKETING.

C. INSULATED INSERTS

1. FOR CLOSED CELL ELASTOMERIC INSULATION UP TO 1" INSULATION WALL THICKNESS USE ARMACELL ARMAFIX OR EQUIVALENT.
2. FOR ALL OTHER INSTALLATIONS REQUIRING INSULATED INSERT BLOCKS USE CALCIUM SILICATE AS MANUFACTURED BY JOHNS MANVILLE OR EQUAL. SEE SECTION *22 07 00 – PLUMBING INSULATION*.

PART 3: EXECUTION

3.1 GENERAL REQUIREMENTS

A. SUPPORT ALL PIPING IN ACCORDANCE WITH THE PIPE SUPPORTS SCHEDULE PROVIDED ON THE DRAWINGS.
B. INSTALL HANGERS AND SUPPORTS SYSTEMS COMPLETE WITH ALL NECESSARY RODS, NUTS, BOLTS, ATTACHMENTS, AND APPURTENANCES.
C. ALL PIPING SHALL BE PLACED AS HIGH AS POSSIBLE, WITHIN 12" OF BOTTOM OF STEEL, OR AS SHOWN ON DRAWINGS.
D. DESIGN HANGERS FOR PIPE THERMAL AND SEISMIC MOVEMENT WITHOUT DISENGAGEMENT OF SUPPORTED PIPE.
E. INSTALL HANGERS AND SUPPORTS TO PROVIDE MINIMUM 2" SPACE BETWEEN FINISHED COVERING AND ADJACENT WORK.
F. INSULATED PIPE: SIZE HANGERS FOR THE TOTAL OUTSIDE DIAMETER OF THE PIPE PLUS THICKNESS OF INSULATION, JACKETING, AND PROTECTIVE SHIELD (AS APPLICABLE).

3.2 PIPE RACKS

A. WHERE SEVERAL PIPES CAN BE INSTALLED IN PARALLEL AND AT THE SAME ELEVATION, PROVIDE MULTIPLE OR TRAPEZE HANGERS. USE SMALLEST PIPE SIZE TO DETERMINE HANGER SPACING.
B. WHERE PIPE RACKS SERVICE PIPE, CONDUIT, DUCTWORK, ETC. FROM MULTIPLE TRADES, PROVIDE COORDINATION WITH OTHER TRADES TO ENSURE SUFFICIENT CLEARANCE FOR ACCESS, MAINTENANCE, AND SERVICE OF ALL INSTALLED PIPING AND APPURTENANCES.
C. PIPE SPACING
    1. PIPE PLUS COVERING 8" DIAMETER AND LESS: PROVIDE 2" CLEARANCE BETWEEN PIPE PLUS COVERING OUTSIDE DIAMETER AND ADJACENT WORK.
    2. PIPE PLUS COVERING LARGER THAN 8": PROVIDE 3" CLEARANCE BETWEEN PIPE PLUS COVERING OUTSIDE DIAMETER AND ADJACENT WORK.

3.3 HANGER RODS

A. HANGER RODS SHALL BE CONNECTED TO 'C' CLAMPS, BEAM CLAMPS, INSERTS, CLIPS WELDED TO THE STRUCTURAL STEEL, OR SUPPORTED FROM THE MASONRY STRUCTURAL MEMBERS. HANGER ROD DIAMETER SHALL BE AS OUTLINED IN THE PIPE SUPPORTS SCHEDULE ON THE PLUMBING DRAWINGS. HANGER ROD LENGTH SHALL BE AS REQUIRED TO FACILITATE CORRECT INSTALLATION, ELEVATION, AND SLOPE OF PIPING SYSTEMS.

3.4 HORIZONTAL PIPING

A. SUPPORT HORIZONTAL PIPING AS OUTLINED IN THE PIPE SUPPORTS SCHEDULE ON THE DRAWINGS.
B. PLACE HANGERS WITHIN 12" OF EACH CHANGE IN DIRECTION.
C. USE HANGERS WITH 1 1/2" MINIMUM VERTICAL ADJUSTMENT.

3.5 VERTICAL PIPING

A. SUPPORT VERTICAL PIPING AS OUTLINED IN THE PIPE SUPPORTS SCHEDULE ON THE DRAWINGS.
B. SUPPORT VERTICAL PIPING AT EVERY FLOOR AND AT THE BASE OF EVERY RISER.
C. SUPPORT RISER PIPING INDEPENDENTLY OF CONNECTED HORIZONTAL PIPING.

3.6 BUILDING ATTACHMENTS

A. PROHIBITED INSTALLATION PRACTICES
    1. BAND IRON, WIRE, AND CHAINS SHALL NOT BE PERMITTED.
    2. THE HANGING OF PIPES FROM THE JOIST CROSS BRACING SHALL NOT BE PERMITTED.
    3. THE HANGING OF ONE PIPE FROM ANOTHER SHALL NOT BE PERMITTED.
    4. THE HANGING OF PIPES FROM THE ROOF DECK SHALL NOT BE PERMITTED.
B. BEAM HANGERS

1. LOADS LESS THAN 200 LB: 'C' CLAMP ON BOTTOM CHORD.
2. LOADS OVER 200 LB BUT LESS THAN 400 LB: 'C' CLAMP ON TOP CHORD.
3. LOADS GREATER THAN 400 LB: 'C' CLAMP ON TOP OR BOTTOM CHORD, REINFORCE W/ 2" ANGLE WELDED TO OPPOSITE CHORD PANEL POINT PER STRUCTURAL DETAIL DRAWINGS.

C. INSERTS
1. USE INSERTS FOR PRE-CAST OR CMU WALL SUPPORT AND CONCRETE FLOOR DECK SUPPORT WHEN BUILDING STEEL IS NOT AVAILABLE TO SUPPORT PIPING.
2. SIZE INSERTS FOR HANGER ROD DIAMETER REQUIRED TO SUPPORT INTENDED LOADING. INSTALL INSERTS PER MANUFACTURER'S OR STRUCTURAL ENGINEER'S INSTRUCTIONS.

D. INSULATED METAL PANEL FASTENERS
1. THE USE OF SHEET METAL SCREWS, WELDING TO THE METAL PANEL, AND BONDING ADHESIVE SHALL NOT BE PERMITTED.
2. REFER TO DETAILS ON THE DRAWINGS.

3.7 PIPE SHIELDS, SADDLES, AND INSULATED INSERTS

A. PROTECTION SHIELDS
1. INSULATION SHIELDS ARE REQUIRED AT EVERY HANGER INSTALLED AROUND INSULATED PIPE, AND ON BOTH SIDES OF CLAMPS AND U-BOLTS INSTALLED AROUND INSULATED PIPE.
2. ADHERE SHIELD TO INSULATION WITH ADHESIVE AND METAL STRAP LOCATED AT EACH END.
3. INSTALL SHIELDS OF THE PROPER LENGTH TO DISTRIBUTE WEIGHT EVENLY AND TO PREVENT SAGGING OR INDENTATION OF INSULATION AT HANGER.
4. INSTALL SHIELD SO THAT HANGER IS PLACED AT THE CENTER OF THE SHIELD.

B. SADDLES
1. SADDLES ARE REQUIRED AT ALL SUPPORT LOCATIONS OF NON-RIDGED FOAM INSULATED HOT PIPES ON ROLLERS.
2. USE SADDLE SIZED FOR PIPE DIAMETER AND INSULATION THICKNESS. WELD SADDLE TO PIPE. FILL SADDLE VOID WITH INSULATION THAT MATCHES ADJOINING INSULATION. INSULATION JACKETING SHALL FULLY ENCLOSE SADDLE. INSTALL SADDLE SO THAT HANGER IS PLACED AT THE CENTER OF THE SADDLE.

C. INSULATED INSERTS
1. INSERT BLOCKS ARE REQUIRED AT ALL SUPPORT LOCATIONS OF INSULATED PIPING SYSTEMS AS FOLLOWS:
    a. GLASS FIBER INSULATED PIPES
        1) PROVIDE INSERT BLOCKS ON ALL COLD PIPE SIZES
        2) PROVIDE INSERT BLOCKS ON ALL HOT PIPES LESS THAN 6" DIAMETER (USE SADDLE FOR 6" PIPE AND LARGER).
    b. ELASTOMERIC INSULATED PIPES
        1) PROVIDE INSERT BLOCKS ON ALL COLD PIPE SIZES.
        2) PROVIDE INSERT BLOCKS ON ALL HOT PIPES LESS THAN 6" DIAMETER (USE SADDLE FOR 6" PIPE AND LARGER).
    c. POLYISOCYANURATE INSULATED PIPES
        1) PROVIDE INSERT BLOCKS ON ALL PIPES LARGER THAN 6" DIAMETER.
    d. CLOSED CELL FOAM (FOAMGLAS) INSULATED PIPES
        1) PROVIDE INSERT BLOCKS ON ALL PIPES LARGER THAN 6" DIAMETER.
2. INSERT MATERIAL SHALL BE HYDROUS CALCIUM SILICATE INSULATION OR OTHER HEAVY DENSITY INSULATING MATERIAL SUITABLE FOR THE SERVICE TEMPERATURE. SEE SECTION *22 07 00 – PLUMBING INSULATION* FOR MORE INFORMATION.
3. INSERT LOCATION SHALL BE BETWEEN SUPPORT SHIELD AND PIPING AND UNDER THE FINISH JACKET.

4. INSERT SHALL BE A MINIMUM 6 INCHES LONG, OF SAME THICKNESS AND CONTOUR AS ADJOINING INSULATION; MAY BE FACTORY FABRICATED.

END OF SECTION

SECTION 22 05 53
IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1: GENERAL

1.1 SUMMARY

A. THE WORK OF THIS SECTION SHALL INCLUDE:

1. EQUIPMENT TAGS
2. VALVE TAGS
3. PIPE SERVICE MARKERS

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. THE FOLLOWING REFERENCED SECTIONS ARE LISTED AS A MINIMUM OF ADDITIONAL REQUIREMENTS AND/OR WORK NOT INCLUDED IN THIS SECTION WHICH MAY BE REQUIRED TO BE PERFORMED UNDER OTHER DESIGNATED SECTIONS:

1. *22 05 01 – SUPPLEMENTARY COMPONENTS FOR PLUMBING WORK*
2. *22 05 23 – GENERAL DUTY VALVES FOR PLUMBING PIPING*
3. *22 07 00 – PLUMBING INSULATION*
4. *22 10 00 – PLUMBING PIPING*
5. *22 30 00 – PLUMBING EQUIPMENT*

1.3 REFERENCE STANDARDS

A. ASME (AMERICAN SOCIETY OF MECHANICAL ENGINEERS)

1. A13.1 SCHEME FOR THE IDENTIFICATION OF PIPING SYSTEMS

1.4 SUBMITTALS

A. SUBMITTALS SHALL BE SUBMITTED IN CONFORMANCE WITH THE REQUIREMENTS OF SECTION *22 00 01 – PLUMBING GENERAL PROVISIONS*.

B. SUBMITTALS ARE REQUIRED FOR:

1. EQUIPMENT TAGS
2. VALVE TAGS
3. PIPE SERVICE MARKERS

C. SUBMIT SAMPLES OF PRODUCTS, TAGS, STENCILS, AND PAINT DATA.

D. SUBMIT VALVE AND EQUIPMENT CHARTS AND SCHEDULES INCLUDING TAG NUMBER, LOCATION, TYPE, MANUFACTURER'S NAME, AND MODEL NUMBER.

1.5 MISCELLANEOUS

A. CONTRACTOR SHALL PROVIDE TO THE OWNER 15% ADDITIONAL IDENTIFICATION MATERIALS OVER THE AMOUNT USED AT PROJECT CLOSEOUT.

PART 2: PRODUCTS

2.1 MANUFACTURERS

A. IDENTIFICATION MATERIALS SHALL BE AS MANUFACTURED BY BRADY, BRIMAR INDUSTRIES, SETON, OR APPROVED EQUAL.

2.2 EQUIPMENT TAGS

A. CONSTRUCTION: LAMINATED THREE-LAYER PLASTIC.

B. LABELING: ENGRAVED BLACK LETTERS ON LIGHT CONTRASTING BACKGROUND COLOR FOR READING CLARITY. EQUIPMENT TAG LABEL WRITING SHALL MATCH WHAT IS SHOWN ON EQUIPMENT SCHEDULES AND SPECIFICATIONS.

C. SIZE: 2" HIGH BY 4" WIDE.

D. ATTACHMENT: SECURE TAG TO EQUIPMENT WITH BRASS SELF TAPPING SCREWS.

2.3 VALVE TAGS

A. CONSTRUCTION: VALVE IDENTIFICATION TAGS SHALL BE MADE OF BRASS, ENGRAVED LAMINATED PLASTIC, OR ENGRAVED ANODIZED ALUMINUM WHEN LOCATED IN NON-PROCESS AREAS. TAGS SHALL BE MADE OF ENGRAVED STAINLESS STEEL WHEN LOCATED IN PROCESS AREAS.

B. LABELING: IDENTIFICATION TAGS SHALL BE LABELED AS FOLLOWS, WHERE "#" IS THE VALVE NUMBER AS SHOWN ON DRAWINGS. WHERE VALVES ARE NOT TAGGED ON DRAWINGS, AN IDENTIFICATION TAG IS NOT REQUIRED. MARKING SHALL BE STAMPED OR ENGRAVED INDELIBLY, BLACK LETTERING ON LIGHT CONTRASTING BACKGROUND COLOR FOR READING CLARITY.

PIPING SYSTEM	LABEL
ACID WASTE	AW-V#
COMPRESSED AIR	CA-V#
DOMESTIC COLD WATER	CW-V#
DOMESTIC HOT WATER	HW-V#
DOMESTIC HOT WATER RETURN	HWR-V#
NON-POTABLE WATER	NPW-V#
PROCESS DRAIN	PD-V#
SANITARY SEWER	SAN-V#
NATURAL GAS	NG-V#

C. SIZE: TAGS SHALL BE 2" DIAMETER.

D. ATTACHMENT: TAGS SHALL BE ATTACHED TO VALVES WITH CHROME-PLATED BEADED CHAIN FOR NON-PROCESS AREAS AND STAINLESS STEEL BEADED CHAIN FOR PROCESS AREAS.

2.4 PIPE SERVICE MARKERS

A. PIPE PLUS FINISHED COVERING OUTER DIAMETER LESS THAN 1 1/2"

1. SINGLE STRIP INDIVIDUAL MARKER OF FLEXIBLE VINYL FILM TAPE WITH PRESSURE SENSITIVE ADHESIVE BACKING AND PRINTED MARKINGS.

B. PIPE PLUS FINISHED COVERING OUTER DIAMETER 1 1/2" AND LARGER

1. 'FULL WRAP AROUND STYLE', FACTORY FABRICATED, FLEXIBLE SEMI-RIGID PLASTIC, PREFORMED TO FIT AROUND PIPE OR PIPE COVERING.
   OR
2. 'FULL WRAP AROUND STYLE', FLEXIBLE VINYL FILM TAPE WITH PRESSURE SENSITIVE ADHESIVE BACKING AND PRINTED MARKINGS.

C. PIPING SHALL BE IDENTIFIED AS TO THE SERVICE OF THE PIPE, THE NORMAL DIRECTION OF FLOW, AND PRESSURE AS APPROPRIATE. FLOW ARROWS SHALL BE AT LEAST SIX (6) INCHES LONG.

D. PIPE SERVICE MARKERS SHALL HAVE SYMBOLS AND LETTERS OF THE FOLLOWING SIZE:

PIPE / INSULATION DIAMETER	MIN. LENGTH	SIZE OF LETTERS
3/4" – 1 1/4"	8"	1/2"
1 1/2" – 2 3/8"	8"	3/4"
2 1/2" – 7 7/8"	12"	1 1/4"
8" – 10"	24"	2 1/2"
OVER 10"	32"	3 1/2"

E. COLOR AND LETTERING FOR PIPING SYSTEMS SHALL CONFORM TO THE PIPE SYSTEMS IDENTIFICATION SCHEDULE PROVIDED ON THE DRAWINGS, UNLESS THERE IS AN EXISTING PLANT STANDARD CONTRACTOR IS DIRECTED TO FOLLOW BY THE CONSTRUCTION MANAGER OR OWNER.

PART 3: EXECUTION

3.1 EXAMINATION AND PREPARATION

A. DEGREASE AND CLEAN SURFACES TO RECEIVE ADHESIVE FOR IDENTIFICATION MATERIALS.

B. EQUIPMENT, PIPE, VALVES, ETC. MUST BE PAINTED AND INSULATED PER SPECIFICATIONS BEFORE INSTALLING IDENTIFICATION MATERIALS.

3.2 GENERAL REQUIREMENTS

A. IDENTIFICATION MATERIALS SHALL BE SECURED TO THE EQUIPMENT, VALVE, PIPE, ETC. METHOD OF SECURING EACH TYPE SHALL BE APPROVED BY PLANT SANITATION MANAGER.

B. IDENTIFICATION MATERIALS SHALL BE INSTALLED SO AS NOT TO CREATE VOIDS OR HARBORAGES, INCLUDING INACCESSIBLE SPACES BEHIND TAGS OR LABELS. ALL OPEN SPACES MUST BE EASILY ACCESSIBLE FOR CLEANING OR MUST BE HERMETICALLY SEALED.

C. INSTALLATION OF IDENTIFICATION MATERIALS IS TO BE COORDINATED WITH OTHER CRAFTS TO INSURE PROPER AND TIMELY INSTALLATION.

D. INSTALL IDENTIFICATION MATERIALS SUCH THAT THEY CAN BE EASILY SEEN FROM THE PLANT FLOOR LEVEL.

3.3 EQUIPMENT TAGS

A. LABEL ALL PLUMBING EQUIPMENT WITH DESIGNATIONS AS INDICATED ON THE PLUMBING SCHEDULES AND DRAWINGS.

B. SIGNS SHALL BE PLACED ON THE EQUIPMENT IN A LOGICAL, EASILY VISIBLE LOCATION TO MAINTENANCE PERSONNEL, E.I. NEAR CONTROL PANELS, DISCONNECT SWITCHES, ON OR NEAR EQUIPMENT MAIN ACCESS DOORS AND PANELS, ETC.

3.4 VALVE TAGS

A. INSTALL TAGS ON VALVES AND CONTROL DEVICES. VALVE TAGS SHALL ONLY BE REQUIRED WHERE VALVES ARE TAGGED ON DRAWINGS OR IN EQUIPMENT LISTS.

B. ATTACH TAGS TO THE STEM OF EACH VALVE WITH APPROPRIATE BEADED CHAIN.

C. LIST EACH TAGGED VALVE IN A VALVE SCHEDULE FOR EACH PIPING SYSTEM.

D. INSTALL FRAMED VALVE SCHEDULE IN EACH MAJOR MECHANICAL EQUIPMENT ROOM.

3.5 PIPE SERVICE MARKERS

A. PIPING SYSTEM LABELS SHALL BE APPLIED TO PIPE AT THE FOLLOWING LOCATIONS:

1. EVERY 25 FT ON STRAIGHT RUNS.
2. ALL CHANGES IN DIRECTION AND ALL TEE CONNECTIONS.
3. ALL VALVE DROPS FOR FIXTURES AND EQUIPMENT NEAR VALVES USED BY OPERATORS.
4. BEFORE AND AFTER ALL VIEWING OBSTRUCTIONS.
5. AT BOTH SIDES OF ALL PENETRATIONS THROUGH WALLS, FLOORS, ROOFS, PLATFORMS, ETC.

3.6 ADJUSTING AND CLEANING

A. RELOCATE PLUMBING IDENTIFICATION MATERIALS AND DEVICES THAT HAVE BECOME VISUALLY BLOCKED BY OBSTRUCTIONS.

B. CLEAN FACE OF IDENTIFICATION DEVICES AND GLASS FRAMES OF VALVE CHARTS.

END OF SECTION

SECTION 22 07 00
PLUMBING INSULATION

PART 1: GENERAL

1.1 SUMMARY

A. THE WORK OF THIS SECTION SHALL INCLUDE:

1. GLASS FIBER INSULATION
2. CLOSED CELL ELASTOMERIC INSULATION
3. POLYISOCYANURATE OR CLOSED CELL RIGID POLYURETHANE INSULATION
4. CLOSED CELL FOAM (FOAMGLAS) INSULATION
5. CALCIUM SILICATE INSULATION
6. BARRIER FREE LAVATORY INSULATION
7. INSULATION JACKETS
8. HEAT TRACING

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. THE FOLLOWING REFERENCED SECTIONS ARE LISTED AS A MINIMUM OF ADDITIONAL REQUIREMENTS AND/OR WORK NOT INCLUDED IN THIS SECTION WHICH MAY BE REQUIRED TO BE PERFORMED UNDER OTHER DESIGNATED SECTIONS:

1. *22 05 01 – SUPPLEMENTARY COMPONENTS FOR PLUMBING WORK*
2. *22 05 29 – HANGERS AND SUPPORTS FOR PLUMBING PIPING*

1.3 REFERENCE STANDARDS

A. ADA (AMERICANS WITH DISABILITIES ACT)

B. ASHRAE (AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS)

1. 90.1 (2010) ENERGY STANDARD FOR BUILDINGS EXCEPT LOW-RISE RESIDENTIAL BUILDINGS.

C. ASTM (ASTM INTERNATIONAL)

1. B209 STANDARD SPECIFICATION FOR ALUMINUM AND ALUMINUM-ALLOY SHEET AND PLATE
2. C177 STANDARD TEST METHOD FOR STEADY-STATE HEAT FLUX MEASUREMENTS AND THERMAL TRANSMISSION PROPERTIES BY MEANS OF THE GUARDED-HOT-PLATE APPARATUS
3. C209 STANDARD TEST METHODS FOR CELLULOSIC FIBER INSULATING BOARD
4. C240 STANDARD TEST METHODS FOR TESTING CELLULAR GLASS INSULATION BLOCK
5. C335 STANDARD TEST METHOD FOR STEADY-STATE HEAT TRANSFER PROPERTIES OF PIPE INSULATION
6. C518 STANDARD TEST METHOD FOR STEADY-STATE HEAT THERMAL TRANSMISSION PROPERTIES BY MEANS OF THE HEAT FLOW METER APPARATUS
7. C533 STANDARD SPECIFICATION FOR CALCIUM SILICATE BLOCK AND PIPE THERMAL INSULATION
8. C534 STANDARD SPECIFICATION FOR PREFORMED FLEXIBLE ELASTOMERIC CELLULAR THERMAL INSULATION IN SHEET AND TUBULAR FORM
9. C547 STANDARD SPECIFICATION FOR MINERAL FIBER PIPE INSULATION
10. C552 STANDARD SPECIFICATION FOR CELLULAR GLASS THERMAL INSULATION
11. C591 STANDARD SPECIFICATION FOR UNFACED PREFORMED RIGID CELLULAR POLYISOCYANURATE THERMAL INSULATION
12. C921 STANDARD PRACTICE FOR DETERMINING THE PROPERTIES OF JACKETING MATERIALS FOR THERMAL INSULATION
13. C1639 STANDARD SPECIFICATION FOR FABRICATION OF CELLULAR GLASS PIPE AND TUBING INSULATION
14. C1767 STANDARD SPECIFICATION FOR STAINLESS STEEL JACKETING FOR INSULATION
15. D1056 STANDARD SPECIFICATION FOR FLEXIBLE CELLULAR MATERIALS – SPONGE OR EXPANDED RUBBER
16. D1784 STANDARD SPECIFICATION FOR RIGID POLY (VINYL CHLORIDE)(PVC) COMPOUNDS AND CHLORINATED POLY (VINYL CHLORIDE)(CPVC) COMPOUNDS

17. E84 STANDARD TEST METHOD FOR SURFACE BURNING CHARACTERISTICS OF BUILDING MATERIALS
18. E96 STANDARD TEST METHOD FOR WATER VAPOR TRANSMISSION

D. IECC (INTERNATIONAL ENERGY CONSERVATION CODE)
E. NAIMA (NORTH AMERICAN INSULATION MANUFACTURERS ASSOCIATION)
F. UL (UNDERWRITER'S LABORATORIES)

1.4 SUBMITTALS

A. SUBMITTALS SHALL BE SUBMITTED IN CONFORMANCE WITH THE REQUIREMENTS OF SECTION *22 00 01 – PLUMBING GENERAL PROVISIONS*.
B. SUBMITTALS ARE REQUIRED FOR:
1. PIPE INSULATION
2. INSULATION JACKETS

1.5 INSULATION CLASSIFICATIONS

A. IN THIS SPECIFICATION, THE INSULATION CLASS DESCRIBES THE TYPE OF INSULATION MATERIAL ON THE BASIS OF SERVICE. ADDITIONAL INFORMATION FOR EACH INSULATION CLASS IS LOCATED ON THE PIPE INSULATION SCHEDULE INCLUDED ON THE DRAWINGS.
1. AS: ANTI-SWEAT SERVICE
2. CC1: COLD CONSERVATION #1 SERVICE (>35°F)
3. CC2: COLD CONSERVATION #2 SERVICE (20°F TO 35°F)
4. HC1: HEAT CONSERVATION #1 SERVICE (≥220°F)
5. HC2: HEAT CONSERVATION #2 SERVICE (141°F TO 219°F)
6. HC3: HEAT CONSERVATION #3 SERVICE (≤140°F)
7. PP: PERSONNEL PROTECTION SERVICE (>140°F)

PART 2: PRODUCTS

2.1 MANUFACTURERS

A. INSULATION SHALL BE AS MANUFACTURED BY ARMACELL, ARMSTRONG, ITW INSULATION SYSTEMS, JOHNS MANVILLE, OWENS CORNING, PITTSBURGH CORNING, OR APPROVED EQUAL.

2.2 GENERAL REQUIREMENTS

A. ALL INSULATION MATERIALS SHALL BE ASBESTOS FREE.
B. CONFORM TO MAXIMUM FLAME SPREAD/SMOKE DEVELOPED RATING OF 25/50 IN ACCORDANCE WITH ASTM E84 AND UL 723.
C. WHERE PIPING SYSTEMS ARE INDICATED TO BE INSULATED, INSULATION SHALL BE PROVIDED ON ALL PIPING, VALVES, AND FITTINGS WITHIN THE SYSTEM UNLESS NOTED OTHERWISE.

2.3 GLASS FIBER INSULATION

A. INSULATION: ASTM C547; RIGID MOLDED, NONCOMBUSTIBLE.
1. 'K' VALUE: ASTM C177, 0.24 AT 75°F.
2. MAXIMUM SERVICE TEMPERATURE: 850°F
3. MAXIMUM MOISTURE ABSORPTION: 0.2% BY VOLUME
B. FITTINGS AND VALVES
1. INSULATED WITH INSULATION CEMENT OR MOLDED FITTING INSULATION TO THICKNESS OF ADJOINING INSULATION, FINISHED WITH TWO COATS OF LAGGING CLOTH.
C. VAPOR BARRIER JACKET
1. ASTM C921, WHITE KRAFT PAPER WITH GLASS FIBER YARN, BONDED TO ALUMINIZED FILM.
2. MOISTURE VAPOR TRANSMISSION: ASTM E96; 0.02 PERM-INCHES.
D. VAPOR BARRIER LAP ADHESIVE
1. COMPATIBLE WITH INSULATION.
2. INSTALLATION OF INSULATION ON COLD WATER PIPING SHALL NOT UTILIZE STAPLES.

2.4 CLOSED CELL ELASTOMERIC INSULATION

A. INSULATION: ARMACELL AP, ARMACELL NH, ARMAFLEX SS, OR EQUIVALENT: ASTM C534, TYPE I TUBULAR AND ASTM D1056, 2B1; MOLDED, 25/50 FLAME/SMOKE RATING BY ASTM E84.

1. 'K' VALUE: ASTM C177, 0.27 AT 75°F.
2. MAXIMUM SERVICE TEMPERATURE: 180°F
3. MAXIMUM MOISTURE ABSORPTION: ASTM C209 0.2% BY VOLUME.
4. MOISTURE VAPOR TRANSMISSION: ASTM E96; 0.08 PERM-INCHES.

B. FITTINGS AND VALVES SHALL BE COVERED WITH MITER-CUT INSULATION AND JOINTS SEALED. TAPING JOINTS CLOSED WILL NOT BE ACCEPTABLE.

C. ALL SEAMS SHALL BE CEMENTED CLOSED TIGHT WITH CEMENT SPECIFICALLY MANUFACTURED FOR THE MATERIAL.

2.5 POLYISOCYANURATE OR CLOSED CELL RIGID POLYURETHANE INSULATION

A. INSULATION: ITW TRYMER 2000XP OR EQUIVALENT: ASTM C591, TYPE IV, 25/450 FLAME/SMOKE RATING BY ASTM E84.

1. 'K' VALUE: ASTM C518, 0.19 AT 75°F.
2. MAXIMUM SERVICE TEMPERATURE: 300°F
3. MAXIMUM MOISTURE ABSORPTION: ASTM C27; <0.7% BY VOLUME.
4. MOISTURE VAPOR TRANSMISSION: ASTM E96; 4 PERM-INCHES.

B. FITTINGS AND VALVES SHALL BE INSULATED USING FACTORY-FABRICATED FITTINGS. FITTINGS SHALL BE FINISHED WITH PRE-MOLDED PVC COVERS. THE PIPING SHALL BE FURNISHED WITH A PVC JACKET IN ALL FOOD PRODUCTION AREAS.

C. STAINLESS STEEL PIPING OPERATING ABOVE 120°F SHALL BE COATED WITH RG-2400 LT OR WRAPPED WITH ALUMINUM FOIL PRIOR TO APPLYING INSULATION.

2.6 CLOSED CELL FOAM (FOAMGLAS) INSULATION

A. INSULATION: REACTED FOAMGLAS CELLULAR GLASS BY PITTSBURGH CORNING OR EQUIVALENT; ASTM C552 AND ASTM C1639, 0/0 FLAME/SMOKE RATING BY ASTM E84.

1. 'K' VALVE: ASTM C177, 0.29 AT 75°F.
2. MAXIMUM SERVICE TEMPERATURE: 900°F
3. MAXIMUM MOISTURE ABSORPTION: ASTM C240; <0.2% BY VOLUME.
4. MOISTURE VAPOR TRANSMISSION: ASTM E96; 0.0 PERM-INCHES.

B. FITTINGS AND VALVES SHALL BE INSULATED WITH PRE-MOLDED COVERS IN TWO HALVES WHEN AVAILABLE. PIPING INSULATION SHALL BE IN PRE-MOLDED PIECES OF VENDOR STANDARD LENGTH.

1. INSULATION AT FITTINGS AND ELBOWS SHALL BE MADE WITH PRE-FORMED CALCIUM SILICATE ELBOW AND FITTING PIECES. USE OF MASTIC WITH WIRE MESH REINFORCEMENT IS PROHIBITED.

2.7 CALCIUM SILICATE INSULATION

A. INSULATION: THERMO-12 GOLD OR EQUIVALENT; ASTM C533, TYPE 1, 0/0 FLAME/SMOKE RATING BY ASTM E84.

1. 'K' VALUE: ASTM C518 AND C335, 0.37 AT 100°F.
2. MAXIMUM SERVICE TEMPERATURE: 1200°F

2.8 BARRIER FREE LAVATORY INSULATION

A. ADA-CONFORMING, WHEELCHAIR ACCESSIBLE LAVATORY P-TRAP AND ANGLE VALVE ASSEMBLIES SHALL BE COVERED WITH THE MOLDED CLOSED CELL VINYL, ANTIMICROBIAL UNDERSINK PROTECTIVE PIPE COVERS AND ACCESSORIES, WHITE COLOR. COVER SHALL BE SECURED WITH FLUSH REUSABLE FASTENERS, ANGLE STOPS SHALL HAVE LOCKING ACCESS COVER.

B. MANUFACTURERS: TRUEBRO, INC., LAV-GUARD SYSTEM, OR EQUAL.

2.9 INSULATION JACKETS

A. PVC JACKET

1. JACKET: ASTM D1784, ONE PIECE MOLDED TYPE FITTING COVERS AND SHEET MATERIAL, OFF-WHITE COLOR.
    a. SERVICE TEMPERATURE: 0°F – 150°F
    b. MOISTURE VAPOR TRANSMISSION: ASTM E96; 0.002 PERM-INCHES.
    c. THICKNESS: 15 MIL

d. CONNECTIONS: BRUSH ON WELDING ADHESIVE.

2. ADHESIVE MASTIC
   a. COMPATIBLE WITH INSULATION.
3. MANUFACTURERS: CEEL-CO., CERTAIN-TEED, SPEED LINE MANUFACTURING CO., PROTO CORP., OR EQUAL.

B. CANVAS JACKET: UL LISTED
1. FABRIC: ASTM C921, 6 OZ/SQ. YD., PLAIN WEAVE COTTON TREATED WITH DILUTE FIRE RETARDANT LAGGING ADHESIVE.
2. LAGGING ADHESIVE
   a. COMPATIBLE WITH INSULATION.

C. ALUMINUM JACKET: ASTM B209
1. THE JACKET SHALL BE FURNISHED WITH A 3 MIL THICK POLYSURLYN MOISTURE RETARDER (FACTORY HEAT-LAMINATED SYSTEM).
2. THICKNESS: 0.016" SHEET
3. FINISH: "SMOOTH" OPTION.
4. JOINING: LONGITUDINAL SLIP JOINTS AND 2" (50 mm) LAPS.
5. FITTINGS: 0.016" THICK DIE SHAPED FITTING COVERS WITH FACTORY ATTACHED PROTECTIVE LINER.
6. METAL JACKET BANDS: 3/8" WIDE; 0.010" THICK STAINLESS STEEL.
7. MANUFACTURERS: PABCO-CHILDERS METALS OR EQUAL.

D. STAINLESS STEEL JACKET: ASTM C1767, TYPE T304 S.S.
1. THE JACKET SHALL BE FURNISHED WITH A 3 MIL THICK POLYSURLYN MOISTURE RETARDER (FACTORY HEAT-LAMINATED SYSTEM).
2. THICKNESS: 0.016" SHEET
3. FINISH: "SMOOTH" OPTION.
4. JOINING: LONGITUDINAL SLIP JOINTS AND 2" (50 mm) LAPS.
5. FITTINGS: 0.016" THICK MULTI-PIECE TYPE T316 S.S., FACTORY FABRICATED.
6. METAL JACKET BANDS: 3/8" WIDE; 0.010" THICK STAINLESS STEEL.
7. MANUFACTURERS: PABCO-CHILDERS METALS OR EQUAL.

PART 3: EXECUTION

3.1 EXAMINATION AND PREPARATION

A. VERIFY THAT PIPING HAS BEEN TESTED BEFORE APPLYING INSULATION MATERIALS.
B. VERIFY THAT SURFACES ARE CLEAN AND DRY, WITH FOREIGN MATERIAL REMOVED.

3.2 GENERAL REQUIREMENTS

A. ALL PIPING SHALL BE INSULATED AND JACKETED IN ACCORDANCE WITH THE PIPE INSULATION SCHEDULE PROVIDED ON THE DRAWINGS.
B. INSTALL INSULATION MATERIALS IN ACCORDANCE WITH NAIMA NATIONAL INSULATION STANDARDS.
C. ALL INSULATION SHALL BE INSTALLED BY A QUALIFIED INSULATION SUBCONTRACTOR WHO IS THOROUGHLY EXPERIENCED IN THIS TYPE OF WORK AND WHO HAS ADEQUATE FACILITIES AND EQUIPMENT TO PERFORM THE SCOPE OF WORK.
D. APPLICATION AND FINISH ON ALL PIPES, FITTING, AND VALVES SHALL BE AS RECOMMENDED BY MANUFACTURER AND APPROVED BY THE ENGINEER.
E. MAINTAIN REQUIRED APPLICATION TEMPERATURE, AS SPECIFIED BY THE INSULATION MANUFACTURER, BEFORE, DURING, AND AFTER INSTALLATION FOR MINIMUM OF 24 HOURS.
F. EXPOSED PIPING: LOCATE INSULATION AND COVER SEAMS IN LEAST VISIBLE LOCATIONS.

3.3 INSULATED PIPES CONVEYING FLUIDS BELOW AMBIENT TEMPERATURE

A. INSULATE ENTIRE SYSTEM INCLUDING FITTINGS, VALVES, UNIONS, FLANGES, STRAINERS, FLEXIBLE CONNECTIONS, EXPANSION JOINTS, AND ANY OTHER PIPING COMPONENTS.
B. PROVIDE VAPOR BARRIER JACKETS, FACTORY-APPLIED OR FIELD-APPLIED. SECURE WITH SELF-SEALING LONGITUDINAL LAPS AND BUTT STRIPS WITH PRESSURE SENSITIVE ADHESIVE. SECURE WITH OUTWARD CLINCH EXPANDING STAPLES AND VAPOR BARRIER MASTIC.

C. INSULATE FITTINGS, JOINTS, AND VALVES WITH MOLDED INSULATION OF LIKE MATERIAL AND THICKNESS AS ADJACENT PIPE. FINISH WITH GLASS CLOTH AND VAPOR BARRIER ADHESIVE OR PVC FITTING COVERS.

3.4 INSULATED PIPES CONVEYING FLUIDS ABOVE AMBIENT TEMPERATURE

A. PROVIDE STANDARD JACKETS, WITH OR WITHOUT VAPOR BARRIER, FACTORY-APPLIED OR FIELD-APPLIED. SECURE WITH SELF-SEALING LONGITUDINAL LAPS AND BUTT STRIPS WITH PRESSURE SENSITIVE ADHESIVE. SECURE WITH OUTWARD CLINCH EXPANDING STAPLES.

B. INSULATE FITTINGS, JOINTS, AND VALVES WITH INSULATION OF LIKE MATERIAL AND THICKNESS AS ADJOINING PIPE.

C. FOR HOT PIPING CONVEYING FLUIDS 140°F OR LESS, DO NOT INSULATE FLANGES AND UNIONS AT EQUIPMENT, BUT BEVEL AND SEAL ENDS OF INSULATION.

D. FOR HOT PIPING CONVEYING FLUIDS OVER 140°F, INSULATE FLANGES AND UNIONS AT EQUIPMENT.

E. PERSONNEL PROTECTION: FOR HOT PIPING OVER 140°F AND LESS THAN 250°F REQUIRING PERSONNEL PROTECTION INSULATION, USE ARMAFLEX NH INSULATION OR EQUIVALENT.

3.5 PENETRATIONS & OBSTRUCTIONS

A. CONTINUE INSULATION THROUGH WALLS, SLEEVES, PIPE HANGERS, AND OTHER PIPE PENETRATIONS WHERE SPECIFIED AND DETAILED. FINISH AT SUPPORTS, PROTRUSIONS, AND INTERRUPTIONS. FIRE-STOP AT ALL FIRE SEPARATIONS.

3.6 HEAT TRACING

A. HEAT TRACING CABLE SHALL BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURER RECOMMENDATIONS. PROVIDE ADEQUATE CABLE OVERLAP OR SPIRAL FACTOR TO KEEP PIPES FROM FREEZING WITH SPECIFIED COVERING AND ENVIRONMENTAL CONDITIONS. THE PLUMBING CONTRACTOR SHALL WIRE THE HEAT TRACING AND THERMOSTAT FROM A DISCONNECT SWITCH PROVIDED BY THE ELECTRICAL CONTRACTOR.

B. SUPPLY WIRING SHOULD BE SUITABLE FOR A MINIMUM TEMPERATURE OF 170°F.

C. THE PIPE TEMPERATURE SENSING ELEMENT SHALL NOT BE LOCATED WITHIN 5 FEET OF A BEGINNING, END, SPLICE, OR ANY OTHER DISRUPTION OF THE THERMAL INSULATION.

END OF SECTION

SECTION 22 10 00
PLUMBING PIPING

PART 1: GENERAL

1.1 SUMMARY

A. THE WORK OF THIS SECTION SHALL INCLUDE:

1. PIPING (PIPE, FITTINGS, JOINTS, AND ACCESSORIES)
2. PIPE MATERIAL TRANSITION FITTINGS
3. MISCELLANEOUS ADAPTER FITTINGS
4. FIXTURE & EQUIPMENT CONNECTIONS
5. EXPANSION JOINTS
6. PIPE PENETRATIONS
7. TESTING OF PIPING SYSTEMS
8. CLEANING AND STERILIZATION OF PIPING SYSTEMS

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. THE FOLLOWING REFERENCED SECTIONS ARE LISTED AS A MINIMUM OF ADDITIONAL REQUIREMENTS AND/OR WORK NOT INCLUDED IN THIS SECTION WHICH MAY BE REQUIRED TO BE PERFORMED UNDER OTHER DESIGNATED SECTIONS:

1. *22 05 01 – SUPPLEMENTARY COMPONENTS FOR PLUMBING WORK*
2. *22 05 19 – METERS AND GAUGES FOR PLUMBING PIPING*
3. *22 05 23 – GENERAL DUTY VALVES FOR PLUMBING PIPING*
4. *22 05 29 – HANGERS AND SUPPORTS FOR PLUMBING PIPING*
5. *22 05 53 – IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT*
6. *22 07 00 – PLUMBING INSULATION*
7. *22 13 19 – PLUMBING SPECIALTIES*
8. *22 30 00 – PLUMBING EQUIPMENT*
9. *22 40 00 – PLUMBING FIXTURES*
10. *31 00 00 – EARTHWORK*

1.3 REFERENCE STANDARDS

A. PIPE AND FITTING STANDARDS: REFER TO PIPE CLASSIFICATIONS SCHEDULE ON DRAWINGS.

B. AGA (AMERICAN GAS ASSOCIATION)

C. ANSI (AMERICAN NATIONAL STANDARDS INSTITUTE)

1. Z21.24 CONNECTORS FOR GAS APPLIANCES
2. Z21.41 QUICK DISCONNECT DEVICES FOR USE WITH GAS FUEL APPLIANCES

D. ASME (AMERICAN SOCIETY OF MECHANICAL ENGINEERS)

1. A112.18.6 FLEXIBLE WATER CONNECTORS
2. B31.1 POWER PIPING
3. B31.8 GAS TRANSPORTATION AND DISTRIBUTION PIPING SYSTEMS
4. B31.9 BUILDING SERVICES PIPING
5. E119 FIRE TESTS OF BUILDING CONSTRUCTION AND MATERIALS

E. AWWA (AMERICAN WATER WORKS ASSOCIATION)

1. C651 DISINFECTING WATER MAINS
2. C652 DISINFECTING OF WATER STORAGE FACILITIES

F. CISPI (CAST IRON SOIL PIPE INSTITUTE)

1. 301-12 STANDARD SPECIFICATION FOR HUBLESS CAST IRON SOIL PIPE AND FITTINGS FOR SANITARY AND STORM DRAIN, WASTE, AND VENT PIPING APPLICATIONS
2. 310-12 STANDARD SPECIFICATION FOR COUPLING FOR USE IN CONNECTION WITH HUBLESS CAST IRON SOIL PIPE AND FITTINGS FOR SANITARY AND STORM DRAIN, WASTE, AND VENT PIPING APPLICATIONS

G. CSA (COMPLIANCE SAFETY ACCOUNTABILITY)

H. FM GLOBAL (FACTORY MUTUAL INSURANCE COMPANY)

1. 1-11 FIRE FOLLOWING EARTHQUAKES
2. 7-54 NATURAL GAS AND GAS PIPING

I. NFPA (NATIONAL FIRE PROTECTION ASSOCIATION)

1. NFPA 54 NATIONAL FUEL GAS CODE

J. NSF (NSF INTERNATIONAL)
1. 14 PLASTICS PIPING SYSTEM COMPONENTS AND RELATED MATERIALS
2. 61 DRINKING WATER SYSTEM COMPONENTS – HEALTH EFFECTS
3. 372 LEAD CONTENT CERTIFICATION

K. UL (UNDERWRITER'S LABORATORIES)

1.4 SUBMITTALS

A. SUBMITTALS SHALL BE SUBMITTED IN CONFORMANCE WITH THE REQUIREMENTS OF SECTION *22 00 01 - PLUMBING GENERAL PROVISIONS*.

B. SUBMITTALS ARE REQUIRED FOR:
1. PIPING (PIPE, FITTINGS, JOINTS, AND ACCESSORIES)
2. PIPE MATERIAL TRANSITION FITTINGS
3. MISCELLANEOUS ADAPTER FITTINGS
4. FIXTURE & EQUIPMENT CONNECTIONS
5. EXPANSION JOINTS
6. PIPE PENETRATION COMPONENTS (SLEEVES, ESCUTCHEON PLATES, FLASHING, SEALANT)

1.5 QUALITY ASSURANCE

A. WELDING REQUIREMENTS
1. MATERIALS AND PROCEDURES: CONFORM TO ASME CODE AND APPLICABLE STATE LABOR REGULATIONS.
2. CERTIFICATION: IN ACCORDANCE WITH ANSI/ASME SECTION 9.

1.6 TESTS

A. FURNISH ALL LABOR, MATERIAL, INSTRUMENTS, SUPPLIES AND SERVICES, AND BEAR ALL COSTS FOR THE ACCOMPLISHMENT OF THE TESTS SPECIFIED IN PART 3.

B. PERFORM ALL TESTS, OTHER THAN SPECIFIED HEREIN, WHICH MAY BE REQUIRED BY LEGAL AUTHORITIES OR BY AGENCIES TO WHOSE REQUIREMENTS THIS WORK IS TO CONFORM.

PART 2: PRODUCTS

2.1 PIPING CLASSES

A. SEE PIPE CLASSIFICATIONS SCHEDULE PROVIDED ON DRAWINGS.

2.2 PIPE MATERIAL TRANSITION FITTINGS

A. GRAVITY DRAIN SYSTEMS
1. FLEXIBLE COUPLINGS (12" DIAMETER PIPE AND LESS)
a. UNDERGROUND PIPE
1) SLEEVE MATERIAL: NEOPRENE
2) SHIELD / BAND MATERIAL: TYPE 300 SERIES S.S.
3) MAX TEMPERATURE: 250°F
4) MANUFACTURER / MODEL: MISSION RUBBER PRODUCTS HEAVYWEIGHT COUPLINGS OR APPROVED EQUAL.
b. ABOVE GROUND PIPE
1) SLEEVE MATERIAL: NEOPRENE
2) SHIELD / BAND MATERIAL: TYPE 300 SERIES S.S.
3) MAX TEMPERATURE: 250°F
4) MANUFACTURER / MODEL: FERNCO PROFLEX MODEL, MISSION RUBBER PRODUCTS BAND-SEAL MODEL, OR APPROVED EQUAL.
2. PIPE EXCEEDING 12" DIAMETER
a. USE ANSI B16 CLASS 150 FLANGES, SEALING GASKET DESIGNED FOR INTENDED TEMPERATURE AND WASTE, AND S.S. BOLTING HARDWARE.

B. PRESSURE PIPING SYSTEMS
1. 1 1/2" DIAMETER PIPE AND SMALLER
a. PIPE MATERIAL TRANSITION ADAPTER FITTING SPECIFICALLY DESIGNED FOR APPLICATION OF JOINING TWO DISSIMILAR MATERIAL PIPES.

b. THREADED ADAPTER FITTINGS EACH END MATCHING PIPE CLASSIFICATION WHERE INSTALLED (ONLY ACCEPTABLE WITH WRITTEN APPROVAL FROM THE ENGINEER).

2. 2" DIAMETER PIPE AND LARGER

a. ANSI B16 FLANGES EACH END MATCHING PIPE CLASSIFICATION WHERE INSTALLED.

2.3 MISCELLANEOUS ADAPTER FITTINGS

A. NIPPLES: NIPPLES SHALL BE THE SAME MATERIAL AND CLASS AS THE PIPING IN WHICH INSTALLED.

B. UNIONS: UNION MATERIAL, PIPE CONNECTIONS, AND GASKET SHALL MATCH PIPE CLASSIFICATION WHERE INSTALLED.

C. DIELECTRIC CONNECTIONS: HARD RUBBER THREADED BUSHING INSERTED BETWEEN TWO DISSIMILAR METALS, EACH END OF UNION CONNECTION MATCHING PIPE CLASSIFICATIONS WHERE INSTALLED.

D. THREADED CONNECTIONS: SEE PIPE CLASSIFICATIONS SCHEDULE ON DRAWINGS.

E. FLANGED CONNECTIONS: SEE PIPE CLASSIFICATIONS SCHEDULE ON DRAWINGS.

2.4 FIXTURE & EQUIPMENT CONNECTIONS

A. NATURAL GAS SYSTEMS

1. FLEXIBLE EQUIPMENT CONNECTIONS (ONLY WHERE SPECIFIED)

a. 1/2" AND UNDER: YELLOW COATED CORRUGATED STAINLESS STEEL TUBE FLEXIBLE CONNECTOR, DORMONT SERIES 19C AND 20C OR EQUAL.

b. 3/4" TO 1 1/4": GRAY PVC COATED CORRUGATED STAINLESS STEEL TUBE HIGH BTU FLEXIBLE CONNECTOR, DORMONT SERIES 41, 51, 61 OR EQUAL.

c. 1 1/2" AND LARGER: AGA/CSA GAS METRALOOP BY METRAFLEX OR EQUAL.

B. WATER DISTRIBUTION SYSTEMS

1. FIXTURE SUPPLY RISERS

a. SEE SECTION *22 40 00 – PLUMBING FIXTURES*.

2. FLEXIBLE EQUIPMENT CONNECTIONS (ONLY WHERE SPECIFIED)

a. COPPER PIPE

1) ANSI/NSF 61 AND NSF 372, FLEXIBLE BRONZE HOSE AND BRAID, COPPER BRAID BANDS, COPPER FEMALE SWEAT JOINT CONNECTIONS. MASON INDUSTRIES CPSB-NSF OR EQUAL.

b. STAINLESS STEEL PIPE

1) 1 1/2" DIAMETER AND SMALLER: ANSI/NSF 61 AND NSF 372, FLEXIBLE STAINLESS STEEL BRAIDED HOSE, STAINLESS STEEL BRAID BANDS, STAINLESS STEEL SCHEDULE 40 MALE NPT JOINT CONNECTIONS. MASON INDUSTRIES MNSS-NSF OR EQUAL.

2) 2” DIAMETER AND LARGER: ANSI/NSF 61 AND NSF 372, FLEXIBLE STAINLESS STEEL BRAIDED HOSE, STAINLESS STEEL BRAID BANDS, STAINLESS STEEL ASA 150 LB FLANGE JOINT CONNECTIONS. MASON INDUSTRIES FFSS-NSF OR EQUAL.

2.5 EXPANSION JOINTS

A. NATURAL GAS SYSTEMS

1. SEISMIC EXPANSION JOINTS

a. AGA/CSA GAS METRALOOP BY METRAFLEX OR EQUAL.

B. WATER DISTRIBUTION SYSTEMS

1. SEISMIC EXPANSION JOINTS

a. NSF 372 CERTIFIED, LEAD-FREE COPPER METRALOOP BY METRAFLEX OR EQUAL.

2.6 PIPE PENETRATIONS

A. SLEEVES

1. PROVIDE WATERSTOPS ON ALL SLEEVES USED FOR WATERTIGHT PENETRATIONS.

2. BELOW GRADE PENETRATIONS
    a. PROVIDE "LINK SEAL" CASING SEAL AND SLEEVE AS MANUFACTURED BY THUNDERLINE CORPORATION.
3. NON-FIRE RATED PARTITIONS
    a. UTILITY AREAS: 16 Ga. GALVANIZED STEEL SLEEVE SIZED FOR APPLICATION (SEE PART 3).
    b. PROCESS AREAS: 16 Ga. TYPE 304 S.S. SLEEVE SIZED FOR APPLICATION (SEE PART 3).
4. FIRE RATED PARTITIONS
    a. PROVIDE PREFABRICATED FIRE RATED SLEEVES INCLUDING SEALS, UL LISTED; OR PROVIDE SCHEDULE 40 STEEL SLEEVE SIZED FOR REQUIRED SPACE BETWEEN SLEEVE AND CARRIER PIPE (WHERE APPLICABLE) (SEE PART 3).

B. FIRE-STOPPING MATERIALS
1. SEE SECTION *22 05 01 – SUPPLEMENTARY COMPONENTS FOR PLUMBING WORK* FOR FIRE-STOPPING MATERIALS.

C. ESCUTCHEON PLATES
1. OFFICE AND RESIDENTIAL AREAS: CHROME-PLATED STEEL.
2. UTILITY AREAS: 16 Ga. TYPE 304 S.S. AS MANUFACTURED BY AWI OR EQUAL.
3. PROCESS AREAS: 16 Ga. TYPE 304 S.S. AS MANUFACTURED BY AWI OR EQUAL.

D. ROOF FLASHING
1. METAL FLASHING: 26 Ga. GALVANIZED STEEL.
2. FLEXIBLE FLASHING: 47 MIL THICK SHEET BUTYL; COMPATIBLE WITH ROOFING.
3. CAPS: STEEL, 22 Ga. MINIMUM; USE 16 Ga. AT FIRE RESISTANT ELEMENTS.

PART 3: EXECUTION

3.1 PIPING SYSTEMS INSTALLATION

A. GENERAL REQUIREMENTS
1. REMOVE SCALE AND DIRT, ON INSIDE AND OUTSIDE OF SYSTEM COMPONENTS, BEFORE ASSEMBLY.
2. ROUTE PIPING IN AN ORDERLY MANNER.
3. INSTALL PIPING TO CONSERVE BUILDING SPACE AND NOT INTERFERE WITH USE OF SPACE.
4. GROUP PIPING WHENEVER PRACTICAL AT COMMON ELEVATIONS.
5. INSTALL PIPING TO ALLOW FOR EXPANSION AND CONTRACTION WITHOUT STRESSING PIPE, JOINTS, OR CONNECTED EQUIPMENT.
6. BELOW GROUND PIPE INSTALLATIONS
    a. VERIFY THAT EXCAVATION BASE IS READY TO RECEIVE WORK AND THAT EXCAVATIONS, DIMENSIONS, AND ELEVATIONS ARE AS INDICATED ON DRAWINGS.
    b. HAND TRIM EXCAVATIONS TO REQUIRED ELEVATIONS. GRADE TRENCH BOTTOM TO PROVIDE A SMOOTH, FIRM, STABLE, AND ROCK-FREE FOUNDATION THROUGHOUT THE LENGTH OF THE PIPE.
    c. REMOVE LARGE STONES OR OTHER HARD MATTER WHICH COULD DAMAGE PIPING OR IMPEDE CONSISTENT BACKFILLING OR COMPACTION. REMOVE UNSTABLE, SOFT, AND UNSUITABLE MATERIALS AT THE SURFACE UPON WHICH PIPES OR STRUCTURES ARE TO BE LAID AND BACKFILL WITH STRUCTURAL FILL OR SCREENED GRAVEL TO INDICATED LEVEL.
    d. SHAPE BOTTOM OF TRENCH TO FIT BOTTOM OF PIPE. FILL UNEVENNESS WITH TAMPED SAND BACKFILL. DIG BELL HOLES AT EACH PIPE JOINT TO RELIEVE THE BELLS OF ALL LOADS AND TO ENSURE CONTINUOUS BEARING OF THE PIPE BARREL ON THE FOUNDATION. BACKFILL AND TAMP BY HAND TO THE SPRINGLINE OF THE PIPE.

e. MAINTAIN OPTIMUM MOISTURE CONTENT OF BEDDING MATERIAL TO ATTAIN REQUIRED COMPACTION DENSITY.
f. INSTALL PIPE, FITTINGS, AND ACCESSORIES IN ACCORDANCE WITH ASTM D232, A74 AND MANUFACTURER INSTRUCTIONS. SEAL JOINTS WATERTIGHT.
g. PLACE PIPE ON MINIMUM 4" DEEP BEDDING COURSE.
h. LAY PIPE TO SLOPE GRADIENTS NOTED ON DRAWINGS WITH MAXIMUM VARIATION FROM TRUE SLOPE OF 1/8" VERTICAL IN 10 FT HORIZONTAL. PLACE BELL ENDS OF PIPE FACING UPSTREAM. INSTALL GASKETS, SEALS, SLEEVES, AND COUPLINGS IN ACCORDANCE WITH MANUFACTURER RECOMMENDATIONS.
i. INSTALL INITIAL BACKFILL ON SIDES AND OVER TOP OF PIPE. PROVIDE TOP COVER TO MINIMUM COMPACTED THICKNESS OF 12", COMPACT TO 95% STANDARD PROCTOR MAXIMUM DRY DENSITY.
j. REFER TO SECTION *31 00 00 – EARTHWORK* FOR ADDITIONAL REQUIREMENTS. DO NOT DISPLACE OR DAMAGE PIPE WHEN COMPACTING.

B. DRAIN, WASTE, AND VENT PIPING
1. INTERIOR PIPING SHALL PITCH IN ACCORDANCE WITH CODE REQUIREMENTS, UNLESS OTHERWISE NOTED. BURIED SOIL AND WASTE PIPING SHALL BE MINIMUM OF 2" DIAMETER.
2. ALL CHANGES IN PIPE SIZE AND DIRECTION SHALL BE MADE WITH Y'S AND CLEANOUTS, REDUCING FITTINGS, AND RECESSED REDUCERS. Y'S AND 45 DEGREE FITTINGS OR 45 DEGREE COMBINATION FITTINGS SHALL BE USED WHEREVER CONDITIONS PERMIT.
3. SANITARY LONG SWEEP BENDS AND Y'S SHALL BE USED FOR CONNECTIONS TO BRANCH LINES FOR FIXTURES AND Y'S ON VERTICAL RUNS OF PIPE. LONG TURN FITTINGS SHALL BE USED WHEREVER CONDITIONS PERMIT.
4. ALL FITTINGS, REGARDLESS OF TYPE, SHALL BE FURNISHED COMPLETE WITH THE NECESSARY BOLTS, WASHERS, OR ANY OTHER FASTENING DEVICE COMMONLY REQUIRED AND ESSENTIAL FOR COMPLETE INSTALLATION.
5. CLEANOUTS SHALL BE INSTALLED WHERE INDICATED ON THE DRAWINGS, OR APPROXIMATELY EVERY 50 FT ALONG HORIZONTAL RUNS, AT ALL CHANGES IN DIRECTION, AND AT THE BASE OF ALL STACKS. CLEANOUTS OCCURRING IN OR BACK OF WALLS SHALL BE EXTENDED OUT TO FINISHED WALL AND FINISHED WITH FLUSH METAL ACCESS PANEL. CLEANOUTS LOCATED IN FLOOR SHALL BE EXTENDED TO GRADE AND FINISHED WITH AN ACCESS COVER. RUNNING CLEANOUTS MAY BE USED WHERE IT IS IMPRACTICAL TO USE END CLEANOUTS AT BASE OF RISERS.
6. EACH FIXTURE, DRAINAGE SPECIALTY, AND PIECE OF EQUIPMENT MUST BE SEPARATELY TRAPPED UNLESS OTHERWISE NOTED. ALL MAIN STACKS OF BACK VENTILATION SHALL RUN PARALLEL AND AS CLOSE AS POSSIBLE TO THE SOIL STACK, AND SHALL CONNECT TO THE VENT CONTINUATION OF THE SOIL STACK AT LEAST 3 FT ABOVE THE HIGHEST PLUMBING FIXTURE ON THE STACK. HORIZONTAL VENT LINES SHALL PITCH TOWARD A WASTE LINE.

C. WATER DISTRIBUTION PIPING
1. ALL INTERIOR WATER PIPING SHALL BE INSTALLED WITHOUT TRAPS OR POCKETS AND SHALL PITCH TO DRAW OFFS SO THAT THE WHOLE SYSTEM OR INDIVIDUAL SECTIONS CAN BE PROPERLY DRAINED.
2. PIPING SHALL BE SLOPED TO ALLOW FOR COMPLETE DRAINAGE OF THE SYSTEM WITH DRAIN VALVES IN ALL LOW POINTS NOT CAPABLE OF BEING DRAINED BY GRAVITY.
3. ALL DRAW OFF VALVES SHALL HAVE HOSE ENDS WHICH SHALL BE CAPPED.
4. PIPING SHALL BE PITCHED UP TOWARD RISERS AND FIXTURES FOR PROPER AIR RELIEF.

D. NATURAL GAS PIPING
1. PIPING INSTALLED ON ROOF SHALL BE A MINIMUM OF 3 1/2" ABOVE THE FINISHED ROOF SURFACE OR AS DIRECTED BY THE AUTHORITY HAVING JURISDICTION.

2. INSTALL MINIMUM 6” DEEP DIRT LEGS AT EACH EQUIPMENT CONNECTION AND BUILDING SERVICE ENTRANCE. LOCATE DIRT LEGS DOWNSTREAM OF EQUIPMENT ISOLATION VALVES IN A MANNER THAT FACILITATES EASE OF REMOVAL, CLEANING, AND INSPECTION.
3. BRANCH LINES SHALL COME OFF THE TOP OF THE MAIN HEADER PIPE.
4. PROVIDE VENTS FOR REGULATORS THAT REQUIRE VENTING. ROUTE VENT PIPING TO THE OUTDOORS A MINIMUM 15 FT AWAY FROM FRESH AIR INTAKES. VENT TERMINATION SHALL NOT ALLOW FOR ENTRY OF INSECTS, WATER, AND FOREIGN OBJECTS. VENT PIPE SHALL MATCH THE REGULATOR VENT CONNECTION SIZE AND BE OF THE SAME PIPE CLASSIFICATION OF PIPE WHERE REGULATOR IS INSTALLED UNLESS NOTED OTHERWISE.

3.2 PIPE JOINTS INSTALLATION

A. GENERAL REQUIREMENTS
1. EXERCISE CARE WHEN MAKING PIPE JOINTS AND MAKE JOINTS IN ACCORDANCE WITH THE PIPE MATERIAL MANUFACTURER’S RECOMMENDATIONS AND THE FOLLOWING REQUIREMENTS.
2. IN EACH INSTANCE OF PIPE JOINING, THOSE PORTIONS OF PIPES INVOLVED MUST BE ABSOLUTELY CLEAN JUST PRIOR TO ASSEMBLY.
3. IF A JOINT IS EXTREMELY DIFFICULT TO ASSEMBLE OR SEALING IS NOT EFFECTIVE, DISASSEMBLE THE JOINT AND CORRECT THE DIFFICULTY. REMAKE THE JOINT USING NEW MATERIALS WHEN NECESSARY.
4. JOINTS SHALL NOT BE MADE IF THE MATERIALS OR AIR TEMPERATURE IS NOT WITHIN MANUFACTURER SPECIFIED LIMITS.

B. SWEAT JOINTS
1. CUT TUBING AND PIPING ENDS SQUARE, DEBURR AND REAM TO SIZE OF ORIGINAL BORE. PRIOR TO APPLYING FLUX AND SWEATING, CLEAN PIPE ENDS AND FITTING SURFACES INVOLVED IN THE JOINT TO BRIGHT METAL WITHOUT MARRING SURFACES.
2. FINISHED JOINTS SHALL BE FILLED THE FULL LENGTH OF THE SOCKET, SHOW NO EVIDENCE OF HARD-TEMPER DUE TO OVERHEATING, NO EVIDENCE OF IMPROPER SOLDER DRAW, AND EXCESS SOLDER MUST BE REMOVED.

C. THREADED JOINTS
1. CUT PIPE ENDS SQUARE, DEBURR AND REAM TO SIZE OF ORIGINAL BORE. CUT THREADS TO STANDARD GAUGE DEPTH AND LENGTH AND CLEAN THREADS FREE OF OIL AND CUTTINGS.
2. USE “TEFLON” FORMULATION JOINT TAPE OR “TEFLON” JOINT PASTE TO AID IN JOINT LUBRICATION AND SEALING IN JOINING OPERATION.

D. FLANGED JOINTS
1. FACE ACCURATELY, INSTALL GASKETS AND DRAW UP SQUARE AND TIGHT TO INSURE FULL GASKET FLOW SEAL. TIGHTEN BOLTS TO REQUIRED TORQUE AND IN CORRECT SEQUENCE AS RECOMMENDED BY THE FLANGE MANUFACTURER.

E. NO-HUB JOINTS
1. NO-HUB JOINT ENDS MUST BE PROPERLY ENTERED IN THE GASKET SHIELD/CLAMP ASSEMBLY PRIOR TO TIGHTENING.
2. MAKE NO-HUB JOINTS IN ACCORDANCE WITH CISPI.

F. SOCKET (SOLVENT CEMENT) JOINTS
1. ALL INSTALLERS SHALL BE ASME B31.3 CERTIFIED.
2. PREPARATION: PIPE SHALL BE CUT SQUARELY WITH A FINE-TOOTHED SAW OR KNIFE. REMOVE ALL BURRS WITH A FILE. MARK INSERTION DEPTH ON ADJOINING PIPE.
3. PRIMER: APPLY PRIMER AGGRESSIVELY ONTO FITTING SOCKET AND WORK INTO THE SURFACE. APPLY PRIMER AGGRESSIVELY ONTO PIPE SURFACE 1/2" PAST INSERTION MARK AND WORK INTO SURFACE. APPLY ADDITIONAL COATS OF PRIMER AS DIRECTED BY PIPE MANUFACTURER’S INSTALLATION DOCUMENTS.

4. CEMENT: APPLY CEMENT TO PRIMER WHILE PRIMER IS WET. APPLY A FULL EVEN LAYER OF CEMENT TO THE PIPE SURFACE 1/2" PAST INSERTION MARK AND WORK INTO SURFACE. APPLY A MEDIUM EVEN LAYER OF CEMENT TO THE SOCKET FITTING AND WORK INTO SURFACE. APPLY A SECOND FULL EVEN LAYER OF CEMENT TO THE PIPE SURFACE AND WORK INTO SURFACE.
5. JOIN PIPE FITTINGS: ASSEMBLE PIPE WHEN CEMENT IS STILL FLUID. FULLY INSERT PIPE INTO SOCKET, CONFIRM INSERTION DEPTH WITH A MEASURING TAPE. USE A PULLING TOOL TO HOLD PIPE IN PLACE FOR SET TIME REQUIRED BY PIPE MANUFACTURER.
6. CLEANING: REMOVE EXCESS CEMENT FROM PIPE EXTERIOR SURFACE AFTER PIPE JOINT IS CONSTRUCTED.

G. ELECTROFUSION JOINTS
1. ALL INSTALLERS SHALL BE TRAINED IN THE INSTALLATION OF ELECTROFUSION JOINTS AND MUST PROVIDE PROOF OF PIPE MANUFACTURER TRAINING PROGRAM COMPLETION TO THE CONSTRUCTION MANAGER PRIOR TO PIPE INSTALLATION. JOINING OF ELECTROFUSION JOINTS SHALL ONLY BE DONE USING PIPE MANUFACTURER APPROVED SPECIALTY TOOLS AND INSTALLATION PRACTICES.

3.3 PIPE MATERIAL TRANSITION FITTINGS
A. INSTALL PIPE MATERIAL TRANSITION FITTINGS AS SHOWN ON DRAWINGS AND AS REQUIRED FOR CHANGES IN PIPE CLASSIFICATIONS.

3.4 CONNECTIONS
A. GENERAL REQUIREMENTS
1. DRAWINGS INDICATE GENERAL ARRANGEMENT OF PIPING, FITTINGS, AND SPECIALTIES.
2. CONNECTIONS TO EQUIPMENT, FIXTURES, DRAIN SPECIALTIES, ETC., SHALL BE MADE IN ACCORDANCE WITH THE SHOP DRAWINGS AND ROUGH-IN MEASUREMENTS FURNISHED BY THE MANUFACTURER OF THE PARTICULAR EQUIPMENT FURNISHED. ANY AND ALL ADDITIONAL CONNECTIONS NOT SHOWN ON THE DRAWINGS, BUT CALLED FOR BY THE EQUIPMENT MANUFACTURER'S SHOP DRAWINGS OR REQUIRED FOR THE SUCCESSFUL OPERATION OF THE PARTICULAR EQUIPMENT FURNISHED, SHALL BE INSTALLED WITH NO ADDITIONAL CHARGE.

B. DRAIN, WASTE, AND VENT PIPING
1. INSTALL DRAIN AND VENT CONNECTION SIZES AS INDUCTED, BUT NOT LESS THAN REQUIRED BY THE AUTHORITY HAVING JURISDICTION.
2. INSTALL UNION AT EACH EQUIPMENT AND FIXTURE DRAIN CONNECTION (UNDERGROUND DRAIN SPECIALTIES SHALL NOT BE CONSIDERED FIXTURES OR EQUIPMENT).
3. REFER TO DETAILS FOR ADDITIONAL CONNECTION REQUIREMENTS AT SPECIFIC LOCATIONS.

C. WATER DISTRIBUTION AND NATURAL GAS PIPING
1. INSTALL EQUIPMENT AND FIXTURE SUPPLY CONNECTION SIZES AS INDUCTED, BUT NOT LESS THAN REQUIRED BY THE AUTHORITY HAVING JURISDICTION.
2. INSTALL SHUTOFF VALVE AND UNION AT EACH EQUIPMENT AND FIXTURE SUPPLY CONNECTION. USE FLANGES INSTEAD OF UNIONS FOR 2" DIAMETER PIPE AND LARGER.
3. REFER TO DETAILS FOR ADDITIONAL CONNECTION REQUIREMENTS AT SPECIFIC LOCATIONS.

3.5 EXPANSION JOINTS
A. SEISMIC / THERMAL EXPANSION JOINTS
1. INSTALL WITH ADEQUATE CLEARANCE FOR MAXIMUM ALLOWED MOVEMENT OF THE EXPANSION JOINT.
2. FOR NON-THERMAL APPLICATIONS WHEN PIPE IS SPANNING A BUILDING'S SEISMIC EXPANSION JOINT, GUIDES ARE NOT REQUIRED.
3. FOR THERMAL EXPANSION APPLICATIONS WHEN PIPE IS SUPPORTED BY HANGERS THAT ARE EXPECTED TO SWING MORE THAN 4 DEGREES FROM THE VERTICAL, GUIDES ARE REQUIRED WITHIN 15 PIPE DIAMETERS OF THE EXPANSION JOINT.

3.6 PIPE PENETRATIONS

A. GENERAL REQUIREMENTS

1. INSTALL PIPES CENTERED IN SLEEVES SO THAT NEITHER THE PIPE NOR ITS INSULATION (WHERE APPLICABLE) TOUCHES THE SLEEVE AT ANY POINT.

B. INSULATED METAL PANELS (IMP)

1. REFER TO DETAILS PROVIDED ON THE DRAWINGS.

C. MASONRY CONSTRUCTION

1. REFER TO DETAILS PROVIDED ON THE DRAWINGS.

D. GYPSUM BOARD

1. REFER TO DETAILS PROVIDED ON THE DRAWINGS.

E. ROOFING SYSTEMS

1. REFER TO DETAILS PROVIDED ON THE DRAWINGS.

3.7 TESTING

A. GENERAL REQUIREMENTS

1. THE PLUMBING CONTRACTOR SHALL NOTIFY THE ENGINEER THREE WORKING DAYS PRIOR TO THE DAY TESTS ARE TO BE MADE. TEST ALL PIPING AND MAKE IT GAS AND WATER TIGHT, IN ACCORDANCE WITH THE AUTHORITY HAVING JURISDICTION AND ORDINANCES, AND IN THE PRESENCE AND TO THE SATISFACTION OF THE APPLICABLE INSPECTOR ALONG WITH THE ENGINEER AND HIS OR HER REPRESENTATIVE.
2. NO PIPING SHALL BE BURIED, CONCEALED, OR INSULATED BEFORE TESTED AND APPROVED. PARTIAL TESTS SHALL BE MADE AS REQUIRED, BY THE PROGRESS OF THE WORK, AND THE PLUMBING CONTRACTOR SHALL ACCOMMODATE THE TESTING OPERATIONS TO THE PROGRESS OF THE PROJECT. FURNISH ALL EQUIPMENT, LABOR, SERVICES AND APPARATUS; ALSO PAY FOR ALL COSTS FOR PERTINENT TESTS. ALL APPROVALS SHALL BE RENDERED IN WRITING AND SUBMITTED TO THE ENGINEER. REMEDY ALL DEFECTIVE WORK AND REPLACE ALL DEFECTIVE MATERIALS, EQUIPMENT, OR FIXTURES WITH NEW ONES OF THE SPECIFIED GRADE. NO CAULKING, PEENING, OR WICKING OF SCREWED JOINTS OR HOLES WILL BE ACCEPTABLE. THIS CONTRACTOR SHALL MAKE AND REMOVE ALL TEMPORARY PIPING AND LINE CONNECTIONS REQUIRED FOR THE TESTS AND SHALL DISPOSE OF TEST WATER AND ALL WASTES AFTER TESTS IN A SATISFACTORY AND NON DAMAGING MANNER.
3. PROVIDE WRITTEN REPORTS TO ENGINEER OF EACH INDIVIDUAL TEST PROCEDURE PERFORMED. REPORTS SHALL INCLUDE THE FOLLOWING MINIMUM INFORMATION:
    a. PROJECT LOCATION INFORMATION
    b. CONTRACTOR'S NAME
    c. NAME OF PERSON TEST PERFORMED BY
    d. NAME AND COMPANY OF PERSON WHO OBSERVED TEST WITH CONTRACTOR
    e. PIPING SYSTEM
    f. SECTION OF SYSTEM TESTED
    g. DATE OF TEST
    h. METHOD OF TEST
    i. ANTICIPATED SYSTEM WORKING PRESSURE
    j. GAUGE RANGE AND INCREMENTATION USED
    k. START TIME OF TEST
    l. START TEST PRESSURE
    m. END TIME OF TEST
    n. END TEST PRESSURE
    o. OBSERVED LOSS IN PRESSURE
    p. NOTES ON ANY OBSERVED LEAKS

B. TEST GAUGES

1. TESTS REQUIRING A PRESSURE LESS THAN 1 PSI SHALL UTILIZE A U-TUBE OR DIGITAL MANOMETER.

2. TESTS REQUIRING A PRESSURE OF 1 PSI TO 10 PSI OR LESS SHALL UTILIZE A TESTING GAUGE HAVING INCREMENTS OF 0.10 PSI OR LESS.
3. TESTS REQUIRING A PRESSURE OF GREATER THAN 10 PSI BUT LESS THAN OR EQUAL TO 100 PSI SHALL UTILIZE A TESTING GAUGE HAVING INCREMENTS OF 1 PSI OR LESS.
4. TESTS REQUIRING A PRESSURE OF GREATER THAN 100 PSI SHALL UTILIZE A TESTING GAUGE HAVING INCREMENTS OF 2 PSI OR LESS.

C. PIPING SYSTEMS

TEST PIPING SYSTEMS ACCORDING TO PROCEDURES OF AUTHORITIES HAVING JURISDICTION OR, IN ABSENCE OF PUBLISHED PROCEDURES, AS FOLLOWS:

1. GRAVITY DRAIN SYSTEMS
    a. TEST FOR LEAKS AND DEFECTS IN NEW PIPING AND PARTS OF EXISTING PIPING THAT HAVE BEEN ALTERED, EXTENDED, OR REPAIRED. IF TESTING IS PERFORMED IN SEGMENTS, SUBMIT SEPARATE REPORT FOR EACH TEST, COMPLETE WITH DIAGRAM OF PORTION OF PIPING TESTED.
    b. LEAVE UNCOVERED AND UNCONCEALED NEW, ALTERED, EXTENDED, OR REPLACED DRAINAGE AND VENT PIPING UNTIL IT HAS BEEN TESTED AND APPROVED. EXPOSE WORK THAT WAS COVERED OR CONCEALED BEFORE IT WAS TESTED.
    c. ROUGHING-IN PLUMBING TEST PROCEDURE: TEST DRAINAGE AND VENT PIPING, EXCEPT OUTSIDE LEADERS, ON COMPLETION OF ROUGHING-IN. CLOSE OPENINGS IN PIPING SYSTEM EXCEPT THE HIGHEST OPENING, AND FILL WITH WATER TO POINT OF OVERFLOW, BUT NOT LESS THAN 10 FT HEAD OF WATER. FROM 15 MINUTES BEFORE INSPECTION STARTS TO COMPLETION OF INSPECTION, WATER LEVEL MUST NOT DROP. INSPECT JOINTS FOR LEAKS. MULTIPLE ROUGH-IN TESTS FOR SEGMENTS OF THE PIPING SYSTEM ARE ALLOWABLE.
    d. FINISHED PLUMBING TEST PROCEDURE: AFTER ALL PLUMBING PIPING HAS BEEN SET AND TRAPS FILLED WITH WATER, TEST CONNECTIONS AND PROVE THEY ARE GASTIGHT AND WATERTIGHT. PLUG ALL PIPE OPENINGS ABOVE SLAB AND BELOW GROUND BUILDING DRAINS WHERE THEY LEAVE BUILDING. INTRODUCE A PUNGENT, THICK SMOKE INTO ENTIRE PIPING SYSTEM BY ONE OR MORE SMOKE MACHINES AS REQUIRED. A PRESSURE EQUAL TO 1" W.C. SHALL BE HELD FOR NO LESS THAN 15 MINUTES. USE U-TUBE OR MANOMETER INSERTED IN TRAP TO MEASURE THIS PRESSURE. AIR PRESSURE MUST REMAIN CONSTANT WITHOUT INTRODUCING ADDITIONAL AIR THROUGHOUT PERIOD OF INSPECTION. INSPECT PLUMBING SYSTEM FOR LEAKS.
    e. REPAIR LEAKS AND DEFECTS WITH NEW MATERIALS AND RE-TEST PIPING, OR PORTION THEREOF, UNTIL SATISFACTORY RESULTS ARE OBTAINED.
    f. PREPARE REPORTS FOR TESTS AND REQUIRED CORRECTIVE ACTION.
2. FORCED SEWER SYSTEMS
    a. FORCED SEWER TESTS SHALL CONSIST OF PLUGGING THE END OF THE BUILDING SEWER AT THE POINT OF CONNECTION WITH THE PUBLIC SEWER OR BUILDING GRAVITY SEWER AND APPLYING A WATER PRESSURE OF 5 PSI GREATER THAN THE PUMP RATING, AND MAINTAINING SUCH PRESSURE FOR NO LESS THAN 15 MINUTES.
    b. REPAIR LEAKS AND DEFECTS WITH NEW MATERIALS AND RE-TEST PIPING, OR PORTION THEREOF, UNTIL SATISFACTORY RESULTS ARE OBTAINED.
    c. PREPARE REPORTS FOR TESTS AND REQUIRED CORRECTIVE ACTION.
3. WATER DISTRIBUTION SYSTEMS
    a. UPON COMPLETION OF A SECTION OF, OR THE ENTIRE WATER SUPPLY SYSTEM, THE SYSTEM, OR PORTION COMPLETED, SHALL BE TESTED AND PROVED TIGHT UNDER A WATER PRESSURE NOT LESS THAN 125 PSI. THIS PRESSURE SHALL

BE HELD FOR NOT LESS THAN 15 MINUTES. THE WATER UTILIZED FOR TESTS SHALL BE OBTAINED FROM A POTABLE SOURCE OF SUPPLY.

b. REPAIR LEAKS AND DEFECTS WITH NEW MATERIALS AND RE-TEST PIPING, OR PORTION THEREOF, UNTIL SATISFACTORY RESULTS ARE OBTAINED.

c. PREPARE REPORTS FOR TESTS AND REQUIRED CORRECTIVE ACTION.

4. NATURAL GAS SYSTEMS

a. TEST MEDIUM: TEST MEDIUM SHALL BE AN INERT GAS. OXYGEN SHALL NOT BE PERMITTED.

b. PREPARATION: TEST PIPE BEFORE PAINTING, COVERING, OR CONCEALING PIPE. PIPE JOINTS SHALL BE LEFT EXPOSED AND SHALL BE EASILY OBSERVED DURING TESTS. ISOLATE ARES NOT INCLUDED IN CURRENT TEST (IF APPLICABLE) WITH ISOLATION VALVES, BLIND FLANGES, OR CAPS.

c. TEST PRESSURE: THE TEST PRESSURE SHALL BE 1.5 TIMES THE WORKING PRESSURE OF THE PORTION OF PIPE TESTED, UNLESS THE SYSTEM WORKING PRESSURE IS BELOW 2 PSIG, IN WHICH CASE THE TEST PRESSURE SHALL BE 3 PSIG.

d. TEST DURATION: TEST DURATION SHALL BE 1/2 HOUR FOR EACH 500 CUBIC FEET OF PIPE VOLUME TESTED. WHEN TESTING A SYSTEM WITH VOLUME LESS THAN 10 CUBIC FEET, THE MINIMUM TEST TIME SHALL BE 10 MINUTES.

e. DETECTION OF LEAKS: THE TEST PRESSURE SHALL REMAIN CONSTANT WITHOUT SHOWING ANY SIGNS OF LEAKAGE OR DEFECTS.

f. CORRECTION: REPAIR LEAKS AND DEFECTS WITH NEW MATERIALS AND RE-TEST PIPING, OR PORTION THEREOF, UNTIL SATISFACTORY RESULTS ARE OBTAINED.

g. PREPARE REPORTS FOR TESTS AND REQUIRED CORRECTIVE ACTION.

3.8 CLEANING AND STERILIZATION OF PIPING SYSTEMS

A. THE PLUMBING CONTRACTOR SHALL BE RESPONSIBLE FOR THE CLEANING AND PURGING OF ALL PERTINENT SYSTEMS AFTER INSTALLATION AND BEFORE SYSTEM OPERATION. ANY DAMAGE TO THE BUILDING, ITS FINISH, OR FURNISHINGS DUE TO THE CONTRACTOR'S FAILURE TO PROPERLY CLEAN THE SYSTEM, SHALL BE REPAIRED OR REPLACED AT CONTRACTOR EXPENSE.

B. ALL FINISHED METAL WORK SHALL BE CLEANED, POLISHED, AND LEFT BRIGHT. ALL EQUIPMENT, PIPE, VALVES, DRAINS AND FITTINGS SHALL BE CLEANED OF GREASE, METAL CUTTING, AND SLUDGE WHICH MAY HAVE ACCUMULATED DURING CONSTRUCTION AND/OR TESTING.

C. THE ENTIRE POTABLE WATER SYSTEM SHALL BE THOROUGHLY STERILIZED BY THE PLUMBING CONTRACTOR. IN THE ABSENCE OF A PRESCRIBED METHOD, THE PLUMBING CONTRACTOR SHALL STERILIZE IN ACCORDANCE WITH AWWA C651 OR AWWA C652 OR AS DESCRIBED HEREIN. THE SYSTEM SHALL BE FILLED WITH A WATER/CHLORINE SOLUTION CONTAINING NOT LESS THAN 50 PARTS PER MILLION OF CHLORINE AND THE SOLUTION SHALL BE ALLOWED TO REMAIN IN THE SYSTEM FOR A PERIOD OF 24 HOURS; OR THE SYSTEM SHALL BE FILLED WITH A WATER/CHLORINE SOLUTION CONTAINING NOT LESS THAN 200 PARTS PER MILLION OF CHLORINE AND THE SOLUTION SHALL BE ALLOWED TO REMAIN IN THE SYSTEM FOR A PERIOD OF 3 HOURS. DURING STERILIZATION ALL VALVES AND FAUCETS SHALL BE OPENED AND CLOSED SEVERAL TIMES. AFTER STERILIZATION, THE SOLUTION SHALL BE FLUSHED FROM THE SYSTEM WITH CLEAN POTABLE WATER UNTIL THE RESIDUAL CHLORINE CONTENT IS NOT GREATER THAN 0.2 PARTS PER MILLION. STERILIZATION SHALL BE TO THE SATISFACTION OF THE BOARD OF HEALTH. SUBMIT CERTIFICATION, IN WRITING, THAT THIS WORK HAS BEEN ACCOMPLISHED IN CONFORMANCE WITH THE ABOVE. DISPOSE OF ALL STERILIZING WATER/SOLUTION IN A MANNER ACCEPTABLE TO THE LOCAL AUTHORITIES.

END OF SECTION

SECTION 22 13 19
PLUMBING SPECIALTIES

PART 1: GENERAL

1.1 SUMMARY

A. THE WORK OF THIS SECTION SHALL INCLUDE:

1. FLOOR DRAINS
2. HUB DRAINS
3. CLEANOUTS
4. DRAIN ACCESSORIES (P-TRAPS, TRANSITION FITTINGS)

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. THE FOLLOWING REFERENCED SECTIONS ARE LISTED AS A MINIMUM OF ADDITIONAL REQUIREMENTS AND/OR WORK NOT INCLUDED IN THIS SECTION WHICH MAY BE REQUIRED TO BE PERFORMED UNDER OTHER DESIGNATED SECTIONS:

1. 22 10 00 – PLUMBING PIPING

1.3 REFERENCE STANDARDS

A. ASME (AMERICAN SOCIETY OF MECHANICAL ENGINEERS)

1. A112.6.3 FLOOR AND TRENCH DRAINS
2. A112.6.4 ROOF, DECK, AND BALCONY DRAINS
3. A112.36.2M CLEANOUTS
4. B36.19M STAINLESS STEEL PIPE

1.4 SUBMITTALS

A. SUBMITTALS SHALL BE SUBMITTED IN CONFORMANCE WITH THE REQUIREMENTS OF SECTION *22 00 01 – PLUMBING GENERAL PROVISIONS*.

B. SUBMITTALS ARE REQUIRED FOR:

1. FLOOR DRAINS
2. HUB DRAINS
3. CLEANOUTS
4. DRAIN ACCESSORIES

PART 2: PRODUCTS

2.1 GENERAL REQUIREMENTS

A. SEE PLUMBING SCHEDULES PROVIDED ON DRAWINGS FOR MORE DETAILED INFORMATION OF DRAINAGE SPECIALTIES AND ACCESSORIES INCLUDED IN THE PRODUCTS SECTION SPECIFIED HEREUNDER. MANUFACTURERS AND MODEL NUMBERS ARE USED FOR SETTING A STANDARD OF TYPE AND QUALITY. THE ENGINEER SHALL ALLOW ALTERNATE MANUFACTURERS BASED UPON DETERMINATION OF EQUALITY WITH SCHEDULED EQUIPMENT.

B. WHERE DRAINAGE SPECIALTIES AND ACCESSORIES ARE CALLED OUT TO BE FURNISHED BY OTHERS AND INSTALLED BY THE PLUMBING CONTRACTOR, THE PLUMBING CONTRACTOR SHALL NOT FURNISH THE PRODUCT BUT IS STILL REQUIRED TO RECEIVE, TAKE INVENTORY OF, STORE AND PROTECT, AND PROVIDE INSTALLATION OF DRAINAGE SPECIALTIES AND ACCESSORIES.

2.2 STAINLESS STEEL DRAINAGE SPECIALTIES

THE FOLLOWING PRODUCTS ARE TYPICALLY USED IN FOOD PRODUCTION AREAS BUT MAY ALSO BE LOCATED IN NON-FOOD PRODUCTION AREAS. REFER TO DRAIN TAG CALL-OUTS ON DRAWINGS FOR SPECIFIC LOCATIONS OF EACH DRAIN.

A. FLOOR DRAINS (FD-01, FD-02)

1. SEE SCHEDULES ON DRAWINGS.
2. MANUFACTURERS: AWI, KUSEL, NORTHLAND PROCESS PIPING OR EQUAL.

B. HUB DRAINS (HD-01)

1. SEE SCHEDULES ON DRAWINGS.
2. MANUFACTURERS: AWI, KUSEL, NORTHLAND PROCESS PIPING OR EQUAL.

C. CLEANOUTS (CO-01, CO-2)

1. SEE SCHEDULES ON DRAWINGS.
2. MANUFACTURERS: AWI, KUSEL, NORTHLAND PROCESS PIPING OR EQUAL.

2.3 NON-PROCESS AREA DRAINAGE SPECIALTIES

IN NO INSTANCES SHALL ANY OF THE FOLLOWING DRAIN SPECIALTIES BE INSTALLED IN FOOD PRODUCTION AREAS WITHOUT WRITTEN APPROVAL FROM THE ENGINEER.

A. FLOOR DRAINS (FD-03)
   1. SEE SCHEDULES ON DRAWINGS.
   2. MANUFACTURERS: JAY R. SMITH, JOSAM, MIFAB, WATTS, ZURN OR EQUAL.

B. CLEANOUTS (CO-03, CO-04, C0-5, CO-6)
   1. SEE SCHEDULES ON DRAWINGS.
   2. MANUFACTURERS: JAY R. SMITH, JOSAM, MIFAB, WATTS, ZURN OR EQUAL.

2.4 DRAIN ACCESSORIES

A. P-TRAPS
   1. STAINLESS STEEL P-TRAPS
      a. CONSTRUCTION: SCHEDULE 10 TYPE 304 OR 316 S.S. (MATCH P-TRAP MATERIAL WITH PIPE TAILPIECE MATERIAL AS CALLED OUT ON DRAWINGS), 1.5R ELBOWS, FULL BUTT WELD CONNECTIONS.
      b. WELDS: GROUND SMOOTH ON PIPE EXTERIOR.
      c. FINISH: 150-180 GRIT (RA 32) POLISHED PIPE O.D. WHEN EXPOSED IN FOOD PRODUCTION AREAS, NON-POLISHED IN ALL OTHER INSTANCES.
      d. MANUFACTURERS: AWI, KUSEL, CUSTOM FABRICATED PER DETAILS OR EQUAL.
   2. POLYPROPYLENE P-TRAPS
      a. CONSTRUCTION: MATCH PIPE CLASSIFICATION OF CONNECTING DRAIN PIPE AS CALLED OUT ON DRAWINGS.
      b. MANUFACTURERS: GEORG FISCHER, IPEX OR EQUAL.
   3. CPVC P-TRAPS
      a. CONSTRUCTION: MATCH PIPE CLASSIFICATION OF CONNECTING DRAIN PIPE AS CALLED OUT ON DRAWINGS.
      b. MANUFACTURERS: GEORG FISCHER, IPEX, SPEARS OR EQUAL.
   4. PVC P-TRAPS
      a. CONSTRUCTION: MATCH PIPE CLASSIFICATION OF CONNECTING DRAIN PIPE AS CALLED OUT ON DRAWINGS.
      b. MANUFACTURERS: IPEX, SPEARS OR EQUAL.
   5. CAST-IRON P-TRAPS
      a. CONSTRUCTION: MATCH PIPE CLASSIFICATION OF CONNECTING DRAIN PIPE AS CALLED OUT ON DRAWINGS.
      b. MANUFACTURERS: CHARLOTTE PIPE OR EQUAL.

B. PIPE MATERIAL TRANSITION FITTINGS
   1. SEE SECTION *22 10 00 – PLUMBING PIPING*.

PART 3: EXECUTION

3.1 GENERAL REQUIREMENTS

A. INSTALL ALL DRAINAGE SPECIALTIES IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS AND DETAILS PROVIDED ON THE DRAWINGS.

B. DRAINS SHALL BE LEVELED AND SET WITH RIM ELEVATIONS WITHIN 1/16” OF SPECIFIED.

C. CONCRETE FLOOR SLAB MAY OR MAY NOT HAVE A BUILT-UP FINISHED FLOOR. PLUMBING CONTRACTOR SHALL VERIFY FINAL FLOOR FINISH AT EACH DRAIN AND COORDINATE APPLICABLE DRAIN INSTALLATION WITH CONSTRUCTION MANAGER AND FLOORING CONTRACTOR.

D. ANCHORING CONCRETE
   1. WITH DRAINAGE SPECIALTIES LEVEL AND ELEVATIONS SET, PLUMBING CONTRACTOR SHALL ANCHOR AND SECURE DRAINS WITH ANCHORING CONCRETE AND REBAR AS SHOWN ON DRAWING DETAILS TO MAINTAIN CORRECT POSITION OF DRAIN UNTIL AND DURING POUR OF THE CONCRETE FLOOR SLAB.
   2. TOP OF ANCHORING CONCRETE SHALL BE SET 4" MINIMUM BELOW FINAL FINISH FLOOR GRADE. ANCHORING CONCRETE SHALL ENCASE BOTTOM OF DRAIN BODY AND EXTEND UP TO SETTING RING OR SETTING TABS.

E. PLUMBING CONTRACTOR SHALL PROVIDE PERSONNEL DURING POUR OF CONCRETE FLOOR SLAB TO COORDINATE AND ASSURE DRAINS ARE LEVEL AND AT CORRECT ELEVATION.

3.2 CLEANOUTS

A. LUBRICATE THREADED CLEANOUT PLUGS WITH MIXTURE OF GRAPHITE AND LINSEED OIL.
B. ENSURE CLEARANCE AT CLEANOUT FOR RODDING OF DRAINAGE SYSTEM.
C. TOP SURFACE OF CLEANOUTS SHALL BE INSTALLED 1/8" HIGHER THAN FINAL LOCAL FINISH FLOOR ELEVATION. COORDINATE DRAIN RIM ELEVATIONS WITH SLAB CONTRACTOR, FLOORING CONTRACTOR, AND CONSTRUCTION MANAGER.
D. ENCASE EXTERIOR CLEANOUTS IN CONCRETE, ALIGN TOP SURFACE FLUSH WITH FINISHED GRADE ELEVATION.

3.3 FLOOR DRAINS & HUB DRAINS

A. IN ALL CASES, TOP SURFACE OF DRAIN SHALL BE FLUSH WITH FINAL LOCAL FINISH FLOOR ELEVATION. COORDINATE DRAIN RIM ELEVATIONS WITH SLAB CONTRACTOR, FLOORING CONTRACTOR, AND CONSTRUCTION MANAGER.

3.4 PROTECTION OF WORK

A. ACCEPT DRAIN SPECIALTIES ON SITE IN FACTORY PACKAGING. INSPECT FOR DAMAGE. NOTIFY THE CONSTRUCTION MANAGER OF ANY DAMAGE AND RETURN DAMAGED DRAIN SPECIALTIES FOR NEW REPLACEMENT UNITS IF DIRECTED TO DO SO BY THE CONSTRUCTION MANAGER.
B. KEEP WOOD SHIPPING BLOCKS WITHIN DRAINS DURING DRAIN INSTALLATION AND UP UNTIL FINISHED FLOORING IS COMPLETELY CONSTRUCTED. REMOVE WOOD BLOCKING BEFORE SYSTEM TESTING AND FINAL TURNOVER TO OWNER.
C. TAPE EXPOSED SURFACES OF DRAINAGE SPECIALTIES DURING DRAIN INSTALLATION AND KEEP DRAIN SPECIALTIES TAPED DURING CONSTRUCTION. REMOVE TAPE BEFORE FINAL TURNOVER TO OWNER.
D. PROTECT INSTALLED DRAINS FROM DAMAGE BY SECURING AREAS WITH CONES, CAUTION TAPE, ETC.

3.5 CLEANING

A. AT COMPLETION OF ALL WORK (INCLUDING WORK BY OTHERS IN THE AREA DRAINS ARE INSTALLED), EXPOSED SURFACES OF DRAIN SPECIALTIES SHALL BE THOROUGHLY CLEANED RETURNING THEM TO "AS-NEW" CONDITION.

END OF SECTION

SECTION 22 30 00
PLUMBING EQUIPMENT

PART 1: GENERAL

1.1 SUMMARY

A. THE WORK OF THIS SECTION SHALL INCLUDE:

1. WATER HEATERS
2. EXPANSION TANKS
3. RELIEF VALVES
4. PUMPS
5. BACKFLOW PREVENTERS
6. WATER REGULATORS
7. GAS REGULATORS
8. TEMPERING VALVES
9. TRAP PRIMER VALVES
10. WATER HAMMER ARRESTORS
11. TRIM AND ACCESSORIES FOR ALL ABOVE MENTIONED EQUIPMENT

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. THE FOLLOWING REFERENCED SECTIONS ARE LISTED AS A MINIMUM OF ADDITIONAL REQUIREMENTS AND/OR WORK NOT INCLUDED IN THIS SECTION WHICH MAY BE REQUIRED TO BE PERFORMED UNDER OTHER DESIGNATED SECTIONS:

1. *22 05 19 – METERS AND GAUGES FOR PLUMBING PIPING*
2. *22 05 23 – GENERAL DUTY VALVES FOR PLUMBING PIPING*
3. *22 05 53 – IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT*
4. *22 10 00 – PLUMBING PIPING*

1.3 REFERENCE STANDARDS

A. ANSI (AMERICAN NATIONAL STANDARDS INSTITUTE)

1. Z21.22 RELIEF VALVES FOR HOT WATER SUPPLY SYSTEMS
2. Z21.80 LINE PRESSURE REGULATORS
3. Z358.1 AMERICAN NATIONAL STANDARD FOR EMERGENCY EYEWASH AND SHOWER EQUIPMENT

B. ASME (AMERICAN SOCIETY OF MECHANICAL ENGINEERS)

1. A112.1.2 AIR GAPS IN PLUMBING SYSTEMS (FOR PLUMBING FIXTURES AND WATER-CONNECTED RECEPTORS)

C. ASSE (AMERICAN SOCIETY OF SANITARY ENGINEERING)

1. 1001 ATMOSPHERIC TYPE VACUUM BREAKERS
2. 1003 WATER PRESSURE REDUCING VALVES FOR DOMESTIC WATER DISTRIBUTION SYSTEMS
3. 1008 PLUMBING ASPECTS OF RESIDENTIAL FOOD WASTE DISPOSER UNITS
4. 1010 WATER HAMMER ARRESTERS
5. 1011 HOSE CONNECTION VACUUM BREAKERS
6. 1012 BACKFLOW PREVENTER WITH AN INTERMEDIATE ATMOSPHERIC VENT
7. 1013 REDUCED PRESSURE PRINCIPLE BACKFLOW PREVENTERS & REDUCED PRESSURE FIRE PROTECTION PRINCIPLE BACKFLOW PREVENTERS
8. 1015 DOUBLE CHECK BACKFLOW PREVENTER ASSEMBLIES & DOUBLE CHECK FIRE PROTECTION BACKFLOW PREVENTER ASSEMBLIES
9. 1017 TEMPERATURE ACTUATED MIXING VALVES FOR HOT WATER DISTRIBUTION SYSTEMS
10. 1018 TRAP SEAL PRIMER VALVES – POTABLE WATER SUPPLIED
11. 1019 VACUUM BREAKER WALL HYDRANTS, FROST RESISTANT, AUTOMATIC DRAINING
12. 1020 PRESSURE VACUUM BREAKER ASSEMBLY
13. 1035 LABORATORY FAUCET BACKFLOW PREVENTERS
14. 1044 TRAP SEAL PRIMER DEVICES – DRAINAGE TYPES AND ELECTRONIC DESIGN TYPES
15. 1052 HOSE CONNECTION BACKFLOW PREVENTERS

16. 1071 TEMPERATURE ACTUATED MIXING VALVES FOR PLUMBED EMERGENCY EQUIPMENT

D. AWWA (AMERICAN WATER WORKS ASSOCIATION)
1. C550 PROTECTIVE INTERIOR COATINGS FOR VALVES AND HYDRANTS

E. FDA (FOOD AND DRUG ADMINISTRATION)

F. FM GLOBAL (FACTORY MUTUAL INSURANCE COMPANY)

G. NFPA (NATIONAL FIRE PROTECTION ASSOCIATION)
1. NFPA 54 NATIONAL FUEL GAS CODE
2. NFPA 70 NATIONAL ELECTRICAL CODE

H. NSF (NSF INTERNATIONAL)
1. 61 DRINKING WATER SYSTEM COMPONENTS – HEALTH EFFECTS
2. 372 LEAD CONTENT COMPLIANCE

I. PDI (PLUMBING & DRAINAGE INSTITUTE)
1. G101 TESTING AND RATING PROCEDURE FOR GREASE INTERCEPTORS
2. WH 201 WATER HAMMER ARRESTERS STANDARD

J. UL (UNDERWRITER'S LABORATORIES)

1.4 SUBMITTALS

A. SUBMITTALS SHALL BE SUBMITTED IN CONFORMANCE WITH THE REQUIREMENTS OF SECTION *22 00 01 – PLUMBING GENERAL PROVISIONS*.

B. SUBMITTALS ARE REQUIRED FOR:
1. WATER HEATERS
2. EXPANSION TANKS
3. RELIEF VALVES
4. PUMPS
5. BACKFLOW PREVENTERS
6. WATER REGULATORS
7. GAS REGULATORS
8. TEMPERING VALVES
9. TRAP PRIMER VALVES
10. WATER HAMMER ARRESTORS
11. TRIM AND ACCESSORIES

C. PROVIDE DIMENSION DRAWINGS INDICATING COMPONENTS AND CONNECTIONS TO OTHER EQUIPMENT AND PIPING.

D. PROVIDE SIZES AND CAPACITIES.

E. PROVIDE ELECTRICAL CHARACTERISTICS AND CONNECTION REQUIREMENTS.

PART 2: PRODUCTS

2.1 GENERAL REQUIREMENTS

A. SEE PLUMBING SCHEDULES PROVIDED ON DRAWINGS FOR MORE DETAILED INFORMATION OF EQUIPMENT AND ACCESSORIES INCLUDED IN THE PRODUCTS SECTION SPECIFIED HEREUNDER. MANUFACTURERS AND MODEL NUMBERS ARE USED FOR SETTING A STANDARD OF TYPE AND QUALITY. THE ENGINEER SHALL ALLOW ALTERNATE MANUFACTURERS BASED UPON DETERMINATION OF EQUALITY WITH SCHEDULED EQUIPMENT.

B. WHERE EQUIPMENT AND ACCESSORIES ARE CALLED OUT TO BE PROVIDED BY OTHERS AND INSTALLED BY THE PLUMBING CONTRACTOR, THE PLUMBING CONTRACTOR SHALL NOT FURNISH THE PRODUCT BUT IS STILL REQUIRED TO RECEIVE, TAKE INVENTORY OF, STORE AND PROTECT, AND PROVIDE INSTALLATION OF EQUIPMENT AND ACCESSORIES.

2.2 WATER HEATERS

A. GAS-FIRED WATER HEATERS
1. TANK-TYPE (GWH-01, GWH-02, GWH-03, GWH-04)
a. TYPE: AUTOMATIC, NATURAL GAS-FIRED, VERTICAL STORAGE.
b. PERFORMANCE: WATER HEATER RATED STORAGE CAPACITY, MINIMUM GAS INPUT, AND MINIMUM RECOVERY SHALL BE AS SCHEDULED ON DRAWINGS.

c. TANK: TANK SHALL BE LINED WITH VITREOUS ENAMEL AND SHALL HAVE A BOLTED HAND HOLE CLEANOUT. THE TANK SHALL HAVE FOUR EXTRUDED MAGNESIUM ANODE RODS INSTALLED IN SEPARATE HEAD COUPLINGS. THE HEATER TANK SHALL BE INSULATED WITH NON-CFC FOAM. TANK TO BE PROVIDED WITH FACTORY BRASS DRAIN VALVE.
d. CONTROLS: WATER HEATER SHALL BE EQUIPPED WITH AN ELECTRONIC IGNITION SYSTEM, CONTROL SHALL BE AN ADJUSTABLE ELECTRONIC THERMOSTAT TO ANY TEMPERATURE UP TO 180°F. A RECYCLING ENERGY CUT OFF (E.C.O.) SHUTS OFF ALL GAS IN THE EVENT OF AN OVERHEAT CONDITION. THE ENTIRE INSTALLATION SHALL BE MADE IN COMPLIANCE WITH STATE AND LOCAL CODES AND ORDINANCES.
e. WATER HEATER SHALL BE EQUIPPED WITH ASME RATED T&P RELIEF VALVE AND A PREMIX SEALED COMBUSTION SYSTEM FOR DIRECT VENTING USING EITHER 4" OR 6" VENT PIPE (115V AC REQUIRED). THE WATER HEATER SHALL BE FACTORY ASSEMBLED AND TESTED.
f. THE WATER HEATER SHALL BE APPROVED FOR ZERO CLEARANCES TO COMBUSTIBLES.
g. MANUFACTURERS: A.O. SMITH, BRADFORD WHITE, OR EQUAL.

2.3 EXPANSION TANKS

A. TYPE: DIAPHRAGM
B. PERFORMANCE: SIZE PER MANUFACTURER'S RECOMMENDATIONS AT LOCATION WHERE INSTALLED.
C. CONSTRUCTION: DEEP DRAWN STEEL, POLYPROPYLENE INTERIOR LINER, BAKED EPOXY-POLYESTER EXTERIOR COATING, BUTYL RUBBER DIAPHRAGM.
D. MAXIMUM TEMPERATURE: 200°F
E. MAXIMUM PRESSURE: 150 PSIG
F. NSF/ANSI 61-G AND 372 COMPLIANT.
G. MANUFACTURERS: A.O. SMITH, BRADFORD WHITE, OR EQUAL.

2.4 RELIEF VALVES

A. VACUUM RELIEF VALVES
1. AGA AND CGA CERTIFIED. TESTED AND RATED UNDER ANSI Z21.22. MAXIMUM WATER WORKING PRESSURE 200 PSI, MAXIMUM TEMPERATURE 250°F. 3/4" NPT MALE INLET CONNECTION WITH VENTING CAPACITY OF 15 CFM. OPENS AT LESS THAN ½" VACUUM.
2. MANUFACTURER / MODEL: WATTS MODEL LFN36 OR EQUAL.

B. TEMPERATURE AND PRESSURE RELIEF VALVES
1. BRONZE BODY CONSTRUCTION, TAMPER-RESISTANT BONNET SCREWS, AND INTEGRAL TEST LEVER. AGA-ANSI Z21.22 AND ASME SECTION IV RATED, CGA LISTED. STANDARD TEMPERATURE RELIEF OF 210°F, PRESSURE RELIEF RANGE OF 75 PSI TO 150 PSI.
2. MANUFACTURERS: WATTS OR EQUAL. SELECTION BASED UPON THE LATEST ANSI Z21.22 LISTING REQUIREMENTS FOR TEMPERATURE DISCHARGE CAPACITY.

2.5 PUMPS

A. IN-LINE CIRCULATION PUMPS (CP-01, CP-02)
1. PERFORMANCE: AS SCHEDULED ON DRAWINGS.
2. CASING: STAINLESS STEEL, RATED FOR 125 PSIG WORKING PRESSURE.
3. IMPELLER: STAINLESS STEEL
4. SHAFT: STAINLESS STEEL WITH INTEGRAL THRUST COLLAR AND TWO OIL LUBRICATED STAINLESS STEEL SLEEVE BEARINGS.
5. SEAL: CARBON ROTATING AGAINST A STATIONARY CERAMIC SEAT.
6. DRIVE: FLEXIBLE COUPLING.
7. AQUASTAT CONTROLLER

a. TYPE: ADJUSTABLE THERMOSTATIC SWITCH, CLIP-ON-PIPE STYLE SIZED FOR PIPE WHERE INSTALLED. CIRCULATION PUMPS WITH INTEGRAL SPEED CONTROL OR AQUASTAT SHALL NOT REQUIRE AN ADDITIONAL AQUASTAT.
b. ELECTRICAL: 120V

8. UL LISTED.
9. NSF CERTIFIED.
10. MANUFACTURERS: TACO, GRUNDFOS OR EQUAL.

2.6 BACKFLOW PREVENTERS

A. ANTI-SIPHON PRESSURE VACUUM BREAKERS

1. VACUUM BREAKERS SHALL HAVE COPPER ALLOY BODY, BRASS HOOD, CELCON BONNET, SILICON RUBBER VENT DISC AND CHECK VALVE DISK, NORYL CHECK VALVE SEAT, POLYPROPYLENE DISC HOLDER FLOAT, ALL CHROME-PLATED EXTERIOR COMPONENTS. SUITABLE FOR TEMPERATURES UP TO 140°F.
2. ASSE 1020 COMPLIANT.
3. NSF CERTIFIED.
4. SIZE PER MANUFACTURERS RECOMMENDED TYPICAL MAXIMUM FLOW RATE.
5. MANUFACTURER / MODEL: WATTS SERIES LF800M4QT (INTERIOR APPLICATIONS) AND LF800M4FR (EXTERIOR APPLICATIONS) OR EQUAL.

B. REDUCED PRESSURE ZONE (RPZ) ASSEMBLIES

1. ASSE 1013 COMPLIANT.
2. NSF CERTIFIED.
3. 2” AND SMALLER (BFP-01)
   a. PERFORMANCE: AS SCHEDULED ON DRAWINGS.
   b. LEAD FREE COPPER ALLOY BODY, 909 CELCON CHECK SEATS, S.S. RELIEF VALVE SEATS, COPPER ALLOY TEST COCKS.
   c. QUARTER-TURN BALL VALVES ON INLET AND OUTLET.
   d. STRAINER ON INLET.
   e. CONNECTIONS: 3/4" – 1” FEMALE NPT, 1 1/4" – 2” MALE NPT.
   f. MANUFACTURER / MODEL: WATTS LF909 SERIES OR EQUAL.
4. 2 1/2" AND LARGER (BFP-02)
   a. PERFORMANCE: AS SCHEDULED ON DRAWINGS.
   b. 304 S.S. HOUSING AND SLEEVE, NORYL & S.S. CHECKS, EPDM CHECK DISCS AND ELASTOMERS, BRONZE BODY NICKEL PLATED TEST COCKS, 300 S.S. PINS & FASTENERS, S.S. SPRINGS.
   c. OS&Y VALVES ON INLET AND OUTLET.
   d. STRAINER ON INLET.
   e. CONNECTIONS: ANSI B16.1 CLASS 125 FLANGES.
   f. MANUFACTURER / MODEL: WATTS 957 SERIES OR EQUAL.

2.7 WATER REGULATORS

A. PERFORMANCE: SIZE PER INTENDED INLET AND OUTLET OPERATING CONDITIONS AS DEPICTED ON DRAWINGS AND MANUFACTURER’S REQUIREMENTS.
B. TYPE: SINGLE SEATED, DIRECT OPERATED, INTEGRAL BYPASS.
C. CONSTRUCTION: BRONZE OR CAST IRON BODY WITH CORROSION RESISTANT INTERIOR COMPONENTS. CAST IRON INTERIOR COMPONENTS THAT COME INTO CONTACT WITH POTABLE WATER SHALL BE AWWA C550 OR FDA APPROVED.
D. ASSE 1003 COMPLIANT.
E. NSF CERTIFIED.
F. MANUFACTURERS: WATTS, ZURN, OR EQUAL.

2.8 GAS REGULATORS

A. MAXIMUM INLET PRESSURE OF 125 PSIG, MAXIMUM OUTLET PRESSURE OF 15 PSIG.
B. OUTLET PRESSURE RANGE AS SPECIFIED ON DRAWINGS. SPRING-LOADED DIAPHRAGM PRESSURE REGULATION, POSITIVE LOCK-UP TYPE, PRESSURE OPERATING RANGE AS REQUIRED

FOR THE PRESSURE REDUCTION INDICATED, VOLUME CAPACITY NOT LESS THAN INDICATED. SOCKET WELDED ENDS FOR SIZES 1 1/2" AND SMALLER, OTHERWISE FLANGED.

C. MANUFACTURERS: ROCKWELL, FISHER, INVENSYS OR EQUAL.

2.9 TEMPERING VALVES

A. SYSTEM TEMPERING VALVES (TV-01)
   1. PERFORMANCE: AS SCHEDULED ON DRAWINGS.
   2. TYPE: ADJUSTABLE THERMOSTATIC MIXING, WALL MOUNT.
   3. CONSTRUCTION: BRONZE BODY WITH REPLACEABLE CORROSION RESISTANT COMPONENTS, STAINLESS STEEL PISTON AND LINER, LIQUID FILLED THERMAL MOTOR AND PISTON CONTROL MECHANISM, INTEGRAL CHECK STOPS AND REMOVABLE STRAINERS. VALVE SHALL CONTROL TEMPERATURE WITHIN +/- 3°F FROM LOW FLOW TO MAXIMUM FLOW RATE.
   4. INLET WATER TEMPERATURE: MAXIMUM 200°F
   5. TEMPERED WATER RANGE: 100°F – 150°F
   6. ASSE 1017 COMPLIANT.
   7. NSF CERTIFIED.
   8. MANUFACTURERS: BRADLEY OR EQUAL.

B. FIXTURE TEMPERING VALVES
   1. TYPE: ADJUSTABLE THERMOSTATIC MIXING, WALL MOUNT.
   2. CONSTRUCTION: PISTON-CONTROL MECHANISM, POSITIVE SHUTOFF OF HOT WATER WHEN COLD WATER SUPPLY IS LOST, BRONZE BODY AND CAP WITH REPLACEABLE CORROSION-RESISTANT COMPONENTS, INCLUDING STAINLESS STEEL PISTON AND LINER.
   3. INLET WATER TEMPERATURE: MAXIMUM 200°F
   4. TEMPERED WATER RANGE: 95°F – 115°F
   5. ASSE 1016 AND ASSE 1070 COMPLIANT.
   6. NSF CERTIFIED.
   7. MANUFACTURER / MODEL
      a. SINGLE FAUCET: BRADLEY MODEL S59-2007 OR EQUAL.
      b. UP TO (4) FAUCETS: BRADLEY MODEL S59-4008 OR EQUAL.

C. EMERGENCY FIXTURE TEMPERING VALVES
   1. TYPE: ADJUSTABLE THERMOSTATIC MIXING, WALL MOUNT.
   2. CONSTRUCTION: LIQUID-FILLED THERMAL MOTOR AND PISTON CONTROL MECHANISM WITH POSITIVE SHUTOFF OF HOT WATER WHEN COLD WATER SUPPLY IS LOST. VALVE ALLOWS COLD FLOW IN EVENT OF LOSS OR INTERRUPTION OF HOT WATER SUPPLY OR THERMOSTAT FAILURE. VALVE CONTROLS OUTLET TEMPERATURE OVER WIDE FLOW RANGE AND IS SUITABLE FOR DRENCH SHOWER AND EYEWASH APPLICATIONS. VALVE INCLUDES VANDAL-RESISTANT TEMPERATURE ADJUSTMENT, DIAL THERMOMETER, INTEGRAL STRAINER, AND CHECK STOPS.
   3. INLET WATER TEMPERATURE: MAXIMUM 180°F
   4. TEMPERED-WATER SETTING: FACTORY PRESET, 85°F
   5. TEMPERED-WATER RANGE: 65°F – 95°F
   6. ANSI Z358.1 AND ASSE 1071 COMPLIANT.
   7. NSF CERTIFIED.
   8. MANUFACTURER / MODEL
      a. SINGLE EYE/FACE WASH OR UP TO (3) EYE WASHES: BRADLEY NAVIGATOR S19-2000 OR EQUAL.
      b. SINGLE COMBINATION SHOWER/EYE WASH STATION: BRADLEY NAVIGATOR S19-2100, GUARDIAN G3800LF, OR EQUAL.

2.10 TRAP PRIMER VALVES

A. MECHANICAL FLUSH ACTIVATED (TP-01, TP-02, TP-03)

1. TRAP PRIMER VALVES SHALL AUTOMATICALLY ACTIVATE WHEN SUBJECTED TO A PRESSURE DROP OF 5 TO 10 PSIG IN THE CONNECTING COLD WATER SUPPLY LINE.
2. VALVES SHALL BE MACHINED OF CORROSION RESISTANT BRASS AND CONTAIN NO SPRINGS OR DIAPHRAGMS AND SHALL HAVE INTEGRAL CHECK VALVES AND VACUUM BREAKER.
3. "O" RING SEALS TESTED FOR RELIABILITY AT A TEMPERATURE RANGE OF -40° TO 450°F.
4. CONNECTIONS: INLET OPENING 1/2" MALE NPT, OUTLET 1/2" FEMALE NPT.
5. OPERATING PRESSURE: 20 PSI – 80 PSI
6. WATER DISTRIBUTION UNITS SHALL BE PROVIDED FOR DISTRIBUTION AND PRIMING OF MULTIPLE TRAPS.
7. ASSE 1018 COMPLIANT.
8. MANUFACTURER / MODEL: PRECISION PLUMBING PRODUCTS PRIME-RITE MODEL OR EQUAL.

2.11 WATER HAMMER ARRESTORS

A. SEE SCHEDULES ON DRAWINGS.
B. WATER HAMMER ARRESTORS SHALL CONFORM TO THE REQUIREMENTS OF PDI WH 201, ASSE 1010, AND ANSI A112.26.1. SIZE AS REQUIRED.
C. MANUFACTURERS: PRECISION PLUMBING PRODUCTS, JAY R. SMITH, OR EQUAL.

PART 3: EXECUTION

3.1 GENERAL REQUIREMENTS

A. INSTALL ALL PLUMBING EQUIPMENT IN ACCORDANCE WITH MANUFACTURER INSTALLATION INSTRUCTIONS AND DETAILS PROVIDED ON DRAWINGS.
B. EQUIPMENT ROUGH-IN
   1. COORDINATE EQUIPMENT WITH PLUMBING PIPING, ELECTRICAL WORK, AND OTHER TRADES TO ACHIEVE A COMPLETE OPERATING SYSTEM.
   2. LOCATE EQUIPMENT FOR EASE OF OBSERVATION, MAINTENANCE, SERVICING, AND REPLACEMENT. REFER TO CLEARANCES REQUIRED BY EACH EQUIPMENT MANUFACTURER.
   3. CONFIRM CORRECT ORIENTATION OF EQUIPMENT AS RECOMMENDED BY EACH EQUIPMENT MANUFACTURER'S INSTALLATION INSTRUCTIONS.
C. EQUIPMENT CONNECTIONS
   1. SEE SECTION *22 10 00 – PLUMBING PIPING*.

3.2 WATER HEATERS

A. ELECTRIC WATER HEATERS SHALL CONFORM TO THE PROVISIONS OF NFPA 70. FUEL-FIRED WATER HEATERS SHALL CONFORM TO THE REQUIREMENTS OF THE INTERNATIONAL MECHANICAL CODE. GAS-FIRED WATER HEATERS SHALL CONFORM TO THE REQUIREMENTS OF THE INTERNATIONAL FUEL GAS CODE.
B. LOCATION: WATER HEATERS AND STORAGE TANKS SHALL BE INSTALLED IN A MANNER TO PROVIDE EASE OF OBSERVATION, MAINTENANCE, SERVICING, AND REPLACEMENT. INSTALL WATER HEATER STORAGE TANKS ON 4" HIGH CONCRETE HOUSEKEEPING PAD (FLOOR LEVEL INSTALLATION) OR STRUCTURAL FRAME ASSEMBLY (ABOVE FLOOR LEVEL INSTALLATION).
C. DRAIN PAN: WATER HEATER STORAGE TANKS INSTALLED ABOVE GROUND FLOOR LEVEL SHALL BE PROVIDED WITH A 1 1/2" DEEP 24 Ga. S.S. DRAIN PAN. DRAIN PAN OVERALL DIMENSIONS SHALL BE SIZED TO CAPTURE ALL WATER LEAKAGE FROM THE WATER HEATER STORAGE TANK AND ITS CONNECTIONS. DRAIN PAN SHALL BE CONNECTED TO A MINIMUM 3/4" DIAMETER DRAIN PIPE WHICH SHALL BE ROUTED TO A SUITABLE INDIRECT WASTE DISCHARGE POINT WITH REQUIRED AIR GAP.
D. SAFETY DEVICES: INSTALL REQUIRED SAFETY DEVICES AS SHOWN ON MANUFACTURER'S INSTRUCTIONS, DETAILS PROVIDED ON DRAWINGS, AND AS REQUIRED BY THE AUTHORITY HAVING JURISDICTION.

3.3 RELIEF VALVES

A. TEMPERATURE AND PRESSURE RELIEF VALVES SHALL BE INSTALLED WITH DISCHARGE DRAIN PIPED TO 6" ABOVE FLOOR (OR DRAIN PAN WHERE APPROPRIATE) AND TERMINATE OPEN-ENDED IN THE SAME ROOM AS THE WATER HEATER IN A PLACE READILY OBSERVED BY PLANT PERSONNEL. THE DISCHARGE PIPING SHALL NOT BE TRAPPED, SHALL BE CAPABLE OF DRAINING BY GRAVITY, SHALL NOT HAVE TEE FITTINGS OR VALVES, SHALL NOT HAVE THREADED CONNECTIONS, SHALL NOT DISCHARGE IN A MANNER THAT COULD CAUSE INJURY OR STRUCTURAL DAMAGE, SHALL BE THE FULL DIAMETER OF THE RELIEF VALVE CONNECTION SIZE, AND SHALL BE INDEPENDENT FROM ANY OTHER PIPING SYSTEMS.

3.4 PUMPS

A. PROVIDE AIR COCK AND DRAIN CONNECTION ON HORIZONTAL PUMP CASINGS.

B. PROVIDE LINE SIZED ISOLATING VALVE AND STRAINER ON SUCTION AND LINE SIZED SOFT SEATED CHECK VALVE AND BALANCING VALVE ON DISCHARGE.

C. DECREASE FROM LINE SIZE WITH LONG RADIUS REDUCING ELBOWS OR REDUCERS. SUPPORT PIPING ADJACENT TO PUMP SUCH THAT NO WEIGHT IS CARRIED ON PUMP CASINGS. PROVIDE SUPPORTS UNDER ELBOWS ON PUMP SUCTION FOR DISCHARGE LINE SIZES 4" AND LARGER.

D. ENSURE PUMPS OPERATE AT SPECIFIED SYSTEM FLUID TEMPERATURES WITHOUT VAPOR BINDING AND CAVITATION, ARE NON-OVERLOADING IN PARALLEL OR INDIVIDUAL OPERATION, AND OPERATE WITHIN 25% OF MIDPOINT OF PUBLISHED MAXIMUM EFFICIENCY CURVE.

E. ALIGN AND VERIFY ALIGNMENT OF BASE MOUNTED PUMPS PRIOR TO START-UP.

3.5 BACKFLOW PREVENTERS

A. INSTALL APPROVED POTABLE WATER PROTECTION DEVICES ON PLUMBING LINES WHERE CONTAMINATION OF DOMESTIC POTABLE WATER MAY OCCUR, SUCH AS BUT NOT LIMITED TO: BOILER FEED WATER LINES, JANITOR ROOMS, FIRE SPRINKLER SYSTEMS, PREMISE ISOLATION, IRRIGATION SYSTEMS, FLUSH VALVES, AND HOSE BIBS.

B. PIPE RELIEF FROM BACKFLOW PREVENTER (WHERE APPLICABLE) TO LOCAL DRAIN AND DISCHARGE WITH REQUIRED AIR GAP.

3.6 WATER REGULATORS

A. INSTALL WATER PRESSURE REDUCING VALVES AT FIXTURE CONNECTIONS WHERE THE BUILDING WATER STATIC PRESSURE EXCEEDS 80 PSI OR WHERE THE BUILDING WATER STATIC PRESSURE EXCEEDS THE MAXIMUM ALLOWABLE PRESSURE AT THE INTENDED USER.
EXCEPTION: SERVICE LINES TO STILL COCKS AND EXTERIOR HYDRANTS MAY EXCEED 80 PSI, BUT SHALL BE LESS THAN MANUFACTURER'S PUBLISHED MAXIMUM OPERATING PRESSURE.

B. PROVIDE PRESSURE INDICATORS ON EACH SIDE OF WATER PRESSURE REDUCING VALVES.

3.7 GAS REGULATORS

A. INSTALL PRESSURE REGULATORS WHERE REQUIRED FOR NATURAL GAS BURNING APPLIANCES AND AS SHOWN ON DRAWINGS. PROVIDE 1/4" PRESSURE GAUGE PORT, 1/4" BALL VALVE, 1/4" FEMALE COUPLING AND 1/4" PLUG ON EACH SIDE OF PRESSURE REDUCING VALVES. INSTALL ISOLATION VALVE UPSTREAM OF REGULATORS.

B. REGULATOR VENT PIPING: SEE SECTION *22 10 00 – PLUMBING PIPING*.

3.8 TRAP PRIMER VALVES

A. INSTALL TRAP SEAL PRIMER VALVES ABOVE THE FINISHED FLOOR LEVEL IN AN ACCESSIBLE LOCATION. SLOPE TRAP PRIMER SUPPLY TUBING AS REQUIRED TO DRAIN TO THE SUPPLYING TRAP CONNECTION BY GRAVITY. INSTALL ISOLATION VALVE ON SUPPLY LINE IN CLOSE PROXIMITY TO TRAP SEAL PRIMER (IF NOT INTEGRAL TO EQUIPMENT).

3.9 WATER HAMMER ARRESTORS

A. INSTALL WATER HAMMER ARRESTORS COMPLETE WITH ACCESSIBLE ISOLATION VALVE ON HOT AND COLD WATER SUPPLY PIPING TO FIXTURES WITH QUICK CLOSING VALVES SUCH AS WATER CLOSET AND URINAL FLUSH VALVES AND AS SHOWN ON PLANS.

3.10 TESTING

A. TEST EQUIPMENT OPERATIONS IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS. TROUBLESHOOT ISSUES AND REPLACE FAULTY COMPONENTS AS REQUIRED TO RESOLVE

ISSUES. RE-TEST TO CONFIRM SYSTEM OPERATIONS. REPEAT AS NECESSARY UNTIL ALL EQUIPMENT IS FUNCTIONING AS INTENDED AND TO THE SATISFACTION OF THE OWNER.

3.11 PROTECTION OF WORK

A. ACCEPT EQUIPMENT ON SITE IN FACTORY PACKAGING. INSPECT FOR DAMAGE. NOTIFY THE CONSTRUCTION MANAGER OF ANY DAMAGE AND RETURN DAMAGED EQUIPMENT FOR NEW REPLACEMENT UNITS IF DIRECTED TO DO SO BY THE CONSTRUCTION MANAGER.

B. PROTECT EQUIPMENT FROM DAMAGE BY SECURING AREAS AND BY LEAVING FACTORY PACKAGING IN PLACE TO PROTECT EQUIPMENT AND PREVENT USE. REMOVE PROTECTIVE FILM RIGHT BEFORE FINAL TURNOVER TO OWNER.

C. TEMPORARILY COVER AND PROTECT EQUIPMENT DURING CONSTRUCTION AGAINST DIRT, WATER, AND CHEMICAL OR MECHANICAL INJURY.

3.12 CLEANING

A. AT COMPLETION OF ALL WORK (INCLUDING WORK BY OTHERS IN THE AREA EQUIPMENT IS INSTALLED), EXPOSED SURFACES OF EQUIPMENT SHALL BE THOROUGHLY CLEANED RETURNING THEM TO “AS-NEW” CONDITION.

END OF SECTION

SECTION 22 40 00
PLUMBING FIXTURES

PART 1: GENERAL

1.1 SUMMARY

A. THE WORK OF THIS SECTION SHALL INCLUDE:

1. PLUMBING FIXTURES
2. EMERGENCY PLUMBING FIXTURES
3. FIXTURE CARRIERS
4. TRIM AND ACCESSORIES

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. THE FOLLOWING REFERENCED SECTIONS ARE LISTED AS A MINIMUM OF ADDITIONAL REQUIREMENTS AND/OR WORK NOT INCLUDED IN THIS SECTION WHICH MAY BE REQUIRED TO BE PERFORMED UNDER OTHER DESIGNATED SECTIONS:

1. *22 05 01 – SUPPLEMENTARY COMPONENTS FOR PLUMBING WORK*
2. *22 05 23 – GENERAL DUTY VALVES FOR PLUMBING PIPING*
3. *22 10 00 – PLUMBING PIPING*
4. *22 30 00 – PLUMBING EQUIPMENT*

1.3 REFERENCE STANDARDS

A. ANSI (AMERICAN NATIONAL STANDARDS INSTITUTE)

1. Z124.1.2 PLASTIC BATHTUB AND SHOWER UNITS
2. Z124.5 PLASTIC TOILET (WATER CLOSET) SEATS
3. Z358.1 EMERGENCY EYE WASH AND SHOWER EQUIPMENT

B. ASME (AMERICAN SOCIETY OF MECHANICAL ENGINEERS)

1. A112.6.1 SUPPORTS FOR OFF-THE-FLOOR PLUMBING FIXTURES FOR PUBLIC USE
2. A112.18.1 PLUMBING SUPPLY FITTINGS
3. A112.19.1 ENAMELED CAST IRON AND ENAMELLED STEEL PLUMBING FIXTURES
4. A112.19.2 CERAMIC PLUMBING FIXTURES
5. A112.19.3 STAINLESS STEEL PLUMBING FIXTURES
6. A112.19.5 FLUSH VALVES AND SPUDS FOR WATER CLOSETS, TANKS, AND URINALS
7. A112.21.3M HYDRANTS FOR UTILITY AND MAINTENANCE USE

C. ASSE (AMERICAN SOCIETY OF SANITARY ENGINEERING)

1. 1037 PRESSURIZED FLUSHING DEVICES (FLUSHOMETERS) FOR PLUMBING FIXTURES

D. AWWA (AMERICAN WATER WORKS ASSOCIATION)

1. C550 PROTECTIVE INTERIOR COATINGS FOR VALVES AND HYDRANTS

E. FDA (FOOD AND DRUG ADMINISTRATION)

F. IAPMO (INTERNATIONAL ASSOCIATION OF PLUMBING AND MECHANICAL OFFICIALS)

G. NSF (NSF INTERNATIONAL)

1. 61 DRINKING WATER SYSTEM COMPONENTS – HEALTH EFFECTS
2. 372 LEAD CONTENT COMPLIANCE

H. UL (UNDERWRITER'S LABORATORIES)

1.4 SUBMITTALS

A. SUBMITTALS SHALL BE SUBMITTED IN CONFORMANCE WITH THE REQUIREMENTS OF SECTION *22 00 01 – PLUMBING GENERAL PROVISIONS*.

B. SUBMITTALS ARE REQUIRED FOR:

1. PLUMBING FIXTURES
2. EMERGENCY PLUMBING FIXTURES
3. FIXTURE CARRIERS
4. TRIM AND ACCESSORIES

PART 2: PRODUCTS

2.1 GENERAL REQUIREMENTS

A. SEE PLUMBING SCHEDULES PROVIDED ON DRAWINGS FOR MORE DETAILED INFORMATION OF PLUMBING FIXTURES AND ACCESSORIES INCLUDED IN THE PRODUCTS SECTION SPECIFIED HEREUNDER. MANUFACTURERS AND MODEL NUMBERS ARE USED FOR SETTING A STANDARD OF

TYPE AND QUALITY. THE ENGINEER SHALL ALLOW ALTERNATE MANUFACTURERS BASED UPON DETERMINATION OF EQUALITY WITH SCHEDULED EQUIPMENT.

B. WHERE PLUMBING FIXTURES AND ACCESSORIES ARE CALLED OUT TO BE PROVIDED BY OTHERS AND INSTALLED BY THE PLUMBING CONTRACTOR, THE PLUMBING CONTRACTOR SHALL NOT FURNISH THE PRODUCT BUT IS STILL REQUIRED TO RECEIVE, TAKE INVENTORY OF, STORE AND PROTECT, AND PROVIDE INSTALLATION OF PLUMBING FIXTURES AND ACCESSORIES.

2.2 PRODUCT FINISHES

A. ALL PLUMBING FIXTURES AND ACCESSORIES SHALL BE PROVIDED WITH FINISH AS SCHEDULED ON DRAWINGS OR AS DIRECTED BY ARCHITECT OR OWNER.

2.3 PLUMBING FIXTURES

A. WATER CLOSETS (WC-01 & WC-02)
   1. SEE SCHEDULES ON DRAWINGS.
   2. MANUFACTURERS: KOHLER, AMERICAN STANDARD, TOTO, CRANE, OR EQUAL.

B. LAVATORY SINKS
   1. INTEGRAL COUNTERTOP BOWL (LV-01 & LV-02)
      a. SEE SCHEDULES ON DRAWINGS.
      b. MANUFACTURERS: BY ARCHITECT.
   2. WALL HUNG (LV-03)
      a. SEE SCHEDULES ON DRAWINGS.
      b. MANUFACTURERS: KOHLER, AMERICAN STANDARD, TOTO, CRANE, OR EQUAL.

C. HAND SINKS (HS-01, HS-02)
   1. SEE SCHEDULES ON DRAWINGS.
   2. MANUFACTURERS: ADVANCE TABCO, FAB WRIGHT INC. OR EQUAL.

D. UTILITY SINKS (US-01)
   1. SEE SCHEDULES ON DRAWINGS.
   2. MANUFACTURERS: ADVANCE TABCO, FAB WRIGHT INC. OR EQUAL.

E. MOP SINKS (MS-01)
   1. SEE SCHEDULES ON DRAWINGS.
   2. MANUFACTURERS: STERN-WILLIAMS OR EQUAL.

F. DRINKING FOUNTAINS (DF-01)
   1. SEE SCHEDULES ON DRAWINGS.
   2. MANUFACTURERS: ELKAY, OASIS INTERNATIONAL, BRADLEY, OR EQUAL.

G. SHOWERS (SH-01 & SH-02)
   1. SEE SCHEDULES ON DRAWINGS.
   2. MANUFACTURERS: KOHLER, LASCO, STERLING, OR EQUAL.

2.4 EMERGENCY PLUMBING FIXTURES

A. COMBINATION EMERGENCY EYE WASH AND SHOWER (ES-01)
   1. SEE SCHEDULES ON DRAWINGS.
   2. MANUFACTURERS: BRADLEY, GUARDIAN EQUIPMENT, ACORN SAFETY, HAWS CORP, OR EQUAL.

2.5 FIXTURE CARRIERS

A. CLOSET CARRIERS
   1. ASME/ANSI A112.6.1M, CAST IRON BODY WITH ADJUSTABLE GASKET FACEPLATE CHAIR CARRIERS FOR WALL HUNG WATER CLOSETS WITH INTEGRAL DRAIN HUB AND VENT, ADJUSTABLE SPUD, LUGS FOR FLOOR AND WALL ATTACHMENT, AUXILIARY ANCHOR FOOT ASSEMBLY, REAR ANCHOR TIE DOWN, AND THREADED FIXTURE STUDS WITH NUTS AND WASHERS.

B. WALL-MOUNTED LAVATORY CARRIERS
   1. WALL MOUNTED LAVATORY
      a. ASME A112.6.1; CAST IRON AND STEEL FRAME WITH TUBULAR LEGS, LUGS FOR FLOOR AND WALL ATTACHMENT, THREADED STUDS FOR FIXTURE HANGER OR CONCEALED ARM SUPPORTS AS SCHEDULED, BEARING PLATE AND STUDS.

2. ADA WALL MOUNTED LAVATORY
    a. ASME A112.6.1; CAST IRON AND STEEL FRAME WITH TUBULAR LEGS, LUGS FOR FLOOR AND WALL ATTACHMENT, CONCEALED ARM SUPPORTS, BEARING PLATE AND STUDS.
3. ALL LAVATORY CHAIR CARRIERS SHALL BE CAPABLE OF SUPPORTING THE LAVATORY WITH A 250 LB VERTICAL LOAD APPLIED AT THE FRONT OF THE FIXTURE.

C. WHERE WATER CLOSETS, LAVATORIES, OR SINKS ARE INSTALLED BACK-TO-BACK AND CARRIERS ARE SPECIFIED, PROVIDE ONE CARRIER TO SERVE BOTH FIXTURES IN LIEU OF INDIVIDUAL CARRIERS.

D. MANUFACTURERS: JAY R. SMITH, JOSAM, ZURN, OR EQUAL.

2.6 TRIM AND ACCESSORIES

A. FAUCETS
1. SEE SCHEDULES ON DRAWINGS.

B. SUPPLY STOPS
1. NON-PROCESS AREAS
    a. ASME A112.18.1, NSF 61; CHROME-PLATED BRASS BODY, MAX TEMPERATURE 140°F, MAX PRESSURE 125 PSI.
2. PROCESS AREAS
    a. ANGLE STOPS ARE NOT PERMITTED IN PROCESS AREAS. PROVIDE ISOLATION VALVES ON SUPPLY LINES AT A HEIGHT NOT GREATER THAN 6'-4" ABOVE THE FLOOR LEVEL. SEE DETAILS AND SECTION *22 10 00 – PLUMBING PIPING* FOR ADDITIONAL CONNECTION REQUIREMENTS.

C. SUPPLY RISERS
1. ASME A112.18.6; NSF 61; BRAIDED STAINLESS STEEL FLEXIBLE TUBE CONNECTOR, MAX WATER PRESSURE 125 PSI, MAX TEMPERATURE 180°F.
2. ASME A112.18.1, NSF 61; RIGID COPPER TUBE, CHROME-PLATED, MAX WATER PRESSURE 125 PSI, MAX TEMPERATURE 180°F.
3. MANUFACTURER / MODEL: MAINLINE MLB SERIES OR EQUAL.

D. GRID STRAINERS
1. STAINLESS STEEL BODY AND BASKET FOR ALL APPLICATIONS. SEE SCHEDULES FOR ADDITIONAL INFORMATION.
2. MANUFACTURER / MODEL: MAINLINE ML SERIES OR EQUAL.

E. P-TRAPS
1. OFFICE AND RESIDENTIAL AREAS
    a. CHROME-PLATED CAST BRASS TUBE WITH CLEANOUT.
    b. MANUFACTURER / MODEL: ZURN Z87 SERIES, MAINLINE ML707 SERIES, OR EQUAL.
2. INDUSTRIAL AREAS (FOOD PRODUCTION, UTILITY AREAS, ETC.)
    a. SEE DETAILS ON DRAWINGS.

F. FIXTURE TRIM PIECES
1. ESCUTCHEON PLATES
    a. SEE SECTION *22 10 00 – PLUMBING PIPING*.

G. OTHER ACCESSORIES
1. SEE SCHEDULES AND DETAILS ON DRAWINGS.

PART 3: EXECUTION

3.1 EXAMINATION

A. VERIFY THAT WALLS AND FLOOR FINISHES ARE PREPARED AND READY FOR INSTALLATION OF FIXTURES.

B. VERIFY THAT ELECTRIC POWER IS AVAILABLE AND OF CORRECT CHARACTERISTICS FOR POWERED FIXTURES.

C. CONFIRM THAT MILLWORK IS CONSTRUCTED WITH ADEQUATE PROVISION FOR THE INSTALLATION OF COUNTERTOP LAVATORIES AND SINKS.

3.2 PREPARATION

A. ROUGH-IN FIXTURE PIPING CONNECTIONS. COORDINATE PIPING ROUGH-IN WITH SINK CONSTRUCTION, MOUNTING HEIGHT, BUILDING FEATURES, AND ELECTRICAL CONNECTIONS (WHERE APPLICABLE). PLUMBING SHOP DRAWING SUBMITTALS SHALL TAKE PRECEDENCE OVER CONSTRUCTION DETAILS, SCHEDULES, ETC. WHEN ROUGHING-IN FIXTURES.

B. REVIEW MILLWORK SHOP DRAWINGS. CONFIRM LOCATION AND SIZE OF FIXTURES AND OPENINGS BEFORE ROUGH-IN AND INSTALLATION.

3.3 GENERAL REQUIREMENTS

A. ASSEMBLE PLUMBING FIXTURES AND TRIM ACCORDING TO THE MANUFACTURER'S WRITTEN INSTRUCTIONS AND DETAILS PROVIDED ON DRAWINGS.

B. INSTALL COMPONENTS LEVEL AND PLUMB.

C. INSTALL AND SECURE FIXTURES IN PLACE AS DETAILED, SPECIFIED, AND AS REQUIRED.

D. MOUNTING HEIGHTS SHALL BE AS SCHEDULED OR AS SHOWN ON ARCHITECTURAL DETAILS, WITH ARCHITECTURAL DETAILS TAKING PRECEDENCE.

E. WHERE EXISTING FIXTURES AND FITTINGS ARE INDICATED TO BE REUSED OR RELOCATED, DOCUMENTATION OF CONDITION SHALL BE SENT TO THE ENGINEER FOR APPROVAL PRIOR TO CONSTRUCTION.

3.4 FIXTURE CARRIERS

A. FIXTURE CARRIER SUPPORTS SHALL BE BOLTED THROUGH FLOOR STRUCTURE AND SECURED TO FRAMING TO PREVENT MOVEMENT OF CARRIER AND FIXTURE, AS RECOMMENDED BY MANUFACTURER.

3.5 FIXTURE ACCESSORIES

A. INSTALL TRAPS ON FIXTURE OUTLETS FOR EASE OF REMOVAL, SERVICING, AND CLEANING. OMIT TRAPS ON FIXTURES HAVING INTEGRAL TRAPS.

B. INSTALL FIXTURE STOPS IN READILY ACCESSIBLE LOCATIONS FOR SERVICING.

C. PROVIDE STAINLESS STEEL RIGID OR FLEXIBLE SUPPLIES TO FIXTURES WITH STOPS, REDUCERS, AND ESCUTCHEONS (WHERE SPECIFIED).

3.6 SEALING

A. SEAL ALL GAPS BETWEEN FIXTURES AND WALL AND FLOOR SURFACES WITH A USDA APPROVED SEALANT.

3.7 ADJUSTING

A. ADJUST STOPS OR VALVES FOR INTENDED WATER FLOW RATE TO FIXTURES WITHOUT SPLASHING, NOISE, OR OVERFLOW.

3.8 TESTING

A. TEST FIXTURES TO DEMONSTRATE PROPER OPERATION. REPLACE MALFUNCTIONING UNITS OR COMPONENTS AS REQUIRED UNTIL ALL FIXTURES ARE FUNCTIONING AS INTENDED AND TO THE SATISFACTION OF THE OWNER.

3.9 PROTECTION OF WORK

A. ACCEPT FIXTURES ON SITE IN FACTORY PACKAGING. INSPECT FOR DAMAGE. NOTIFY THE CONSTRUCTION MANAGER OF ANY DAMAGE AND RETURN DAMAGED FIXTURES FOR NEW REPLACEMENT UNITS IF DIRECTED TO DO SO BY THE CONSTRUCTION MANAGER.

B. PROTECT FIXTURES FROM DAMAGE BY SECURING AREAS AND BY LEAVING FACTORY PACKAGING IN PLACE TO PROTECT FIXTURES AND PREVENT USE. REMOVE PROTECTIVE FILM RIGHT BEFORE FINAL TURNOVER TO OWNER.

C. TEMPORARILY COVER AND PROTECT FIXTURES DURING CONSTRUCTION AGAINST DIRT, WATER, AND CHEMICAL OR MECHANICAL INJURY.

D. DO NOT PERMIT USE OF FIXTURES DURING CONSTRUCTION PERIOD.

3.10 CLEANING

A. AT COMPLETION OF ALL WORK (INCLUDING WORK BY OTHERS IN THE AREA FIXTURES ARE INSTALLED), EXPOSED SURFACES OF FIXTURES SHALL BE THOROUGHLY CLEANED RETURNING THEM TO "AS-NEW" CONDITION.

END OF SECTION

SECTION 31 00 00
EARTHWORK

PART 1: GENERAL

1.1 SUMMARY

A. THE WORK OF THIS SECTION SHALL INCLUDE:

1. SOIL MATERIALS
2. BURIED WARNING AND IDENTIFICATION TAPE
3. DEWATERING
4. EXCAVATION
5. STORAGE OF SOIL MATERIALS
6. BACKFILL
7. FILL
8. MOISTURE CONTROL
9. COMPACTION OF BACKFILL AND FILL
10. ROUGH GRADING
11. DISPOSAL OF SURPLUS AND WASTE MATERIALS

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. THE FOLLOWING REFERENCED SECTIONS ARE LISTED AS A MINIMUM OF ADDITIONAL REQUIREMENTS AND/OR WORK NOT INCLUDED IN THIS SECTION WHICH MAY BE REQUIRED TO BE PERFORMED UNDER OTHER DESIGNATED SECTIONS:

1. *22 10 00 – PLUMBING PIPING*

1.3 REFERENCE STANDARDS

A. ASTM (ASTM INTERNATIONAL)

1. D448 STANDARD CLASSIFICATION FOR SIZES OF AGGREGATE FOR ROAD AND BRIDGE CONSTRUCTION
2. D698 STANDARD TEST METHODS FOR LABORATORY COMPACTION CHARACTERISTICS OF SOIL USING STANDARD EFFORT
3. D1556 STANDARD TEST METHOD FOR DENSITY AND UNIT WEIGHT OF SOIL IN PLACE BY SAND-CONE METHOD
4. D1586 STANDARD TEST METHOD FOR STANDARD PENETRATION TEST (SPT) AND SPLIT-BARREL SAMPLING OF SOILS
5. D2167 STANDARD TEST METHOD FOR DENSITY AND UNIT WEIGHT OF SOIL IN PLACE BY THE RUBBER BALLOON METHOD
6. D2487 STANDARD PRACTICE FOR CLASSIFICATION OF SOILS FOR ENGINEERING PURPOSES (UNIFIED SOIL CLASSIFICATION SYSTEM)
7. D2922 STANDARD TEST METHOD FOR DENSITY OF SOIL AND SOIL-AGGREGATE IN PLACE BY NUCLEAR METHODS (SHALLOW DEPTH)
8. D2937 STANDARD TEST METHOD FOR DENSITY OF SOIL IN PLACE BY THE DRIVE-CYLINDER METHOD
9. D2940 STANDARD SPECIFICATION FOR GRADED AGGREGATE MATERIAL FOR BASES OR SUBBASES FOR HIGHWAYS OR AIRPORTS
10. D3740 STANDARD PRACTICE FOR MINIMUM REQUIREMENTS FOR AGENCIES ENGAGED IN TESTING AND/OR INSPECTION OF SOIL AND ROCK AS USED IN ENGINEERING DESIGN AND CONSTRUCTION
11. E329 STANDARD SPECIFICATION FOR AGENCIES ENGAGED IN CONSTRUCTION INSPECTION, TESTING, OR SPECIAL INSPECTION
12. E548 STANDARD GUIDE FOR GENERAL CRITERIA USED FOR EVALUATING LABORATORY COMPETENCE

B. EPA (ENVIRONMENTAL PROTECTION AGENCY)

1. 600/4-79/020 GROUNDWATER AND WASTEWATER CONTROL CHECK STANDARDS
2. SW-846.3-3A TEST METHODS FOR EVALUATING SOLID WASTE; PHYSICAL/CHEMICAL METHODS

C. ISO (INTERNATIONAL ORGANIZATION FOR STANDARDIZATION)

1. 7131 EARTH-MOVING – LOADERS – TERMINOLOGY AND COMMERCIAL SPECIFICATIONS

D. OSHA (OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION)

1.4 SUBMITTALS

A. SUBMITTALS SHALL BE SUBMITTED IN CONFORMANCE WITH THE REQUIREMENTS OF SECTION *22 00 01 – PLUMBING GENERAL PROVISIONS*.

B. SUBMITTALS ARE REQUIRED FOR:

1. MATERIAL TEST REPORTS

TESTS SHALL BE PERFORMED BY A QUALIFIED TESTING AGENCY INDICATING AND INTERPRETING TEST RESULTS FOR COMPLIANCE OF THE FOLLOWING:

a. CLASSIFICATION ACCORDING TO ASTM D2487 OF EACH ON-SITE OR BORROW SOIL MATERIAL PROPOSED FOR FILL AND BACKFILL.

b. LABORATORY COMPACTION CURVE ACCORDING TO ASTM D698 FOR EACH ON-SITE OR BORROW SOIL MATERIAL PROPOSED FOR FILL AND BACKFILL.

2. BURIED WARNING AND IDENTIFICATION TAPE

1.5 DEFINITIONS

A. BACKFILL: SOIL MATERIALS USED TO FILL AN EXCAVATION.

1. INITIAL BACKFILL: BACKFILL PLACED BESIDE AND OVER PIPE IN A TRENCH, INCLUDING HAUNCHES TO SUPPORT SIDES OF PIPE.

2. FINAL BACKFILL: BACKFILL PLACED OVER INITIAL BACKFILL TO FILL A TRENCH.

B. BASE COURSE: AGGREGATE LAYER PLACED BETWEEN THE SUBBASE COURSE AND ASPHALT PAVING.

C. BEDDING COURSE: AGGREGATE LAYER PLACED OVER THE EXCAVATED SUBGRADE IN A TRENCH BEFORE LAYING PIPE.

D. BORROW SOIL: SATISFACTORY SOIL IMPORTED FROM OFF-SITE FOR USE AS FILL OR BACKFILL.

E. DRAINAGE FILL: AGGREGATE LAYER SUPPORTING SLAB-ON-GRADE USED TO MINIMIZE UPWARD CAPILLARY FLOW OF PORE WATER.

F. EXCAVATION: REMOVAL OF MATERIAL ENCOUNTERED ABOVE SUBGRADE ELEVATIONS.

1. ADDITIONAL EXCAVATION: EXCAVATION BELOW SUBGRADE ELEVATIONS AS DIRECTED BY CONSTRUCTION MANAGER. ADDITIONAL EXCAVATION AND REPLACEMENT MATERIAL WILL BE PAID FOR ACCORDING TO CONTRACT PROVISIONS FOR CHANGES IN THE WORK.

2. BULK EXCAVATION: EXCAVATIONS MORE THAN 10 FT IN WIDTH AND PITS MORE THAN 30 FEET EITHER LENGTH OR WIDTH.

3. UNAUTHORIZED EXCAVATION: EXCAVATION BELOW SUBGRADE ELEVATIONS OR BEYOND INDICATED DIMENSIONS WITHOUT DIRECTION BY CONSTRUCTION MANAGER. UNAUTHORIZED EXCAVATION, AS WELL AS REMEDIAL WORK DIRECTED BY CONSTRUCTION MANAGER, SHALL BE PERFORMED BY THE CONTRACTOR WITHOUT ADDITIONAL COMPENSATION.

G. FILL: SOIL MATERIALS USED TO RAISE EXISTING GRADES.

H. ROCK: ROCK MATERIAL IN BEDS, LEDGES, UNSTRATIFIED MASSES, AND CONGLOMERATE DEPOSITS AND BOULDERS OF ROCK MATERIAL IN CONFORMANCE WITH THE FOLLOWING:

1. 3/4 CU. YD OR MORE IN VOLUME THAT WHEN TESTED BY AN INDEPENDENT GEOTECHNICAL TESTING AGENCY, ACCORDING TO ASTM D1586, EXCEEDS A STANDARD PENETRATION RESISTANCE OF 100 BLOWS/2".

2. EXCEEDING 1 CU. YD. FOR BULK EXCAVATION OR 3/4 CU. YD FOR FOOTING, TRENCH, AND PIT EXCAVATION THAT CANNOT BE REMOVED BY ROCK EXCAVATING EQUIPMENT EQUIVALENT TO THE FOLLOWING IN SIZE AND PERFORMANCE RATINGS WITHOUT SYSTEMATIC DRILLING, RAM HAMMERING, RIPPING, OR BLASTING (WHEN PERMITTED):

a. BULK EXCAVATION: LATE-MODEL, TRACK-MOUNTED LOADER; RATED AT NOT LESS THAN 210 HP FLYWHEEL POWER AND DEVELOPING A MINIMUM OF 45,000 LB BREAKOUT FORCE; MEASURED ACCORDING TO ISO 7131.

I. STRUCTURES: BUILDINGS, FOOTINGS, FOUNDATIONS, RETAINING WALLS, SLABS, TANKS, CURBS, MECHANICAL AND ELECTRICAL APPURTENANCES, OR OTHER MAN-MADE STATIONARY FEATURES CONSTRUCTED ABOVE OR BELOW THE GROUND SURFACE.

J. SUBBASE COURSE: AGGREGATE LAYER PLACED BETWEEN THE SUBGRADE AND BASE COURSE FOR ASPHALT PAVING, OR AGGREGATE LAYER PLACED BETWEEN THE SUBGRADE AND A CONCRETE PAVEMENT OR WALK.

K. SUBGRADE: SURFACE OR ELEVATION REMAINING AFTER COMPLETING EXCAVATION, OR TOP SURFACE OF A FILL OR BACKFILL IMMEDIATELY BELOW SUBBASE, DRAINAGE FILL, OR TOPSOIL MATERIALS.

L. UTILITIES: ON-SITE UNDERGROUND PIPES, CONDUITS, DUCTS, AND CABLES, AS WELL AS UNDERGROUND SERVICES WITHIN BUILDINGS.

1.6 QUALITY ASSURANCE

A. GEOTECHNICAL TESTING AGENCY QUALIFICATIONS: INDEPENDENT TESTING AGENCY QUALIFIED ACCORDING TO ASTM E329 TO CONDUCT SOIL MATERIALS AND ROCK-DEFINITION TESTING, AS DOCUMENTED ACCORDING TO ASTM D3740 AND ASTM E548.

B. PRE-EXCAVATION CONFERENCE: CONDUCT CONFERENCE AT PROJECT SITE TO COMPLY WITH REQUIREMENTS IN DIVISION 1 SECTION "PROJECT MEETINGS".

PART 2: PRODUCTS

2.1 SOIL MATERIALS

A. GENERAL: PROVIDE BORROW SOIL MATERIALS WHEN SUFFICIENT SATISFACTORY SOIL MATERIALS ARE NOT AVAILABLE FROM EXCAVATIONS.

B. SATISFACTORY SOILS

1. EXCAVATED SOIL MATERIALS DETERMINED TO BE SUITABLE AS REFERENCED IN THE PROJECT GEOTECHNICAL INVESTIGATION REPORT AND/OR APPROVED BY THE GEOTECHNICAL ENGINEER.
2. BORROW SOIL MATERIALS APPROVED BY THE GEOTECHNICAL ENGINEER TO BE BROUGHT IN FOR INTENDED USE, TESTED FOR TPH, BTEX AND FULL TCLP INCLUDING IGNITABILITY, CORROSIVITY AND REACTIVITY. SOIL MATERIALS SHALL CONTAIN LESS THAN 100 PARTS PER MILLION (PPM) OF TOTAL HYDROCARBONS (TPH) AND LESS THAN 10 PPM OF THE SUM OF BENZENE, TOLEUNE, ETHYL BENZENE, AND XYLENE (BTEX). SOIL MATERIALS SHALL NOT FAIL THE TCLP TEST.
    a. TPH CONCENTRATIONS SHALL BE DETERMINED BY USING EPA 600/4-79/020 METHOD 418.1.
    b. BTEX CONCENTRATIONS SHALL BE DETERMINED BY USING EPA SW-846.3-3A METHOD 1311.
    c. PROVIDE BORROW SITE TESTING FOR TPH, BTEX AND TCLP FROM A COMPOSITE SAMPLE OF MATERIAL FROM THE BORROW SITE, WITH AT LEAST ONE TEST FROM EACH BORROW SITE.

C. UNSATISFACTORY SOILS

1. ASTM D2487 SOIL CLASSIFICATION GROUPS GC, SC, ML, MH, CL, CH, OL, OH, AND PT, OR A COMBINATION OF THESE GROUP SYMBOLS.
2. OTHERWISE SATISFACTORY SOIL MATERIALS NOT MAINTAINED WITHIN 2% OF OPTIMUM MOISTURE CONTENT AT TIME OF COMPACTION.

D. BACKFILL AND FILL: SATISFACTORY SOIL MATERIALS.

E. SUBBASE: NATURALLY OR ARTIFICIALLY GRADED MIXTURE OF NATURAL OR CRUSHED GRAVEL, CRUSHED STONE, AND NATURAL OR CRUSHED SAND; ASTM D2940; WITH AT LEAST 90% PASSING A 1 1/2” SIEVE AND NOT MORE THAN 12% PASSING A NO. 200 SIEVE.

F. BASE: NATURALLY OR ARTIFICIALLY GRADED MIXTURE OF NATURAL OR CRUSHED GRAVEL, CRUSHED STONE, AND NATURAL OR CRUSHED SAND; ASTM D2940; WITH AT LEAST 95% PASSING A 1 1/2” SIEVE AND NOT MORE THAN 8% PASSING A NO. 200 SIEVE.

G. ENGINEERED FILL: BASE MATERIALS.

H. BEDDING: NATURALLY OR ARTIFICIALLY GRADED MIXTURE OF NATURAL OR CRUSHED GRAVEL, CRUSHED STONE, AND NATURAL OR CRUSHED SAND; ASTM D2940; EXCEPT WITH 100% PASSING A 1” SIEVE AND NOT MORE THAN 8% PASSING A NO. 200 SIEVE.

I. DRAINAGE FILL: WASHED, NARROWLY GRADED MIXTURE OF CRUSHED STONE, OR CRUSHED OR UNCRUSHED GRAVEL; ASTM D448; COARSE-AGGREGATE GRADING SIZE 57; WITH 100% PASSING A 1 1/2" SIEVE AND 0 TO 5% PASSING A NO. 8 SIEVE.

J. FILTERING MATERIAL: EVENLY GRADED MIXTURE OF NATURAL OR CRUSHED GRAVEL, OR CRUSHED STONE AND NATURAL SAND; ASTM D448; COARSE-AGGREGATE GRADING SIZE 67; WITH 100% PASSING A 1" SIEVE AND 0 TO 5% PASSING A NO. 4 SIEVE.

K. IMPERVIOUS FILL: CLAYEY GRAVEL AND SAND MIXTURE CAPABLE OF COMPACTING TO A DENSE STATE.

2.2 BURIED WARNING AND IDENTIFICATION TAPE

A. NON-DETECTIBLE WARNING TAPE: ACID AND ALKALI RESISTANT POLYETHYLENE FILM WARNING TAPE MANUFACTURED FOR MARKING AND IDENTIFYING UNDERGROUND UTILITIES, MINIMUM 6" WIDE AND 4 MILS THICK, CONTINUOUSLY INSCRIBED WITH A DESCRIPTION OF UTILITY; COLORED AS FOLLOWS:

1. BLUE: WATER SYSTEMS
2. GREEN: SEWER SYSTEMS

B. DETECTIBLE WARNING TAPE: SIMILAR CONSTRUCTION AND COLOR CODING AS SPECIFIED IN NON-DETECTIBLE WARNING TAPE SECTION ABOVE BUT WITH DETECTIBLE METALLIC CORE ENCASED IN A PROTECTIVE JACKET FOR CORROSION PROTECTION, DETECTABLE BY METAL DETECTOR WHEN TAPE IS BURIED UP TO 30" DEEP.

PART 3: EXECUTION

3.1 PREPARATION

A. PROTECT STRUCTURES, UTILITIES, SIDEWALKS, PAVEMENTS, AND OTHER FACILITIES FROM DAMAGE CAUSED BY SETTLEMENT, LATERAL MOVEMENT, UNDERMINING, WASHOUT, AND OTHER HAZARDS CREATED BY EARTHWORK OPERATIONS.

B. PROTECT SOILS AGAINST FREEZING TEMPERATURES OR FROST. PROVIDE PROTECTIVE INSULATING MATERIALS AS NECESSARY.

C. PROVIDE EROSION-CONTROL MEASURES TO PREVENT EROSION OR DISPLACEMENT OF SOILS AND DISCHARGE OF SOIL-BEARING WATER RUNOFF OR AIRBORNE DUST TO ADJACENT PROPERTIES AND WALKWAYS.

3.2 DEWATERING

A. PREVENT SURFACE WATER AND GROUND WATER FROM ENTERING EXCAVATIONS, FROM PONDING ON PREPARED SUBGRADES, AND FROM FLOODING PROJECT SITE AND SURROUNDING AREA.

B. PROTECT SUBGRADES FROM SOFTENING, UNDERMINING, WASHOUT, AND DAMAGE BY RAIN OR WATER ACCUMULATION.

1. REROUTE SURFACE WATER RUNOFF AWAY FROM EXCAVATED AREAS. DO NOT ALLOW WATER TO ACCUMULATE IN EXCAVATIONS. DO NOT USE EXCAVATED TRENCHES AS TEMPORARY DRAINAGE DITCHES.
2. INSTALL A DEWATERING SYSTEM TO KEEP SUBGRADES DRY AND CONVEY GROUND WATER AWAY FROM EXCAVATIONS. MAINTAIN UNTIL DEWATERING IS NO LONGER REQUIRED.

C. IN THE EVENT SOIL MATERIALS HAVE BEEN DISTURBED BY WATER, THE DISTURBED SOIL MATERIAL SHALL BE REMOVED UP TO THE POINT OF FIRM DRY UNDISTURBED SOIL MATERIAL AFTER THE WATER IS UNDER CONTROL. REPLACE DISTURBED SOIL MATERIALS WITH NEW SOIL MATERIALS OF CORRECT TYPE.

3.3 EXPLOSIVES

A. DO NOT USE EXPLOSIVES.

3.4 EXCAVATION

A. GENERAL REQUIREMENTS

1. PROTECTION: SHORING, SHEETING, AND BRACING SHALL BE REQUIRED TO PROTECT WORKMEN, BANKS, ADJACENT PAVING, STRUCTURES, AND UTILITIES IN COMPLIANCE WITH OSHA REGULATIONS AND THE AUTHORITY HAVING JURISDICTION.

a. EXTEND SHORING AND BRACING TO THE BOTTOM OF THE EXCAVATION. SHORE EXCAVATIONS THAT ARE CARRIED BELOW THE ELEVATIONS OF ADJACENT EXISTING FOUNDATIONS.
b. IF THE BEARING OF ANY FOUNDATION IS DISTURBED BY EXCAVATING, IMPROPER SHORING OR REMOVAL OF SHORING, PLACING OF BACKFILL, AND SIMILAR OPERATIONS, PROVIDE CONCRETE FILL SUPPORT UNDER DISTURBED FOUNDATIONS AS DIRECTED BY THE CONSTRUCTION MANAGER AT NO ADDITIONAL COST TO THE OWNER. DO NOT REMOVE SHORING UNTIL PERMANENT WORK IN EXCAVATION HAS BEEN INSPECTED AND APPROVED BY CONSTRUCTION MANAGER.

2. IF EXCAVATED MATERIALS INTENDED FOR BACKFILL AND FILL INCLUDE UNSATISFACTORY SOIL MATERIALS AND ROCK, REPLACE WITH SATISFACTORY SOIL MATERIALS.
3. FRENCH DRAINS, SUMPS, DITCHES OR TRENCHES WILL NOT BE PERMITTED WITHIN 3 FT OF THE FOUNDATION OF ANY STRUCTURE, EXCEPT WITH SPECIFIC WRITTEN APPROVAL AND AFTER SPECIFIC CONTRACTUAL PROVISIONS FOR RESTORATION OF THE FOUNDATION AREA HAS BEEN MADE.
4. UNCLASSIFIED EXCAVATION: EXCAVATION TO SUBGRADE ELEVATIONS REGARDLESS OF THE CHARACTER OF SURFACE AND SUBSURFACE CONDITIONS ENCOUNTERED, INCLUDING ROCK, SOIL MATERIALS, AND OBSTRUCTIONS.
5. CLASSIFIED EXCAVATION: EXCAVATION TO SUBGRADE ELEVATIONS CLASSIFIED AS EARTH AND ROCK EXCAVATION.
    a. EARTH EXCAVATION
        1) INCLUDES EXCAVATING PAVEMENTS AND OBSTRUCTIONS VISIBLE ON SURFACE; UNDERGROUND STRUCTURES, UTILITIES, AND OTHER ITEMS INDICATED TO BE REMOVED; TOGETHER WITH SOIL, BOULDERS, AND OTHER MATERIALS NOT CLASSIFIED AS ROCK OR UNAUTHORIZED EXCAVATION.
        2) INTERMITTENT DRILLING, BLASTING (IF PERMITTED), RAM HAMMERING, OR RIPPING OF MATERIAL NOT CLASSIFIED AS ROCK EXCAVATION IS EARTH EXCAVATION.
    b. ROCK EXCAVATION
        1) DO NOT EXCAVATE ROCK UNTIL IT HAS BEEN CLASSIFIED AND CROSS-SECTIONED BY CONSTRUCTION MANAGER.
        2) ROCK EXCAVATION INCLUDES REMOVAL AND DISPOSAL OF ROCK.
        3) ROCK EXCAVATION WILL BE PAID FOR BY ADJUSTING THE CONTRACT SUM ACCORDING TO UNIT PRICES INCLUDED IN THE CONTRACT DOCUMENTS.

B. EXCAVATION FOR STRUCTURES
1. EXCAVATION FOR UNDERGROUND TANKS, BASINS, AND MECHANICAL OR ELECTRICAL UTILITY STRUCTURES: EXCAVATE TO ELEVATIONS AND DIMENSIONS INDICATED WITHIN A TOLERANCE OF PLUS OR MINUS 1/2". DO NOT DISTURB BOTTOM OF EXCAVATIONS INTENDED FOR BEARING SURFACE.

C. EXCAVATION FOR UTILITY TRENCHES
1. EXCAVATE TRENCHES TO INDICATED GRADIENTS, LINES, DEPTHS, AND ELEVATIONS.
    a. BEYOND BUILDING PERIMETER, EXCAVATE TRENCHES TO ALLOW INSTALLATION OF TOP OF PIPE BELOW FROST LINE.
2. EXCAVATE TRENCHES TO UNIFORM WIDTHS TO PROVIDE A WORKING CLEARANCE ON EACH SIDE OF PIPE. EXCAVATE TRENCH WALLS VERTICALLY FROM TRENCH BOTTOM TO 12" HIGHER THAN TOP OF PIPE, UNLESS OTHERWISE INDICATED.
    a. CLEARANCE: 12" ON EACH SIDE OF PIPE.
3. TRENCH BOTTOMS: EXCAVATE TRENCHES 4" DEEPER THAN BOTTOM OF PIPE ELEVATION TO ALLOW FOR BEDDING COURSE. HAND EXCAVATE FOR BELL OF PIPE.

a. EXCAVATE TRENCHES 6" DEEPER THAN ELEVATION REQUIRED IN ROCK OR OTHER UNYIELDING BEARING MATERIAL TO ALLOW FOR BEDDING COURSE.
b. FOR PIPES 6" AND LARGER, SHAPE BOTTOM OF TRENCH TO SUPPORT BOTTOM 90 DEGREES OF PIPE CIRCUMFERENCE. FILL DEPRESSIONS WITH TAMPED SAND BACKFILL.

D. WHERE UNIDENTIFIED EXISTING UTILITIES ARE ENCOUNTERED DURING EXCAVATION, DETERMINE WHETHER SAID UTILITIES ARE ACTIVE OR ABANDONED.
1. REMOVE INTERFERING PORTIONS OF ABANDONED UTILITIES AND CAP OR PLUG OPEN ENDS OF PIPE TO REMAIN.
a. CAP OR PLUG MUST SEAL THE OPENING IN SUCH A MANNER THAT WOULD PERMIT REMAINING PORTIONS OF THE UTILITY TO BE REACTIVATED.
2. NOTIFY OWNER FOR INSTRUCTION ON UTILITIES WHICH ARE DETERMINED TO BE ACTIVE.
a. DO NOT PROCEED WITHOUT INSTRUCTIONS, EXCEPT TO CORRECT AN IMMEDIATE HAZARD OR EMERGENCY CONDITION.
b. RELOCATION WORK PERFORMED ON AN ACTIVE UTILITY WITHOUT OBTAINING PRIOR APPROVAL FROM OWNER AND CONSTRUCTION MANAGER SHALL BE DONE AT THE CONTRACTOR'S EXPENSE AND LIABILITY.

3.5 APPROVAL OF SUBGRADE

A. NOTIFY CONSTRUCTION MANAGER WHEN EXCAVATIONS HAVE REACHED REQUIRED SUBGRADE.
B. IF CONSTRUCTION MANAGER DETERMINES THAT UNSATISFACTORY SOIL IS PRESENT, CONTINUE EXCAVATION AND REPLACE WITH COMPACTED BACKFILL OR FILL MATERIAL AS DIRECTED.
1. ADDITIONAL EXCAVATION AND REPLACEMENT MATERIAL WILL BE PAID FOR ACCORDING TO CONTRACT PROVISIONS FOR CHANGES IN THE WORK.
C. PROOF ROLL SUBGRADE WITH HEAVY PNEUMATIC-TIRED EQUIPMENT TO IDENTIFY SOFT POCKETS AND AREAS OF EXCESS YIELDING. DO NOT PROOF ROLL WET OR SATURATED SUBGRADES.
D. RECONSTRUCT SUBGRADES DAMAGED BY FREEZING TEMPERATURES, FROST, RAIN, ACCUMULATED WATER, OR CONSTRUCTION ACTIVITIES AS DIRECTED BY CONSTRUCTION MANAGER.

3.6 STORAGE OF SOIL MATERIALS

A. STOCKPILE BORROW MATERIALS AND SATISFACTORY EXCAVATED SOIL MATERIALS AT LOCATION DIRECTED BY THE CONSTRUCTION MANAGER. STOCKPILE SOIL MATERIALS WITHOUT INTERMIXING. PLACE, GRADE, AND SHAPE STOCKPILES TO DRAIN SURFACE WATER. COVER TO PREVENT WINDBLOWN DUST.
1. STOCKPILE SOIL MATERIALS AWAY FROM EDGE OF EXCAVATIONS. DO NOT STORE WITHIN DRIP LINE OF TREES, EDGES OF BUILDINGS, OR OTHER AREAS THAT WOULD INTRODUCE WATER.
2. STOCKPILES SHALL BE COVERED TO PREVENT EROSION IF LEFT UNDISTURBED FOR MORE THAN 48 HOURS.

3.7 BACKFILL

A. GENERAL: PLACE AND COMPACT BACKFILL IN EXCAVATIONS PROMPTLY, BUT NOT BEFORE COMPLETING THE FOLLOWING:
1. CONSTRUCTION BELOW FINISH GRADE INCLUDING, WHERE APPLICABLE, DAMPPROOFING, WATERPROOFING, AND PERIMETER INSULATION.
2. SURVEYING LOCATIONS OF UNDERGROUND UTILITIES FOR RECORD DOCUMENTS.
3. INSPECTING AND TESTING UNDERGROUND UTILITIES.
4. REMOVING CONCRETE FORMWORK.
5. REMOVING TRASH AND DEBRIS.
6. REMOVING TEMPORARY SHORING AND BRACING, AND SHEETING.
7. INSTALLING PERMANENT OR TEMPORARY HORIZONTAL BRACING ON HORIZONTALLY SUPPORTED WALLS.
B. UTILITY TRENCH BACKFILL

1. PLACE AND COMPACT BEDDING COURSE ON TRENCH BOTTOMS AND WHERE INDICATED. SHAPE BEDDING COURSE TO PROVIDE CONTINUOUS SUPPORT FOR BELLS, JOINTS, AND BARRELS OF PIPES AND JOINTS, FITTINGS, AND BODIES OF CONDUITS.
2. BACKFILL TRENCHES EXCAVATED UNDER FOOTINGS AND WITHIN 18" OF BOTTOM OF FOOTINGS; FILL WITH CONCRETE TO BOTTOM OF FOOTING ELEVATION.
3. PROVIDE 4" THICK, CONCRETE-BASE SLAB SUPPORT FOR PIPING LESS THAN 30" BELOW SURFACE OF ROADWAYS. AFTER INSTALLING AND TESTING, COMPLETELY ENCASE PIPING IN A MINIMUM OF 4" OF CONCRETE BEFORE BACKFILLING OR PLACING ROADWAY SUBBASE.
4. PLACE AND COMPACT INITIAL BACKFILL OF SUBBASE MATERIAL, FREE OF PARTICLES LARGER THAN 1", TO A HEIGHT OF 12" OVER THE UTILITY PIPE.
    a. CAREFULLY COMPACT MATERIAL UNDER PIPE HAUNCHES AND BRING BACKFILL EVENLY UP ON BOTH SIDES AND ALONG THE FULL LENGTH OF UTILITY PIPING TO AVOID DAMAGE OR DISPLACEMENT OF UTILITY SYSTEM.
5. COORDINATE BACKFILLING WITH UTILITIES TESTING.
6. FILL VOIDS WITH APPROVED BACKFILL MATERIALS WHILE SHORING AND BRACING, AND AS SHEETING IS REMOVED.
7. PLACE AND COMPACT FINAL BACKFILL OF SATISFACTORY SOIL MATERIAL TO FINAL SUBGRADE.
8. INSTALL DETECTABLE WARNING TAPE DIRECTLY ABOVE UTILITIES, 12" BELOW FINISHED GRADE, EXCEPT 6" BELOW SUBGRADE UNDER PAVEMENTS AND SLABS.

C. BACKFILL OF UNAUTHORIZED EXCAVATION
1. BACKFILL UNDER FOUNDATIONS OR WALL FOOTINGS BY EXTENDING BOTTOM ELEVATION OF CONCRETE FOUNDATION OR FOOTING TO EXCAVATION BOTTOM, WITHOUT ALTERING TOP ELEVATION. LEAN CONCRETE FILL MAY BE USED WHEN APPROVED BY CONSTRUCTION MANAGER.
2. BACKFILL UNAUTHORIZED EXCAVATIONS UNDER OTHER CONSTRUCTION OR UTILITY PIPE AS DIRECTED BY CONSTRUCTION MANAGER.

3.8 FILL

A. PREPARATION: REMOVE VEGETATION, TOPSOIL, DEBRIS, UNSATISFACTORY SOIL MATERIALS, OBSTRUCTIONS, AND DELETERIOUS MATERIALS FROM GROUND SURFACE BEFORE PLACING FILLS.

B. PLOW, SCARIFY, BENCH, OR BREAK UP SLOPED SURFACES STEEPER THAN 1 VERTICAL TO 4 HORIZONTAL SO FILL MATERIAL WILL BOND WITH EXISTING MATERIAL.

C. PLACE AND COMPACT FILL MATERIAL IN LAYERS TO REQUIRED ELEVATIONS AS FOLLOWS:
1. UNDER GRASS AND PLANTED AREAS: USE SATISFACTORY SOIL MATERIAL.
2. UNDER WALKS AND PAVEMENTS: USE SATISFACTORY SOIL MATERIAL.
3. UNDER STEPS AND RAMPS: USE ENGINEERED FILL.
4. UNDER BUILDING SLABS: USE ENGINEERED FILL.
5. UNDER FOOTINGS AND FOUNDATIONS: USE ENGINEERED FILL.

3.9 MOISTURE CONTROL

A. UNIFORMLY MOISTEN OR AERATE SUBGRADE AND EACH SUBSEQUENT FILL OR BACKFILL LAYER BEFORE COMPACTION TO WITHIN 2% OF OPTIMUM MOISTURE CONTENT.
1. DO NOT PLACE BACKFILL OR FILL MATERIAL ON SURFACES THAT ARE MUDDY, FROZEN, OR CONTAIN FROST OR ICE.
2. REMOVE AND REPLACE, OR SCARIFY AND AIR-DRY, OTHERWISE SATISFACTORY SOIL MATERIAL THAT EXCEEDS OPTIMUM MOISTURE CONTENT BY 2% AND IS TOO WET TO COMPACT TO SPECIFIED DRY UNIT WEIGHT.

3.10 COMPACTION OF BACKFILLS AND FILLS

A. PLACE BACKFILL AND FILL MATERIALS IN LAYERS NOT MORE THAN 8" IN LOOSE DEPTH FOR MATERIAL COMPACTED BY HEAVY COMPACTION EQUIPMENT, AND NOT MORE THAN 4" IN LOOSE DEPTH FOR MATERIAL COMPACTED BY HAND-OPERATED TAMPERS.

B. PLACE BACKFILL AND FILL MATERIALS EVENLY ON ALL SIDES OF STRUCTURES TO REQUIRED ELEVATIONS, AND UNIFORMLY ALONG THE FULL LENGTH OF EACH STRUCTURE.

C. COMPACT SOIL TO NOT LESS THAN THE FOLLOWING PERCENTAGES OF MAXIMUM DRY UNIT WEIGHT ACCORDING TO ASTM D698:

1. UNDER STRUCTURES, BUILDING SLABS, STEPS, AND PAVEMENTS: SCARIFY AND RE-COMPACT TOP 12" OF EXISTING SUBGRADE AND EACH LAYER OF BACKFILL OR FILL MATERIAL AT 95%.
2. UNDER WALKWAYS: SCARIFY AND RE-COMPACT TOP 6" BELOW SUBGRADE AND COMPACT EACH LAYER OF BACKFILL OR FILL MATERIAL AT 92%.
3. UNDER LAWN OR UNPAVED AREAS: SCARIFY AND RE-COMPACT TOP 6" BELOW SUBGRADE AND COMPACT EACH LAYER OF BACKFILL OR FILL MATERIAL AT 85%.

3.11 ROUGH GRADING

A. RESTORE GRADE WITH BACKFILL AND FILL TO INDICATED ELEVATIONS WITHIN THE SPECIFIED TOLERANCE LISTED BELOW:

1. TOLERANCE: +/-0.5 FT

B. FINAL GRADING SHALL BE PERFORMED BY OTHERS.

3.12 FIELD QUALITY CONTROL

A. TESTING AGENCY: OWNER WILL ENGAGE A QUALIFIED INDEPENDENT GEOTECHNICAL ENGINEERING TESTING AGENCY TO PERFORM FIELD QUALITY-CONTROL TESTING.

B. ALLOW TESTING AGENCY TO INSPECT AND TEST SUBGRADES AND EACH FILL OR BACKFILL LAYER. PROCEED WITH SUBSEQUENT EARTHWORK ONLY AFTER TEST RESULTS FOR PREVIOUSLY COMPLETED WORK COMPLY WITH REQUIREMENTS.

C. TESTING AGENCY WILL TEST COMPACTION OF SOILS IN PLACE ACCORDING TO ASTM D1556, ASTM D2167, ASTM D2922, AND ASTM D2937, AS APPLICABLE. TESTS WILL BE PERFORMED AT THE FOLLOWING LOCATIONS AND FREQUENCIES:

1. TRENCH BACKFILL: AT EACH COMPACTED INITIAL AND FINAL BACKFILL LAYER, AT LEAST ONE TEST FOR EACH 150 FT OR LESS OF TRENCH LENGTH, BUT NO FEWER THAN TWO TESTS.

D. WHEN TESTING AGENCY REPORTS THAT SUBGRADES, FILLS, OR BACKFILLS HAVE NOT ACHIEVED DEGREE OF COMPACTION SPECIFIED, SCARIFY AND MOISTEN OR AERATE, OR REMOVE AND REPLACE SOIL TO DEPTH REQUIRED; RE-COMPACT AND RETEST UNTIL SPECIFIED COMPACTION IS OBTAINED.

3.13 PROTECTION OF FINISHED WORK

A. PROTECTING GRADED AREAS: PROTECT NEWLY GRADED AREAS FROM TRAFFIC, FREEZING, AND EROSION. KEEP FREE OF TRASH AND DEBRIS.

B. REPAIR AND RE-ESTABLISH GRADES TO SPECIFIED TOLERANCES WHERE COMPLETED OR PARTIALLY COMPLETED SURFACES BECOME ERODED, RUTTED, SETTLED, OR WHERE COMPACTION IS COMPROMISED DUE TO SUBSEQUENT CONSTRUCTION OPERATIONS OR WEATHER CONDITIONS.

1. SCARIFY OR REMOVE AND REPLACE SOIL MATERIAL TO DEPTH AS DIRECTED BY CONSTRUCTION MANAGER; RE-SHAPE AND RE-COMPACT.

C. WHERE SETTLING OCCURS BEFORE PROJECT CORRECTION PERIOD ELAPSES, REMOVE FINISHED SURFACING, BACKFILL WITH ADDITIONAL SOIL MATERIAL, COMPACT, AND RECONSTRUCT SURFACING.

1. RESTORE APPEARANCE, QUALITY, AND CONDITION OF FINISHED SURFACING TO MATCH ADJACENT WORK, AND ELIMINATE EVIDENCE OF RESTORATION.

3.14 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. TRANSPORT SURPLUS SATISFACTORY SOIL MATERIALS TO DESIGNATED STORAGE AREAS ON OWNER'S PROPERTY. STOCKPILE OR SPREAD SOIL AS DIRECTED BY CONSTRUCTION MANAGER.

B. REMOVE WASTE MATERIAL, INCLUDING UNSATISFACTORY SOIL, ROCK, TRASH, AND DEBRIS, AND LEGALLY DISPOSE OF IT OFF OWNER'S PROPERTY AS DIRECTED BY THE CONSTRUCTION MANAGER.

3.15 CLEAN-UP

A. UPON COMPLETION OF EARTHWORK OPERATIONS, CLEAN AREAS WITHIN CONTRACT LIMITS, REMOVE TOOLS AND EQUIPMENT. PROVIDE SITE CLEAR, CLEAN, FREE OF DEBRIS, AND SUITABLE FOR SUBSEQUENT CONSTRUCTION OPERATIONS.

END OF SECTION

03300 CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. CONSTRUCTION DRAWINGS, SPECIFICATIONS AND PROVISIONS OF THE CONTRACT INCLUDING GENERAL AND SUPPLEMENTAL CONDITIONS AND OTHER DIVISION 1 SPECIFICATION SECTIONS, ARE HEREBY MADE A PART OF THIS SECTION AS FULLY AND COMPLETELY AS IF REPEATED HEREIN.

1.02 ITEMS REQUIRED BUT NOT SPECIFIED

A. IF AN ITEM OR MATERIAL OF THIS TRADE IS INDICATED ON THE DRAWINGS BUT NOT SPECIFICALLY LISTED IN THIS SECTION, PROVIDE SUCH ITEM OR MATERIAL AT A STANDARD OF QUALITY EQUAL TO THE STANDARD ESTABLISHED FOR THE BALANCE OF THE WORK SPECIFIED, IN ACCORDANCE WITH THE ARCHITECT'S INTERPRETATION.

1.03 EXECUTION, CORRELATION AND INTENT

A. IN CASE OF AN INCONSISTENCY BETWEEN DRAWINGS AND SPECIFICATIONS, OR WITHIN EITHER DOCUMENT NOT CLARIFIED BY ADDENDUM, THE BETTER QUALITY OR GREATER QUANTITY OF WORK IS TO BE PROVIDED, IN ACCORDANCE WITH THE ARCHITECT'S INTERPRETATION.

1.04 DESCRIPTION

A. BASIC SPECIFICATION: PERFORM WORK OF THIS SECTION ACCORDING TO ACI 301-99, "SPECIFICATIONS FOR STRUCTURAL CONCRETE FOR BUILDINGS", EXCEPT AS SPECIFICALLY MODIFIED HEREIN. NUMBERS IN PARENTHESES (0.00) INDICATE A RELATED PARAGRAPH OF ACI 301.

B. WORK INCLUDED: ALL CAST-IN-PLACE CONCRETE FOUNDATION WORK SHOWN ON THE DRAWINGS AND REQUIRED BY THESE SPECIFICATIONS. ALLOW FOR THE INSTALLATION OF CAST-IN ITEMS FURNISHED UNDER OTHER SECTIONS.
   1. CONCRETE COLUMN AND WALL FOOTINGS, INCLUDING EXCAVATION.
   2. CONCRETE COLUMN PIERS AND FOUNDATION WALLS, INCLUDING EXCAVATION AND COMPACTED BACKFILL.
   3. INSTALLING EMBEDDED ITEMS, ADHESIVE TYPE COLUMN ANCHOR BOLTS, PROVIDED BY OTHERS.
   4. GROUTING OF COLUMN BASE PLATES.
   5. COATING PORTION OF STRUCTURAL STEEL COLUMNS AND BASE PLATES BELOW FLOOR WITH BITUMINOUS COATING.
   6. GRADING WORK ASSOCIATED WITH FOUNDATION EXCAVATIONS TO BRING ADJACENT AREAS INTO COMPLIANCE WITH SUBGRADE CONSTRUCTION TOLERANCE.
   7. FOUNDAITON INSULATION.

C. WORK NOT INCLUDED:
   1. INTERIOR SLABS ON GRADE & SLABS ON METAL DECK (SPECIFIED IN 033100).
   2. FIELD INSPECTION AND TESTING SERVICES.

D. COOPERATE WITH OTHER TRADES WHO WILL PROVIDE AND INSTALL ITEMS OF WORK (SLEEVES, PIPING, CONDUIT, INSERTS, ETC.) TO BE CAST IN THE CONCRETE. PLACE NO CONCRETE UNTIL ALL SUCH ITEMS ARE IN PLACE.

E. INSPECTION AND TESTING SERVICES REQUIRED BY THIS SECTION TO ESTABLISH MIX DESIGNS ARE TO BE PERFORMED BY AN AGENCY RETAINED BY THE CONTRACTOR (1.6.3). INSPECTION AND TESTING SERVICES REQUIRED BY THIS SECTION FOR ALL FIELD SAMPLING AND TESTING REQUIRED ARE TO BE PERFORMED BY AN AGENCY RETAINED BY THE OWNER/CONSTRUCTION MANAGER (1.6.4).

1.05 QUALITY ASSURANCE

A. REFERENCE STANDARDS: COMPLY WITH THE FOLLOWING ACI PUBLICATIONS EXCEPT WHERE

MORE STRINGENT REQUIREMENTS ARE SHOWN OR SPECIFIED:
1. ACI 301, SPECIFICATIONS FOR STRUCTURAL CONCRETE.
2. ACI 318, BUILDING CODE REQUIREMENTS FOR REINFORCED CONCRETE.

1.06 SUBMITTALS

A. SUBMIT A MIX DESIGN FOR EACH CLASS OF CONCRETE REQUIRED (1.6.3). CONCRETE PROPORTIONS SHALL BE ESTABLISHED ON THE BASIS OF PREVIOUS FIELD EXPERIENCE OR TRIAL MIXTURES (4.2.3).

B. SUBMIT SHOP DRAWINGS FOR ALL REINFORCING. INDICATE STRENGTH, SIZE, AND DETAILS OF ALL BAR REINFORCING, AND STYLE AND SPECIFICATION OF ALL WELDED WIRE FABRIC (3.1.1).

C. SUBMIT PRODUCT LITERATURE FOR ADMIXTURES AND CURING COMPOUNDS PROPOSED FOR USE.

D. SUBMIT REPORTS OF ALL REQUIRED TESTING AND INSPECTION.

1.07 FIELD REFERENCE MANUALS

A. PROVIDE AT LEAST ONE COPY OF THE ACI FIELD REFERENCE MANUAL, SP-15, AND ONE COPY OF CRSI'S "PLACING REINFORCING BARS", IN THE FIELD OFFICE AT ALL TIMES (1.4.3).

PART 2 - PRODUCTS

2.01 MATERIALS

A. CEMENT (4.2.1.1): PORTLAND CEMENT, ASTM C150, TYPE I. TYPE II OR III (HIGH EARLY STRENGTH) MAY BE USED WITH WRITTEN APPROVAL AND AT THE CONTRACTOR'S EXPENSE. ALL CEMENT FOR CONCRETE EXPOSED TO VIEW TO BE FROM THE SAME MILL.

B. WATER: POTABLE.

C. AGGREGATES: ASTM C33, (4.2.1.2). USE SIZE NO. 57 FOR ALL CLASSES.

D. ADMIXTURES (WHERE REQUIRED OR PERMITTED):
1. WATER-REDUCING: ASTM C494, TYPE A OR D (4.2.1.4).
2. MID-RANGE WATER-REDUCING ADMIXTURE: ASTM C494, TYPE A (4.2.1.4).
3. AIR-ENTRAINING: ASTM C260.
4. HIGH-RANGE WATER-REDUCING ADMIXTURE (SUPERPLASTICIZER): ASTM C494, TYPE F OR G (4.2.1.4).
5. NON-CHLORIDE, NON-CORROSIVE ACCELERATOR: ASTM C494, TYPE C OR E (4.2.1.4).
6. CALCIUM CHLORIDE IS NOT PERMITTED (4.2.2.6).
7. USE OF ADMIXTURES OTHER THAN THOSE LISTED WILL BE PERMITTED ONLY WHEN APPROVED PRIOR TO BID.

E. REINFORCING (3.2.1):
1. RECYCLED CONTENT OF STEEL PRODUCTS: PROVIDE PRODUCTS WITH AN AVERAGE RECYCLED CONTENT OF STEEL PRODUCTS SO POSTCONSUMER RECYCLED CONTENT PLUS ONE-HALF OF PRECONSUMER RECYCLED CONTENT IS NOT LESS THAN 25 PERCENT
2. DEFORMED BARS: ASTM A615, A616, A617, OR A706. MINIMUM YIELD STRENGTH TO BE 60 KSI.

F. PERIMETER INSULATION: POLYSTYRENE RIGID BOARD INSULATION BY DOW CHEMICAL FORMS THE BASIS OF DESIGN. COMPARABLE MATERIALS BY OWENS CORNING AND TENNECO ARE ACCEPTABLE:
1. RIGID INSULATION: "STYROFOAM SQUARE EGE (SE)"
2. THERMAL VALUE: R = 5.0 PER INCH.
3. COMPRESSIVE STRENGTH: 25 PSI MINIMUM.
4. THICKNESS: 2 INCHES UNLESS NOTED.

5. COMPLIANCE: ASTM C-578, TYPE IV.

G. BELOW GRADE BITUMINOUS COATING ON STRUCTURAL STEEL:
1. SSPC PAINTING SYSTEM 9.01, COLD APPLIED ASPHALT MASTIC.

2.02 MIXES

THE FOLLOWING CLASSES OF CONCRETE ARE REQUIRED (4.2.2.8):

TYPE	F'c(28 DAY)	WEIGHT	MAX. WATER CEMENT RATIO	AIR CONTENT
CLASS I FOUNDATIONS, INTERIOR WALLS, INTERIOR PIERS, MUD SLABS				
	3000 PSI	NORMAL	0.45	-
CLASS II EXPOSED FOUNDATION, WALLS, PIERS, AND ALL OTHER EXTERIOR CONCRETE				
	4,500 PSI	NORMAL	0.40	5 - 7% MAX.
CLASS III WALL CURBING				
	4,000 PSI	NORMAL	0.38	5 -7% MAX.
CLASS IV LEAN	1500 PSI		-	OPTIONAL
CLASS V INTERIOR SLABS ON GRADE	(SEE SPECIFICATION 033100)			
CLASS VI INTERIOR SLABS ON DECK	(SEE SPECIFICATION 033100)			
CLASS VII STAIR PAN FILL				
	3500 PSI	NORMAL	-	-

1. SLUMP: 5" MAXIMUM, EXCEPT FOR CLASS III SLUMP SHALL NOT EXCEED 2". IF A SUPERPLASTICIZER IS USED, INITIAL SLUMP TO BE 2" TO 3", INCREASED TO 8" MAXIMUM AFTER ADDITION (AT THE JOB SITE) OF THE SUPERPLASTICIZER.
2. MIXES TO BE PUMPED ARE TO BE SO IDENTIFIED ON THE MIX DESIGN SUBMITTAL. ALL PUMPED MIXES AND CLASS III ARE TO HAVE A MID-RANGE OR HIGH-RANGE WATER REDUCER.
3. ALL ADMIXTURES (OTHER THAN SUPERPLASTICIZER) ARE TO BE ADDED AT THE BATCH PLANT. SUPERPLASTICIZERS, DESIGNED FOR ADDITION TO THE MIX AT THE PLANT, MAY BE ADDED AT THE BATCH PLANT WITH VERIFICATION FROM THE STRUCTURAL ENGINEER AND VERIFICATION THAT THE WATER-TO-CEMENT RATIO HAS NOT BEEN EXCEEDED..
4. CLASS III AND VII SHALL HAVE MAXIMUM 3/8" AGGREGATE (#8) SIZE

PART 3 - EXECUTION

3.01 SURFACE CONDITIONS

A. VERIFY THAT FOOTING EXCAVATIONS ARE FREE OF WATER AND ICE, ARE OF THE REQUIRED DIMENSIONS, AND HAVE BEEN APPROVED BY THE SOILS ENGINEER, PRIOR TO PLACING CONCRETE (5.3.1).

B. DETERMINE FIELD CONDITIONS BY ACTUAL MEASUREMENT.

C. NOTIFY ENGINEER AND TESTING LABORATORY NOT LESS THAN 24 HOURS IN ADVANCE OF PLACING CONCRETE. PLACE CONCRETE ONLY WHEN TESTING LABORATORY PERSONNEL ARE PRESENT, UNLESS THIS REQUIREMENT IS SPECIFICALLY WAIVED IN WRITING BY THE OWNER.

3.02 FORMWORK

A. FOOTINGS MAY BE CAST AGAINST EARTH CUTS WHEN SOIL CONDITIONS PERMIT.

B. REMOVAL OF FORMS AND SHORING:
1. REMOVE NO FORMS WITHIN 24 HOURS AFTER PLACEMENT.
2. SHORING IS TO REMAIN IN PLACE UNTIL CONCRETE REACHES ITS DESIGN STRENGTH. WINDSOR PENETROMETER IS TO BE USED TO VERIFY IN-PLACE STRENGTH IF FORMS ARE REMOVED PRIOR TO 28 DAYS AFTER CASTING CONCRETE.

C. CHAMFER EXPOSED CORNERS AND EDGES OF PERMANENTLY EXPOSED CONCRETE, UNLESS NOTED OTHERWISE.

3.03 JOINTING

A. EXPOSED CONCRETE FOUNDATION WALLS:
1. LOCATE CONTROL (CONTRACTION) JOINTS IN THE EXPOSED FACE OF FOUNDATION WALLS, AS SHOWN ON THE DRAWINGS. IN THE ABSENCE OF INFORMATION ON DRAWINGS, LOCATE AT A MAXIMUM SPACING OF 20'-0

3.04 FINISHES

A. CAST-IN-PLACE CONCRETE WALLS SHALL HAVE A SMOOTH FORM FINISH (5.3.3.3.B).
1. CLASS A, 1/8 INCH FOR SMOOTH-FORMED FINISHED SURFACES, WHERE EXPOSED TO VIEW.
2. CLASS C, 1/2 INCH FOR ROUGH-FORMED FINISHED SURFACES, UNLESS NOTED

3.05 CURING AND PROTECTION

A. TEMPERATURE:
1. WHEN AIR TEMPERATURE DURING PLACEMENT IS LESS THAN 40 DEGREES, OR WILL BE WITHIN 24 HOURS, TEMPERATURE OF CONCRETE AS PLACED IS TO BE BETWEEN 50 AND 70 DEGREES (55 AND 75 DEGREES FOR SECTIONS LESS THAN 12 INCHES THICK) AND A NON-CHLORIDE ACCELERATOR SHALL BE USED. MAINTAIN CONCRETE TEMPERATURE WITHIN THESE LIMITS FOR THE FULL CURING PERIOD OF 7 DAYS. (4.2.2.7 AND 5.3.1.6).
2. WHEN AIR TEMPERATURE DURING PLACEMENT IS GREATER THAN 80 DEGREES, A WATER-REDUCING RETARDER SHALL BE USED.

B. CURING:
1. CURE CONCRETE IN ACCORDANCE WITH 5.3.6.

3.06 FIELD QUALITY CONTROL

A. OBTAIN CONCRETE FOR REQUIRED TESTS AT POINT OF PLACEMENT. IF CONCRETE IS PUMPED, OBTAIN CONCRETE FOR TESTS AT DISCHARGE END. (1.6.4.3)

B. FOR EACH CONCRETE CLASS OTHER THAN LEAN CONCRETE, PERFORM ONE STRENGTH TEST FOR EACH 50 YARDS OR FRACTION THEREOF, FOR ONE DAY PLACEMENT OF UP TO 300 YARDS (1.6.4.2.D). PERFORM ONE STRENGTH TEST FOR EACH 100 YARDS OR FRACTION THEREOF, FOR ONE DAY PLACEMENTS OF GREATER THAN 300 YARDS.

C. DETERMINE SLUMP FOR EACH STRENGTH TEST (1.6.4.3.F).

D. DETERMINE AIR CONTENT FOR EACH STRENGTH TEST OF CLASS II & CLASS III CONCRETE (1.6.4.2.H).

E. DETERMINE CONCRETE TEMPERATURE FOR EACH STRENGTH TEST (1.6.4.2.G).

F. DO NOT PLACE CONCRETE WHEN SLUMP, AIR CONTENT, OR TEMPERATURE VARY FROM ALLOWABLE. .

G. MAINTAIN RECORDS OF ALL TESTS, INDICATING EXACT LOCATION OF THE STRUCTURE REPRESENTED BY EACH TEST.

H. TEST CYLINDERS SHALL BE STORED AT THE JOBSITE FOR THE FIRST 20 HOURS, PLUS OR MINUS 4 HOURS, IN A PROTECTED LOCATION, WITH THE TEMPERATURE MAINTAINED BETWEEN 60 AND 80 DEGREES, OR RESULTS SHALL BE CONSIDERED UNACCEPTABLE.

I. ALL FIELD TESTING AND INSPECTIONS SHALL BE PERFORMED BY AN ACI CONCRETE FIELD TESTING TECHNICIAN GRADE 1, OR EQUIVALENT (16.2).

END OF SECTION

033100 INDUSTRIAL FLOOR SLABS

PART 1 - GENERAL

1.01 ITEMS REQUIRED BUT NOT SPECIFIED

A. IF AN ITEM OR MATERIAL OF THIS TRADE IS INDICATED ON THE DRAWINGS BUT SPECIFICALLY LISTED IN THIS SECTION, PROVIDE SUCH ITEM OR MATERIAL AT A STANDARD OF QUALITY EQUAL TO THE STANDARD ESTABLISHED FOR THE BALANCE OF THE WORK SPECIFIED, IN ACCORDANCE WITH THE ARCHITECT'S INTERPRETATION.

1.02 EXECUTION, CORRELATION, AND INTENT

A. IN CASE OF AN INCONSISTENCY BETWEEN DRAWINGS AND SPECIFICATIONS, OR WITHIN EITHER DOCUMENT NOT CLARIFIED BY ADDENDUM, THE BETTER QUALITY OR GREATER QUANTITY OF WORK IS TO BE PROVIDED, IN ACCORDANCE WITH THE ARCHITECT'S INTERPRETATION.

1.03 DESCRIPTION

A. BASIC SPECIFICATION: PERFORM WORK OF THIS SECTION ACCORDING TO ACI 301_10, "SPECIFICATIONS FOR STRUCTURAL CONCRETE", EXCEPT AS SPECIFICALLY MODIFIED HEREIN. NUMBERS IN PARENTHESES (0.00) INDICATE A RELATED PARAGRAPH OF ACI 301.

B. WORK INCLUDED: ALL INTERIOR CAST_IN_PLACE CONCRETE SLABS AS SHOWN ON THE DRAWINGS AND REQUIRED BY THESE SPECIFICATIONS. ALLOW FOR THE INSTALLATION OF CAST_IN ITEMS FURNISHED UNDER OTHER SECTIONS.

C. ALL WORK OF THIS SECTION SHALL BE CONSIDERED A SINGLE SOURCE RESPONSIBILITY, AND SHALL BE WHOLLY PROVIDED AND PERFORMED ONLY BY CONCRETE SUBCONTRACTORS. SINGLE SOURCE RESPONSIBILITY SHALL INCLUDE ACCEPTANCE OF THE SUBGRADE.

D. PROVIDE ASSISTANCE TO THE OWNER'S TESTING LABORATORY TO VERIFY THE ACCURACY OF SUBGRADE PRIOR TO CONCRETE PLACEMENT. SEE SUBGRADE AND FLOOR SLAB THICKNESS TOLERANCE REQUIREMENTS.

E. COOPERATE WITH OTHER TRADES WHO WILL PROVIDE AND INSTALL ITEMS OF WORK (SLEEVES, PIPING, CONDUIT, INSERTS, ETC.) TO BE CAST IN THE CONCRETE. PLACE NO CONCRETE UNTIL ALL SUCH ITEMS ARE IN PLACE.

F. INSPECTION AND TESTING SERVICES REQUIRED TO ESTABLISH MIX DESIGNS ARE TO BE PERFORMED BY AN AGENCY RETAINED BY THE CONTRACTOR (1.6.2). OTHER SERVICES REQUIRED BY THIS SECTION ARE TO BE PERFORMED BY AN AGENCY RETAINED BY THE CONSTRUCTION MANAGER (1.6.3). THE CONTRACTOR SHALL PROVIDE SPACE AND SOURCE OF ELECTRICAL POWER ON THE PROJECT SITE FOR FACILITIES TO BE USED FOR INITIAL CURING OF CONCRETE TEST SPECIMENS AS REQUIRED BY ASTM C31 / C31M (1.6.2.2.D). THE OWNER'S TESTING AGENCY SWILL CONDUCT CONCRETE STRENGTH TESTS DURING CONSTRUCTION BY MAKING AND CURING TEST SPECIMENS IN ACCORDANCE WITH ASTM C39/C39M AND TESTING THEM ACCORDINT TO ASTM C39/C39M (1.6.3.2.E). THE OWNER'S TESTING AGENCY SHALL PROVIDE THE FACILITIES FOR CURING CONCRETE TEST SPECIMENS.

G. RELATED WORK SPECIFIED ELSEWHERE: THE GENERAL PROVISIONS OF THE CONTRACT APPLY TO THE WORK OF THIS SECTION, AS THOUGH REPRODUCED HEREIN. CAREFULLY EXAMINE ALL OTHER SECTIONS AND ALL DRAWINGS FOR RELATED WORK.

1.04 QUALITY ASSURANCE

A. REFERENCE STANDARDS (LATEST EDITION): COMPLY WITH THE FOLLOWING ACI PUBLICATIONS EXCEPT WHERE MORE STRINGENT REQUIREMENTS ARE SHOWN OR SPECIFIED:
   1. ACI 301, SPECIFICATIONS FOR STRUCTURAL CONCRETE.

2. ACI 318, BUILDING CODE REQUIREMENTS FOR STRUCTURAL CONCRETE AND COMMENTARY.
3. SP-66, ACI DETAILING MANUAL
4. ACI 302.1R, GUIDE TO CONCRETE FLOOR AND SLAB CONSTRUCTION
5. ACI 117, SPECIFICATION FOR TOLERANCES FOR CONCRETE CONSTRUCTION AND MATERIALS AND COMMENTARY.
6. ACI 223R, GUIDE FOR THE USE OF SHRINKAGE-COMPENSATING CONCRETE.
7. "PLACING REINFORCING BARS", CRSI
8. ACI 305.1 SPECIFICATION FOR HOT WEATHER CONCRETING.
9. ACI 306.1 STANDARD SPECIFICATION FOR COLD WEATHER CONCRETING.
10. ACI 308.1 SPECIFICATION FOR CURING CONCRETE
11. LEED REFERENCE GUIDE FOR BUILDING DESIGN AND CONSTRUCTION (LEED V4) US GREEN BUILDING COUNCIL

B. A PRE-CONSTRUCTION MEETING TO ESTABLISH QUALITY CONTROL SHALL BE SCHEDULED BY THE CONSTRUCTION MANAGER, AT LEAST 10 WORKING DAYS PRIOR TO THE SCHEDULED DATE OF CONCRETE PLACEMENT FOR THE FIRST SECTION OF FLOOR SLAB. THE MEETING SHALL BE FOR THE PURPOSE OF REVIEWING, IN DETAIL, THE DESIGN OF CONCRETE MIXES; HOW THE CONCRETE FLOORS WILL BE PLACED, FINISHED, CURED, AND PROTECTED; AND PLACEMENT SCHEDULES. THE CONTRACTOR SHALL INVITE A RESPONSIBLE REPRESENTATIVE OF ALL FIELD PERSONNEL AND MATERIAL SUPPLIERS DIRECTLY INVOLVED WITH THE PLACEMENT AND FINISHING OF THE SLAB TO BE PRESENT SO THAT THEY CAN ESTABLISH A PROCEDURE WHICH WILL ENABLE THEM TO MEET THE FULL INTENT OF THE PROJECT SPECIFICATIONS. ATTENDANCE BY THE CONCRETE SUPPLIER, THE CONCRETE SUBCONTRACTOR, AND THE OWNER'S TESTING LABORATORY IS MANDATORY. THE STRUCTURAL ENGINEER AND ARCHITECT SHOULD ALSO BE PRESENT. IT SHALL BE ASCERTAINED DURING THE MEETING THAT ALL PARTIES ARE FAMILIAR WITH THE REQUIREMENTS APPLICABLE TO THEM, AND ANY POTENTIAL DIFFICULTIES WITH THESE REQUIREMENTS SHALL BE RESOLVED. MINUTES OF THIS MEETING SHALL BE PREPARED BY THE GENERAL CONTRACTOR, AND SUBMITTED WITHIN 3 WORKING DAYS TO ALL PRESENT, AND TO THE CONSTRUCTION MANAGER.

C. INSTALLER QUALIFICATIONS: A QUALIFIED INSTALLER WHO EMPLOYS ON PROJECT PERSONNEL QUALIFIED AS ACI-CERTIFIED FLATWORK TECHNICIAN AND FINISHER AND A SUPERVISOR WHO IS AN ACI-CERTIFIED CONCRETE FLATWORK TECHNICIAN.

D. MANUFACTURER QUALIFICATIONS: A FIRM EXPERIENCED IN MANUFACTURING READY-MIXED CONCRETE PRODUCTS AND THAT COMPLIES WITH ASTM C 94/C 94M REQUIREMENTS FOR PRODUCTION FACILITIES AND EQUIPMENT.
1. MANUFACTURER CERTIFIED ACCORDING TO NRMCA'S "CERTIFICATION OF READY MIXED CONCRETE PRODUCTION FACILITIES."

E. TESTING AGENCY QUALIFICATIONS: AN INDEPENDENT AGENCY, ACCEPTABLE TO AUTHORITIES HAVING JURISDICTION, QUALIFIED ACCORDING TO ASTM C 1077 AND ASTM E 329 FOR TESTING INDICATED, AS DOCUMENTED ACCORDING TO ASTM E 548.
1. PERSONNEL CONDUCTING FIELD TESTS SHALL BE QUALIFIED AS ACI CONCRETE FIELD TESTING TECHNICIAN, GRADE 1, ACCORDING TO ACI CP-01 OR AN EQUIVALENT CERTIFICATION PROGRAM.
2. PERSONNEL PERFORMING LABORATORY TESTS SHALL BE ACI-CERTIFIED CONCRETE STRENGTH TESTING TECHNICIAN AND CONCRETE LABORATORY TESTING TECHNICIAN - GRADE I. TESTING AGENCY LABORATORY SUPERVISOR SHALL BE AN ACI-CERTIFIED CONCRETE LABORATORY TESTING TECHNICIAN - GRADE II.

1.05 SUBMITTALS

A. COORDINATE WITH THE CONSTRUCTION MANAGER TO ENSURE THAT THE MIX DESIGNS ARE ESTABLISHED AND SUBMITTED TO THE ENGINEER FOR APPROVAL. ALLOW SUFFICIENT TIME TO ESTABLISH MIX DESIGNS, SO AS NOT TO UNDULY AFFECT THE SCHEDULE. SUBMIT FOR APPROVAL A MIX DESIGN FOR ALL CLASSES OF CONCRETE (1.6.2). CONCRETE PROPORTIONS SHALL BE ESTABLISHED ON THE BASIS OF PREVIOUS FIELD EXPERIENCE OR TRIAL MIXTURES (4.2.3).

B. SUBMIT SHOP DRAWINGS FOR ALL REINFORCING. INDICATE STRENGTH, SIZE, AND DETAILS OF ALL BAR REINFORCING, AND STYLE AND SPECIFICATION OF ALL WELDED WIRE FABRIC (3.3.1).

C. SUBMIT PRODUCT LITERATURE FOR THE FOLLOWING:
   1. ADMIXTURES
   2. CURING COMPOUNDS AND SEALERS.
   3. JOINT FILLERS
   4. VAPOR BARRIER
   5. UNDERSLAB INSULATION
   6. JOINT DOWELS

D. SUBMIT REPORTS OF ALL REQUIRED TESTING AND INSPECTION.

E. SUBMIT TEST DATA FOR AGGREGATES PROPOSED FOR USE, INCLUDING AGGRGATE GRADATIONS, INDICATING SOURCE AND COMPLIANCE WITH SPECIFICATION REQUIREMENTS. DATE OF TEST TO BE NO MORE THAN 90 DAYS PRIOR TO SUBMITTAL. RESUBMIT IN ADVANCE OF ANY PROPOSED CHANGE IN SOURCE.

F. SUBMIT A PROPOSED SCHEDULE OF POURS AND A DRAWING INDICATING THE PROPOSED SEQUENCE OF FLOOR SLAB PLACEMENT. CONSTRUCTION JOINTS AND CONTROL/CONTRACTION JOINTS SHALL BE INDICATED THEREON.

G. SUBMIT PROPOSED MATERIAL FOR SUBGRADE DRAINAGE FILL AND BASE MATERIALS, INDICATING SOURCE AND GRADATION.

H. CERTIFICATION OF EXPERIENCE: SUBMIT, ON REQUEST ONLY, WRITTEN DESCRIPTION OF PERSONNEL, PROJECTS, AND EQUIPMENT WHICH DOCUMENT THE EXPERIENCE AND QUALIFICATIONS REQUIRED OF THE FLOOR SLAB CONTRACTOR. UPON REQUEST, SUBMIT ACI CERTIFICATES FOR CONCRETE FLATWORK FINISHERS AND/OR SPECIALTY COMMERCIAL/INDUSTRIAL FLATWORK FINISHERS TO VERIFY PERSONNEL QUALIFICATIONS.

1.06 FIELD REFERENCE MANUALS

A. PROVIDE AT LEAST ONE COPY OF THE ACI FIELD REFERENCE MANUAL, SP_15 (1.3.3), AND ONE COPY OF CRSI'S "PLACING REINFORCING BARS", IN THE FIELD OFFICE AT ALL TIMES (1.4.3).

PART 2 - PRODUCTS

2.01 MATERIALS

A. CEMENT (4.2.1.1, 11.2.1.1):
   1. PORTLAND CEMENT, ASTM C150, TYPE I OR II. ALL CEMENT TO BE FROM THE SAME MILL. ASTM C150 TYPE III, HIGH EARLY STRENGTH CEMENT SHALL NOT BE USED.
   2. EXPANSIVE PORTLAND CEMENT, ASTM C845, TYPE E-1 (K) (10.1.1); OR ASTM C150 TYPE I OR II WITH EXPANSIVE TYPE-K COMPONENT.

B. WATER: POTABLE.

C. AGGREGATES: NORMAL WEIGHT CONFORMING TO ASTM C33. USE A SINGLE SOURCE OF UNIFORM QUALITY THROUGHOUT THE WORK
   1. CLASS 5 (INDUSTRIAL) AND 6 (HEAVY INDUSTRIAL) FLOORS: FOR SLABS 5-1/2" THICK OR THICKET, USE SIZE NO 467 COARSE AGGREGATE (1 ½" MAXIMUM SIZE) (11.2.1.2.A). FOR 4" THICK SLABS, USE 1" NOMINAL MAXIMUM COARSE AGGREGATE (NO 57 COARSE AGGREGATE)
      a. THE COMBINED AGGREGATE PARTICLE DISTRIBUTION SHALL BE ANALYZED USING THE "COARSENESS FACTOR CHART' (FIGURE 8.9.2.2) IN ACI 301.1R-15 "GUIDE TO CONCRETE FLOOR AND SLAB CONSTRUCTION". THE COMBINED COARSE AND FINE AGGREGATE CHALL FALL IN ZONE II.
      b. ADJUSTED WORKABILITY FACTOR SHALL BE BETWEEN 32% AND 42%. THE COARSE FACTOR SHALL BE BETWEEN 55%

AND 75%.

c. SUBMIT PROPOSED AGGREGATE GRADATION WITH MIX DESIGN.

D. GROUND GRANULATED BLAST-FURNACE, GGBF, SLAG: ASTM C989 (4.2.1.1.E).

E. FLY ASH: ASTM C618, TYPE C OR F (4.2.1.1.D).

F. ADMIXTURES (WHERE REQUIRED, PERMITTED AND APPROVED BY ENGINEER):

1. WATER_REDUCING ADMIXTURE: THE ADMIXTURE SHALL CONFORM TO ASTM C494, TYPE A (4.2.1.4). THE FOLLOWING ARE ACCEPTABLE:
   a. EUCON WR 75 BY THE EUCLID CHEMICAL CO.
   b. POZZOLITH 80 BY BASF (MASTER BUILDERS)CONST. CHEMICALS
   c. PLASTOCRETE 161 BY SIKA CHEMICAL CORP.
   d. DARACEM 55, 65 BY W.R. GRACE CO.
   e. WRDA SERIES BY W.R. GRACE CO.
2. WATER REDUCING, RETARDING ADMIXTURE: THE ADMIXTURE SHALL CONFORM TO ASTM C_494, TYPE D (4.2.1.4). THE FOLLOWING ARE ACCEPTABLE:
   a. EUCON RETARDER_75 BY EUCLID CHEMICAL CO.
   b. POZZOLITH 100XR BY BASF (MASTER BUILDERS)
   c. PLASTIMENT BY SIKA CHEMICAL CORP.
   d. DARATARD-17 BY W.R. GRACE CO.
3. HIGH RANGE WATER REDUCING ADMIXTURE (SUPERPLASTICIZER): THE ADMIXTURE SHALL CONFORM TO ASTM C_494, TYPE F OR G (4.2.1.4). THE FOLLOWING ARE ACCEPTABLE:
   a. EUCON 37 BY EUCLID CHEMICAL CO.
   b. SIKAMENT 300 BY SIKA CHEMICALS CORP.

   THE FOLLOWING ARE ACCEPTABLE FOR ADDITION TO THE MIX AT THE BATCH PLANT:
   c. DARCEM SERIES BY W.R. GRACE CO.
   d. RHEOBUILD 1000 BY BASF (MASTER BUILDERS)
4. ACCELERATING ADMIXTURES: THE ADMIXTURE SHALL CONFORM TO ASTM C-494 TYPE C OR E (4.2.1.4). THE FOLLOWING ARE ACCEPTABLE:
   a. ACCELGUARD 80 BY EULID CHEMICAL CO.
   b. POZZOLITH, POZZUTEC BY BASF (MASTER BUILDERS)
   c. PLASTOCRETE 161FL, PLATOCRETE 161HE, SIKAST NC, SIKASET BY SIKA CHEMICAL CORP
   d. DARASET SERIES, GILCO, LUBRICON, POLARSET, DCI BY WR GRACE
5. CALCIUM CHLORIDE: CALCIUM CHLORIDE OR ADMIXTURES CONTAINING MORE THAN 0.05% CHLORIDE IONS ARE NOT PERMITTED (4.2.2.5, 11.2.1.3.A).
6. .AIR ENTRAINING ADMIXTURES ARE PROHIBITED IN CONCRETE MIXTURES FOR USE IN SLABS TO RECEIVE A HARD-TROWLED FINISH (11.2.1.3.B)
7. CERTIFICATION: WRITTEN CONFORMANCE TO ABOVE MENTIONED REQUIREMENTS WILL BE REQUIRED FROM THE ADMIXTURE MANUFACTURER PRIOR TO MIX DESIGN REVIEW BY THE ENGINEER.
8. UPON REQUEST ONLY, PROVIDE A QUALIFIED FULL_TIME REPRESENTATIVE TO ASSURE PROPER USE OF ADMIXTURES.
9. USE OF ADMIXTURES OTHER THAN THOSE LISTED WILL BE PERMITTED ONLY WHEN APPROVED PRIOR TO MIX DESIGN APPROVAL.

G. REINFORCING (3.2.1):

1. DEFORMED BARS: ASTM A615 OR A706. MINIMUM YIELD STRENGTH TO BE 60 KSI.
2. WELDED WIRE FABRIC: ASTM A185/A185M. WHERE THIS IS USED, PROVIDE IN SHEET FORM (NOT ROLLS).
3. REINFORCING SUPPORTS ARE REQUIRED FOR ALL REINFORCING IN SLABS ON GRADE. SUPPORTS SHALL BE OF SUFFICIENT QUALITY AND STRENGTH TO HOLD REINFORCEMENT AT THE PROPER ELECATION WHILE PLACING CONCRETE.
4. FIBER REINFORCEMENT: PROVIDE ONE OF THE FOLLOWING WHERE REQUIRED:

a. FORTA CR - 1 ½ LONG, 1.5#/CY BY FORTA CORP.
b. FIBERMESH - GRADED SIZE, 1.5#/CY BY FIBERMESH CORP.

H. PREMOLDED EXPANSION JOINT FILLER: ASTM D1751 (2.2.1.4).

I. VAPOR BARRIER/RETARDER (11.2.4): MEMBRANE SHALL MEET THE FOLLOWING PROPERTIES:
1. CONFORM TO ASTM E1745 "STANDARD SPECIFICATION OF PLASTIC WATER VAPOR RETARDERS USED IN CONTACT WITH SOIL OR GRANULAR FILL UNDER CONCRETE SLABS", MEET OR EXCEED CLASS A.
2. MINIMUM THICKNESS OF VAPOR RETARDER SHALL BE 10 MILS.
3. PERMEANCE RATING: ASTM E-96 OR ASTM F1249; 0.01 PERMS OR LESS.
4. SEAM/TRANSITION TAPE: TAP WITH PRESSURE SENSITIVE ADHESIVE OR DOUBLE SIDED ADHESIVE. MINIMUM 4" WIDE. CONSTRUCT PIP BOOTS FROM VAPOR RETARDER MATERIAL AND PRESSURE SENSITIVE TAPE PER MANUFACTURERS RECOMMENDATIONS.
5. WHERE SPECIFIED, PROVIDE PRODUCTS BY ONE OF THE FOLLOWING:
a. STEGO WRAP (10 MIL) VAPOR BARRIER; STEGO INDUSTRIES, SAN JUAN CAPISTRANO, CALIFORNIA.
b. VAPOR GUARD; REEF INDUSTRIES, HOUSTON, TEXAS

J. CONTROL JOINT DOWELS (11.2.6)
1. SMOOTH ROUND DOWELS CUT FROM HOT ROLLED BAR PER ASTM A36 TO WITHIN 3/16” OF SPECIFIED LENGTH.
2. DOWELS SHALL BE SET IN DOWEL BASKETS WITH SIDE FRAME SUPPORTS FABRICATED FROM ¼ DIAMETER COLD DRAWN WIRE
3. DOWELS SHALL BE WELDED ON ONE END, INTO THE SIDE FRAMES.
4. EIGHT GAGE WIRES WILL BE WELDED, ACROSS THE SIDE FRAMES AT APPROXIMATELY 3'-0” O/C TO KEEP THE ASSEMBLY STABLE DURING SHIPPING AND INSTALLATION.
5. THE FINISHED ASSEMBLY SHALL HOLD THE DOWELS STRAIGHT AND LEVEL TO WITHIN 1/8” OF THE MID-DEPTH OF THE SLAB.
6. WHEN REQUIRED BY THE CONTRACT DOCUMENTS, PLATE DOWELS SHALL BE DOUBLE TAPERED STEEL PLATES, PRE ASSEMBLED AND SUPPORTED BY WIRE FRAME TO KEEP THE ASSEMBLY STABLE DURING SHIPPING AND CONSTRUCTION. THE FOLLOW IS ACCEPTABLE:
a. "DOUBLE TAPERED BASKET" BY SIKA GREENSTREAK.
b. "PD3 BASKET" BY PNA CONSTRUCTION TECHNOLOGIES.

K. ARMORED CONSTRUCTION JOINT ASSEMBLY
1. PRE-FABRICATED AND ASSEMBLED BARS WITH HEADED STUDS, AND SHIPPING/INSTALLATION ANCHORAGES WHICH WILL PERMIT FREE MOVEMENT OF JOINT AFTER INSTALLATION . THE FOLLOWING IS ACCEPTABLE:
a. ARMOR-EDGE JOINT
ASSEMBLY BY PNA CONSTRUCTION TECHNOLOGIES

L. ARMORED SLAB EDGE ASSEMBLY - NEW-TO-EXISTING SLABS
1. PROVIDE PRE-FABRICATED JOINT ASSEMBLY FOR NEW SLAB CONSTRUCTION ADJOINING EXISTING SLABS WHERE NOTED ON DRAWINGS. PROVIDE THE FOLLOWING, OR APPROVED EQUAL:
a. “ARMOR-EGE n2e JOINT ASSEMBLY” BY PNA CONSTRUCTION TECHNOLOGIES.

M. CONSTRUCTION JOINT DOWELS (11.2.6)
1. WHEN REQUIRED BY THE CONTRACT DOCUMENTS, USE SMOOTH SQUARE DOWELS PRE-MANUFACTURED WITH A DOWEL SLEEVE COVERING HALF THE DOWL WITH FOAM INSERT ON SIDES OF DOWEL. THE FOLLOWING ARE ACCEPTABLE:
a. SPEED DOWEL BY SIKA GREENSTREAK.
b. ROUND DOWEL BASKET BY PNA TECHNOLOGIES.
2. WHEN REQUIRED BY CONTRACT DOCUMENTS, PLATE DOWELS SHALL BE PREFABRICATED FLAT PLATE STEEL DOWELS WITH PRE-ASSEMBLED POCKET FORMER. THE FOLLOWING IS ACCEPTABLE:
a. DIAMOND DOWEL BY PNA CONSTRUCTION TECHNOLOGIES
b. SPEED PLATE BY SIKA GREENSTREAK GROUP

N. CONCRETE CURING MATERIALS (11.2.9)

1. MOISTURE_RETAINING COVER FOR MOIST CURE: PROVIDE ONE OF THE FOLLOWING, COMPLYING WITH ASTM C171 FOR CONCRETE FLOORS THAT ARE TO BE EXPOSED OR TO RECEIVE FLOOR SEALER / HARDENER OR URETHANE TOPPING.
   a. WATERPROOF PAPER
   b. POLYETHYLENE FILM
   c. WHITE BURLAP_POLYETHYLENE SHEET
2. CHEMICAL CURING COMPOUND: WATER-BASED, NON SOLIDS, BLEND OF SODIUM, POTASSIUM AND META SILICATES TO CURE CONCRETE, LEAVING CONCRETE SURFACES RESIDUE AND MEMBRANE FREE. THE FOLLOWING ARE ACCEPTABLE:
   a. L&M CURE AS MANUFACTURED BY L&M CONSTRUCTION CHEMICALS, INC.
3. WATER BORNE LIQUID MEMBRANE_FORMING CURING COMPOUND (11.2.9.1): LIQUID TYPE MEMBRANE_FORMING LOW-VOC CURING COMPOUND, COMPLYING WITH ASTM C309, TYPE I, CLASS B, DISSIPATING. IN ACCORDANCE WITH ACI 302.1R-15, "GUIDE TO CONCRETE FLOOR AND SLAB CONSTRUCTION", A LETTER OF COMPATIBILITY WITH APPLIED FINISHES MUST BE ISSUED BY THE COMPOUND MANUFACTURER. COMPOUNDS FOUND TO BE INCOMPATIBLE WITH FINISH SHALL BE ABRASIVELY REMOVED BY APPLICATOR AT NO COST TO THE OWNER OR FINISH TRADE. SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE THE FOLLOWING FOR CONCRETE FLOORS THAT ARE TO RECEIVE APPLIED FINISHED FLOOR MATERIALS, OR APPROVED EQUAL.
   a. KUREZ DR-100 VOX; EUCLID CHEMICAL CO., CLEVELAND, OHIO.
   b. LM CURE R; LM CONSTRUCTION CHEMICALS, OMAHA, NEBRASKA.
4. CURING AND SEALING COMPOUND: THE COMPOUND SHALL CONFORM TO ASTM C309, TYPE 1 OR 1D, CLASS B, 28 PERCENT SOLIDS CONTENT MINIMUM, AND SHALL HAVE TEST DATA FROM AN INDEPENDENT LABORATORY INDICATING A MAXIMUM MOISTURE LOSS OF 0.030 GRAMS PER SQ.CM. WHEN APPLIED AT A COVERAGE RATE OF 300 SQ. FT. PER GALLON. MANUFACTURER'S CERTIFICATION IS REQUIRED. PROVIDE ONE OF THE FOLLOWING, OR APPROVED EQUAL:
   a. SUPER DIAMOND CLEAR VOXBY EUCLID CHEMICAL CO.
   b. KURE-N-SEAL 30 BY SONNEBORN
5. DISSIPATING CURING COMPOUND: THE COMPOUND SHALL CONFORM TO ASTM C309 AND IS TO BE USED ON SLABS THAT ARE TO RECEIVE SUBSEQUENT APPLIED FINISHES AND WHERE NOTED ON THE DRAWINGS. INSTALL IN STRICT ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS AND SUPERVISION. VERIFY COMPOUND IS COMPATIBLE WITH THE APPLIED FINISH PRIOR TO PLACEMENT, SUBJECT TO APPROVAL THE FOLLOWING ARE ACCEPTABLE:
   a. KUREZ DR VOX BY EUCLID CHEMICAL
   b. CLEAR SURE J11W BY DAYTON SUPERIOR
   c. DR CURE BY KAUFMAN PRODUCTS
   d. SAFE-CURE CLEAR DR BY CHEMMASTERS

O. BENTONITE WATERSTOP (VOCLAY):

1. WATERSTOP SHALL CONSIST OF SODIUM BENTONITE AND BUTYL RUBBER COMPOUND FORMED INTO FLEXIBLE STRIPS. ADHESIVE MUST BE USED TO ADHERE WATERSTOP TO DRY CONCRETE SURFACE. INSTALL PER MANUFACTURER'S INSTRUCTIONS. PROVIDE THE FOLLOWING:
   a. WATERSTOP-RX102 BY COLLOID ENVIRONMENTAL TECHNOLOGIES (CETGO)

P. FLEXIBLE JOINT FILLER FOR EXPOSED NON-INDUSTRIAL FLOORS: ONE- OR TWO-PART SELF LEVELING POLYURETHANE. THE FOLLOWING AREA ACCEPTABLE:

1. MASTERFILL CJ BY MASTER BUILDERS
2. EULASTIC BY EUCLID CHEMICALS
3. SIKADURE 51 SL BY SIKA CORP.

Q. SEMI-RIGID EPOXY JOINT FILLER FOR EXPOSED INDUSTRIAL SLABS: (11.2.7) 100 PERCENT SOLIDS, TWO-COMPONENT POURABLE EPOXY, MINIMUM SHORE HARDNESS OF 80. WHEN MEASURED IN ACCORDANCE WITH ASTM D2240. PROVIDE

ONE OF THE FOLLOWING, OR APPROVED EQUAL:

1. EUCO 700 BY EUCLID CHEMICAL CO.
2. BURKEPOXY REFLEX BY BURKE
3. MM-80 BY METGER/MCGUIRE

R. JOINT FILLER FOR FREEZER FLOORS: 100 PERCENT SOLIDS, TWO-COMPONENT POLYUREA POLYMER LIQUID. THE FOLLOWING, OR APPROVED EQUAL, IS ACCEPTABLE:

1. SPAL-PRO RSF BY METGER/MCGUIRE

S. SUBGRADE DRAINAGE FILL: WASHED, NARROWLY GRADED MIXTURE OF CRUSHED STONE, OR CRUSHED OR UNCRUSHED GRAVEL: ASTM D448; COARSE AGGREGATE GRADING SIZE #57, WITH 100 PERCENT PASSING A 1 INCH SIEVE.

T. SUB-SLAB "CRUSHER-RUN": WIDELY GRADED, ROCK DUST TO 1 ½" MAXIMUM; NCDOT ABC.

U. BITUMINOUS COATING FOR BELOW-GRADE STEEL: COLD-APPLIED ASPHALT MASTIC, SSPC-PS-9.01, COMPOUNDED FOR 15 MIL DRY FILM THICKNESS PER COAT. PROVIDE INERT TYPE, NONCORROSIVE COMPOUND FREE OF ASBESTOS FIBERS, SULFUR COMPONENTS AND OTHER DELETERIOUS IMPURITIES.

V. EPOXY CRACK INJECTION ADHESIVE (REPAIR): ASTM C881, TYPE I, GRADE 1, SOLVENT FREE.

1. PRODUCTS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE PRODUCTS BY ONE OF THE FOLLOWING:
   a. SIKADUR 35 HI-MOD LV; SIKA CORP., LYNDHURST, NEW JERSEY.
   b. SURE-INJECT (J-56); DAYTON SUPERIOR CORP., OREGON, ILLINOIS.
   c. EUCO #352 LV; EUCLID CHEMICAL CO., CLEVELAND, OHIO.

W. SEMI-RIGID POLYUREA JOINT FILLER FOR COOLER AND FREEZER FLOOR SLABS (11.2.7): 100 PERCENT SOLIDS, TWO-COMPONENT POURABLE POLYUREA POLYMER, MINIMUM SHORE HARDNESS "A" OF 80 WHEN MEASURED IN ACCORDANCE WITH ASTM D2240. PROVIDE ONE OF THE FOLLOWING, OR APPROVED EQUAL:

1. SPAL-PRO 2000 BY METZGER/McGUIRE
2. QWIKJOINT 200 BY EUCLID CHEMICAL

X. CHEMICAL DENSIFIER AND SEALER (11.2.10): CLEAR, PENETRATING, WATER-BASED VOC COMPLIANT BLEND OF LITHIUM SILICATES. PRODUCT MUST BE USDA COMPLIANT. PROVIDE THE FOLLOWING OR APPROVED EQUAL:

1. CONSOLIDECK LS BY PROSOCO
2. ULTRASIL LI+ BY EUCLID CHEMICAL
3 LiON HARD BY L&M CONSTRUCTION CHEMICALS

Y. CONCRETE BONDING AGENT: ASTM C1059 LATEX-BASED LIQUID BONDING SYSTEMS FOR CONCRETE. THE FOLLOWING ARE ACCEPTABLE:

a. TAMMSWELD BY EUCLID CHEMICAL
b. WELD-CRETE BY LARSEN PRODUCTS
c. EVERWELD BY L&M CONSTRUCTION CHEMICALS
d. INTRALOK BY W.R. MEADOWS

Z. OVERLAYMENT MORTAR: TWO-COMPONENT POLYMER MODIFIED CONCRETE TOPPING MATERIAL. POWDER MATERIAL SHALL BE A CEMENT BASED MIX WITH GRADED SILICA. SUBJECT TO COMPLIANCE WITH REQUIREMENTS, THE FOLLOWING, OR APPROVED EQUAL, IS ACCEPTABLE:

1. PATCHCRETE BY LYONS MANUFACTURING

AA. UNDERSLAB INSULATION - PROVIDE THE FOLLOWING OR APPROVED EQUAL:

1. STYROFOAM HI-60 BY DOW CHEMICAL

AB. BELOW-GRADE STEEL COATING: BRUSH-GRADE, LIQUID APPLIED ASPALTIC DAMPPROOFING, DESIGNED FOR

APPLICATION TO BELOW-GRADE METAL SURFACES. PROVIDE THE FOLLOWING, OR APPROVED EQUAL:

1. WEATHERPROOF BY FBC CHEMICAL CORP.

AC. SHAKE-ON HARDENER (11.2.11): BLEND OF MINERAL (NON-METALLIC) AGGREGATES, COMBINED WITH CEMENT. PROVIDE THE FOLLOWING OR APPROVED EQUAL.

1. EMORY TUFF BY DAYTON SUPERIOR
2. SURFLEX TR BY EUCLID CHEMCIAL
3. MASTERTOP 100 (MASTERCRON) BY BASF (MASTER BUILDERS)

2.02 MIXES

THE FOLLOWING CLASSES OF CONCRETE ARE REQUIRED (4.2.2.8):

TYPE	F'C(28 DAY)	WEIGHT	MAXIMUM WATER CEMENT RATIO	MAX AIR CONTENT
CLASS V INTERIOR SLABS ON GRADE				
	4,000 PSI	NORMAL	0.52	1.5% MAX.
CLASS VI INTERIOR SLABS ON DECK				
	4,000 PSI	NORMAL	0.52	1.5% MAX

1. SLUMP: MAXIMUM 5". IF A SUPERPLASTICIZER IS USED, INITIAL SLUMP OF THE CONCRETE TO BE 2 TO 3 INCHES, INCREASED TO 8" MAXIMUM AFTER ADDITION (AT THE JOB SITE) OF THE SUPERPLASTICIZER. FOR THE HIGH RANGE WATER REDUCING ADMIXTURE ADDED AT THE BATCH PLANT, VERIFICATION IS TO BE INCLUDED ON THE DELIVERY TICKET WHICH INDICATES THAT THE WATER-TO-CEMENT RATIO AND THE SLUMP REQUIREMENTS HAVE NOT BEEN EXCEEDED.
2. ALL CONCRETE IS TO BE READY_MIXED (4.3.1.1 AND 4.3.1.2). ALL ADMIXTURES ARE TO BE ADDED AT THE BATCH PLANT, EXCEPT FOR SUPERPLASTICIZERS.
3. MIXES INTENDED TO BE PUMPED ARE TO BE SO IDENTIFIED ON THE MIX DESIGN SUBMITTED FOR APPROVAL.
4. FLY ASH OR GROUND-GRANULATED BLAST FURNACE SLAG IS ACCEPTABLE AND SHALL BE INCLUDED IN THE WATER-TO-CEMENTITIOUS RATIO. REPLACEMENT OF CEMENT BY FLY ASH OR SLAG UP TO 20% OF TOTAL CEMENTITIOUS IS ACCEPTABLE. REPLACEMENT OF CEMENT BY A COMBINATION OF FLY ASH AND GROUND-GRANULATED BLAST FURNACE SLAG UP TO 40% OF TOTAL CEMENTITIOUS CONTENT IS ACCEPTABLE.
5. UNAUTHORIZED JOBSITE ADDITION OF WATER IS NOT PERMITTED.

PART 3 EXECUTION

3.01 SURFACE CONDITIONS

A. SUBGRADE CONSTRUCTION TOLERANCE FOR SLABS ON GRADE (11.3.1): THE SLAB CONTRACTOR SHALL BE RESPONSIBLE FOR THE FLATNESS OF THE SUBGRADE BASE CONSTRUCTION. THE CONTRACTOR SHALL PROVIDE A LASER INSTRUMENT AND ONE LABORER TO ASSIST THE OWNER'S TESTING LABORATORY, WHO WILL PERFORM AN AUDIT OF SUBGRADE LEVELNESS PRIOR TO CONCRETE PLACEMENT. TOLERANCE LIMITS FOR BASE CONSTRUCTION SHALL BE +0" (HIGH) TO - 3/4" (LOW). SUBGRADE READINGS SHALL BE MADE FOR THE ENTIRE AREA OVER WHICH CONCRETE IS TO BE PLACED, ON A GRID OF 10 FEET BY 10 FEET. ANY PORTION OF THE BASE NOT MEETING THIS REQUIREMENT SHALL BE CORRECTED PRIOR TO CONCRETE PLACEMENT.

B. UPON COMPLETION OF THE SUBGRADE AUDIT, THE CONCRETE SUBCONTRACTOR SHALL SUBMIT CERTIFICATION THAT THE SUBGRADE MEETS THE SPECIFIED TOLERANCES. INCLUDE TEST REPORTS FROM THE OWNER'S INDEPENDENT TESTING LABORATORY. NO CONCRETE PLACEMENT SHALL BE MADE UNTIL THE REQUIRED CERTIFICATION HAS BEEN RECEIVED AND REVIEWED BY THE CONSTRUCTION MANAGER.

C. IF AND WHERE REQUIRED FOR INTERIOR SLABS, PLACE 10 MIL VAPOR RETARDER OVER AREA, WITH 4" LAP AT SECTIONS AND TAPE ALL JOINTS.

D. PLACE A 3 " LEVELED LAYER OF COMPACTED (TO 95% MODIFIED PROCTOR) "CRUSHER RUN" BASE MATERIAL (1-1/2" TO ROCK DUST) FOLLOWED BY A THIN LAYER OF FINES (NO. 10 PER ASTM D448) ON THE SURFACE TO FILL-IN THE OPEN GRADED AREAS TO ACHIEVE A "SMOOTH" BASE. ADD JUST ENOUGH WATER FOR INITIAL COMPACTION IN ORDER TO MAXIMIZE THE "BLOTTING EFFECT" OF THE "CRUSHER RUN".

E. USE THE ASTM D698, METHOD D, TO DETERMINE DENSITY AND USE A NUCLEAR DENSITY TEST DEVICE ASTM D6938 TO DETERMINE COMPLIANCE IN FIELD, BY OWNER'S INDEPENDENT TESTING LABORATORY.

F. VERIFY THAT THE PREPARED BASE, SUBASE, SUBGRADE AND SUBSTRATES ARE FREE OF WATER AND ICE, AND HAVE BEEN APPROVED BY THE SOILS ENGINEER INCLUDING PROOF-ROLLING OF THE PREPARED BASE, PRIOR TO PLACING CONCRETE (5.3.1, 11.3.1).

G. APPROVAL IS REQUIRED FROM THE OWNER'S ENGINEER OR DESIGNATED REPRESENTATIVE ON ALL BELOW SLAB PREPARATORY WORK BEFORE PROCEEDING WITH THE PLACEMENT OF CONCRETE.

H. NOTIFY ARCHITECT/ENGINEER AND TESTING LABORATORY NOT LESS THAN 24 HOURS IN ADVANCE OF PLACING CONCRETE. PLACE CONCRETE ONLY WHEN TESTING LABORATORY PERSONNEL ARE PRESENT, UNLESS THIS REQUIREMENT IS SPECIFICALLY WAIVED IN WRITING BY THE OWNER.

I. LEVEL AREA AND COMPACT SO THAT THE FINISHED SUBGRADE WILL PASS A 95% MODIFIED PROCTOR COMPACTION TEST, UNLESS OTHER PERCENT COMPACTION IS APPROVED BY THE OWNER'S ENGINEER. PLACE A LEVELED LAYER OF COMPACTED (TO 95% MODIFIED PROCTOR) "CRUSHER RUN" APPROVED BASE MATERIAL (1 1/2" TO ROCK DUST) AND IF NEEDED, FOLLOWED BY A THIN LAYER OF FINES (NO. 10 PER ASTM D448) ON THE SURFACE TO FILL-IN THE OPEN GRADED AREAS TO ACHIEVE A "SMOOTH" BASE. ADD JUST ENOUGH WATER FOR INITIAL COMPACTION IN ORDER TO MAXIMIZE THE "BLOTTING EFFECT" OF THE "CRUSHER RUN."

J. RE-WETTING OF BASE IS PERMITTED TO MAINTAIN COMPACTION, BUT SHOULD BE KEPT TO A MINIMUM AND COMPLETED A MINIMUM OF 24 HOURS PRIOR TO SLAB PLACEMENT.

K. RECOMPACTION REQUIRED DURING THE SLAB PLACEMENT SHOULD BE DONE WITH A DRUM ROLLER. VIBRATORY PLATE COMPACTION IS NOT PERMITTED DURING CONCRETE PLACEMENT.

3.02 CONCRETE REINFORCEMENT:

A. INTERIOR: SUPPORT STEEL REINFORCEMENT INCLUDING WELDED WIRE REINFORCEMENT BY USING CONTINUOUS STEEL (OR APPROVED PLASTIC) SLAB BOLSTER UPPERS (SBU) OR UPPER CONTINUOUS STEEL (OR APPROVED PLASTIC) HIGH CHAIRS PLACED EVERY 3'- 0" O.C. WELDED WIRE REINFORCEMENT SHALL NOT BE PLACED ON THE GROUND AND PULLED UP NOR WALKED-IN AFTER CONCRETE PLACEMENT. CONCRETE BLOCK OR OTHER TYPE SUPPORT MATERIALS ARE NOT ACCEPTABLE. TIE WIRE TO BE USED AT EVERY CROSS BAR. BEND LOOSE WIRES DOWN INTO SLAB AREA. SEE DRAWINGS FOR SPECIFIC REQUIREMENTS.

B. NOTE: THE SUPPORT SLAB BOLSTERS OR HIGH CHAIRS SHOULD HAVE ADEQUATE BASE SUPPORT SO THAT WORKMEN STEPPING ON THE RE-BAR DO NOT CAUSE THE SUPPORT STEEL TO SINK INTO THE "CRUSHER RUN" BASE MATERIAL OR TEAR/ PUNCTURE THE VAPOR BARRIER IF INSTALLED.

C. INTERIOR AND/OR EXTERIOR:

1. MARK CONTROL JOINT LOCATION ON SIDE SCREED FORMS IN BOTH DIRECTIONS AND IF DIRECTED BY THE DRAWINGS OR ARCHITECT / ENGINEER CUT EVERY OTHER WIRE MESH OR REINFORCING BAR THAT THE CONTROL JOINT WILL CROSS. (NOTE: REDUCING THE AMOUNT OF STEEL REINFORCEMENT CROSSING THE JOINT FURTHER ENHANCES THE ACTIVITY OF THE FUNCTION OF THE CONTROL JOINTS.)
2. WHEN ROUND, SQUARE OR PLATE DOWEL BASKETS ARE USED, INTERRUPT ALL REINFORCING AND MARK CONTROL JOINT LOCATIONS ON SIDE FORMS IN BOTH DIRECTIONS AND SNAP CHALK LINE ON TOP OF NEWLY PLACED SLAB BETWEEN MARKS TO IDENTIFY FUTURE SAW CUT LOCATIONS.

3.03 DELIVERY, PLACEMENT, AND TOLERANCES DELIVERY:

A. DELIVERY (4.3.2.):

1. CONFORM TO ASTM C94.
2. DELIVERY TICKETS TO CONTAIN THE FOLLOWING, IN ADDITION TO THE INFORMATION REQUIRED BY C94:
   a. READING OF REVOLUTION COUNTER AT FIRST ADDITION OF WATER.
   b. TYPE AND BRAND OF CEMENT.
   c. AMOUNT OF CEMENT.
   d. TOTAL WATER CONTENT BY PRODUCER.
   e. MAXIMUM SIZE OF AGGREGATE.
   f. ADDITIONAL INFORMATION REQUIRED FOR BATCH PLANT ADDED SUPERPLASTIZER.
3. NON_AGITATING TYPE EQUIPMENT IS NOT TO BE USED FOR TRANSPORTATION.
4. WATER MAY NOT BE ADDED AT THE JOB SITE, EXCEPT AS AUTHORIZED BY THE TESTING LABORATORY IN ORDER TO ACHIEVE MINIMUM SLUMP. TESTING LABORATORY PERSONNEL WILL BE DIRECTED TO REJECT ANY CONCRETE TRUCK TO WHICH UNAUTHORIZED WATER HAS BEEN ADDED.
5. UNLESS APPROVED BY THE ARCHITECT/ ENGINEER DISCHARGE CONCRETE WITHIN 1_1/2 HOURS OR 300 REVOLUTIONS, WHICHEVER COMES FIRST, AFTER THE INTRODUCTION OF WATER TO CEMENT AND AGGREGATES, OR THE INTRODUCTION OF CEMENT TO THE AGGREGATES (4.1.2.10, 4.3.2.2). ENGINEER OR TESTING LABORATORY MAY REQUIRE AN EARLIER DISCHARGE DURING HOT WEATHER.

B. PLACEMENT (5.3.2. 5.3.4):

1. UNLESS OTHERWISE SPECIFIED, A MINIMUM OF ONE FINISHER OR FINISHING SUPERVISOR SHALL BE CERTIFIED ACI FLATWORK CONCRETE FINISHER OR ACI SPECIALITY COMMERCIAL / INDUSTRIAL FLATWORK FINISHER OR EQUIVALENT. PLACE CONCRETE WITHIN 6 FEET OF FINAL POSITION. SPREADING WITH VIBRATORS IS PROHIBITED.
2. MAXIMUM FREE FALL SHALL BE 5 FEET.
3. THICKNESS TOLERANCE:
   a. CONCRETE THICKNESS SHALL BE MAINTAINED WITHIN THE FOLLOWING TOLERANCES FROM THE SPECIFIED THICKNESS:
      (1) OVERTHICKNESS: MAXIMUM 1/2"
      (2) UNDERTHICKNESS:MAXIMUM 1/4"
   b. AVERAGE THICKNESS SHALL BE NOT LESS THAN THAT SPECIFIED ON THE DRAWINGS.
   c. MINIMUM NUMBER OF SLAB THICKNESS SAMPLES SHALL BE FOUR (4) FOR EACH 5,000 SQFT OR PART THEREFOR (ACI 117, 4.5.4).
4. CONCRETE WHICH DOES NOT MEET THE ABOVE CRITERIA SHALL BE SUBJECT TO REJECTION AT THE OWNER'S SOLE DISCRETION.
5. POWER SCREED VIBRATOR IS TO BE USED WHENEVER POSSIBLE. WHEN POWER SCREED IS NOT AVAILABLE, USE ELECTRIC POWERED CONCRETE VIBRATOR (VERTICALLY APPLIED TO CONCRETE).
6. 100% CONSOLIDATION IS REQUIRED. DO NOT OVER VIBRATE OR ALLOW WATER IN MIX TO SURFACE.
7. CONCRETE SLABS WHICH ARE REJECTED DUE TO VARIANCE FROM ALLOWABLE TOLERANCE SHALL BE REMOVED AND REPLACED AT NO COST TO THE OWNER.

8. USE THE ALTERNATE "LONG" STRIP PATTERN LAYOUT AS RECOMMENDED BY ACI. DO NOT USE THE "CHECKERBOARD" PLACEMENT PATTERN.
9. POSTPONING EACH STEP OF FINISHING (AND THE INHERENT REWORKING OF THE SURFACE) AS LONG AS POSSIBLE WITHOUT ENDANGERING RESULTS (11.3.5).

C. RECORDS: KEEP A COMPLETE LOG OF POURS, INCLUDING DATE, LOCATION, QUANTITY, WEATHER CONDITION AND IDENTIFICATION OF TEST CYLINDERS FOR EACH POUR.

D. DRY-SHAKE HARDENER: PROVIDE WHERE INDICATED IN SLAB SCHEDULE.

1. AFTER CONCRETE HAS BEEN PLACED, IMMEDIATELY SCREED, THEN BULLFLOAT OR HIGHWAY STRAIGHTEDGE SURFCE. ALLOW BLEED WATER TO SURFACE.
2. AFTER WATER SHEEN HAS DISAPPEARED AND JUST BEFORE INITIAL SET, FLOAT SURFACE OF SLAB “OPEN” WITH MECHANICAL FLOAT FITTED WITH FLOAT BLADES.
3. DO NOT APPLY HARDENER INTO BLEED WATER. IF EXCESSIVE BLEED WATER IS PRESENT, REMOVE STANDING WATER. DO NOT DELAY PLACEMENT AS THERE MAY NOT BE ENOUGH MOISTURE AT THE SURFACE TO HYDRATE THE CEMENT BNIDERS IN THE FLOOR HARDENERS.
4. APPLY A TOTAL OF 1.0 POUNDS PER SQUARE FOOT. APPLY IN TWO APPLICATIONS IF RECOMMENDED BY MANUFACTURER. EVENLY DISTRIBUTE THE HARDENER MATERIAL USING A MECHANICAL SPREADER.
5. WHEN THE MATERIAL DARKENS SLIGHTLY FROM THE ABSORBED MOISTURE, FLOAT USING HAND WOODEN FLOATS OR POWER TROWELS WITH KICK-OFF FLOAT SHOES. CARE SHOULD BE TAKEN NOT TO TEAR THROUGH THE SURFACE OF THE HARDENER TO THE UNDERLYING CONCRETE.
6. AFTER THE SURFACE HAS FURTHER STIFFENED, IT SHOULD BE MACHINE TROWELED TO A BLEMISH FREE FINISH. CARE SHOULD BE TAKEN NOT TO TROWEL-BURN THE SURFACE.
7. AFTER COMPLETION OF FINAL TROWELING, AND WHEN SURFACE WILL NOT BE MARRED BY FOOT TRAFFICE, APPLY MEMBRANE CURING COMPOUND RECOMMENDED AND APPROVED BY SURFACE HARDENER MANUFACTURER. DO NOT WATER OR MOIST CURE, OR CURE WITH POLYETHYYLENE.
8. KEEP SLAB FREE OF TRAFFIC FOR A MINIMUM OF 10 DAYS.

3.04 JOINTING (5.3.5. 11.3.6.)

A. SAW CUT:

1. LOCATE CONTROL (CONTRACTION) JOINTS AS SHOWN ON THE DRAWINGS. A ENTRY DRY-CUTTING SAW SHALL BE USED IMMEDIATELY AFTER FINAL FINISHING WITHIN 1 TO 6 HOURS. SCHEDULE SLAB POURS AND SAW CUTTING OPERATIONS SUCH THAT SAWING IS COMPLETED PRIOR TO THE ONSET OF SHRINKAGE CRACKING (5.3.5. 11.3.6.3). CUTTING MUST BE PERFORMED AS SOON AS THE CONCRETE SURFACE IS FIRM ENOUGH NOT TO BE TORN OR DAMAGED BY THE BLADES. VACUUM DUST FROM SAW CUT BEFORE APPLYING MOISTURE - RETAINING COVER OR CURING COMPOUND. CUTTING OF JOINTS SHALL NOT TO BE DELAYED UNTIL THE NEXT DAY.
2. PROVIDE ISOLATION JOINTS AT COLUMNS (1/2 INCH THICK) AND AT WALLS (1/8 INCH THICK). WHERE ISOLATION JOINT WILL BE EXPOSED TO VIEW, SET TOP OF JOINT FILLER BELOW TOP OF SLAB A DISTANCE EQUAL TO THE FILLER THICKNESS, TO RECEIVE SEALANT. WHERE NOT EXPOSED TO VIEW, SET TOP OF FILLER FLUSH WITH TOP OF SLAB (11.3.6.1). WHERE SHRINKAGE COMPENSATING CONCRETE IS USED, PROVIDE ISOLATION JOINTS AT COLUMNS AND WALLS (1" THICK).
3. JOINT DEPTH AND SPACING OF CONTROL JOINTS (5.3.5, 11.3.6.3):
   a. DEPTH OF SAW CUTS: FOR EARLY - ENTRY DRY - CUTTING SAW, $1\frac{1}{2}" \pm \frac{1}{4}"$ ($1\frac{1}{4}"$ TO $1\frac{3}{4}"$) FOR SLAB THICKNESS UP TO 9" UNLESS OTHERWISE SPECIFIED.
   b. JOINT SPACING TO BE AS SHOWN ON THE DRAWINGS. ALTERNATE JOINT LAYOUT MAY BE PROPOSED BY CONTRACTOR, BUT MUST BE APPROVED IN WRITING BY ARCHITECT / ENGINEER PRIOR TO CONSTRUCTION. UNLESS OTHERWISE SPECIFIED OR APPROVED, JOINT SPACING SHALL NOT EXCEED 15FT AND PANEL ASPECT RATIOS SHALL NOT EXCEED 1.5.
   c. CONTROL JOINTS INDICATED TO BE DOWELED SHALL HAVE TAPERED PLATE STEEL DOWELS CENTERED UNDER THE

CONTROL JOINT LOCATION.

4. EXPANSION JOINTS:
   a. PLACEMENT: FULL DEPTH OF CROSS SECTION, ALONG ADJACENT CONCRETE STRUCTURES, EQUIPMENT FOUNDATIONS, AND EXISTING SLABS.
   b. MATERIAL: PRE-MOLDED ASPHALT, SPONGE RUBBER, FIBER, OR CORK, WITH REMOVABLE PLASTIC JOINT CAP AT TOPSIDE FOR FINAL JOINT FILLER SEALANT.
5. CONSTRUCTION JOINTS (5.3.2.6, 11.3.6.2):
   a. FORMS: OIL BEFORE PLACING CONCRETE.
   b. TYPE: DOWELS - SQUARE OR PLATE STEEL DOWELS, INSTALLED PERPENDICULAR TO THE PLANE OF THE JOINT BOTH HORIZONTALLY AND VERTICALLY, INSTALLED PER MANUFACTURER, AND PLACED AT MID-CROSS SECTION.
      (1) INTERIOR: PER DETAIL ON DRAWINGS.
      (2) NO SQUARE DOWEL CLOSER THAN 12" FROM A CORNER
      (3) NO PLATE DOWEL CLOSER THAN 6" FROM A CORNER.
   c. LOCATION: AS DEEMED NECESSARY PER JOB CONDITIONS AND APPROVED BY ARCHITECT / ENGINEER.
      (1) STRAIGHTNESS: $\frac{1}{4}$" OVER A DISTANCE OF 10FT
      (2) $\frac{3}{4}$" HORIZONTAL AND VERTICAL OF PLACEMENT LOCATION s TO BE TOOLED AT TIME OF FINISH; FOLLOWED BY SAW CUT (USING TOOL OF 1/16 R OR LESS).
   d. UNLESS OTHERWISE SPECIFIED, DOWELED CONSTRUCTION JOINTS DESIGNED TO ALLOW WIDENING SHALL BE SAW CUT TO $\frac{1}{4}$ SLAB THICKNESS OR 2 INCHES, WHICHEVER IS SMALLER. ALIGN SAW CUT WITH JOINT.

B. SEMI-RIGID EPOXY OR POLYUREA JOINT FILLERS:
1. PLACEMENT OF JOINT FILLER IS TO BE DELAYED AS LONG AS POSSIBLE, PREFERABLY AT LEAST 90 DAYS AFTER CONCRETE PLACEMENT, TO ALLOW CONCRETE SHRINKAGE TO TAKE PLACE.
2. ROOM SCHEDULED TO BE COOLED MUST BE BROUGHT TO OPERATING TEMPERATURE AND STABILIZED FOR 72 HOUR PRIOR TO FILLING JOINTS.
3. PRIOR TO FILLING JOINTS, ALL JOINTS SHALL BE COMPLETELY CLEANED OF ALL CONCRETE DUST AND LAITANCE, DIRT, AND OTHER FOREIGN MATERIALS. AFTER CLEANING, JOINTS ARE TO BLOWN OUT WITH HIGH PRESSURE WATER FOLLOWED BY COMPRESSED AIR. JOINT FILLING SHALL NOT COMMENCE UNTIL AN ON-SITE INSPECTION OF CLEANED JOINTS HAS BEEN MADE BY THE CONSTRUCTION MANAGER. CONCRETE CONTRACTOR SHALL COORDINATE INSPECTION WITH THE CONSTRUCTION MANAGER, AND SUPERVISOR IN CHARGE OF JOINT FILLING SHALL BE PRESENT DURING THE INSPECTION, TO ENSURE THAT JOINT FILLING REQUIREMENTS ARE FULLY UNDERSTOOD.
4. JOINTS SHALL BE FILLED FULL DEPTH. INITIAL FILLING OF JOINT IS TO BE APPROXIMATELY 2/3 OF JOINT DEPTH, FOLLOWED CLOSELY BY FINAL FILLING (AFTER SETTLEMENT OF INITIAL PLACEMENT) LEVEL WITH FINISHED FLOOR. SEATING OF JOINT FILLER AT JOINT BOTTOM IS CRITICAL TO JOINT PERFORMANCE. SAND, BACKING ROD, OR OTHER JOINT FILLER MATERIALS ARE SPECIFICALLY PROHIBITED. FOR JOINTS WITH SIGNIFICANT SHRINKAGE CRACKS BELOW SAWN JOINTS, THE JOINTS SHALL BE SEALED WITH TAPE PRIOR TO INSTALLING FILLER, OR SILICA SAND MAY BE USED ONLY UP TO THE BOTTOM OF THE JOINT, SO AS TO PREVENT LOSS OF FILLER MATERIAL.
5. FREEZER JOINTS SHALL NOT BE FILLED UNTIL SLAB HAS BEEN AT OPERATING TEMPERATURES FOR A MINIMUM OF 72 HOURS.

3.05 FINISHES

A. FINISH ON FLATWORK IS TO BE AS FOLLOWS:
1. INTERIOR FLOOR AREAS TO REMAIN EXPOSED _ TROWELED FINISH (5.3.4.2.C, 11.3.5).
   a. A MINIMUM OF THREE TROWELINGS SHALL BE USED, WITH A TIME LAPSE BETWEEN SUCCESSIVE TROWELINGS TO PERMIT CONCRETE TO BECOME HARDER. AS THE SURFACE STIFFENS, SMALLER TROWELS SHALL BE USED TO PROVIDE SUFFICIENT PRESSURE FOR PROPER FINISHING.
2. MAN-POWER:
   a. THE CONTRACTOR SHALL PROVIDE AN ADEQUATE NUMBER OF QUALIFIED CONCRETE FINISHES IN ORDER TO OBTAIN THE FINISH SPECIFIED WITHIN THE CONCRETE 'SET-UP' TIME PERIOD.

b. DO NOT SPRINKLE CEMENT ON SURFACE WATER ON THE CONCRETE SURFACE FOR FINISHING PURPOSES.

c. DO NOT PERFORM ANY FINISHING OPERATIONS WHILE WATER IS PRESENT ON THE SURFACES.

3. AREAS INDICATED ON DRAWINGS OR AS REQUIRED BY THESE SPECIFICATIONS:

B. SURFACES OF FLOOR SLABS SHALL BE FINISHED TO THE FOLLOWING TOLERANCES, PER ACI 117 (5.3.4.3):

1. INDUSTRIAL FLOOR SLABS: REFER TO SLAB SCHEDULE ON SHEET S2.03 FOR FLATNESS AND LEVELNESS REQUIREMENTS.

2. MINIMUM FLATNESS AND LEVELNESS AS SPECIFIED ON THE DRAWING. PRECEDING VALUES ARE AVERAGE VALUES TO BE OBTAINED OVER A GIVEN AREA. MINIMUM LOCAL VALUES (ONE - HALF BAY) OF 75 PERCENT OF MINIMUM AVERAGE VALUES SHALL BE ALL LOCATIONS.

3. UNLESS OTHERWISE SPECIFIED, THE MINIMUM OVERALL SURFACE FLATNESS SHALL BE FF35, LEVELNESS SHALL BE FL25, AND LOCAL AREA MINIMUMS SHALL BE FF23, FL17, AS DETERMINED BY ASTM E1155 (11.3.5.1).

4. TESTING BY THE TESTING LABORATORY SHALL BE MADE ON THE DAY FOLLOWING PLACEMENT OF THE FIRST CONCRETE POUR. TESTS SHALL BE MADE IN ACCORDANCE WITH ASTM E1155. AFTER IT IS ESTABLISHED THAT PROPER PROCEDURES ARE BEING UTILIZED TO OBTAIN THE DESIRED RESULTS, FLATNESS/LEVELNESS TESTS SHALL BE PERFORMED ONLY AS DIRECTED BY THE OWNER.

C. ANY BAY NOT CONFORMING TO THE ABOVE FLATNESS AND LEVELNESS REQUIREMENTS SHALL BE REMOVED, REPLACED, AND RETESTED, AT NO EXPENSE TO THE OWNER OR CONSTRUCTION MANAGER.

D. "F NUMBERS" SHALL BE SUBMITTED TO THE CONSTRUCTION MANAGER AND ENGINEER IMMEDIATELY AFTER THEY ARE DETERMINED BY THE TESTING LABORATORY.

3.06 CURING AND PROTECTION

A. TEMPERATURE:

1. WHEN AIR TEMPERATURE DURING PLACEMENT IS LESS THAN 40 DEGREES, OR WILL BE WITHIN 24 HOURS, TEMPERATURE OF CONCRETE AS PLACED IS TO BE BETWEEN 55 AND 75 DEGREES. MAINTAIN CONCRETE TEMPERATURE WITHIN THESE LIMITS FOR THE FULL CURING PERIOD OF 7 DAYS. (4.2.2.7 AND 5.3.1.6).

a. DO NOT PLACE CONCRETE IN CONTACT WITH SURFACES LESS THAN 35F (5.3.2.1.b).

b. FOR SLABS PLACED ON GROUND, THE MAXIMUM TEMPERATURE DIFFERENCE BETWEEN THE BASE OR AMBIENT TEMPERATURE AND FRESH CONCRETE TEMPERATURE SHALL BE 30F.

2. WHEN AIR TEMPERATURE IS MORE THAN 80 DEGREES, ALL CONCRETE SHALL CONTAIN AT LEAST ONE OF THE FOLLOWING: TYPE B RETARDED; TYPE D WATER-REDUCING AND RETARDER; OR HYDRATION CONTROLLING ADMIXTURE MEETING THE REQUIREMENTS OF ASTM C494 / C494M.

B. CURING (5.3.6, 11.3.7):

1. WHEN MOIST CURING IS REQUIRED, ALL SLAB AREAS SHALL BE MOIST_CURED USING ONE OR MORE OF THE METHODS LISTED IN ACI 301, SECTION 5.3.6.4.A THROUGH 5.3.6.4.D. WHEN CHEMICAL CURING IS INDICATED, SLAB AREAS SHALL RECEIVE AN APPLICATION OF CURING COMPOUND (5.3.6.4.E), EXCEPT THAT WHEN CONCRETE IS PLACED IN THE OPEN, AND THE AIR TEMPERATURE EXCEEDS 75 DEGREES, THE CONCRETE IS TO BE MOIST_CURED FOR THE FIRST 24 HOURS.

2. WHICHEVER CURING METHOD IS USED, IT IS TO COMMENCE IMMEDIATELY AFTER DISAPPEARANCE OF WATER SHEEN, AND CONTINUE FOR AT LEAST 7 DAYS (5.3.6.1). DO NOT ALLOW CURING TO BE DELAYED OVERNIGHT.

3. PREVENT EXCESSIVE MOISTURE LOSS FROM FORMED SURFACES (5.3.6.3). IF EDGE FORMS ARE REMOVED BEFORE 7 DAYS HAVE ELAPSED, CURE THE FORMED SURFACES BY MOIST_CURING OR APPLICATION OF CURING COMPOUND FOR THE REMAINDER OF THE CURING PERIOD.

4. SLABS SCHEDULE TO RECEIVE SPECIFIED LIQUID CHEMICAL HARDENER/DENSIFIER SHALL BE CURED AND PREPARED IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS:

a. MOIST CURE

b. CHEMICAL CURING COMPOUND SHALL BE REMOVED BEFORE THE APPLICATION OF THE HARDENER/DENSIFIER.

C. PREVENTION OF PLASTIC SHRINKAGE CRACKING:

1. PLASTIC SHRINKAGE CRACKING, CAUSED BY RAPID LOSS OF MOISTURE BEFORE CURING BEGINS, SHALL BE PREVENTED BY THE FOLLOWING PRACTICES AS NECESSARY:
   a. ERECTION OF WINDBREAKS.
   b. ERECTION OF SUNSHADES, OR SCHEDULING CONCRETE PLACEMENT AT NIGHT OR AFTER THE ROOF DECK IS INSTALLED.
   c. UTILIZING FOG SPRAYS BEFORE FINAL FINISHING AND THE START OF CURING; COVERING WITH POLYETHYLENE SHEETING OR DAMP BURLAP IMMEDIATELY AFTER SCREEDING AND FLOATING; AND THE USE OF MONO-MOLECULAR FILMS TO REDUCE EVAPORATION BETWEEN THE VARIOUS PLACING AND FINISHING OPERATIONS.
   d. POSTPONING EACH STEP OF FINISHING (AND THE INHERENT REWORKING OF THE SURFACE) AS LONG AS POSSIBLE WITHOUT ENDANGERING RESULTS.

D. CURING COMPOUND: APPLY UNIFORMLY TO FLOORS AND SLABS INDICATED IN A CONTINUOUS OPERATION BY POWER SPRAY OR ROLLER ACCORDING TO MANUFACTURER'S WRITTEN INSTRUCTIONS. RECOAT AREAS SUBJECTED TO HEAVY RAINFALL WITHIN 3 HOURS AFTER INITIAL APPLICATION. REPEAT PROCESS 24 HOURS LATER AND APPLY A SECOND COAT. MAINTAIN CONTINUITY OF COATING AND REPAIR DAMAGE DURING CURING PERIOD.

3.07 ACCEPTANCE (1.7)

A. CONCRETE WORK WITH SERIOUS CRAZING, CRUSTING, AGGREGATE SHADOWING, MORTAR FLAKING, TROWEL MARKS, CRACKING, DEVIATION FROM TOLERANCES, OR OTHER VARIATION FROM CONTRACT REQUIREMENTS IS SUBJECT TO REJECTION (1.7.1.2).

B. WHEN OBSERVATIONS OR TESTS INDICATE THAT THE CONTRACT REQUIREMENTS HAVE NOT BEEN MET, THE CONTRACTOR IS TO BEAR THE COSTS OF ANY ADDITIONAL TESTING AND ANALYSIS TO DETERMINE ACCEPTABILITY, AND ALSO THE COST OF REMOVAL AND REPLACEMENT, IF SUCH IS REQUIRED (1.6.5.1, 1.7.1.5, 1.7.4, AND 1.7.5).

3.08 FIELD QUALITY CONTROL

A. TESTING AND INSPECTING: OWNER WILL ENGAGE A SPECIAL INSPECTOR TO PERFORM FIELD TESTS AND INSPECTIONS AND PREPARE TEST REPORTS.

B. INSPECTIONS:

1. STEEL REINFORCEMENT PLACEMENT.
2. STEEL REINFORCEMENT WELDING.
3. HEADED BOLTS AND STUDS.
4. VERIFICATION OF USE OF REQUIRED DESIGN MIXTURE.
5. CONCRETE PLACEMENT, INCLUDING CONVEYING AND DEPOSITING.
6. CURING PROCEDURES AND MAINTENANCE OF CURING TEMPERATURE.
7. VERIFICATION OF CONCRETE STRENGTH BEFORE REMOVAL OF SHORES AND FORMS FROM BEAMS AND SLABS.

C. CONCRETE TESTS: TESTING OF COMPOSITE SAMPLES OF FRESH CONCRETE OBTAINED ACCORDING TO ASTM C 172 SHALL BE PERFORMED ACCORDING TO THE FOLLOWING REQUIREMENTS:

1. TESTING FREQUENCY: PER STATEMENT OF SPECIAL INSPECTION
2. SLUMP: ASTM C 143; ONE TEST AT POINT OF PLACEMENT FOR EACH COMPOSITE SAMPLE (EACH STRENGTH TEST SPECIMEN FOR EACH 50 CUBIC YARDS OR FRACTIONS THEREOF FROM EACH MIX DESIGN OF CONCRETE PLACED IN ANY ONE DAY). PERFORM ADDITIONAL TESTS WHEN CONCRETE CONSISTENCY APPEARS TO CHANGE.
3. AIR CONTENT: ASTM C 231, PRESSURE METHOD, FOR NORMAL-WEIGHT CONCRETE; ASTM C 173, VOLUMETRIC METHOD, FOR STRUCTURAL LIGHTWEIGHT CONCRETE; ONE TEST FOR EACH COMPOSITE SAMPLE, BUT NOT LESS THAN ONE TEST FOR EACH DAY'S POUR OF EACH CONCRETE MIXTURE.

4. CONCRETE TEMPERATURE: ASTM C 1064; ONE TEST HOURLY WHEN AIR TEMPERATURE IS 40 DEG F AND BELOW AND WHEN 80 DEG F AND ABOVE, AND ONE TEST FOR EACH COMPOSITE SAMPLE.
5. UNIT WEIGHT: ASTM C 567, FRESH UNIT WEIGHT OF STRUCTURAL LIGHTWEIGHT CONCRETE; ONE TEST FOR EACH COMPOSITE SAMPLE, BUT NOT LESS THAN ONE TEST FOR EACH DAY'S POUR OF EACH CONCRETE MIXTURE.
6. COMPRESSION TEST SPECIMENS: ASTM C 31.
   a. CAST AND LABORATORY CURE TWO SETS OF TWO STANDARD CYLINDER SPECIMENS FOR EACH COMPOSITE SAMPLE.
7. COMPRESSIVE-STRENGTH TESTS: PERFORM ONE STRENGTH TEST FOR EACH 50 CUBIC YARDS OR FRACTIONS THEREOF FROM EACH MIX DESIGN OF CONCRETE PLACED IN ANY ONE DAY.
8. STRENGTH OF EACH CONCRETE MIXTURE WILL BE SATISFACTORY IF EVERY AVERAGE OF ANY THREE CONSECUTIVE COMPRESSIVE-STRENGTH TESTS EQUALS OR EXCEEDS SPECIFIED COMPRESSIVE STRENGTH AND NO COMPRESSIVE-STRENGTH TEST VALUE FALLS BELOW SPECIFIED COMPRESSIVE STRENGTH BY MORE THAN 500 PSI.
9. TEST RESULTS SHALL BE REPORTED IN WRITING TO ARCHITECT, CONCRETE MANUFACTURER, AND CONTRACTOR WITHIN 48 HOURS OF TESTING. REPORTS OF COMPRESSIVE-STRENGTH TESTS SHALL CONTAIN PROJECT IDENTIFICATION NAME AND NUMBER, DATE OF CONCRETE PLACEMENT, NAME OF CONCRETE TESTING AND INSPECTING AGENCY, LOCATION OF CONCRETE BATCH IN WORK, DESIGN COMPRESSIVE STRENGTH AT 28 DAYS, CONCRETE MIXTURE PROPORTIONS AND MATERIALS, COMPRESSIVE BREAKING STRENGTH, AND TYPE OF BREAK FOR BOTH 7- AND 28-DAY TESTS.
10. NONDESTRUCTIVE TESTING: IMPACT HAMMER, SONOSCOPE, OR OTHER NONDESTRUCTIVE DEVICE MAY BE PERMITTED BY ARCHITECT BUT WILL NOT BE USED AS SOLE BASIS FOR APPROVAL OR REJECTION OF CONCRETE.
11. ADDITIONAL TESTS: TESTING AND INSPECTING AGENCY SHALL MAKE ADDITIONAL TESTS OF CONCRETE WHEN TEST RESULTS INDICATE THAT SLUMP, AIR ENTRAINMENT, COMPRESSIVE STRENGTHS, OR OTHER REQUIREMENTS HAVE NOT BEEN MET, AS DIRECTED BY ARCHITECT. TESTING AND INSPECTING AGENCY MAY CONDUCT TESTS TO DETERMINE ADEQUACY OF CONCRETE BY CORED CYLINDERS COMPLYING WITH ASTM C 42 OR BY OTHER METHODS AS DIRECTED BY ARCHITECT.
12. ADDITIONAL TESTING AND INSPECTING, AT CONTRACTOR'S EXPENSE, WILL BE PERFORMED TO DETERMINE COMPLIANCE OF REPLACED OR ADDITIONAL WORK WITH SPECIFIED REQUIREMENTS.
13. CORRECT DEFICIENCIES IN THE WORK THAT TEST REPORTS AND INSPECTIONS INDICATE DOES NOT COMPLY WITH THE CONTRACT DOCUMENTS.

D. CONCRETE TEMPERATURE OF 90F OR ABOVE IN TRUCK AT SITE WILL BE REJECTED.

E. CONCRETE WHICH ARRIVES AT THE JOB SITE WITH EXCESSIVE AIR CONTENT (GREATER THAN 3%) OR EXCESSIVE SLUMP, OR TO WHICH UNAUTHORIZED WATER HAS BEEN ADDED, SHALL BE REJECTED.

F. DO NOT PLACE CONCRETE WHEN SLUMP, TEMPERATURE, OR TIME VARY FROM ALLOWABLE (1.6.8).

G. CONDUCT A SUBGRADE TOLERANCE SURVEY, PER THE REQUIREMENTS OF SECTION 3.01.A.

H. DETERMINATION OF THE FLATNESS AND LEVELNESS OF A CONCRETE SLAB SHALL BE MADE ON THE DAY FOLLOWING PLACEMENT OF EACH CONCRETE POUR. TESTS SHALL BE MADE IN ACCORDANCE WITH ASTM E1155.

I. TEST CYLINDERS SHALL BE STORED AT THE JOBSITE FOR THE FIRST 20 HOURS, PLUS OR MINUS 4 HOURS, IN A PROTECTED LOCATION AND ENVIRONMENT PREVENTING MOISTURE LOSS FROM TEST CYLINDERS, WITH THE TEMPERATURE MAINTAINED BETWEEN 60 AND 80 DEGREES, OR RESULTS OF STRENGTHS TESTS SHALL BE CONSIDERED UNACCEPTABLE.

J. MAINTAIN RECORDS OF ALL TESTS, INDICATING EXACT LOCATION OF THE STRUCTURE REPRESENTED BY EACH TEST.

K. USAGE: UNLESS APPROVED BY THE ARCHITECT / ENGINEER DO NOT ALLOW ANY LOADING ON NEW CONCRETE SURFACES OTHER THAN LIGHT FOOT TRAFFIC FOR A PERIOD OF 7 DAYS AFTER PLACEMENT. LIGHT CONSTRUCTION TRAFFIC SUCH

AS SMALL LIFTS CAN RESUME ON NEW SLABS AFTER A PERIOD OF 14 DAYS AFTER PLACEMENT. USE OF HEAVY CONSTRUCTION EQUIPMENT CONCRETE TRUCKS, BUGGIES, DUMP TRUCKS, CRANES, ETC., IS PROHIBITED AT ALL TIMES DURING CURING OPERATION OF 28 DAYS UNTIL CONCRETE HAS REACHED DESIGN VALUES ON INTERIOR AND EXTERIOR PAVED CONCRETE SURFACES.

L. PERFORM JOB SITE MONITORING OF CONCRETING OPERATIONS, INCLUDING SLUMP TESTING OF EACH TRUCK OF CLASS VI CONCRETE. CONCRETE WHICH ARRIVES AT THE JOB SITE WITH EXCESSIVE AIR CONTENT (GREATER THAN 3%) OR EXCESSIVE SLUMP, OR TO WHICH UNAUTHORIZED WATER HAS BEEN ADDED, SHALL BE REJECTED.

M. OBTAIN CONCRETE FOR REQUIRED TESTS AT POINT OF PLACEMENT. IF CONCRETE IS PUMPED, OBTAIN CONCRETE FOR TESTS AT DISCHARGE END (1.6.3.3).

N. PERFORM STRENGTH, TEMPERATURE, SLUMP AND AIR TESTS PER SPECIFICATIONS.

O. DETERMINE CONCRETE TEMPERATURE FOR EACH STRENGTH TEST (1.6.3.2.d).

END OF SECTION

042000 - UNIT MASONRY ASSEMBLIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. CONSTRUCTION DRAWINGS, SPECIFICATIONS AND PROVISIONS OF THE CONTRACT INCLUDING GENERAL AND SUPPLEMENTAL CONDITIONS AND OTHER DIVISION 01 SPECIFICATION SECTIONS, ARE HEREBY MADE A PART OF THIS SECTION AS FULLY AND COMPLETELY AS IF REPEATED HEREIN.

1.02 ITEMS REQUIRED BUT NOT SPECIFIED

A. IF AN ITEM OR MATERIAL OF THIS TRADE IS INDICATED ON THE DRAWINGS BUT NOT SPECIFICALLY LISTED IN THIS SECTION, PROVIDE SUCH ITEM OR MATERIAL AT A STANDARD OF QUALITY EQUAL TO THE STANDARD ESTABLISHED FOR THE BALANCE OF THE WORK SPECIFIED, IN ACCORDANCE WITH THE ARCHITECT'S INTERPRETATION.

1.03 EXECUTION, CORRELATION AND INTENT

A. IN CASE OF AN INCONSISTENCY BETWEEN DRAWINGS AND SPECIFICATIONS, OR WITHIN EITHER DOCUMENT NOT CLARIFIED BY ADDENDUM, THE BETTER QUALITY OR GREATER QUANTITY OF WORK IS TO BE PROVIDED, IN ACCORDANCE WITH THE ARCHITECT'S INTERPRETATION.

1.04 SECTION INCLUDES

A. FURNISH AND INSTALL:

B. REINFORCED UNIT MASONRY CONSTRUCTION AS SHOWN ON THE DRAWINGS AND DESCRIBED HEREIN.
   1. CONCRETE MASONRY UNITS.
      a. STANDARD UNITS.
      b. GROUND FACE UNITS.
   2. PRECAST LINTELS.
   3. MORTAR AND GROUT.
   4. GROUT FILL FOR HOLLOW METAL STEEL FRAMES, AND WHEREVER TIES OR ANCHORAGE ITEMS OCCUR, AND AS FURTHER INDICATED IN THE DRAWINGS.
   5. VERTICAL AND HORIZONTAL REINFORCING, TIES, ANCHORS, AND OTHER METAL ACCESSORIES, FOR ANCHORING UNIT MASONRY TOGETHER AND TO OTHER MATERIALS.
   6. COMPRESSIBLE JOINT FILLERS FOR CONTROL JOINTS IN UNIT MASONRY WORK AND JOINTS WITH STRUCTURAL STEEL.
   7. METAL / FLEXIBLE SHEET FLASHING.

C. INSTALL THE FOLLOWING FURNISHED UNDER THE INDICATED SECTIONS:
   1. PLACEMENT AND BUILDING-IN OF, AS WORK PROGRESSES, ANCHOR BOLTS, WOOD BLOCKING, AND ANCHORAGE FOR ITEMS FURNISHED OR SET BY OTHER TRADES AS SPECIFIED IN INDIVIDUAL SECTIONS.
   2. CLEAN AND POINT EXPOSED TO VIEW SURFACE MASONRY.

1.05 RELATED SECTIONS

A. SECTION 06 1000 - ROUGH CARPENTRY: SETTING AND TEMPORARY BRACING OF HOLLOW

METAL FRAMES OCCURRING IN MASONRY, AND REMOVAL OF TEMPORARY CENTERING WHEN FRAMES HAVE BEEN BUILT INTO THE MASONRY.

B. SECTION 07 9200 - JOINT SEALERS: SEALANT, CAULKING MATERIALS, AND COMPRESSIBLE JOINT BEAD BACK-UP, IN CONJUNCTION WITH MASONRY WORK.

1.06 REFERENCES

A. COMPLY WITH APPLICABLE REQUIREMENTS OF THE FOLLOWING STANDARDS AND THOSE OTHERS REFERENCED IN THIS SECTION.
   1. AMERICAN CONCRETE INSTITUTE (ACI) AND AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE): ACI 530.1/ASCE 6 - “SPECIFICATIONS FOR MASONRY STRUCTURES”
   2. ASTM (AMERICAN SOCIETY OF TESTING AND MATERIALS)
      a. ASTM A 123 - ZINC (HOT-DIP GALVANIZED) COATING ON IRON AND STEEL PRODUCTS.
      b. ASTM A 153 - ZINC COATING (HOT-DIP) ON IRON AND STEEL HARDWARE.
      c. ASTM A 615 - DEFORMED AND PLAIN BILLET-STEEL BAR FOR CONCRETE REINFORCEMENT.
      d. ASTM C 90 - LOAD-BEARING CONCRETE MASONRY UNITS.
      e. ASTM C 144 - AGGREGATE FOR MASONRY MORTAR.
      f. ASTM C 150 - PORTLAND CEMENT.
      g. ASTM C 270 - MORTAR FOR UNIT MASONRY.
      h. ASTM C 404 - AGGREGATES FOR MASONRY GROUT.
      i. ASTM C 476 - GROUT FOR MASONRY.
      j. ASTM C 1142 - READY-MIX MORTAR FOR UNIT MASONRY.
      k. ASTM E 119 - FIRE TESTS OF BUILDING CONSTRUCTION AND MATERIALS.
   3. AMERICAN NATIONAL STANDARDS INSTITUTE BUILDING CODE REQUIREMENTS.
   4. IMIAC (INTERNATIONAL MASONRY INDUSTRY ALL-WEATHER COUNCIL)
      a. IMIAC - RECOMMENDED PRACTICES AND GUIDE SPECIFICATIONS FOR HOT/COLD WEATHER MASONRY CONSTRUCTION

B. THE FOLLOWING REFERENCE MATERIALS ARE HEREBY MADE A PART OF THIS SECTION BY REFERENCE THERETO:
   1. UL FIRE RESISTANCE DIRECTORY.
   2. IMI: MASONRY CONSTRUCTION GUIDE MANUAL.
   3. PCA, “CONCRETE MASONRY HANDBOOK”.
   4. NCMA (NATIONAL CONCRETE MASONRY ASSOCIATION)
      a. NCMA APPLICABLE TEK BULLETINS.

1.07 SUBMITTALS

A. SUBMIT THE FOLLOWING UNDER PROVISIONS OF DIVISION 1:
   1. LITERATURE: MANUFACTURER'S PRODUCT DATA SHEETS, SPECIFICATIONS, PERFORMANCE DATA, PHYSICAL PROPERTIES FOR EACH ITEM FURNISHED HEREUNDER.
   2. MATERIAL CERTIFICATES: PROVIDE FOR THE FOLLOWING, SIGNED BY MANUFACTURER AND SUBCONTRACTOR CERTIFYING THAT EACH MATERIAL COMPLIES WITH REQUIREMENTS.
      a. EACH DIFFERENT CEMENT PRODUCT REQUIRED FOR MORTAR AND GROUT, INCLUDING NAME OF MANUFACTURER, BRAND, TYPE, AND WEIGHT SLIPS AT

TIME OF DELIVERY.

b. EACH MATERIAL AND GRADE INDICATED FOR REINFORCING BARS.

c. EACH TYPE AND SIZE OF JOINT REINFORCEMENT.

d. EACH TYPE AND SIZE OF ANCHORS, TIES, AND METAL ACCESSORIES.

3. MATERIAL TEST REPORTS FROM A QUALIFIED INDEPENDENT LABORATORY EMPLOYED AND PAID BY SUBCONTRACTOR INDICATING AND INTERPRETING TEST RESULTS RELATIVE TO COMPLIANCE OF THE FOLLOWING PROPOSED MASONRY MATERIALS WITH REQUIREMENTS INDICATED:

a. MORTAR COMPLYING WITH PROPERTY REQUIREMENTS OF ASTM C 270.

b. GROUT MIXES: INCLUDE DESCRIPTION OF TYPE AND PROPORTIONS OF GROUT INGREDIENTS.

c. MASONRY UNITS; REPORT FOR TESTS PERFORMED WITHIN THE PREVIOUS SIX MONTHS.

4. SAMPLES:

a. SAMPLES OF EACH MASONRY ACCESSORY OR ANCHORAGE ITEM REQUIRED.

5. SUBCONTRACTOR'S COLD WEATHER AND HOT WEATHER PROCEDURES: SHOW EVIDENCE OF COMPLIANCE WITH REQUIREMENTS SPECIFIED IN REFERENCED UNIT MASONRY STANDARD.

6. REINFORCING SHOP DRAWINGS.

1.08 QUALIFICATIONS

A. INSTALLER: COMPANY SPECIALIZING IN PERFORMING THE MASONRY WORK OF THIS SECTION WITH MINIMUM OF 10 YEARS DOCUMENTED EXPERIENCE. WORK SHALL BE DONE BY SKILLED WORKMEN, FULLY INSTRUCTED AS TO THE REQUIREMENTS OF THE SPECIFICATIONS AND ADEQUATELY SUPERVISED DURING THE WORK.

1.09 QUALITY ASSURANCE

A. SINGLE-SOURCE RESPONSIBILITY FOR CONCRETE MASONRY UNITS: OBTAIN CONCRETE MASONRY UNITS FOR THE PROJECT FROM A SINGLE MANUFACTURER.

B. SINGLE-SOURCE RESPONSIBILITY FOR MORTAR MATERIALS: OBTAIN MORTAR INGREDIENTS OF UNIFORM QUALITY, INCLUDING COLOR FOR EXPOSED MASONRY, FROM ONE MANUFACTURER FOR EACH CEMENTITIOUS COMPONENT AND FROM ONE SOURCE AND PRODUCER FOR EACH AGGREGATE.

1.10 REGULATORY REQUIREMENTS

A. FIRE PERFORMANCE CHARACTERISTICS: WHERE INDICATED, PROVIDE MATERIALS AND CONSTRUCTION IDENTICAL TO THOSE OF ASSEMBLIES WHOSE FIRE RESISTANCE HAS BEEN DETERMINED PER ASTM E 119 BY A TESTING AND INSPECTING ORGANIZATION, BY EQUIVALENT CONCRETE MASONRY THICKNESS, OR BY ANOTHER MEANS, AS ACCEPTABLE TO AUTHORITIES HAVING JURISDICTION.

1.11 DELIVERY, STORAGE, AND HANDLING

A. GENERAL: DO NOT DELIVER CEMENT, LIME, AND SIMILAR PERISHABLE MATERIALS TO THE SITE UNTIL SUITABLE STORAGE IS AVAILABLE. STORE SUCH MATERIALS IN WEATHERPROOF STRUCTURES, AND ENSURE THAT MATERIALS ARE IN PERFECTLY FRESH CONDITION WHEN BROUGHT FOR USE. PROTECT MASONRY UNITS AND MANUFACTURED PRODUCTS OF ALL TYPES FROM WETTING BY RAIN OR SNOW, AND KEEP COVERED WHEN NOT IN USE.

B. MASONRY FACE UNITS: HANDLE ALL MASONRY UNITS CAREFULLY IN TRANSIT AND ON THE SITE, SO AS TO KEEP UNITS WHOLE, WITH EDGES SHARP, AND FACES CLEAN AND UNDAMAGED. DELIVER ALL MASONRY UNITS ON PALLETS; OR HANDLE UNITS INDIVIDUALLY, AND PROPERLY STACK SAME.

C. AGGREGATES: DELIVER, STORE AND HANDLE AGGREGATE MATERIALS SO AS TO PREVENT CONTAMINATION WITH EARTH OR OTHER FOREIGN MATERIALS.

D. STORE CEMENT, LIME AND SIMILAR PRODUCTS UNDER COVER AND FROM DIRECT CONTACT WITH EARTH OR FLOOR SLABS.

E. MANUFACTURED ITEMS: DELIVER MANUFACTURED PRODUCTS IN ORIGINAL CONTAINERS PLAINLY MARKED WITH PRODUCT IDENTIFICATION AND MANUFACTURER'S NAME.

F. STORE METAL ACCESSORIES AND THE LIKE UNDER COVER AND FROM DIRECT CONTACT WITH GROUND, AND IN MANNER TO PREVENT RUST.

G. DAMAGED MATERIAL: REMOVE ANY DAMAGED OR CONTAMINATED MATERIALS FROM JOB SITE IMMEDIATELY, INCLUDING MATERIALS IN BROKEN PACKAGES, PACKAGES CONTAINING WATER MARKS, OR WHICH SHOW OTHER EVIDENCE OF DAMAGE, UNLESS ARCHITECT SPECIFICALLY AUTHORIZES CORRECTION THEREOF AND USAGE ON PROJECT.

1.12 ENVIRONMENTAL CONDITIONS

A. HOT AND COLD WEATHER REQUIREMENTS AS SPECIFIED BY THE IMIAC (INTERNATIONAL MASONRY INDUSTRY ALL-WEATHER COUNCIL).
   1. HOT WEATHER REQUIREMENTS SHALL BE ENFORCED WHEN AMBIENT TEMPERATURES ARE ABOVE 90 DEGREES FAHRENHEIT (32 DEGREES CELSIUS).
   2. COLD WEATHER REQUIREMENTS SHALL BE ENFORCED WHEN AMBIENT TEMPERATURES BELOW 40 DEGREES FAHRENHEIT (5 DEGREES CELSIUS).

1.13 COORDINATION AND SEQUENCING

A. COORDINATE WORK WITH THAT OF OTHER TRADES WHICH REQUIRE PLACEMENT AND BUILDING-IN OF, AS WORK PROGRESSES, ANCHOR BOLTS, WOOD BLOCKING, HOLLOW METAL FRAMES, AND ANCHORAGE ITEMS.

B. EXAMINE ALL DRAWINGS AS TO REQUIREMENTS FOR THE ACCOMMODATION OF WORK OF OTHER TRADES. PROVIDE ALL REQUIRED RECESSES, CHASES, SLOTS, AND CUTOUTS. PLACE ANCHORS, BOLTS, SLEEVES AND OTHER ITEMS OCCURRING IN THE MASONRY WORK. TAKE EVERY PRECAUTION TO MINIMIZE FUTURE CUTTING AND PATCHING. CLOSELY COORDINATE THE LOCATION AND PLACEMENT OF SUCH ITEMS.

PART 2 PRODUCTS

2.01 CONCRETE MASONRY UNITS

A. LOAD BEARING HOLLOW AND SOLID, LIGHT WEIGHT CONCRETE MASONRY UNITS: CONFORM TO ASTM C90, TYPE 1, CLASS 1, LIGHT WEIGHT, 2-CORE, 58 PERCENT SOLID FOR 2 HOUR FIRE RESISTANT CONSTRUCTION:
   1. PLAIN-FACED UNITS OF NOMINAL THICKNESS INDICATED ON THE DRAWINGS, LIGHT GRAY COLOR WITH UNIFORM MEDIUM-FINE TEXTURE, SOUND, TRUE TO PLANE AND LINE, AND FREE FROM CHIPS, CRACKS, AND OTHER DEFECTS. NOMINAL DIMENSIONS

AS FOLLOWS:

a. NOMINAL 8 X 16 FACE DIMENSIONS.

2. SPECIAL SHAPES: PROVIDE SPECIAL BLOCK TYPES WHERE REQUIRED FOR CORNERS, CONTROL JOINTS AND OTHER SPECIAL CONDITIONS, WHETHER OR NOT SPECIFICALLY INDICATED ON THE DRAWINGS AS “SPECIAL”.
   a. BULLNOSE CORNERS AT OUTSIDE CORNERS
   b. DOUBLE BULLNOSE AT DOOR AND WINDOW ROUGH OPENINGS.
   c. BOND BEAMS.
3. U.L. FIRE RATED CONCRETE MASONRY UNITS: PROVIDE IN ALL FIRE WALL LOCATIONS AS INDICTED ON THE DRAWINGS.
4. AGGREGATE: SAND AND GRAVEL: CONFORM TO ASTM C 331.
5. MINIMUM ALLOWABLE COMPRESSIVE STRENGTH F'm = 1500 PSI WHEN TESTED IN ACCORDANCE WITH ASTM C 140.
6. OVEN DRY DENSITY: 105 POUNDS PER CUBIC FOOT.
7. MOISTURE CONTENT FOR AVERAGE OF 3 UNITS, WHEN DELIVERED, NOT EXCEEDING 35 PERCENT OF THE TOTAL ABSORPTION, WHEN TESTED IN ACCORDANCE WITH ASTM C 140.

2.02 MORTAR

A. MORTAR: SITE-MIXED PORTLAND CEMENT MORTAR COMPLYING WITH ASTM C 270 AS SPECIFIED HEREIN.
   1. ADMIXTURES ARE NOT PERMITTED EXCEPT WHERE EXPRESSLY SPECIFIED HEREIN OR AS OTHERWISE APPROVED BY THE ARCHITECT FOR SPECIFIC FIELD CONDITIONS.

B. MORTAR MATERIALS FOR SITE MIXED MORTAR:
   1. PORTLAND CEMENT FOR MASONRY CONFORMING TO ASTM C 150, TYPE I, NON-STAINING, WITHOUT AIR ENTRAINMENT. USE TYPE III AS NECESSARY FOR LAYING MASONRY IN COLD WEATHER.
   2. FOR CONCRETE MASONRY, USE GRAY COLOR PORTLAND CEMENT
   3. AGGREGATES FOR GROUT: CONFORMING TO ASTM C 144 FOR FINE AGGREGATE AND ASTM C 404, SIZE 8 OR 89.

051200 STRUCTURAL STEEL

PART 1 - GENERAL

1.01 ITEMS REQUIRED BUT NOT SPECIFIED

A. IF AN ITEM OR MATERIAL OF THIS TRADE IS INDICATED ON THE DRAWINGS BUT NOT SPECIFICALLY LISTED IN THIS SECTION, PROVIDE SUCH ITEM OR MATERIAL AT A STANDARD OF QUALITY EQUAL TO THE STANDARD ESTABLISHED FOR THE BALANCE OF THE WORK SPECIFIED, IN ACCORDANCE WITH THE ARCHITECT'S INTERPRETATION.

1.02 EXECUTION, CORRELATION, AND INTENT

A. IN CASE OF AN INCONSISTENCY BETWEEN DRAWINGS AND SPECIFICATIONS OR WITHIN EITHER DOCUMENT NOT CLARIFIED BY ADDENDUM, THE BETTER QUALITY OR GREATER QUANTITY OF WORK IS TO BE PROVIDED, IN ACCORDANCE WITH THE ARCHITECT'S INTERPRETATION.

1.03 DESCRIPTION

A. WORK INCLUDED: ALL LABOR AND MATERIALS REQUIRED TO FURNISH AND INSTALL THE STRUCTURAL STEEL WORK SHOWN ON THE DRAWINGS AND REQUIRED BY THESE SPECIFICATIONS.

1. PROVIDE SPECIAL PREPARATION AND PRIMER AS SPECIFIED.

B. RELATED WORK SPECIFIED ELSEWHERE: THE GENERAL PROVISIONS OF THE CONTRACT APPLY TO THE WORK OF THIS SECTION, AS THOUGH REPRODUCED HEREIN. CAREFULLY EXAMINE ALL OTHER SECTIONS AND ALL DRAWINGS FOR RELATED WORK, WHICH INCLUDES BUT IS NOT LIMITED TO:

1. METAL DECKING: SECTION 053100
2. STEEL JOISTS: SECTION 052100

C. WORK FURNISHED BUT INSTALLED UNDER OTHER SECTIONS:

1. CAST-IN-PLACE ANCHOR BOLTS FOR COLUMNS
2. EMBEDDED ARMORING ANGLES & CHANNELS AT LOADING DOCKS AND OTHER LOCATIONS INDICATED.

D. WORK SPECIFICALLY EXCLUDED, TO BE PERFORMED BY OTHERS:

1. GROUTING UNDER COLUMN BASE PLATES
2. COATING OF STRUCTURAL STEEL COLUMNS AND BASE PLATES BELOW FLOOR WITH BITUMINOUS COATING.

E. WORK AFFECTED BY OTHERS: FRAMING, LOADS, OPENINGS, AND STRUCTURE IN ANY WAY RELATED TO MECHANICAL, ELECTRICAL OR REFRIGERATION REQUIREMENTS IS SHOWN FOR BIDDING PURPOSES ONLY. RESPONSIBILITY FOR COORDINATING THE WORK OF THIS SECTION WITH THESE REQUIREMENTS IS SOLELY THAT OF THE CONTRACTOR. CONTRACTOR'S REVIEW OF SHOW DRAWINGS WILL BE TAKEN TO INDICATE THAT THIS COORDINATION HAS BEEN ACCOMPLISHED.

F. INSPECTION AND TESTING REQUIRED BY THIS SECTION ARE TO BE PERFORMED BY AN AGENCY RETAINED BY THE CONSTRUCTION MANAGER/OWNER. .

1.04 QUALITY ASSURANCE

A. COMPLY WITH THE PROVISIONS OF THE FOLLOWING REFERENCE STANDARDS:

1. BY THE AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC):
   a. SPECIFICATIONS FOR THE DESIGN, FABRICATION AND ERECTION OF STRUCTURAL STEEL FOR BUILDINGS.
   b. SPECIFICATION FOR STRUCTURAL JOISTS USING ASTM A325 OR A490 BOLTS.
   c. CODE OF STANDARD PRACTICE FOR STEEL BUILDINGS AND BRIDGES.
2. BY THE AMERICAN WELDING SOCIETY (AWS):
   a. STRUCTURAL WELDING CODE - STEEL (D1.1).
   b. SYMBOLS FOR WELDING AND NON-DESTRUCTIVE TESTING (A2.4).
3. BY THE STEEL STRUCTURES PAINTING COUNCIL (SSPC):
   a. STEEL STRUCTURES PAINTING MANUAL SYSTEMS AND SPECIFICATIONS.

B. FABRICATOR'S QUALIFICATIONS:

1. MINIMUM FIVE YEARS CONTINUOUS EXPERIENCE IN THE FABRICATION OF STEEL FOR PROJECTS OF SIMILAR QUALITY AND SCOPE.
2. MEMBERSHIP IN THE AMERICAN INSTITUTE OF STEEL CONSTRUCTION, OR SHALL BE CERTIFIED BY AN APPROVED INDEPENDENT PROFESSIONAL TESTING AGENCY AS BEING QUALIFIED FOR CATEGORY I CONVENTIONAL STEEL STRUCTURES IN CONFORMANCE TO THE REQUIREMENTS OF THE AISC QUALITY CERTIFICATION PROGRAM.

C. ERECTOR'S QUALIFICATIONS: A QUALIFIED INSTALLER WHO PARTICIPATES IN THE AISC QUALITY CERTIFICATION PROGRAM AND IS DESIGNATED AN AISC-CERTIFIED ERECTOR, CATEGORY CSE.

D. WELDERS' QUALIFICATIONS: PERSONNEL AND PROCEDURES ARE TO BE QUALIFIED IN ACCORDANCE WITH AWS D1.1.

E. STRUCTURAL FASTENERS SHALL BE MANUFACTURED IN THE UNITED STATES. FABRICATOR SHALL FURNISH PROOF OF U.S. MANUFACTURER. IF IT BECOMES NECESSARY TO USE IMPORTED FASTENERS, EACH SIZE, TYPE, AND EACH LARGE QUANTITY PACKAGE (500 PCS. OR MORE) SHALL UNDERGO A RANDOM SAMPLING OF A MINIMUM OF 5 PIECES FOR TESTING, AND THE TEST RESULTS SHALL BE PROVIDED TO THE A/E. TESTS SHALL BE PERFORMED BY AN INDEPENDENT TESTING AGENCY, AND THE COST SHALL BE INCLUDED IN THE BASE BID. IF INFERIOR FASTENERS ARE DISCOVERED, ALL FASTENERS OF THAT TYPE SHALL BE REMOVED AND REPLACED WITH ACCEPTABLE FASTENERS AT NO COST TO THE OWNER.

1.05 SUBMITTALS

A. CERTIFICATION OF EXPERIENCE: SUBMIT, ON REQUEST ONLY, WRITTEN DESCRIPTIONS OF PERSONNEL, PROJECTS, AND EQUIPMENT WHICH DOCUMENT THE EXPERIENCE AND QUALIFICATIONS REQUIRED OF THE FABRICATOR, ERECTOR, WELDERS, AND INSPECTION AGENCY.

B. SHOP DRAWINGS:

1. INDICATE ALL SHOP AND ERECTION DETAILS, INCLUDING CUTS, COPES, CONNECTIONS, HOLES, THREADED FASTENERS, AND WELDS.
2. INDICATE ALL MATERIAL SPECIFICATIONS AND FINISHES.
3. INDICATE SHOP AND FIELD WELDS WITH SYMBOLS PER AWS A2.4.
4. FOR STRUCTURAL-STEEL CONNECTIONS INDICATED TO COMPLY WITH DESIGN LOADS, INCLUDE STRUCTURAL ANALYSIS DATA SIGNED AND SEALED BY THE QUALIFIED PROFESSIONAL ENGINEER RESPONSIBLE FOR THEIR PREPARATION.

C. PROOF OF COMPLIANCE FOR MATERIALS: SUBMIT, ON REQUEST ONLY, THE FOLLOWING:

1. MILL REPORTS FOR PROPERLY IDENTIFIED MATERIAL.

2. CERTIFICATES ON COMPLIANCE FOR:
   a. STRUCTURAL STEEL SHAPES
   b. HIGH STRENGTH THREADED FASTENERS
   c. SHEAR STUDS.

D. WELDING CERTIFICATES.

1.06 PRODUCT DELIVERY AND STORAGE

A. DELIVERY:

1. COMPLY WITH ASTM A6. NON-COMPLIANCE WILL BE CAUSE FOR REJECTIONS.
2. DELIVER ANCHOR BOLTS AND OTHER ITEMS TO BE EMBEDDED IN CAST-IN-PLACE CONCRETE PRIOR TO THE START OF THAT WORK. PROVIDE SETTING DRAWINGS, TEMPLATES, OR INSTRUCTIONS REQUIRED FOR THE INSTALLATION OF SUCH ITEMS.

B. STORAGE:

1. STORE STEEL AT SITE ABOVE GROUND ON PLATFORMS, SKIDS, OR OTHER SUPPORTS.
2. PROTECT STEEL FROM CORROSION.
3. STORE PACKAGED MATERIALS IN THEIR ORIGINAL UNBROKEN PACKAGES.
4. STORE FASTENERS IN A PROTECTED PLACE. CLEAN AND RELUBRICATE BOLTS AND NUTS THAT BECOME DRY OR RUSTY BEFORE USE.
5. DO NOT STORE MATERIALS ON STRUCTURE IN A MANNER THAT MIGHT CAUSE DISTORTION, DAMAGE, OR OVERLOAD TO MEMBERS OR SUPPORTING STRUCTURES. REPAIR OR REPLACE DAMAGED MATERIALS OR STRUCTURES AS DIRECTED.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. STRUCTURAL STEEL SPECIFIED HEREIN OR ON THE DRAWINGS SHALL CONTAIN THE HIGHEST RECYCLED CONTENT AVAILABLE (A MINIMUM OF 95% WHERE POSSIBLE).

B. STRUCTURAL STEEL SHAPES, PLATES, BARS, ETC.:

1. WIDE FLANGE SHAPES: ASTM A992 FY =50 KSI.
2. ANGLES, CHANNELS, PLATES, RODS, ETC: ASTM A36, FY=36 KSI.

C. STRUCTURAL STEEL TUBING:

1. SQUARE AND RECTANGULAR TUBING: ASTM A500, GRADE B (FY = 46 KSI).
2. ROUND STEEL PIPE: ASTM A53, TYPE E OR S, GRADE B (FY = 35 KSI).

D. THREADED RODS, UNFINISHED BOLTS AND NUTS: ASTM A307 OR A36. PROVIDE HEAVY WASHERS FOR ANCHOR BOLTS.

E. ANCHOR BOLTS: ASTM F1554 GRADE 36, 55, OR 105. PROVIDE HEAVY WASHERS FOR ANCHOR BOLTS.

F. HIGH STRENGTH THREADED FASTENERS: ASTM A325 OR A490.

1. USE 3/4 INCH DIAMETER BOLTS UNLESS NOTED OR REQUIRED TO DEVELOP CONNECTION CAPACITY.
2. BOLTS SHALL HAVE A SUITABLE IDENTIFYING MARK PLACED ON TOP OF THE HEAD BEFORE LEAVING THE FACTORY.

G. WELDING ELECTRODES: CONFORM TO REQUIREMENTS OF AWS D1.1, USING SERIES E70 ELECTRODES, APPROPRIATE FOR THE MATERIALS BEING WELDED.

H. HEADED STUD SHEAR CONNECTORS: CONFORM TO THE REQUIREMENTS OF ANSI/AWS D1.1, CHAPTER 7, TYPE B, AND ASTM A108, MINIMUM 60 KSI.

I. CHEMICAL ANCHORS:

1. ADHESIVE SHALL BE TWO-COMPONENT EPOXY OR OTHER ADHESIVE MORTAR COMBINING RESIN AND HARDENER COMPONENTS. COMPONENTS SHALL BE FURNISHED IN SEPARATE CONTAINERS, DESIGNED TO ACCEPT A STATIC MIXING NOZZLE THAT THOROUGHLY BLENDS THE COMPONENTS AND ALLOWS INJECTION DIRECLY INTO A DRILLED HOLE. MANUFACTURER'S INSTALLATION INSTRUCTIONS MUST BE FOLLOWED. PROVIDE THE FOLLOWING, OR APPROVED EQUAL:
   a. HIT HY 200 BY HILTI FASTENING SYSTEMS
2. ANCHOR RODS: ALL-THREAD ROD; ASTM A36 MINIMUM.

J. EXPANSION ANCHORS:

1. WEDGE ANCHORS SHALL HAVE A ONE PIECE ANCHOR BODY WITH AN EXPANSION MECHANISM OF INTERLOCKING WEDGES. CARBON STEEL COMPONENTS SHALL BE ZINC PLATED ACCORDING TO ASTM B633, GALVANIZED ACCORDING TO ASTM B695, OR STAINLESS STEEL CONFORMING TO ASTM A276 OR ASTM A493 OF MATERIAL MEETING AISI 304 OR 316. THE FOLLOWING ARE ACCEPTABLE:
   a. KWIK BOLT II BY HILTI FASTENING SYSTEMS
   b. RAWL-STUD BY RAWLPLUG COMPANY
2. SLEEVE ANCHORS SHALL BE FLUSH OR SHELL TYPE THAT MEET FEDERAL SPECIFICATION FF-S-325, GROUP II, TYPE 3 CARBON STEEL COMPONENTS SHALL BE ZINC PLATED ACCORDING TO ASTM B633, GALVANIZED ACCORDING TO ASTM B695, OR STAINLESS STEEL CONFORMING TO ASTM A276 OR ASTM A493 OF MATERIAL MEETING AISI 304 OR 316. THE FOLLOWING ARE ACCEPTABLE:
   a. SLEEVE ANCHOR BY HILTI FASTENING SYSTEMS
   b. LOK / BOLT BY RAWLPLUG COMPANY

K. COLUMN FREEZER BLOCKS: UNDER COLUMNS IN FREEZER AREAS (BELOW 32 DEGREES F) AND AS SHOWN IN THE DRAWINGS, PROVIDE HIGH DENSITY RIGID CELLULAR POLYURETHANE BLOCKS. BLOCKS SHALL BE PREFABRICATED WITH ANCHOR BOLT HOLES PREDRILLED TO MATCH BOLT PATTERN. MINIMUM COMPRESSIVE STRENGTH 1500 PSI. PROVIDE ONE OF THE FOLLOWING, OR AN APPROVED EQUAL:

1. GENERAL PLASTICS MANUFACTURING
2. AVE SHADCO INC
3. DOW CHEMICAL COMPANY

2.02 FABRICATION

A. CONFORM TO APPLICABLE PROVISIONS OF THE REFERENCE STANDARDS LISTED IN PART 1 OF THIS SECTION, AS MODIFIED HEREIN.

B. CONNECTION DESIGN:

1. DESIGN CONNECTIONS PER AISC STANDARDS FOR FORCES, MOMENTS AND AXIAL REACTIONS GIVEN ON THE DRAWINGS.
2. BEAMS WITH REACTIONS NOT SHOWN SHALL BE DESIGNED FOR 60% OF THE AISC MAXIMUM TOTAL UNIFORM

LOAD (FACTORED).

3. WIND GIRTS WITH REACTIONS NOT SHOWN SHALL BE DESIGNED FOR A 15 KIP HORIZONTAL REACTION (FACTORED).

C. FOR COMPOSITE MEMBERS WITH SHEAR STUDS, USE 1.4 TIMES THE NON-COMPOSITE CAPACITY OF THE BEAM UNLESS REACTION IS GIVEN ON DRAWINGS.

1. CONNECTION DETAILS ON DRAWINGS ARE TO ILLUSTRATE LOCATION, TYPE, GENERAL ARRANGEMENT ONLY, AND TO ESTABLISH MINIMUM REQUIREMENTS.
2. SHOP CONNECTIONS MAY BE WELDED OR BOLTED, UNLESS SHOWN OTHERWISE.
3. FIELD CONNECTIONS SHALL BE BOLTED, UNLESS SHOWN OTHERWISE.
4. STANDARD BOLTS AND NUTS ARE PERMITTED ONLY FOR CONNECTIONS OF SECONDARY MEMBERS, SUCH AS PURLINS AND GIRTS, UNLESS NOTED OTHERWISE. HIGH STRENGTH THREADED FASTENERS ARE REQUIRED FOR ALL OTHER BOLTED CONNECTIONS.

D. FINISHING: ENDS OF MEMBERS IN DIRECT CONTACT BEARING, SUCH AS COLUMNS AT THEIR BASES AND SPLICES, ARE TO BE "FINISHED", AS DEFINED IN THE CODE OF STANDARD PRACTICE.

E. BEARING AND BASE PLATES: COLUMN BASE PLATES ARE TO BE SHOP ATTACHED.

F. CLEANING:

1. REMOVE OIL, DIRT, LOOSE MILL SCALE, OR THEIR MATERIAL WHICH WOULD IMPAIR WELDING, PERFORMANCE OF FRICTION-TYPE CONNECTIONS, OR ADHERENCE OF CONCRETE.
2. FOR STEEL THAT IS TO BE PAINTED, CLEANING TECHNIQUES ARE TO BE AS REQUIRED BY THE APPROPRIATE SSPC PAINT SPECIFICATION LISTED BELOW.

G. SHOP PAINTING:

1. GENERAL: SHOP PAINT STRUCTURAL STEEL WORK, EXCEPT THOSE MEMBERS OR PORTIONS OF MEMBERS TO BE EMBEDDED IN CONCRETE OR MORTAR. DO NOT PAINT CONTACT SURFACES THAT ARE TO BE WELDED OR HIGH STRENGTH BOLTED WITH FRICTION-TYPE CONNECTIONS.
2. ALL STRUCTURAL STEEL SHALL BE PREPARED AND PRIMED.
   a. SURFACE PREPARATION: CLEAN STEEL IN ACCORDANCE WITH SSPC SP-3 "POWER TOOL CLEANING".
   b. PAINTING: USE PAINTING METHODS THAT WILL RESULT IN FULL COVERAGE OF JOINTS, CORNERS, EDGES AND EXPOSED SURFACE, AT RATE TO PROVIDE A UNIFORM DRY FILM THICKNESS OF 3 TO 5 MILS. APPLY SHOP COAT(S) IN ACCORDANCE WITH SSPC-PS 2.01, 2.02, 2.03, OR 2.04.
   c. PRODUCTS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE THE FOLLOWING:
      1) TNEMEC PERIMEPRIME SERIES 394.
      2) ARCHITECT APPROVED EQUAL.
4. ALL STEEL MEMBERS EXPOSED TO WEATHER SHALL BE GALVANIZED.
   a. SURFACE PREPARATION: CLEAN STEEL IN ACCORDANCE WITH SSPC SP-3 "POWER TOOL CLEANING".
   b. GALVANIZING IS TO CONFORM TO ASTM A153. EXCEPT FOR BOLTS, NUTS, AND ANCHORS, ALL GALVANIZING IS TO BE DONE AFTER FABRICATION

H. CAMBER: PROVIDE CAMBER IN BEAMS AS INDICATED ON THE DRAWINGS.

2.03 SOURCE QUALITY CONTROL

A. OWNER/CONSTRUCTION MANAGER WILL ENGAGE AN INDEPENDENT TESTING AND INSPECTING AGENCY TO PERFORM SHOP TESTS AND INSPECTIONS AND PREPARE TEST REPORTS.

1. PROVIDE TESTING AGENCY WITH ACCESS TO PLACES WHERE STRUCTURAL-STEEL WORK IS BEING FABRICATED OR PRODUCED TO PERFORM TESTS AND INSPECTIONS.

B. CORRECT DEFICIENCIES IN WORK THAT TEST REPORTS INSPECTIONS INDICATE DOES NOT COMPLY WITH THE CONTRACT DOCUMENTS.

C. BOLTED CONNECTIONS: SHOP-BOLTED CONNECTIONS WILL BE INSPECTED ACCORDING TO RCSC'S "SPECIFICATION FOR STRUCTURAL JOINTS USING ASTM A 325 OR A 490 BOLTS."

D. WELDED CONNECTIONS: IN ADDITION TO VISUAL INSPECTION, SHOP-WELDED CONECTIONS WILL BE TESTED AND INSPECTED ACCORDING TO AWS D1.1 AND THE FOLLOWING INSPECTION PROCEDURES, AT TESTING AGENCY'S OPTION:

1. LIQUID PENETRANT INSPECTION: ASTM E 165.
2. MAGNETIC PARTICLE INSPECTION: ASTM E 709; PERFORMED ON ROOT PASS AND ON FINISHED WELD. CRACKS OR ZONES OF INCOMPLETE FUSION OR PENETRATION WILL NOT BE ACCEPTED.
3. ULTRASONIC INSPECTION: ASTM E 164.
4. RADIOGRAPHIC INSPECTION: ASTM E 94.

PART 3 - EXECUTION

3.01 SURFACE CONDITIONS

A. PRIOR TO BEGINNING WORK OF THIS SECTION, VERIFY THAT THE EXISTING CONDITIONS AND THE INSTALLED WORK OF OTHER TRADES IS COMPLETE AND CORRECT TO THE EXTENT NECESSARY FOR THE PROPER EXECUTION OF THE WORK OF THIS SECTION. THIS INCLUDES LOCATIONS OF ANCHOR BOLTS, AND LINES AND GRADES OF BEARING AREAS.

B. THIS STRUCTURE IS DESIGNED TO BE SELF-SUPPORTING AND STABLE AFTER THE BUILDING IS FULLY COMPLETED. IT IS SOLELY THE CONTRACTORS RESPONSIBILITY TO DETERMINE ERECTION PROCEDURE AND SEQUENCE; AND TO ENSURE THE STABILITY OF THE BUILDING AND ITS COMPONENT PARTS, AND OF THE ADEQUACY OF TEMPORARY OR INCOMPLETE CONNECTIONS, DURING ERECTION. THIS INCLUDES THE ADDITION OF WHATEVER TEMPORARY BRACING, GUYS, OR TIE-DOWNS THAT MIGHT BE NECESSARY. SUCH MATERIAL IS NOT SHOWN ON THE DRAWINGS. IF APPLIED, THEY SHALL BE REMOVED AS CONDITIONS PERMIT, AND SHALL REMAIN THE CONTRACTOR'S PROPERTY.

C. SAFETY: IT IS SOLELY THE CONTRACTOR'S RESPONSIBILITY TO FOLLOW ALL APPLICABLE SAFETY CODES AND REGULATIONS GOVERNING THIS WORK.

D. CLEAN BEARING SURFACES AND OTHER SURFACES IN PERMANENT CONTACT, PRIOR TO ASSEMBLY.

E. SPLICES ARE PERMITTED ONLY WHERE INDICATED.

F. TOLERANCES: PER AISC CODE OF STANDARD PRACTICE.

G. FIELD CORRECTION OF FABRICATION ERRORS BY GAS CUTTING IS NOT PERMITTED IN MAJOR MEMBERS WITHOUT PRIOR APPROVAL OF THE ARCHITECT. DO NOT ENLARGE UNFAIR HOLES IN MEMBERS BY BURNING OR BY THE USE OF DRIFT PINS, EXCEPT IN SECONDARY BRACING MEMBER.

H. ALL HIGH STRENGTH BOLTED CONNECTIONS SHALL BE "SNUG TIGHT" CONNECTIONS, UNLESS OTHERWISE INDICATED.

1. SNUG TIGHT IS DEFINED AS THE TIGHTNESS THAT EXISTS WHEN ALL PLIES IN A JOINT ARE IN FIRM CONTACT AND CAN BE ATTAINED WITH A FEW IMPACTS OF AN IMPACT WRENCH OR BY THE FULL EFFORT OF A PERSON USING AN ORDINARY SPUD WRENCH.

2. ALL VERTICAL BUILDING BRACING CONNECTIONS, HANGER CONNECTIONS IN TENSION, AND OTHER CONDITIONS NOTED ON DRAWINGS SHALL BE INSTALLED TO A "SLIP CRITICAL" CONDITION, AS DEFINED BY THE "SPECIFICATION FOR STRUCTURAL JOISTS USING ASTM A325 OR A490 BOLTS".
   a. PROVIDE 5/16" THICK PLATE WASHERS AT ALL SLOTTED HOLES IN "SLIP CRITICAL" CONNECTIONS.
   b. DO NOT USE SLOTTED HOLES IN THE DIRECTION OF THE LOAD.

I. TOUCH-UP PAINTING: AFTER ERECTION, TOUCH-UP FIELD CONNECTIONS AND ABRASIONS IN THE SHOP COAT WITH SAME PAINT USED FOR SHOP COAT. DO NOT PAINT WELDS UNTIL THEY HAVE BEEN CLEANED IN ACCORDANCE WITH AWS D1.1.

3.02 FIELD QUALITY CONTROL

A. A QUALIFIED INDEPENDENT TESTING AND INSPECTING AGENCY RETAINED BY THE OWNER/CONSTRUCTION MANAGER SHALL PERFORM THE FOLLOWING:

1. REVIEW QUALIFICATIONS OF WELDERS, OPERATORS, AND WELDING PROCEDURES SUBMITTED BY THE CONTRACTOR.
2. REVIEW MATERIAL PROOF OF COMPLIANCE, IF SUCH IS REQUIRED.
3. INSPECT BOLTED CONNECTIONS, PER THE REQUIREMENTS OF THE AISC SPECIFICATION FOR STRUCTURAL JOINTS.
4. VISUALLY INSPECT FIELD WELDS PER AWS D1.1. IN ADDITION TO VISUAL INSPECTION, FIELD WELDS WILL BE TESTED ACCORDING TO AWS D1.1 AND THE FOLLOWING RPOCEDURES, AT TESTING AGENCY'S OPTION:
   a. LIQUID PENETRANT INSPECTION: ASTM E 165.
   b. MAGNETIC PARTICLE INSPECTION: ASTM E 709; PERFORMED ON ROOT PASS AND ON FINISHED WELD. CRACKS OR ZONES OF INCOMPLETE FUSION OR PENETRATION WILL NOT BE ACCEPTED.
   c. ULTRASONIC INSPECTION: ASTM E 164.
   d. RADIOGRAPHIC INSPECTION: ASTM E 94.
5. IN ADDITION TO VISUAL INSPECTION, TEST AND INSPECT FIELD-WELDED SHEAR CONNECTORS ACCORDING TO REQUIREMENTS IN AWS D1.1 FOR STUD WELDING AND AS FOLLOWS:
   a. PERFORM BEND TESTS IF VISUAL INSPECTIONS REVEAL EITHER A LESS-THAN-CONTINUOUS 360 DEGREE FLASH OR WELDING REPAIRS TO ANY SHEAR CONNECTOR.
   b. CONDUCT TESTS ON ADDITIONAL SHEAR CONNECTORS IF WELD FRACTURE OCCURS ON SHEAR CONNECTORS ALREADY TESTED, ACCORDING TO REQUIREMENTS IN AWS D1.1.
6. INSPECT CONNECTIONS OF METAL DECKING.
   a. INSPECT METAL DECK ANCHORAGES, FIELD WELDS AND SIDELAP FASTENERS. VERIFY INSTALLATIONS WAS PERFORMED IN ACCORDANCE WITH APPROVED SHOP DRAWINGS AND CONTRACT DRAWINGS.

B. CORRECT DEFICIENCIES IN WORK THAT TEST REPORTS AND INSPECTIONS INDICATE DOES NOT COMPLY WITH THE CONTRACT DOCUMENTS.

3.03 REPAIRS AND PROTECTION

A. REPAIR DAMAGED GALVANIZED COATINGS ON GALVANIZED ITEMS WITH GALVANIZED REPAIR PAINT ACCORDING TO ASTM A 780 AND MANUFACTURER'S WRITTEN INSTRUCTIONS.

END OF SECTION

052100 STEEL JOISTS

PART 1 GENERAL

1.01 ITEMS REQUIRED BUT NOT SPECIFIED

A. IF AN ITEM OR MATERIAL OF THIS TRADE IS INDICATED ON THE DRAWINGS BUT NOT SPECIFICALLY LISTED IN THIS SECTION, PROVIDE SUCH ITEM OR MATERIAL AT A STANDARD OF QUALITY EQUAL TO THE STANDARD ESTABLISHED FOR THE BALANCE OF THE WORK SPECIFIED, IN ACCORDANCE WITH THE ARCHITECT'S INTERPRETATION.

1.02 EXECUTION, CORRELATION, AND INTENT

A. IN CASE OF AN INCONSISTENCY BETWEEN DRAWINGS AND SPECIFICATIONS OR WITHIN EITHER DOCUMENT NOT CLARIFIED BY ADDENDUM, THE BETTER QUALITY OR GREATER QUANTITY OF WORK IS TO BE PROVIDED, IN ACCORDANCE WITH THE ARCHITECT'S INTERPRETATION.

1.03 DESCRIPTION

A. WORK INCLUDED: ALL LABOR AND MATERIALS REQUIRED TO FURNISH AND INSTALL THE STEEL JOIST WORK SHOWN ON THE DRAWINGS AND REQUIRED BY THESE SPECIFICATIONS. INCLUDE ALL BRIDGING, BRACING, BOTTOM CHORD EXTENSIONS, ANCHORS, EXTENDED ENDS AND OTHER ACCESSORIES REQUIRED FOR A COMPLETE INSTALLATION.

B. RELATED WORK SPECIFIED ELSEWHERE: THE GENERAL PROVISIONS OF THE CONTRACT APPLY TO THE WORK OF THIS SECTION, AS THOUGH REPRODUCED HEREIN. CAREFULLY EXAMINE ALL OTHER SECTIONS AND ALL DRAWINGS FOR RELATED WORK, WHICH INCLUDES BUT IS NOT LIMITED TO:
   1. STRUCTURAL STEEL: SECTION 051200
   2. METAL DECKING: SECTION 053100

C. WORK AFFECTED BY OTHERS: MECHANICAL FRAMING, LOADS, OPENINGS, AND STRUCTURE IN ANY WAY RELATED TO MECHANICAL REQUIREMENTS IS SHOWN FOR BIDDING PURPOSES ONLY. RESPONSIBILITY FOR COORDINATING THE WORK OF THIS SECTION WITH THESE REQUIREMENTS IS SOLELY THAT OF THE CONTRACTOR. CONTRACTOR'S REVIEW OF SHOW DRAWINGS WILL BE TAKEN TO INDICATE THAT THIS COORDINATION HAS BEEN ACCOMPLISHED.

D. INSPECTION AND TESTING REQUIRED BY THIS SECTION ARE TO BE PERFORMED BY AN AGENCY RETAINED BY THE CONSTRUCTION MANAGER. SEE SECTION 051200 FOR INSPECTION REQUIREMENTS.

1.04 QUALITY ASSURANCE

A. REFERENCE STANDARDS, BY THE STEEL JOIST INSTITUTE (SJI) AND THE AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC):
   1. STANDARD SPECIFICATIONS FOR OPEN WEB STEEL JOISTS (K-SERIES).
   2. STANDARD SPECIFICATIONS FOR LONGSPAN STEEL JOISTS (LH-SERIES) AND DEEP LONGSPAN STEEL JOISTS (DLH-SERIES).

B. MANUFACTURER'S QUALIFICATIONS: MEMBERSHIP IN THE STEEL JOIST INSTITUTE (SJI).
   1. SUBMIT MANUFACTURER CERTIFICATE, SIGNED BY THE JOIST MANUFACTURER, CERTIFYING THAT PRODUCTS FURNISHED COMPLY WITH SJI STANDARD SPECIFICATIONS AND IS CERTIFIED BY SJI TO MANUFACTURE JOISTS.

C. WELDERS' QUALIFICATIONS: PERSONNEL AND PROCEDURES ARE TO BE QUALIFIED IN ACCORDANCE WITH AWS D1.1.

D. TOLERANCES:
   1. SWEEP: MAXIMUM 1/480 OF JOIST LENGTH. VARIATION, THROUGHOUT FULL LENGTH OF JOIST. "
   2. SPACING: MAXIMUM 1
   3. PLUMBNESS: ¼ INCH PER FOOT OF JOIST DEPTH.

E. STRUCTURAL PERFORMANCE:
   1. ALL ROOF JOISTS SHALL BE DESIGNED FOR NET UPLIFT AS INDICATED ON THE DRAWINGS.
   2. LIMIT LIVE LOAD DEFLECTION OF ROOF JOISTS TO 1/240 OF THE SPAN.

1.05 SUBMITTALS

A. SHOP DRAWINGS:
1. INDICATE MARK, NUMBER, TYPE AND LOCATION OF ALL JOISTS.
2. INDICATE ALL BRIDGING, INCLUDING SIZE, ATTACHMENT TO THE JOISTS, AND ANCHORAGE OF THE ENDS OF EACH LINE.
3. INDICATE BEARING AND CONNECTIONS DETAILS, AND HANDLING INSTRUCTIONS.
4. INDICATE PAINT TYPE, AND ALL ACCESSORIES REQUIRED FOR PROPER INSTALLATION OF JOISTS.
5. INDICATE MEMBER SIZES, GEOMETRY, AND WELDS.
6. INDICATE MEMBER DESIGN FORCES
7. FOR SPECIAL JOISTS, PROVIDE LOAD DIAGRAMS STATING ALL DISTRIBUTED AND CONCENTRATED LOADS APPLIED TO THE JOIST. THESE LOADS SHALL CORRESPOND TO THE LOADS SHOWN ON THE STRUCTURAL CONTRACT DRAWINGS.
8. INDICATE THAT JOISTS AND ACCESSORIES HAVE BEEN DESIGNED FOR SPECIFIED UPLIFT.

B. PROOF OF COMPLIANCE FOR MATERIALS: SUBMIT, ON REQUEST ONLY, THE FOLLOWING:
1. CERTIFIED COPIES OF MILL TEST REPORTS.
2. CERTIFICATES FOR WELDING PROCEDURES AND PERSONNEL.
3. INSPECTION REPORTS FOR FIELD CONNECTIONS.

1.06 PRODUCT DELIVERY, STORAGE AND HANDLING

A. PROVIDE TAGS ON JOISTS FOR READY IDENTIFICATION.

B. STORE JOISTS OFF GROUND, IN UPRIGHT POSITION. KEEP FREE OF DIRT AND OTHER DETRIMENTAL SUBSTANCES.

C. STORE AND HANDLE SO AS TO AVOID DAMAGE TO THE JOISTS. REPAIR OR REPLACE DAMAGED JOISTS. ALL REPAIRS SHALL BE APPROVED BY THE JOIST MANUFACTURER.

PART 2 PRODUCTS

2.01 MATERIALS

A. STEEL JOISTS AND ADDITIONAL STEEL SPECIFIED HEREIN OR ON THE DRAWINGS SHALL CONTAIN THE HIGHEST RECYCLED CONTENT AVAILABLE (A MINIMUM OF 95% WHERE POSSIBLE).

B. JOISTS: PER SJI REQUIREMENTS. CHORDS MAY BE DESIGNED USING FY=55 KSI IF MATERIAL CERTIFICATION IS PROVIDED.

C. BEARING PLATES, BRIDGING, ACCESSORIES: ASTM A36, FY=36 KSI.

D. PAINT: MANUFACTURER'S STANDARD RUST-INHIBITING PRIMER. COLOR: GRAY.

2.02 DESIGN CRITERIA

A. JOISTS SHALL BE DESIGNED TO SUPPORT A MINIMUM 500 LB. CONCENTRATED LOAD PLACED ANYWHERE ON THE TOP & BOTTOM CHORD WITHOUT THE NEED FOR ADDITIONAL WEB REINFORCING. THIS LOAD IS IN ADDITION TO SPECIFIED LOADING. ROUND BAR CHORDS ARE NOT PERMITTED.

B. EXTENDED ENDS ARE TO BE DESIGNED FOR LOADS ON DRAWINGS. IF NONE ARE GIVEN, DESIGN FOR THE SAME LOAD (LBS./LIN.FT.) AS THE JOIST.

C. BRIDGING: ALL BRIDGING SHALL BE ACCORDING TO THE REQUIREMENTS OF SJI.
   1. ADDITIONAL BRIDGING SHALL BE PROVIDED AS REQUIRED FOR DESIGN AND ERECTION CONSIDERATIONS OF SPECIAL JOISTS.
   2. PROVIDE BRIDGING AT FIRST BOTTOM PANEL POINT OF ROOF JOISTS, FOR UPLIFT CONSIDERATIONS.

D. JOISTS, BRIDGING, AND JOIST ANCHORAGES SHALL BE DESIGNED FOR ALL LOADS, INCLUDING NET UPLIFT.

E. JOIST GIRDERS, BRIDGING, AND JOIST GIRDER ANCHORAGES SHALL BE DESIGNED FOR ALL LOADS, INCLUDING COLLECTOR FORCES AND NET UPLIFT.

F. STRUCTURAL PERFORMANCE:
   1. ALL ROOF JOISTS SHALL BE DESIGNED FOR NET UPLIFT INDICATED ON THE DRAWINGS
   2. LIMIT LIVE LOAD DEFLECTION OF ROOF JOISTS TO 1/240 OF THE SPAN.

2.03 FABRICATION

A. FABRICATE STEEL JOISTS IN ACCORDANCE WITH SJI.

B. BOTTOM CHORDS SHALL BE EXTENDED AND CONNECTED TO COLUMNS OR WEBS OF GIRDERS AT COLUMN LINES AND WHERE SHOWN ON STRUCTURAL DRAWINGS.

C. LH & DLH JOIST SEATS SHALL BE STANDARD DEPTH UNLESS SHOWN OTHERWISE. K SERIES JOISTS SHALL BE PROVIDED WITH A 5" SEAT. SEATS SHALL BE BEVELED WHEN SLOPE EXCEEDS ¼ INCH PER FOOT.

D. REMOVE LOOSE SCALE, HEAVY RUST, AND OTHER FOREIGN MATERIALS FROM FABRICATED JOISTS, GIRDERS AND ACCESSORIES BEFORE APPLICATION OF SHOP PAINT. PAINT APPLICATION SHALL COMPLY WITH SJI. PROVIDE GRAY STEEL JOIST SHOP PAINT CONFORMING TO STEEL STRUCTURE PAINTING COUNCIL (SSPC) - PAINT 15 UNLESS NOTED OTHERWISE. APPLY ONE SHOP COAT OF PRIMER PAINT TO STEEL JOISTS AND ACCESSORIES TO PROVIDE A CONTINUOUS DRY PAINT FILM THICKNESS OF LESS THAN 1.0 MIL.

PART 3 EXECUTION

3.01 SURFACE CONDITIONS

A. PRIOR TO BEGINNING WORK OF THIS SECTION, VERIFY THAT THE INSTALLED WORK OF OTHER TRADES IS COMPLETE AND CORRECT TO THE EXTENT NECESSARY FOR THE PROPER EXECUTION OF THE WORK OF THIS SECTION.

B. IN THE EVENT OF DISCREPANCIES, IMMEDIATELY NOTIFY THE ARCHITECT. DO NOT PROCEED WITH WORK AFFECTED BY THE DISCREPANCIES UNTIL THEY HAVE BEEN RESOLVED.

3.02 ERECTION

A. GENERAL: PER REQUIREMENTS OF SJI.

B. CONCENTRATED LOADS: PROVIDE REINFORCING FOR CHORDS OR WEBS AS REQUIRED AT POINTS OF CONCENTRATED LOADS.

C. TOUCH UP PAINTING: AFTER INSTALLATION, TOUCH UP FIELD WELDS, UNPAINTED AREAS, CONNECTIONS, AND ABRASIONS IN THE SHOP COAT, WITH THE SAME PAINT USED FOR THE SHOP COAT.

3.03 FIELD QUALITY CONTROL

A. INSPECTION SHALL BE AS SPECIFIED IN SECTION 051200.

END OF SECTION

053100 METAL DECKING

PART 1 - GENERAL

1.01 ITEMS REQUIRED BUT NOT SPECIFIED

A. IF AN ITEM OR MATERIAL OF THIS TRADE IS INDICATED ON THE DRAWINGS BUT NOT SPECIFICALLY LISTED IN THIS SECTION, PROVIDE SUCH ITEM OR MATERIAL AT A STANDARD OF QUALITY EQUAL TO THE STANDARD ESTABLISHED FOR THE BALANCE OF THE WORK SPECIFIED, IN ACCORDANCE WITH THE ARCHITECT'S INTERPRETATION.

1.02 EXECUTION, CORRELATION, AND INTENT

A. IN CASE OF AN INCONSISTENCY BETWEEN DRAWINGS AND SPECIFICATIONS OR WITHIN EITHER DOCUMENT NOT CLARIFIED BY ADDENDUM, THE BETTER QUALITY OR GREATER QUANTITY OF WORK IS TO BE PROVIDED, IN ACCORDANCE WITH THE ARCHITECT'S INTERPRETATION.

1.03 DESCRIPTION

A. WORK INCLUDED: ALL LABOR AND MATERIALS REQUIRED TO FURNISH AND INSTALL METAL DECKING AND ACCESSORIES INCLUDING CLOSURES AND ROOF SUMP PANS, WHERE SHOWN ON THE DRAWINGS AND/OR REQUIRED FOR A COMPLETE INSTALLATION. OPENINGS IN METAL DECK SHALL BE CUT UNDER THIS SECTION.

B. RELATED WORK SPECIFIED ELSEWHERE: THE GENERAL PROVISIONS OF THE CONTRACT APPLY TO THE WORK OF THIS SECTION, AS THOUGH REPRODUCED HEREIN. CAREFULLY EXAMINE ALL OTHER SECTIONS AND ALL DRAWINGS FOR RELATED WORK, WHICH INCLUDES BUT IS NOT LIMITED TO:
   1. STRUCTURAL STEEL: SECTION 051200
   2. STEEL JOISTS: SECTION 052100

C. INSPECTION AND TESTING REQUIRED BY THIS SECTION ARE TO BE PERFORMED BY AN AGENCY RETAINED BY THE OWNER/CONSTRUCTION MANAGER. SEE SECTION 051200 FOR INSPECTION REQUIREMENTS.

1.04 QUALITY ASSURANCE

A. REFERENCE STANDARDS:
   1. SPECIFICATION FOR THE DESIGN OF COLD-FORMED STEEL STRUCTURAL MEMBERS, BY THE AMERICAN IRON AND STEEL INSTITUTE.
   2. DESIGN MANUAL FOR FLOOR DECKS AND ROOF DECKS, BY THE STEEL DECK INSTITUTE.

B. MANUFACTURER'S QUALIFICATIONS: REGULARLY ENGAGED IN THE MANUFACTURE OF SIMILAR DECKING.

C. WELDERS' QUALIFICATIONS: PERSONNEL AND PROCEDURES ARE TO BE QUALIFIED IN ACCORDANCE WITH AWS D1.1.

D. ERECTOR'S QUALIFICATIONS: PERSONNEL AND PROCEDURES ARE TO BE QUALIFIED PER THE REQUIREMENTS OF THE AMERICAN WELDING SOCIETY, AS GIVEN IN AWS D1.1

E. TESTING AGENCY QUALIFICATIONS: AN INDEPENDENT AGENCY QUALIFIED ACCORDING TO ASTM E 329 FOR TESTING INDICATED.

F. FIRE-TEST RESPONSE CHARACTERISTICS: WHERE INDICATED, PROVIDE STEEL DECK UNITS IDENTICAL TO THOSE TESTED FOR FIRE RESISTANCE PER ASTM E 119 BY A TESTING AND INSPECTING AGENCY ACCEPTABLE TO AUTHORITIES HAVING JURISDICTION.
   1. FIRE-RESISTANCE RATINGS: INDICATED BY DESIGN DESIGNATIONS OF APPLICABLE TESTING AND INSPECTING AGENCY.
   2. STEEL DECK UNITS SHALL BE IDENTIFIED WITH APPROPRIATE MARKINGS OF APPLICABLE TESTING AND INSPECTING AGENCY.

1.05 SUBMITTALS

A. SHOP DRAWINGS:
1. INDICATE MARK, NUMBER, TYPE AND LOCATION OF ALL DECK UNITS.
2. INDICATE METHOD OF ATTACHMENT TO SUPPORTING MEMBERS, AND SIDELAP FASTENING REQUIREMENTS.
3. PROVIDE PRODUCT AND INSTALLATION REQUIREMENTS FOR POWDER ACTUATED FASTENERS.
4. INDICATE DETAILS AND INSTALLATION INSTRUCTIONS FOR ALL ACCESSORIES.
5. INDICATE SEQUENCE OF INSTALLATION, WHERE CRITICAL.
6. WELDING CERTIFICATES.

B. MANUFACTURER'S CERTIFICATION:
1. CERTIFY COMPLIANCE WITH STRUCTURAL CRITERIA. PUBLISHED LOAD TABLES AND LITERATURE ARE USUALLY ACCEPTABLE. PROVIDE DESIGN CALCULATIONS ON REQUEST ONLY.
2. CERTIFY COMPLIANCE WITH FINISH CRITERIA WITH TEST REPORTS AS INDICATED.
3. CERTIFY COMPLIANCE WITH FACTORY MUTUAL REQUIREMENTS.

C. CERTIFICATION OF EXPERIENCE: SUBMIT, ON REQUEST ONLY, WRITTEN DESCRIPTION OF PERSONNEL, PROJECTS, AND EQUIPMENT WHICH DOCUMENT THE EXPERIENCE AND QUALIFICATIONS REQUIRED OF THE MANUFACTURER, ERECTOR, AND WELDERS.

1.06 PRODUCT DELIVERY, STORAGE AND HANDLING

A. PREVENT DAMAGE TO DECK OR FINISH DURING HANDLING AND STORAGE. STORE ON BLOCKING OR PLATFORMS, OFF THE GROUND, WITH ONE ELEVATED FOR DRAINAGE.

B. PROTECT FROM RUSTING WITH WATERPROOF COVERING, OR STORAGE UNDER ROOF. FOLLOW MANUFACTURER'S INSTRUCTIONS FOR STORAGE AND PROTECTION OF DECK SURFACES THAT ARE NOT PAINTED OR GALVANIZED.

PART 2 - PRODUCTS

2.01 DESIGN CRITERIA

A. ROOF DECK:
1. TYPE: SEE STRUCTURAL DRAWINGS.
2. FINISH: GALVANIZED DECK.
3. MEET OR EXCEED FACTORY MUTUAL REQUIREMENTS.
4. ALLOWABLE DEFLECTION: DESIGN AND FABRICATE DECK FOR A MAXIMUM DEFLECTION OF 1/240 OF THE CLEAR SPAN UNDER THE UNIFORM LIVE LOAD.

B. REFERENCE STANDARDS, BY THE STEEL DECK INSTITUTE (SDI):
1. SDI SPECIFICATIONS FOR STEEL ROOF DECK.
2. SDI SPECIFICATIONS FOR COMPOSITE FLOOR DECK.

C. MANUFACTURER'S QUALIFICATIONS: MEMBERSHIP IN THE STEEL DECK INSTITUTE (SDI).

D. SUBMIT MANUFACTURER CERTIFICATE, SIGNED BY THE DECK MANUFACTURER, CERTIFYING THAT PRODUCTS FURNISHED COMPLY WITH SDI STANDARD SPECIFICATIONS AND IS CERTIFIED BY SDI TO MANUFACTURE METAL DECK.

2.02 MATERIAL AND FINISHES

A. MATERIAL: STEEL SHEET CONFORMING TO ASTM A653, STRUCTURAL QUALITY GRADE 80.

B. FINISHES: GALVANIZED CONFORMING TO ASTM A924, G60.

C. GALVANIZING REPAIR PAINT: SSPC PAINT 20 OR DOD-P-21035, WITH DRY FILM CONTAINING A

MINIMUM OF 94 PERCENT ZINC DUST BY WEIGHT.

D. ACCESSORIES: SAME MATERIAL AND FINISH AS DECK UNITS, EXCEPT THAT INTERIOR CLOSURES MAY BE OF COMPRESSIBLE MATERIAL.

E. FIELD TOUCH-UP PAINT: FOR GALVANIZED DECK, USE ZINC CHROMATE PAINT. TOUCH-UP FIELD CONNECTIONS AND ABRASIONS IN THE SHOP COAT WITH SAME PAINT USED FOR SHOP COAT.

F. SELF-TAPPING SCREWS: NO. 10 SELF-DRILLING SCREWS WITH LENGTHS ADEQUATE FOR THICKNESS OF BASE MATERIAL.

G. POWDER ACTUATED FASTENERS: CORROSION-RESISTANT, LOW-VELOCITY, CARBON-STEEL FASTENERS.
   1. FASTENERS SHALL HAVE KNURLED SHANKS; MINIMUM 12MM DIAMETER STEEL WASHERS, AND SHALL BE ZINC ELECTROPLATED IN CONFORMANCE WITH ASTM B633, SC 1, TYPE III.
   2. FASTENERS SHALL BE USED IN CONFORMANCE WITH SDI DESIGN PROCEDURES AND SHALL BE APPROVED BY FACTORY MUTUAL.
   3. USE APPROPRIATE FASTENER FOR DECKING AND SUBSTRATE MATERIAL AND THICKNESS.
   4. SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE ONE OF THE FOLLOWING:
      a. HILTI ENP-19

2.03 FABRICATION

A. UNITS ARE TO BE CONTINUOUS OVER AT LEAST THREE SPANS, WHERE POSSIBLE. END LAPS ARE TO OCCUR OVER SUPPORTS.
   1. ROOF DECK AND NON-COMPOSITE FORM DECK SHALL BE LAPPED OVER SUPPORTS WITH A MINIMUM END BEARING OF 1.5 INCHES FOR ALL DECK UNITS.

B. FORM DECK WITH NESTING SIDELAPS.

C. DECKING SHALL BE CHEMICALLY CLEANED AND PHOSPHATE TREATED AFTER GALVANIZING TO AID IN THE ADHERENCE OF FINAL COAT OF PAINT.

PART 3 - EXECUTION

3.01 SURFACE CONDITIONS

A. PRIOR TO BEGINNING WORK OF THIS SECTION, VERIFY THAT THE INSTALLED WORK OF OTHER TRADES IS COMPLETE AND CORRECT TO THE EXTENT NECESSARY FOR THE PROPER EXECUTION OF THE WORK OF THIS SECTION.

B. IN THE EVENT OF DISCREPANCIES, IMMEDIATELY NOTIFY THE ARCHITECT. DO NOT PROCEED WITH WORK AFFECTED BY THE DISCREPANCIES UNTIL THEY HAVE BEEN RESOLVED.

3.02 ERECTION

A. INSTALL DECKING IN ACCORDANCE WITH APPROVED PLACING DRAWINGS.

B. TOLERANCE: ALIGN ADJACENT UNITS WITH ¼" IN 40 FEET

C. ATTACHMENT TO SUPPORTING MEMBERS:
1. ROOF DECK (TYPICAL): ATTACH TO SUPPORTING STEEL WITH POWER ACTUATED FASTENERS OR SCREWS ONLY AND NOT WELDED TO SUPPORTING STRUCTURE. (SEE S1.601 FOR ATTACHMENT).

2. COMPOSITE FLOOR DECK (MEZZANINE): ATTACH TO SUPPORTING STEEL WITH POWER ACTUATED FASTENERS OR SCREWS ONLY AND NOT WELDED TO SUPPORTING STRUCTURE. FASTENERS SHALL BE AT A MAXIMUM SPACING OF 12 INCHES ON CENTER (EVERY OTHER RIB).

D. MECHANICAL FASTENERS TO BE INSTALLED PER MANUFACTURER'S RECOMMENDATIONS AND FACTORY MUTUAL REQUIREMENTS. SHOP DRAWINGS SHALL BE SUBMITTED INDICATING FASTENER DATA INCLUDING SIZE VERSUS STEEL SUBSTRATE MATERIAL, SPACING, FASTENER CAPACITY, INCLUDING DIAPHRAGM SHEAR CAPACITY, METHODS OF INSTALLATION, AND PROGRAM FOR QUALITY ASSURANCE OF INSTALLATION.

E. SIDELAP FASTENING:
1. ROOF DECK (TYPICAL): SEE S1.601 FOR SIDELAP SPACING. END LAPS SHALL BE A MINIMUM OF 2 INCHES AND SHALL OCCUR OVER THE SUPPORTS.

2. COMPOSITE FLOOR DECK: (2)-#10 SELF-TAPPING SCREWS PER SPAN. END LAPS SHALL BE A MINIMUM OF 2 INCHES AND SHALL OCCUR OVER THE SUPPORTS.

F. OPENINGS: FIELD CUT OPENINGS, BEVELS, MITERS, ETC. AS REQUIRED.
1. REINFORCE ROOF DECKING AROUND OPENINGS LESS THAN 10 INCHES IN ANY DIMENSION BY MEANS OF A FLAT STEEL SHEET PLACED OVER THE OPENING AND SCREWED TO THE TOP SURFACE OF THE DECK. PROVIDE STEEL SHEET OF THE SAME QUALITY AS THE DECK UNITS, NOT LESS THAN 20 GAGE AND AT LEAST 12 INCHES WIDER AND LONGER THAN THE OPENING. PROVIDE FASTENERS AT EACH CORNER AND SPACED NOT MORE THAN 6 INCHES O.C. ALONG EACH SIDE.
2. STEEL ANGLE REINFORCEMENT SHALL BE PROVIDED FOR OPENINGS 10 INCHES AND LARGER. DECK OPENING SHALL BE CUT UNDER THIS SECTION.

G. HANGING LOADS: DO NOT HANG ITEMS FROM THE UNDERSIDE OF METAL DECKS, UNLESS SPECIFICALLY APPROVED BY THE ARCHITECT.

H. CONSTRUCTION LOADS: DO NOT USE DECK AS STORAGE OR WORKING PLATFORM UNTIL IT HAS BEEN PERMANENTLY ATTACHED TO SUPPORTS. ASSURE THAT CONSTRUCTION LOADS DO NOT EXCEED THE CARRYING CAPACITY OF THE DECK.

I. REPAIR AND TOUCH-UP:
1. WHERE THE DECK WILL BE EXPOSED TO VIEW, REMOVE ANY UNITS WITH DAMAGE OR DEFECT THAT CANNOT BE CONCEALED BY PAINTING.
2. WHERE DECK WILL NOT BE EXPOSED TO VIEW, REPAIR ANY CUTS AND HOLES WITH PLATE OF THE SAME GAGE AS DECK.
3. TOUCH UP ALL DAMAGED AREAS OF FINISH, ON BOTH TOP AND BOTTOM SIDES OF DECK.
   a. WIRE BRUSH, CLEAN AND PAINT WITH GALVANIZING REPAIR PAINT, APPLIED IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS AND ASTM A780.

3.03 FIELD QUALITY CONTROL

A. INSPECTION SHALL BE AS SPECIFIED IN SECTION 051200.

END OF SECTION

The Livestock Institute

of Southern New England

Westport, MA

Project No. 4730

Piping Materials Specification

Section 15300

THE DENNIS GROUP, LLC

380 Stevens Avenue, Suite 215
SOLANA BEACH, CALIFORNIA 92075
858.847.9633 ▲ FAX 858.847.9634

1537 MAIN STREET
SPRINGFIELD, MASSACHUSETTS 01103
413.787.1785 ▲ FAX 413.787.1786

136 SOUTH MAIN STREET
SALT LAKE CITY, UTAH 84101
801.531.8585 ▲ FAX 801.531.8586

A	**9/15/16**	**Release for Bid**	**AJG**		
00	**9/8/16**	**Release for Review**	**AJG**		
Issue	**Date**	**Description**	**By**	**Client Approval**	**Date**

Unless notification and/or comments are received from client within two weeks after issue date, all documentation including drawings, specifications, and studies submitted to client shall be considered approved as released.

SPECIFICATION

FOR

PIPING MATERIALS

SECTION 15300

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SPECIFICATION
FOR
PIPING MATERIALS

SECTION 15300

GENERAL NOTES*

1. For hydrostatic testing use only thredolet and solid plug. Seal weld plug after testing is complete.

2. Hydrostatic test vents not required on lines 2" and under.

3. For drains use ball valve with one end screwed and one end socket weld (A13).

4. Use swage reducer where small end is 2" or smaller. Use buttweld reducer where small end is 2 ½" or larger.

5. Branch Connections

RUN	BRANCH	USE THE FOLLOWING
3/4"-2"	Full or reducing	Tee
2 ½" and larger	Full	Tee
2 ½" and larger	Reducing	Use Weld-o-let or Sock-o-let

6. Instrument Connections - (General):

Pressure Indicators:	½" FNPT branch connection with 1/2" valve.
Pressure Gauges:	½" MNPT with ½" MNPT siphons (siphons used on steam and condensate only)
Temperature Indicator/RTD:	¾" FNPT branch connection unless otherwise specified on the drawings.

7. Hydrostatic test all lines except atmospheric vents and drains.

8. 150# F.F. flanges to be used against vendor-supplied 125# F.F. flanges.

9. For application of studs or cap screws refer to job standard.

10. Field fit lengths will be required. Locations of these spools will be at the Engineer's discretion.

11. Where removal of adjacent equipment, fittings, etc. is required, use full lug type butterfly valve.

*See the following individual pipe specifications for application.

SPECIFICATION

FOR

PIPING MATERIALS

SECTION 15300

PIPE CLASSES

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PIPING MATERIAL SPECIFICATION
Pipe Class A10

ITEM	2" AND SMALLER	2½" AND LARGER
Pipe	Copper Type "L" Tubing, ASTM B8872, hard drawn	Same as 2" and smaller
Fittings	Solder joint, wrought copper, ANSI B16.22, Taramet Sterling® solder, tin/copper/selenium composition, lead, antimony and nickel-free, Adapters solder end X NPT	
Solder	Meets ASTM B-32-2001e1 specifications for use in potable water applications (designation 'TC')	
Flanges	Cast Bronze ANSI Class 150. Solder joint, ANSI B16.24	
Bolting	Heavy hex head carbon steel machine bolts, ASTM A307 Grade B with ASTM A563 Grade A heavy hex nut	
Unions	Wrought Copper Alloy Union, B16.22, wrought copper alloy body, cast copper hex nut, metal-to-metal seat, Dielectric, iron pipe threaded x copper solder-joint	
Gaskets	Red Rubber (SBR) Food Grade, 1/8", 150 pound full face, Garlock	
Circuit setters	Bell & Gossett Circuit Setter Plus Calibrated Balance Valve (CB Series)	
Valves*:		
Gate	V-410	
Globe	V-503	
Ball	V-205, V-206	V-201
Butterfly		V-300
Check	V-601, V-608	V-611

*For valve description, see valve index in the back of this section.

Vents: Line size up to ¾" maximum plugged.
Drains: Line size up to ¾" maximum valved
Instrument Connections:
Pressure ½" threaded (NPT female) branch connection
Temperature ¾" threaded (NPT female) branch connection

Notes: For high point vents and low point drains where indicated on piping arrangement drawings, piping subcontractor to provide a ¾" ball valve, female threaded adapter and plug. Tee puller (for branch connections) to be used only with the approval of the Engineer.

PIPING MATERIAL SPECIFICATION
Pipe Class A11

ITEM	2" AND SMALLER	2½" AND LARGER
Pipe	Schedule 40 seamless or ERW carbon steel, ASTM A53, Grade B or A106, Grade B, threaded and coupled	Schedule 40 seamless or ERW carbon steel, ASTM A53, Grade B or A106, Grade B, beveled ends for buttweld
Fittings	Screwed, 150# malleable iron, ANSI B16.3, ASTM A197	Butt weld carbon steel, standard weight, ANSI B16.9, ASTM A234, Grade WPB.
Flanges	Forged steel, 150# flat face, threaded, ANSI B16.5, ASTM A105	150# raised face, weld neck or slip-on, ANSI B16.5, ASTM A105, 150 pound flat face for cast iron valves
Bolting	Same as 2 ½" and larger	Bolts - Heavy Hex Head, carbon steel machine bolt, ASTM A307, Grade B with ASTM A563 Grade A heavy hex nut
Unions	150# malleable iron, threaded ground joint, iron seats, ASTM B16.3, ASTM A197,dielectric with insulating gasket, 250#, ANSI B16.39 – Wilkins Model DU.	Use Flanges
Gaskets	Same as 2-1/2" and larger	150# spiral wound, 304 SS metallic winding material with Teflon filler. Flexitallic style "LS"
Valves:		
Needle	V-100	- - -
Ball	V-205	V-214, V215
Butterfly	- - -	V-300, V-301
Gate	V-410	V-400
Globe	V-503	V-500
Check	V-601	V-615, V-617
Plug	V-700	V-703, V-704

For valve descriptions, see valve index in the back of this section.

Vents: Line size up to ¾" maximum plugged.
Drains: Line size up to ¾" maximum valved

Instrument Connections:

Pressure	½" threaded (NPT female) branch connection
Temperature	¾" threaded (NPT female) branch connection

Notes:
For high point vents and low point drains where indicated on piping arrangement drawings, piping subcontractor to provide a ¾" threaded ball valve and plug.

PIPING MATERIAL SPECIFICATION
Pipe Class A13

ITEM	2" AND SMALLER	2½" AND LARGER
Pipe	Schedule 40 ERW carbon. steel ASTM A53, Grade B or A106, Grade A or ERW, Plain ends	Schedule 40(1) seamless or ERW carbon steel, ASTM A53, Grade B or A106 Grade B, Beveled ends for butt welding
Fittings	3000# socket weld, forged steel ASTM A105, ANSI B16.11	Butt weld carbon steel standard weight, ANSI B16.9, ASTM A234 Grade WPB
Flanges	150# raised face, forged steel socketweld, ANSI B16.5, ASTM A105	150# raised face, weld neck or slip-on, ANSI B16.5, ASTM A105, 150 pound flat face for cast iron valves
Bolting	Same as 2 ½" and larger	Alloy steel, threaded full length, ASTM A193 Grade B7 with two heavy hex nuts, ASTM A194 Grade 2H
Unions	Use Flanges for 2"and above. 3000 pound, Forged Steel Socketweld, integral steel seats, ANSI B16.11	Use Flanges
Gaskets	Same as 2 ½" and larger	150# spiral wound, 304 SS metallic winding material with Teflon filler. Flexitallic style "LS"
"Y" Type Strainer	Screwed iron body, screwed iron cap, Spirax Sarco, Type "IT", 20 mesh	Flanged iron body bolted iron cap, Spirax Sarco, Type CI-250/F-250, 20 mesh
Valves*:		
Ball	V-202, V-208	V-214- - -
Butterfly	- - -	- - -
Gate	V-415, V-405, V-407	V-401, V-403
Globe	V-501,V-507,V-508,V-509	V-501
Check	V-603,V-607,V-609,V-616	V-616
Steam traps	Coil drainage (TF): Spirax Sarco 1 ½" 2", 2 ½" FTB-175 Header drip/drain (TT): Spirax Sarco Cool Blue ¾" TD52	

*For valve descriptions, see valve index in the back of this section.

Condensate lines shall be Schedule 80

All strainers shall be equipped with a V-208 Blowdown Valve

Vents: Line size up to ¾" maximum plugged.

Drains: Line size up to ¾" maximum valved

Instrument Connections:

Pressure ½" threaded (NPT female) branch connection

Temperature ¾" threaded (NPT female) branch connection

PIPING MATERIAL SPECIFICATION
Pipe Class S4

ITEM	3" AND SMALLER	4" AND LARGER
Pipe	Type 316 "L" stainless steel OD tubing, ASTM A269/A270 S2, polished ID and OD to 150-180 grit (32 Ra maximum), 0.065" wall thickness (16 gauge)	Type 316 "L" stainless steel OD tubing, ASTM A269/A270, polished ID and OD to 150-180 grit (32 Ra maximum), 0.083" wall thickness (14 gauge), 6" tubing shall be 0.109" wall thickness (12 gauge)
Fittings	Rath MicroWeld® or equal from 316 "L" SS, fusion butt weld with sanitary type clamp at equipment, swing elbows and where indicated on the drawings. Polished ID and OD to 150-180 grit (32 Ra).	United Industries or TrentTube
Clamp	WCB, Tri-Clover, G/H or Jensen Sanitary clamp, Tri-Clover Type 13MHHS or equal.	Domestic Manufacturer Preferred
Gaskets	EPDM Type 2 style Teflon Type 1 at all swing elbows	
Valves*:		
Ball	V-220, V-221	
Butterfly	V-311	
Check	V-625,V-626,V-627,V-628	
Plug	V-710, V-712	

*For valve description, see valve index in the back of this section.

Instrument Connections:

Temperature:	2" Tri-Clamp
Pressure:	2" Tri-Clamp

Notes: All lines shall be free draining and pitched from high points at no less than $^1/_8$" per foot.
All accessible interior welds shall be cleaned and polished smooth.
All exterior welds shall be cleaned of discoloration.
Clamp connections shall be located at every 90 ° Ell and on straight runs at 20 foot intervals.
Clamps used on the Corn Syrup lines (36 D.E. and 26 D.E) shall be Tri-Clover 13 MHP or equal. Use Type 1 gaskets with this clamp.
All "front" connections on the "Raw" Flow Panels are Cherry-Burrell Male I-Line.
All "front" connections on the "Pasteurized" Flow Panels are Cherry-Burrell Female I-Line

PIPING MATERIAL SPECIFICATION
Pipe Class S5

ITEM	3" AND SMALLER	4" AND LARGER
Pipe	Type 304 "L" stainless steel OD tubing, ASTM A269/A270 S2, polished ID and OD to 150-180 grit (32 Ra maximum), 0.065" wall thickness (16 gauge)	Type 304 "L" stainless steel OD tubing, ASTM A269/A270, polished ID and OD to 150-180 grit (32 Ra maximum), 0.083" wall thickness (14 gauge), 6" tubing shall be 0.109" wall thickness (12 gauge)
Fittings	Rath MicroWeld® or equal from 304 "L" SS, fusion butt weld with sanitary type clamp at equipment, swing elbows and where indicated on the drawings. Polished ID and OD to 150-180 grit (32 Ra).	United Industries or TrentTube
Clamp	WCB, Tri-Clover, G/H or Jensen Sanitary clamp, Tri-Clover Type 13MHHS or equal.	Domestic Manufacturer Preferred
Gaskets	EPDM Type 2 style Teflon Type 1 at all swing elbows	
Valves*:		
Ball	V-220, V-221	
Butterfly	V-312	
Check	V-625,V-626,V-627,V-628	
Plug	V-710, V-712	

*For valve description, see valve index in the back of this section.

Instrument Connections:

Temperature:	2" Tri-Clamp
Pressure:	2" Tri-Clamp

Notes: All lines shall be free draining and pitched from high points at no less than $^1/_8$" per foot.
All accessible interior welds shall be cleaned and polished smooth.
All exterior welds shall be cleaned of discoloration.

PIPING MATERIAL SPECIFICATION
Pipe Class S6

ITEM	3" AND SMALLER	4" AND LARGER
Pipe	Jacketed piping: Type 304 stainless steel OD tubing on product side, ASTM A269/A270, polished ID (Sanitary #4), non-polished OD, 304 SS OD tubing on hot water non-polished ID/OD, 0.065" wall thickness. For jacketed piping fabrication details, see piping drawings.	N/A
Fittings	304 SS, fusion butt weld with sanitary clamp type at equipment, elbows, and for instrument connections, where indicated on the drawings. Polished ID to a Sanitary #4 minimum.	N/A
Clamp	Sanitary clamp Tri-clover type 13MHP more than 8' above finished floor except at swing elbows. Use 13MHHM or equal at swing elbows.	N/A
Gaskets	EPDM Type 2 style Teflon type 1 at all swing elbows	N/A
Valves:		
Ball	V-220, V-223	
Butterfly	V-312	
Check	V-626, V-627	
Plug		

For valve description, see valve index in the back of this section.

Notes: All lines shall be free draining and pitched from high points at no less than 1/8"/ft
All accessible interior welds shall be cleaned and polished smooth. The desired joining method for the tubing and Schedule 5 pipe is an automatic orbital welder (GTAW).
All exterior welds shall be cleaned of discoloration
All tubing and fittings are to be pre-cleaned and shipped and stored sealed

Instrument Connections:

Temperature: 2" Tri-clamp
Pressure: 2" Tri-clamp

PIPING MATERIAL SPECIFICATION
Pipe Class S11

ITEM	2" AND SMALLER	2 ½ " AND LARGER
Pipe	Type 316 “L” stainless steel, schedule 10S, non-polished, seamless or EFW, ASTM A312 Grade TP 316L, plain ends	Type 316 “L” stainless steel, schedule 10S, non-polished, EFW, ASTM A312 TP 316L, beveled ends for butt welding.
Fittings	Cast stainless steel, 150 pound socketweld, ASTM A351, Grade CF8M, ANSI B16.3	Stainless steel, schedule 10S, butt weld, non-polished ASTM A403, GR WP 316L, ANSI B16.9
Flanges	Lap joint type, 150 pound, forged 316 SS, ANSI B16.5 drilling	See 2” Smaller
Stub Ends	Stainless steel, schedule 10S, non-polished butt welding, short length, MSS SP-43 Type A, ASTM A403, GR WP 316L	See 2” Smaller
Bolting	Stainless steel, threaded full length, ASTM A193, GR B8 with two heavy hex nuts, ASTM A194 Grade 8	See 2” Smaller
Unions	Cast stainless steel, 150# socketweld, non-polished, ASTM A351, ANSI B16.3 NOTE:: Option for Hart Industries O-Ring Union in critical service	Use Flanges
Gaskets	Prince Panacea® PT-G White, 1/8" ring type, 150 pound	See 2” Smaller
Valves:		
Needle	- - -	- - -
Ball	V-204, V-211, V-213	V-213, V-216, V-217
Butterfly	- - -	V-305, V-306, V-307, V-313, V-314, V-315
Gate	V-404, V0408	V-402,V-404,V-408
Globe	V-502, V-504	V-502, V-504
Check	V-602, V-604, V-605	V-618, V-619, V-620,V-621
Plug	V-701	V-702

For valve description, see valve index in the back of this section.
For threaded application use a Schedule 40 S buttweld by threaded adapter nipple (T.O.E.). Taper-bore weld end to provide a smooth transition to Schedule 10S pipe. Another method is to use a 3-piece ball valve w/one end FNPT, one end socketweld (refer to V-213). For thread sealant use Rectorseal “Pure White” Teflon Pipe Joint Compound.

Vents: Line size up to ¾” maximum plugged.
Drains: Line size up to ¾” maximum valved

PIPING MATERIAL SPECIFICATION
Pipe Class S12

ITEM	2" AND SMALLER	2 1/2" AND LARGER
Pipe	Type 304 "L" stainless steel, schedule 10S, non-polished, seamless or EFW, ASTM A312 Grade TP 304L, plain ends	Type 304 "L" stainless steel, schedule 10S, non-polished, EFW, ASTM A312 TP 304L, beveled ends for butt welding.
Fittings	Cast stainless steel, 150 pound socketweld, ASTM A351, Grade CF8M, ANSI B16.3	Stainless steel, schedule 10S, butt weld, non-polished ASTM A403, GR WP 316L, ANSI B16.9
Flanges	Slip On type, 150 pound, forged 304l SS, ANSI B16.5 drilling	See 2" Smaller
Stub Ends	Stainless steel, schedule 10S, non-polished butt welding, short length, MSS SP-43 Type A, ASTM A403, GR WP 304L	See 2" Smaller
Bolting	Stainless steel, threaded full length, ASTM A193, GR B8 with two heavy hex nuts, ASTM A194 Grade 8	See 2" Smaller
Unions	Cast stainless steel, 150# socketweld, non-polished, ASTM A351, ANSI B16.3 NOTE:: Option for Hart Industries O-Ring Union in critical service	Use Flanges
Gaskets	150# spiral wound, 304 SS metaliic winding material with Teflon filler Flexitallic Styule LS/LSI	See 2" Smaller
Valves*:		
Needle	- - -	- - -
Ball	V-204, V-211, V-213	V-213, V-216, V-217
Butterfly	- - -	V-305, V-306, V-307
Gate	V-404, V0408	V-402,V-404,V-408
Globe	V-502, V-504	V-502, V-504
Check	V-602,V-604, V-605	V-602, V-604, V-605, V-618, V-619, V-620, V-621
Plug	V-701, V-702	V-701, V-702

For valve description, see valve index in the back of this section.
For threaded application use a Schedule 40 S buttweld by threaded adapter nipple (T.O.E.). Taper-bore weld end to provide a smooth transition to Schedule 10S pipe. Another method is to use a 3-piece ball valve w/one end FNPT, one end socketweld (refer to V-213). For thread sealant use Rectorseal "Pure White" Teflon Pipe Joint Compound.

Vents: Line size up to ¾" maximum plugged.
Drains: Line size up to ¾" maximum valved

PIPING MATERIAL SPECIFICATION
Pipe Class S13

ITEM	2" AND SMALLER	2 ½" AND LARGER
Pipe	Type 304 "L" stainless steel, non-polished, schedule 80S, seamless or EFW, ASTM A312 TP304L, plain ends.	Type 304 "L" stainless steel, non-polished, schedule 40S, seamless or EFW, ASTM A312 TP304L, beveled ends.
Fittings	Forged stainless steel, 3000 pound socketweld, ASTM A182, ANSI B16.11, Grade F304L	Forged stainless steel, standard weight, ANSI B16.9, ASTM A182 Grade F304L
Flanges	Forged stainless steel, 150#, slip-on or weld neck raised face flanges, ASTM A182 Grade F304L.	See 2" Smaller
Bolting	Stainless steel, threaded full length, ASTM A193, GR B8 with two heavy hex nuts, ASTM A194 Grade 8	See 2" Smaller
Unions Hart Industries or equal	3000-pound Forged, Socketweld ends, O-ring "Steamer" Union , ASTM A182, ANSI B16.11, Grade 304L	Use flanges
Gaskets	150# spiral wound, 304 SS metallic winding material with Teflon filler. Flexitallic style "LS	See 2" Smaller
Valves*:		
Needle	- - -	- - -
Ball	V-211, V-216	V-216, V-217
Butterfly	- - -	- - -
Gate	V-404,V411, V413	V-412
Globe	V-502V-511, V-513	V-514
Check	V-606.V-618,V-619,V-621	V-618, V-619, V-620, V-621
Plug	- - -	- - -

*For valve description, see valve index in the back of this section.

Vents: Line size up to ¾" maximum plugged.
Drains: Line size up to ¾" maximum valved

Instrument Connections:

Pressure ½" threaded (NPT female) branch connection
Temperature ¾" threaded (NPT female) branch connection

PIPING MATERIAL SPECIFICATION
Pipe Class S14

ITEM	2" AND SMALLER	2 ½" AND LARGER
Pipe	Type 304 "L" stainless steel, non-polished, schedule 80S, seamless or EFW, ASTM A312 TP304L, plain ends.	Type 304 "L" stainless steel, non-polished, schedule 80S, seamless or EFW, ASTM A312 TP304L, beveled ends.
Fittings	Forged stainless steel, 3000 pound socketweld, ASTM A182, ANSI B16.11, Grade F304L	Forged stainless steel, 3000 pound socketweld, ASTM A182, ANSI B16.11, Grade F304L
Flanges	≤3"SAE 4-Bolt Hydraulic Flange, Code 61, Socketweld ends	≤3"SAE 4-Bolt Hydraulic Flange, Code 61, Socketweld ends, to match Schedule 80 Pipe, >4"Pressure Side - Forged stainless steel, 1500# socketweld raised-face flange, ASTM A182 Grade F304L, Return Side 150#.
Bolting	Same as 2 ½" and larger	≤3" – Use bolt kit with Flange, >4" Stainless steel, threaded full length, ASTM A193, GR B8 with two heavy hex nuts, ASTM A194 Grade 8
Unions Hart Industries or equal	3000-pound Forged, Socketweld ends, O-ring Union w/Viton, ASTM A182, ANSI B16.11, Grade 304L	Use flanges
Gaskets	Same as 2 ½" and larger	≤3" Viton O-Ring >4" 1500# spiral wound, 316 SS metallic winding material with a Teflon filler. Flexitallic style "CGI" spiral wound with Flexicarb Filler or approved equal.
Valves*:		
Pressure Comp. Flow Control	Parker PF Series w/SS Body (¾")	
Needle	- - -	- - -
Ball	V-210, V-219	V-219
Butterfly		
Gate	V-413	
Globe	V-511	
Check	V-620 (Return Lines Only)	V-620 (Return Lines Only)
Plug		

*For valve description, see valve index in the back of this section.

Vents: Line size up to ¾" maximum plugged.

Drains: Line size up to ¾" maximum valved

Instrument Connections:

Pressure ½" threaded (NPT female) branch connection

Temperature ¾" threaded (NPT female) branch connection

PIPING MATERIAL SPECIFICATION
Pipe Class S15

ITEM	2" AND SMALLER	2 ½" AND LARGER
Pipe	Type 316 "L" stainless steel, schedule 40S, non-polished, seamless, ASTM A312 Grade TP 316L, plain ends	Type 316 "L" stainless steel, schedule 40S, non-polished, EFW, ASTM A312 TP 316L, beveled ends for butt welding.
Fittings	Cast stainless steel, 150 pound socketweld, ASTM A351, Grade CF8M, ANSI B16.3	Stainless steel, schedule 40S, butt weld, non-polished ASTM A403, GR WP 316L, ANSI B16.9
Flanges	See 2 ½" and larger	Lap joint type, 150 pound, forged 316 SS, ANSI B16.5 drilling ,
Stub Ends	See 2 ½" and larger	Stainless steel, schedule 40S, non-polished butt welding, short length, MSS SP-43 Type A, ASTM A403, GR WP 316L
Bolting	See 2 ½" and larger	Stainless steel, threaded full length, ASTM A193, GR B8 with two heavy hex nuts, ASTM A194 Grade 8
Unions Hart Industries	3000-pound Forged, Socketweld ends, O-ring Union w/Viton, ASTM A182, ANSI B16.11, Grade 316L	Use Flanges
Gaskets	See 2 ½ " and larger	Prince Panacea® PT-G White, 1/8" ring type, 150 pound

Valves:

Needle	- - -	- - -
Ball	V-204, V-211, V-213	V-216, V-217
Butterfly	- - -	V-305, V-306
Gate	V-408	V-402
Globe	V-504, V-511	V-502
Check	V-602, V-604, V-605, V-622	V-618, V-619, V-620,V-621
Plug	- - -	- - -

For valve description, see valve index in the back of this section.
For threaded application use a Schedule 40 S buttweld by threaded adapter nipple (T.O.E.). Another method is to use a 3-piece ball valve w/one end FNPT, one end socketweld (refer to V-213). For thread sealant use Rectorseal "Pure White" Teflon Pipe Joint Compound.

Vents: Line size up to ¾" maximum plugged.
Drains: Line size up to ¾" maximum valved

Instrument Connections:

Pressure ½" threaded (NPT female) branch connection
Temperature ¾" threaded (NPT female) branch connection

PIPING MATERIAL SPECIFICATION
Pipe Class CP1

ITEM	4" AND SMALLER	6" AND LARGER
Pipe	Schedule 80 CPVC (Type IV, Grade I with cell classification 23447) pipe (IPS Sizes) per ASTM D1784. Pipe shall be NSF-approved for use with corrosive waste drainage systems as a Special Engineered (SE) product and shall bear the NSF mark. CPVC solvent cement shall be specially formulated for resistance to corrosive chemicals and manufactured in accordance with ASTM F493.	Refer to 4" and Smaller
Fittings	Solvent welded socket joints, ASTM D2855 with ASTM D2564.	
Flanges	One Piece (solid) Socket Style – Use Van Stone Flanges where joining to equipment	
Bolting	Bolts – Regular hex head carbon steel A307, Grade B Hex Nuts, unfinished Heavy Carbon steel A307, Use stainless nuts and bolts in the process area.	
Gaskets	1/16" EPDM, per ASTM D-3139	

* For valve descriptions, see Valve Index in the back of this Section

Valves:	
Ball	V-213
Butterfly	
Plug	
Gate	V-491, V-493
Check	V-624, V-617
Pinch	

Instrument Connections:	
Pressure	½" FNPT
Temperature	¾" FNPT

Notes:
1. Use all prefabricated fittings to assemble the piping. Field threading the Schedule 80 pipe is not permitted.

PIPING MATERIAL SPECIFICATION
Pipe Class P1

ITEM	4" AND SMALLER	6" AND LARGER
Pipe	Schedule 80 PVC (Type I, Grade I with cell classification 12454-B) pipe (IPS Sizes) per ASTM D-1784/D-1785. Pipe shall be NSF-approved for use with potable water. PVC solvent cement per ASTM D-2467/F-656/D-2855.	Refer to 4" and Smaller
Fittings	Schedule 80 PVC socket type fittings per ASTM D-2467 Use socket to threaded adapters (ASTM D-2464) where required.	
Flanges	One Piece (solid) Socket Style – Use Van Stone Flanges where joining to equipment	
Bolting	Bolts – Regular hex head carbon steel A307, Grade B Hex Nuts, unfinished Heavy Carbon steel A307, Use stainless nuts and bolts in the process area.	
Gaskets	1/16" Buna N, per ASTM D-3139	
Valves:		
Ball	V-212	
Butterfly	V-304	
Globe	N/A	
Check	V-623	

* For valve descriptions, see Valve Index in the back of this Section

Instrument Connections:	
Pressure	½" FNPT
Temperature	¾" FNPT
Vents	1" – with Nipple and Threaded Cap
Drains	1" – Ball Valve (Slip x Threaded)

Notes:
1. Use all prefabricated fittings to assemble the piping. Field threading the Schedule 80 pipe is not permitted.

PIPING MATERIAL SPECIFICATION
Pipe Class V1

ITEM	1" AND SMALLER	1½" AND LARGER
Pipe	Carbon steel standard weight ASTM A-53 Type F, threaded and coupled ANSI B36.10.	Carbon steel standard weight ASTM A-53 Grade B ERW cut grooved ends for Victaulic style 07 mechanical couplings.
Fittings	Malleable iron ASTM A-197 150# ANSI B16.3 screwed ends, black.	Carbon steel ASTM A-106 Grade B Schedule 80 threaded both ends.
Nipples	Carbon steel ASTM A-106 Grade B, schedule 80 threaded both ends.	
Flanges	Screwed forged steel, ANSI 150# class ASTM A-105 raised face ANSI B16.5.	Weld neck forged steel, ANSI 150# class ASTM A-105 standard bore raised face ANSI B16.5.
Bolting	Same as 1 ½" and larger.	Machine bolts, carbon steel ASTM A-307 Grade B; Thread ANSI B1.1 Class 2A, Heavy hex nuts, carbon steel ASTM A-563 Grade A; Thread ANSI B1.1 Class 2B
Unions	Malleable iron, 300# class, ASTM A-197 bronze to iron seats.	Malleable iron mechanical coupling for grooved end pipe and fittings with EPDM standard gaskets. Victaulic style 07 with Grade E gasket or approved substitute.
Thread Sealant	Teflon ribbon ½" wide by 4 mils thick.	
Gaskets	Same as 1 ½" and larger.	1/16" thick ANSI 150# ring type compressed synthetic fiber with sBR binder (Use FF gaskets with FF flanges). Garlock "Blue Gard" style 3200 or approved substitute.
"Y" Type Strainer	Class 600 cast carbon steel "Y" type strainer to ASTM A216 Grade WCB, screwed screen retainer with threaded blowoff connection, stainless steel screen with .062" perforations, socket weld ends. Mueller figure 862 or approved substitute.	Class 150 cast carbon steel "Y" type strainer to ASTM A216 Grade WCB, bolted screen retainer with threaded blowoff connection, stainless steel screen with 1/8" perforations, raised face flanged ends. Mueller figure 761/ or approved substitute.
Circuit setters	Bell & Gossett (CB Series)	
Valves:		

Ball	Nibco Bronze Ball Valve Full Part, Model # T-585-70 or Apollo carbon steel ball valve, Model # 73A-100 series	Nibco Bronze Ball Valve Std Part, Model # T-580-70
Gate	R-P & C forged steel gate valve with screwed/socketweld ends, Model # F56 or F57	R-P & C forged steel gate valve with 150# flanges, Model # F-158 or Crane cast steel gate valve with 150# flanges, Model # 47
Globe	R-P & C forged steel globe valve with screwed/socketweld ends, Model # F80 or F81	Crane cast steel globe valve with 150# flanges, Model # 143
Butterfly		Centerline/Crane Lug Style Butterfly Valve, Model # C106135 2/5

Vents: Line size up to ¾" maximum plugged.
Drains: Line size up to ¾" maximum valved

Instrument Connections:

Pressure	½" threaded (NPT female) branch connection
Temperature	¾" threaded (NPT female) branch connection

SPECIFICATION

FOR

PIPING MATERIALS

SECTION 15300

VALVES

INDEX

TYPE VALVE	TAG NUMBERS
NEEDLE VALVES	V-100 - V-199
BALL VALVES	V-200 - V-299
BUTTERFLY VALVES	V-300 - V-399
GATE VALVES	V-400 - V-499
GLOBE VALVES	V-500 - V-599
CHECK VALVES	V-600 - V-699
PLUG VALVES	V-700 - V-799

Note: All valves to be tagged by manufacturer with size and "V" numbers corresponding to these specifications. Tag to be 3/4" x 2" SS firmly attached to valve handwheel or operating handle. Use metal stencil for numbering.

Needle Valves

TAG NO.	DESCRIPTION	APPLICABLE PIPING SCH.	MANUFACTURER AND MODEL NO.
V-100	Threaded Ends, Class 200 bronze body, union bonnet, rising stem, non-asbestos packing. Handwheel 3/4" and smaller	A11	Stockham B-64 or equal

Ball Valves

TAG NO.	DESCRIPTION	APPLICABLE PIPING SCH.	MANUFACTURER AND MODEL NO.
V-201	Threaded ends, 400 psi WOG, Bronze body, two piece design, Electroplated nickel brass ball, PTFE seats and seals, lever operated, 3" and 4"	A10	Watts B-6000 or equal
V-202	3 Piece Carbon Steel Body, Socket Weld Ends, 1500 psi WOG, Chrome-plated Carbon Steel Ball, reinforced PTFE Seats, suitable for W.S.P. of 150 psig, lever operated, 2" and smaller	A13	Apollo 83-400
V-203	Threaded ends, 1000 psi WOG (125 psig W.S.P), carbon steel 2-piece body, 304 SS Ball, Full Port, reinforced PTFE seats, Lever operated, 2" and smaller.	A11	Apollo 89-100; Watts C-FBV-1
V-204	Threaded ends, type 316 SS body, ball and stem, two piece design, reinforced Teflon seats and seals. Lever actuated. 2" and smaller.	S11/S12	Apollo 76-100 Watts S-FBV-1
V-205	Threaded ends, 600 psi WOG, bronze body, two piece design, chrome plated brass ball, Teflon seat, lever operated. 2" and smaller	A10 A11	Apollo 70-100 Watts B-6000
V-206	Solder by solder union end, 2-piece, 400 psi WOG, bronze body, Electroplated nickel plated ball, Teflon seat, lever operated, 3"and smaller.	A10	Watts B-6001 or equal
V-208	Threaded x Socketweld ends, 1000 psi WOG, carbon steel 3-piece body. Reinforced Teflon seats and rings. Lever operated. 2" and smaller	A13	Apollo 83R-100 w/ Option 63 or equal
V-209	Carbon Steel 3-Piece ball valve. Plain Socket Weld Pipe Ends. Standard Reinforced TFE seats. Lever operated. 2" and smaller.	A14	Swagelok Series 60 (No Alternate)
V-210	Stainless Steel 3-Piece ball valve. Plain Socket Weld Pipe Ends. Standard RTFE seats. Stainless Steel Fasteners. Lever operated. 2" and smaller. Equipped with LO option for locking handle in open and closed position.	S14	Swagelok Series 60 (No Alternate)
V-211	3 Piece 316 "L" Stainless Steel Body, 316 SS Ball, Socket Weld Ends, RTFE Seats and Seal, Level Operated, 2" and smaller.	S11/S12 S13	Apollo 86A-200
V-212	PVC body and ball, 150 psig @ 73 °F, socket ends, "T" Handle, 4"and smaller	P1 P2	Chemtrol S45TB-V or equal

TAG NO.	DESCRIPTION	APPLICABLE PIPING SCH.	MANUFACTURER AND MODEL NO.
V-213	3 Piece 316 "L" Stainless Steel Body, 316 SS Ball, Threaded x Socket Weld Ends, RTFE Seats and Seal, Level Operated, 2" and smaller.	S11/S12	Apollo 85R-100-63 or equal
V-214	Flanged ends, ANSI Class 150, carbon steel body, 316 SS ball and stem, Firesafe (API 607), Teflon seat and seals. Lever operated. 4" and smaller.	A11 A13	Jamesbury 7150 Worcester AF51/52
V-215	Flanged ends, ANSI Class 150, carbon steel body, 316 SS ball and stem, Firesafe (API 607), Teflon seat and seals. Gear operated. 6" through 10"	A11 A13	Jamesbury 7150 Worcester AF51/52
V-216	Flanged ends, ANSI Class 150, 316 SS body, 316 SS ball and stem, Firesafe (API 607), Teflon seat and seals. Lever operated. 4" and smaller.	S11/S12 S13	Jamesbury 5150 Worcester AF51
V-217	Flanged ends, ANSI Class 150, 316 SS body, 316 SS ball and stem, Firesafe (API 607), Teflon seat and seals. Gear operated. 6" through 10"	S12 S13	Jamesbury 5150 Worcester AF51
V-218	Socketweld ends, 3000 psig rating, forged carbon steel, 3-piece, metal encapsulated seat, lever operated, 4" and smaller.	A14	Marwin Valves 3000 Series or equal
V-219	Socketweld ends, 3000 psig rating, 316 cast stainless steel, 3-piece, metal encapsulated seat, lever operated, 4" and smaller.	S14	Marwin Valves 3000 Series or equal
V-220	Sanitary Tri-clamp ends, type 316 "L" stainless steel body and ball, encapsulated Teflon seats, Teflon packing, seals and rings, lever operated. 1"through 4"	S4 S5	Tri Clover 5308-0818 or equal
V-221	Sanitary butt weld ends, type 316 stainless steel body and ball, encapsulated Teflon seats, Teflon packing, seals and rings, lever operated. 1"through 2"	S4 S5	Tri Clover 5309-0818 or equal

Butterfly Valves

TAG NO.	DESCRIPTION	APPLICABLE PIPING SCH.	MANUFACTURER AND MODEL NO.
V-300	Threaded lug type, 200 psig minimum rating, ductile or cast iron body, aluminum-bronze disc, stainless steel stem, BUNA "N" seat. Lever operated. 2" through 4"	A10 A11	Watts BF-03-121-25 Keystone 222 Dezurik BRSII
V-301	Threaded lug type, 200 psig minimum rating, ductile or cast iron body, aluminum bronze disc, stainless stem, BUNA "N" seat. Gear operated. 6" through 12"	A11	Watts BF-03-121-2G Keystone 222 Dezurik BRSII
V-302	Threaded lug type, 150 pound ductile or cast iron body, 316 SS disc, stainless steel stem, food grade BUNA "N" seat. Gear operated. 2" through 4"	A10	Bray Series 21 Keystone Figure 602
V-303	Wafer Type, 150 pound, Aluminum Body, 316 SS shaft and disc, Food-grade BUNA seats and seals	V2	DEMCO NE-S or equal
V-304	Wafer type 150 PVC body, Schedule 80 design, EPDM seat. Lever operated. 3"through 6"	P1 P2	Chemtrol W45BF-E-LH or equal
V-305	Wafer or lug type, high-performance, ANSI 150 psig, type 316 cast stainless steel body, forged 316 SS shaft and disc, reinforced PTFE seat and seals. Gear operated. 6" through 12"	S11 S12	Xomox Tufline 801/811 Jamesbury 815W WKM MB-1/MA-1
V-306	Wafer or lug type, high-performance, ANSI 150 psig, type 316 cast stainless steel body, forged 316 SS shaft and disc, reinforced PTFE seat and seals.. Lever operated. 2" thru 4"	S11 S12	Xomox Tufline 801/811 Jamesbury 815W WKM 5100
V-307	Wafer or lug type, 150 pound, type 316 cast stainless steel body, forged 316 SS shaft and disc, White BUNA-N seat and seals. Lever operated. 2" thru 4"	S11 S12	Bray Series 20/21 Demco NE-I (Sanitary)
V-310	Sanitary Tri-Clamp ends, type 316 "L" stainless steel body, disc and stem, EPDM seats. 1" through 4"	S4 S5	Alfa-Laval LKB w/multiposition handle
V-311	Sanitary Tri-Clamp ends, type 316 stainless steel body, disc and stem, Silicone seats, locking handle	S4	Lumaco Betterfly or equal
V-312	Sanitary Tri-Clamp ends, type 304 stainless steel body, disc and stem, Silicone seats, locking handle	S5	Lumaco Betterfly or equal
V-313	Threaded lug type, 150 pound ductile or cast iron body, 316 SS disc, stainless steel stem, food grade BUNA "N" seat. Gear operated. 4" through 10"	S11	DEMCO NE-C

V-314	Threaded lug type, 150 pound ductile or cast iron body, 316 SS disc, stainless steel stem, food grade BUNA “N” seat. Gear operated. Greater than 10"	S11	DEMCO NF-C
V-315	Threaded lug type, 150 pound ductile or cast iron body, 316 SS disc, stainless steel stem, food grade BUNA “N” seat. Gear operated. 2" through 12”	S11	Pratt Industrial BF Series

Gate Valves

TAG NO.	DESCRIPTION	APPLICABLE PIPING SCH.	MANUFACTURER AND MODEL NO.
V-400	Flanged ends, ANSI Class 125, cast iron body, bronze mounted, bolted bonnet, rising stem, OS&Y, solid wedge disc, non-asbestos packing, handwheel. 2 ½" and larger	A11	Stockham G-623 Jenkins 454J
V-401	Flanged ends, ANSI Class 150, cast steel body, 13% CR hard faced trim, bolted bonnet, rising stem, flexible wedge, OS&Y, screwed-in seat ring, non-asbestos packing and gaskets, Handwheel. 2"through 12"	A13	Crane 47XU-F Jenkins Figure J1009B8F
V-402	Flanged ends, ANSI Class 150, type 316 stainless steel body and trim, bolted bonnet, solid wedge, OS&Y, non-asbestos Teflon stem packing and bonnet gasket, Handwheel. 2 ½"through 12"	S11 S12 S13	Aloyco 117 Powell 2456
V-403	Flanged ends, ANSI Class 150, forged carbon steel body/bonnet, 13% CR hard faced trim, OS&Y, solid wedge, bolted bonnet, Handwheel. 3"and 4"	A13	Vogt 353 or equal
V-404	Flanged ends, ANSI Class 150, type 316 stainless steel body and trim, bolted bonnet, solid wedge, OS&Y, non-asbestos Teflon stem packing and bonnet gasket. Handwheel.2"and smaller	S11 S12 S13	Crane 117 Powell 2491
V-405	Socketweld ends, ANSI Class 800, forged carbon steel body, 13% CR hard faced trim, welded bonnet, OS&Y, Handwheel. 2" and smaller	A13	Vogt SW 2801 or equal
V-406	Threaded ends, ANSI Class 800, forged carbon steel body, 13% CR hard faced trim, welded bonnet, OS&Y, Handwheel. 2" and smaller	A13	Vogt 2801 or equal
V-407	Threaded x Socketweld ends, ANSI Class 800, forged carbon steel body, 13% CR hard faced trim, welded bonnet, OS&Y, Handwheel. 2" and smaller	A13	Vogt TSW2801 or equal
V-408	Threaded ends, ANSI Class 150, type 316 stainless steel body and trim, bolted bonnet, OS&Y, solid wedge, non-asbestos Teflon stem packing and bonnet gasket, Handwheel. 2"and smaller	S11 S12	Aloyco 110 Powell 2490
V-409	Threaded ends, ANSI Class 150, type 316 stainless steel body and trim, bolted bonnet, OS&Y, solid wedge, 3/4" hose connection, Handwheel. 2" and smaller		Jenkins 372 Powell 503H

TAG NO.	DESCRIPTION	APPLICABLE PIPING SCH.	MANUFACTURER AND MODEL NO.
V-410	Threaded ends, ANSI Class 125, bronze body, bonnet, disc and stem, screwed bonnet, rising stem, solid wedge, Handwheel. 2" and smaller	A10 A11	Crane 428 (1700 Series) Stockham B-100; Powell 500 Kitz 24
V-411	Socket weld ends, ANSI Class 150, type 316 stainless steel body and trim, bolted bonnet, solid wedge, OS&Y, non-asbestos Teflon stem packing and bonnet gaskets, Handwheel. 2”and smaller	S13	Aloyco 114 Powell 2491 or equal
V-412	Butt weld ends, ANSI Class 150, type 316 stainless steel body and trim, bolted bonnet, solid wedge, OS&Y, non-asbestos Teflon stem packing and bonnet gaskets, Handwheel. 3” through 6”.	S13	Powell 2456 (B.W.E.)
V-413	Socketweld ends, ANSI Class 800, forged 316 SS body, welded bonnet, OS&Y, Handwheel. 2" and smaller	S13 S14	Vogt SW2801F8M or equal
V-491	Class 150 flanged knife gate, full port, epoxy coated cast iron body with 316 SS lining, EPDM resilient seat, handwheel operator 2”-24”	D1 P1 S12, CP1	Red Valve Series G, DeZurik Series L Orbinox Series 10
V-492	Class 150 flanged knife gate, v-orifice gate, epoxy coated cast iron body with 316 SS lining, EPDM resilient seat, handwheel operator 2”-24”	D2 P1 S12, CP1	Red Valve Series G, DeZurik Series L Orbinox Series 20
V-493	Class 150 flanged knife gate, full port, epoxy coated cast iron body with 316 SS lining, EPDM resilient seat, chainwheel operated, 2”-24”	D1 P1 S12, CP1	Red Valve Series G, DeZurik Series L Orbinox Series 10
V-494	Class 150 fully lugged knife gate, full port, cast 316 SS body, knife and seat ring, EPDM resilient seat, PTFE/graphite packing, bonneted, handwheel operated, 2”-24”	S11 S15	Orbinox Series 20 DeZurik Vaas 740

Globe Valves

TAG NO.	DESCRIPTION	APPLICABLE PIPING SCH.	MANUFACTURER AND MODEL NO.
V-500	Flanged ends, ANIS Class 125, cast iron body, bronze mounted, bolted bonnet, rising stem, OS&Y, renewable seat and disc, non-asbestos packing, Handwheel. 2"thru 10"	A10 A11	Crane 351 Stockham G-512 Powell 241
V-501	Flanged ends, ANSI Class 150, cast steel body, bolted bonnet, rising stem OS&Y, 13% CR hard faced trim, non-asbestos packing, handwheel. 2" through 12"	A13	Crane 143XU Jenkins J1040B2 Walworth 5275F-UT
V-502	Flanged ends, ANSI Class 150, type 316 stainless steel body and trim, bolted bonnet, plug disc, non-asbestos Teflon stem packing and bonnet gasket, Handwheel. 1/2"thru 10"	S11 S12 S13	Aloyco 317 Powell 2475(1/2" to4") Powell 2629 (6" to 10")
V-503	Threaded ends, ANSI Class 150, bronze body, bonnet and stem, union bonnet, rising stem, non-asbestos packing, renewable PTFE disc, Handwheel. 2"and smaller	A10 A11	Crane 7 TF Stockham B-22-T
V-504	Threaded ends, ANSI Class 150, type 316 cast stainless steel body and trim, bolted bonnet, plug disc, PTFE packing and bonnet gasket, Handwheel. 2"and smaller	S11 S12	Aloyco 310 Powell 2474
V-507	Socketweld ends, ANSI Class 800, forged carbon steel body, 13% CR hard faced trim, OS&Y, bolted bonnet, non-asbestos packing, Handwheel. 2"and smaller	A13 A14	Vogt SW 12141 or equal
V-508	Threaded ends, ANSI Class 800, forged carbon steel body, 13% CR hard faced trim, OS&Y, bolted bonnet, non-asbestos packing, Handwheel. 2"and smaller	A13	Vogt 12141 or equal
V-509	Threaded x socketweld inlet, ANSI Class 800, forged carbon steel body, 13% CR hard faced trim, OS&Y, bolted bonnet, non-asbestos packing, Handwheel. 2"and smaller	A13	Vogt TSW 12141 or equal
V-511	Socketweld ends, ANSI Class 800, type 316 stainless steel body and trim, OS&Y, bolted bonnet, non-asbestos packing, Handwheel. 2"and smaller	S13 S14	Vogt SW 12501 or equal

TAG NO.	DESCRIPTION	APPLICABLE PIPING SCH.	MANUFACTURER AND MODEL NO.
V-512	Threaded ends, ANSI Class 800, type 316 stainless steel body and trim, OS&Y, bolted bonnet, non-asbestos packing, Handwheel. 2”and smaller	S13	Vogt 12501 or equal
V-513	Threaded outlet x socketweld inlet, ANSI Class 800, type 316 stainless steel body and trim, OS&Y, bolted bonnet, non-asbestos packing, Handwheel. 2”and smaller	S13	Vogt TSW 12501 or equal
V-514	Butt weld ends, ANSI Class 150, type 316 stainless steel body and trim, bolted bonnet, solid wedge, OS&Y, non-asbestos Teflon stem packing and bonnet gaskets, Handwheel. 3” through 6”.	S13	Powell 2475 (B.W.E.) Powell 2629 (B.W.E.) >6”

Check Valves

TAG NO.	DESCRIPTION	APPLICABLE PIPING SCH.	MANUFACTURER AND MODEL NO.
V-601	Threaded Ends, Ball Cone Check, 400 psi WOG, Bronze Construction, SS Spring, 3" and smaller	A10 A11	Conbraco 61-100
V-602	Threaded Ends, Ball Cone Check, 400 psi WOG, 316 SS Construction, SS Spring, 2" and smaller	S11 S12	Conbraco 62-100
V-603	Socket weld Ends, ANSI Class 800, Forged Carbon Steel Body, 13% CR hard faced trim, horizontal piston/ball check with screwed bonnet. 2" and smaller	A13	Vogt SW9091
V-604	Threaded ends, ANSI Class 150, type 316 stainless steel body and trim, swing check, bolted bonnet, PTFE gasket. 2" and smaller	S11 S12	Aloyco 370 Powell 2341 (Class 200)
V-605	Threaded ends, spring/disc check, type 316 stainless steel body and spring. 2" and smaller	S11 S12	Check-All "CON" (MNPT) Durabla "SCV" (FNPT)
V-606	Socket weld Ends, ANSI Class 800, Forged 316 L Stainless Steel Body, with 316 SS trim, horizontal/vertical up swing check with bolted bonnet. 2" and smaller	S13	Vogt SWS718
V-607	Socket weld Ends, ANSI Class 800, Forged Carbon Steel Body, 13% CR hard faced trim, horizontal/vertical up swing check with bolted bonnet. 2" and smaller	A13	Vogt SWS701
V-608	Solder Joint Ends, ANSI Class 125, Bronze construction, swing type, 3" and smaller	A10	Nibco S-413 or equal
V-609	Threaded Ends, ANSI Class 800, Forged Carbon Steel Body, 13% CR hard faced trim, horizontal piston/ball check with bolted bonnet. 2" and smaller	A13	Vogt 701
V-610	Aluminum body and disc, bolted bonnet, horizontal swing, food-grade seat and gasket, grooved ends for Victaulic couplings. 2" and larger	V2	Foodline Piping Products VCHK-300
V-611	Flanged Ends, ANSI Class 125, Spring Check, Cast Iron body, bronze trim/internals, 2 ½" and larger	A10	Durabla Model GLC
V-614	Flanged ends, ANSI Class 150, ball check, PFA-lined steel body, PFA-lined ductile iron flanges, PTFE ball. 2" through 4"		Xomox/Tufline 072 NeoTecha KR

TAG NO.	DESCRIPTION	APPLICABLE PIPING SCH.	MANUFACTURER AND MODEL NO.
V-615	Flanged ends, ANSI Class 125, cast iron body, bronze mounted, bolted bonnet, horizontal swing check, bronze disc, non-asbestos gaskets. 2" or larger	A10 A11	Crane 373 Stockham G-931 Powell 559 Kitz 78
V-616	Flanged ends, ANSI Class 150, cast steel body, 13% CR hard faced carbon steel disc, bolted bonnet, horizontal swing, non-asbestos gaskets. 2" through 12"	A13	Crane 147-XU Stockham 1842 Powell 1561 FE Walworth 5341F-UT
V-617	Wafer check, ANSI Class 150, carbon steel body and plates, metal-to-metal seat, serrated RF end connections, Sizes 2" and larger	A10 A11	Marlin Duo-Chek II or equal
V-618	Flanged ends, ANSI Class 150, type 316 stainless steel body and trim, swing check, bolted bonnet, non-asbestos gaskets. 2" through 12"	S11 S12 S13	Aloyco 377 Kitz 150UOAM Powell 2342,2633
V-619	Wafer check, ANSI Class 150, 316 stainless steel body and plates, metal-to-metal seat, serrated RF end connections, Sizes 2" and larger	S11 S12 S13	Duo-Chek or equal
~~V-620~~	~~Flange insert type, ANSI Class 150, type 316 stainless steel body, spring and trim, metal to metal seats. 2" and larger~~	~~S11~~ ~~S12~~ ~~S13~~ ~~S14~~	~~Check-All FIV or equal~~
V-621	Flanged ends, ANSI Class 150, type 316 stainless steel body, spring and trim. 2" and larger	S11 S12 S13	Check-All HVFD or equal
V-622	Socketweld ends, type 316 stainless steel body and trim, swing check, bolted bonnet, PTFE gasket. 2" and smaller	S13	Aloyco 374 Powell 2341
V-623	Socketweld ends (solvent), 150 psi @ 73 °F, PVC Body, Tru-Union ball check, 4" and smaller	P1 P2	Chemtrol U45BC-V or equal
V-625	Sanitary Tri-Clamp Ends, "Y" ball style check valve, EPDM ball, 316 SS body, 1 ½" through 3"	S4 S5	Alfa-Laval 45BYMP or equal
V-626	Sanitary butt weld ends, "Y" ball style check valve, EPDM ball, 316SS body, 1 ½" through 3"	S4 S5	Alfa-Laval L45BYWWW or equal
V-627	Sanitary Tri-Clamped Ends Air Blow Check Valve 304 SS Construction, quick connect adapter	S4 S5	Alfa-Laval 62-326 with Type "A" or "C" quick connect adapter
V-628	Sanitary Tri-Clamped Ends, Use only in vertical, Use optional self-draining bodies for horizontal installation, Disc Check Valve, Type 316 Stainless Steel Body, Spring and Disc, Teflon Gaskets. 1" through 3"	S4 S5	Alfa-Laval B45MP

Plug Valves

TAG NO.	DESCRIPTION	APPLICABLE PIPING SCH.	MANUFACTURER AND MODEL NO.
V-700	Flanged or Threaded End Connections, all iron construction (semi-steel), UL Listed for Gas Service, lubricated plug valve, 3" and smaller FNPT, 4" and 6" 125 pound FF Flange.	A11	North American Manufacturing 1824K
V-701	Flanged ends, ANSI Class 150, type 316 stainless steel, ASTM A351 GR CF8M body and plug, PTFE sleeve, fire safe (API 607), static ground, Lever operator. 1/2" through 3"	S11 S12	Xomox Tufline Figure 067 Durco G4Z411
V-702	Threaded ends, ANSI Class 150, type 316 stainless steel, ASTM A351 GR CF8M body and plug, PTFE sleeve, fire safe (API 607), static ground, Lever operator. 1/2" through 2"	S11 S12	Xomox Tufline Figure 066 Durco GZ412
V-703	Flanged ends, 200 psig CWP, gray iron body, plug and stem, lubricated, two-bolt gland type, short pattern. wrench operated. 1"through 4"	A11	Nordstrom Figure 143
V-704	Flanged ends, 200 psig CWP, gray iron body, plug, and stem, lubricated, two-bolt gland type, short pattern, gear operated. 6"and larger	A11	Nordstrom Figure 149
V-710	Two-way plug, sanitary Tri-clamp ends, type 316 stainless steel body and trim, EPDM packing. Lever operated. 1"through 4"	S4 S5	Koltek AH52
V-712	Three-way plug, sanitary Tri-clamp ends, type 316 stainless steel body and trim, EPDM packing, Lever operated. 1"through 4"	S4 S5	Koltek AH53

THE DENNIS GROUP, LLC

PLANNING ▲ ENGINEERING ▲ CONSTRUCTION MANAGEMENT

Specification for
Oil-Free Compressed Air System

Section 19800A

Project No. 4730

TLI ~ Westport, MA

THE DENNIS GROUP, LLC

PLANNING ▲ ENGINEERING ▲ CONSTRUCTION MANAGEMENT

1537 MAIN STREET
SPRINGFIELD, MASSACHUSETTS 01103
413.787.1785 ▲ FAX 413.787.1786

Issue	Date	Description	By	Approved	Section 19800A
1.0	09/20/16	FOR BID	JN	AS	

Unless notification and/or comments are received from client within two weeks after issue date, all documentation including drawings, specifications, and studies submitted to client shall be considered approved as released.

SPECIFICATION FOR OIL-FREE COMPRESSED AIR SYSTEM
SECTION 19800A

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1. GENERAL
2. DESIGN REQUIREMENTS
3. TRAINING
4. TESTING
5. SHIPPING AND HANDLING
6. DOCUMENTATION/SUBMITTALS

1. GENERAL

1.1 SCOPE

1.1.1 This specification defines the requirements for the design, fabrication, performance, and testing of an oil-free compressed air system to be installed in a mechanical room in a food processing facility in Westport, MA.

1.1.2 Vendor is to supply a complete compressed air system and associated instrumentation and controls. As a minimum, the compressed air system shall consist of the following properly sized equipment:

1.1.2.1 Compressor – One (1) single-stage “oil-free" variable-speed rotary tooth compressor with sufficient capacity to deliver 125 SCFM at 110 psig at the output of the after filter. Unit shall be supplied by and cooled with air from the ambient conditions in section 2.2.

1.1.2.2 Air receiver – One (1) Air receiver with a minimum capacity of at least 300 gallons with all required accessories. Receiver shall be ASME pressure rated for 150 PSIG MAWP.

1.1.2.3 Pre-Filter – One (1) dryer-mounted prefilter. Vendor shall determine filtration level to provide adequate protection of dryer.

1.1.2.4 Air dryer – One (1) compressed air dryer of heatless desiccant type, rated at 150 SCFM at 115 PSIG or 110% of air compressor flow capacity at 115 PSIG, whichever is greater, and pressure dew point of -40°F at design conditions.

1.1.2.5 Post filter – One (1) particulate post filter including factory mounted differential pressure gauges. Filter shall be sized for less than 2 PSID pressure drop at actual air compressor capacity.

1.1.2.6 Electronic Flow Meter (OPTION) – One (1) electronic thermal mass flow meter rated for the full capacity and pressure of the air compressor.

1.1.2.7 Condensate drains – 120 VAC Electronic “zero-loss” automatic condensate drain pots at all drain connections with continuous water flow. Vendor shall also provide a “zero-loss” drain for the air receiver.

1.2 APPLICATION

1.2.1 The compressed air system will be installed indoors at a food processing facility.

1.2.2 The Customer’s usage of compressed air is defined as “Non-contact with product but there is a high risk it may potentially do so.” The required compressed air purity is defined in terms of ISO8573-1 as listed below:

Contaminant	Air Quality Class	Concentration or Dew Point
Particulate	1	20,000 0.1-micron particles per m^3 400 0.5-micron particles per m^3 10 1-micron particles per m^3
Water	2	-40°F PDP
Total Oil (Liquid, Aerosol, & Vapor)	0	Oil-Free

1.3 ITEM NUMBERS

The following numbers shall be used for the major pieces of equipment to be quoted as base quotation:

Item No.	Description	Quantity
AC-1	Air Compressor – Variable Speed	1
AR-1	Air Receiver	1
AD-1	Heatless Desiccant Dryer	1
AF-1	Prefilter	1
AF-2	Particulate Post Filter	1
FM-1	Flow Meter (Option)	1

1.4 CODES AND STANDARDS

The latest editions of the following standards, codes or specifications shall, to the extent specified herein, form a part of this specification:

1.4.1 ASME Section VIII Division 1 for pressure-bearing components such as aftercoolers and dryer vessels

1.4.2 CAGI/PNEUROP PN2CPTC2, Acceptance Test Code for Electrically Driven Packaged Displacement Air Compressors (Annex C to ISO 1217)

1.4.3 ISO 8573-1:2010 Compressed Air Part 1: Contaminants and Purity Classes

1.4.4 OSHA Safety and Health Standards including, but not limited to, CFR 29 1910.263

1.4.5 FM – Factory Mutual

1.4.6 ASHRAE – American Society of Heating, Refrigeration and Air Conditioning Engineers, Inc.

1.4.7 NEMA – National Electrical Manufacturers' Association

1.4.8 NEMA 250 – Enclosures for Electrical Equipment (1000 Volts Maximum)

1.4.9 NEC – National Electric Code

1.4.10 UL – Underwriter Laboratories Inc.

1.4.11 Applicable NFPA standards

1.4.12 All applicable local codes and regulations

1.5 CONFLICTING REQUIREMENTS

The Vendor is responsible for conformance with this specification. Unless a specific exception to this specification is submitted with the proposal, it is assumed that each component, construction and design rigidly conforms to this specification. All conflicts between the requirements of this specification and standards shall be referred to the Purchaser for clarification before proceeding with the manufacture of the equipment.

1.6 UTILITIES

1.6.1 Electric power is available at 480 VAC, 3 phase, 60 Hz.

1.6.2 Electric power is available at 120 VAC, single phase, 60 Hz.

1.6.3 Electric power is available at 24 VAC, single phase, 60 Hz.

1.6.4 If additional Utilities are required for equipment operation, Vendor shall notify and confirm availability with Engineer/Owner during the bid process.

2. DESIGN REQUIREMENTS

2.1 GENERAL DESIGN

2.1.1 The compressed air system will be installed indoors in a mechanical area. It shall be designed and constructed to operate satisfactorily under the specified conditions for 24 hours/day, 7 days/week, 365 days/year with periodic scheduled shutdown for preventative maintenance.

2.1.2 The compressed air system and auxiliaries shall be designed for rapid economical maintenance. Any components requiring maintenance access shall be easily accessible.

2.1.3 All rotating and reciprocating components shall be properly guarded to meet or exceed OSHA requirements. All equipment shall be provided with suitable ladders, access platforms and protective handrails/toeboards in accordance with OSHA requirements.

2.1.4 Noise levels from each piece of equipment shall not exceed 80 DBA at 3 feet. A noise enclosure should be quoted as an option if these conditions cannot be met. Vendor should include amount of attenuation offered. Vendor shall clearly state the amount of noise generated by the equipment under all conditions in the proposal. Include base noise level and attenuated noise level.

2.1.5 All piping shall be made of a non-corrosive material.

2.2 OPERATING CONDITIONS

2.2.1 Operation Summary

The compressed air system shall be designed to operate under the following conditions:

	Requirements:
Discharge Temperature Compressor Outlet	By Vendor – Provide in Proposal
Flow Rate to Dryer (Nominal/Rated SCFM)	By Vendor – Provide in Proposal
Flow Rate from Dryer (Nominal/Rated SCFM)	By Vendor – Provide in Proposal
Cooling Air Supply Max Temperature	104°F DB / 77°F WB
Cooling Air Flow Required	By Vendor – Provide in Proposal
Air Press. Drop Across Air Dryer & Filters	By Vendor – Provide in Proposal
Actual Flow Rate (Output from Post Filter)	125 CFM @ 110 psig*
Pressure Dew Point (Output from Post Filter)	-40°F @ 115 psig
Suction Condition	104°F DB / 77°F WB
Maximum Ambient Temperature	104°F DB / 77°F WB
Elevation Above Sea Level	140 FT

*: Vendor to state maximum actual flow rate and pressure available from compressor quoted.

2.3 COMPONENT SPECIFICATION

2.3.1 One (1) Air Compressor: AC-1

2.3.1.1 Single-stage, air-cooled, oil-free rotary tooth air compressor rated at a minimum of 125 SCFM at 125 psig discharge pressure (or as required for 110 psig system delivery). The compressor shall have the following features and components:

2.3.1.1.1 Vendor proposal shall include compressor performance data based on System Operating Conditions in Section 2.2.

2.3.1.1.2 Fully integrated frequency converter for variable speed operation.

2.3.1.1.3 Compressor shall be sized to continuously deliver 125 SCFM at 110 PSIG at the output from the post filter during peak purge loss of heatless desiccant dryer (AD-1). Sizing AC-1 for the "average" purge loss of AD-1 is not acceptable.

2.3.1.1.4 Inlet air filter comprising replaceable cartridge rated at SAE fine efficiency rating or engineering approved equal. Provide factory mounted inlet filter differential pressure indicator.

2.3.1.1.5 Complete lube oil system with cooler, main and auxiliary pumps, and all valves, controls, and piping. Lubricating oil shall be rated for a minimum operating life of 8,700 hours.

2.3.1.1.6 Aftercooler designed, fabricated and stamped in accordance with ASME pressure code, protected with ASME/NB safety relief valve.

2.3.1.1.7 Full modulating controls for standalone operation.

2.3.1.1.8 Intercooler and aftercooler condensate trap shall be electronic 120 VAC "zero-loss" drain valves installed and prewired by factory. Provide manual bypasses for all water drains.

2.3.1.1.9 Integral or externally mounted outlet check valve.

2.3.1.1.10 ANSI rated connection for compressed air. All other connections shall be NPT.

2.3.1.1.11 Base frame with integrally mounted drip tray and acoustically insulated enclosure per 2.1.4.

2.3.1.2 Compressor Control Panel

2.3.1.2.1 Control panel should include a microprocessor or PLC-based control system and an operator interface from which to control and monitor the major machine functions. All interface with, input from, and output to operators will be through this control panel.

2.3.1.2.2 Compressor shall have local interface display for fault analysis, startup, setup and pressure and temperature indicators.

2.3.1.2.3 Digital input/output signals shall be 24 VDC devices.

2.3.1.2.4 Analog input/output signals shall be 4-20 mA current loop devices.

2.3.1.2.5 It is intended that compressor and control panel be skid-mounted.

2.3.1.2.6 Compressor shall be equipped with high air discharge temperature shutdown switch, as well as controls for any other operating conditions that could damage the compressor or affect the air delivery to the processing equipment.

2.3.1.2.7 Compressor operation shall be controlled via the air discharge pressure.

2.3.2 One (1) Heatless Desiccant Dryer (Dew point of -40°F): AD-1

2.3.2.1 Provide with a mounted prefilter (AF-1) with a differential pressure gauge. Vendor shall determine filtration level to provide adequate protection of dryer.

2.3.2.2 Prefilter condensate traps shall be 120VAC electronic "zero-loss" drain valves, automatically draining the collected moisture separated from the air in the filter vessel.

2.3.2.3 Vendor proposal shall list the peak and average purge air flow loss of AD-1. Vendor shall also provide the duration of purge and regeneration.

2.3.2.4 The heatless desiccant air dryer shall be furnished to provide a minimum of 150 SCFM at 115 PSIG or 110% of air compressor flow capacity at 115 PSIG, whichever is greater, and pressure dew point of -40°F at design conditions.

2.3.2.4.1 Provide NEMA 4 control panel with display showing the vessel in service, dew point and vessel in regeneration status.

2.3.2.4.2 Dryer shall have a cool air sweep function to reduce the humidity spike as vessels enter service after regeneration.

2.3.2.4.3 Provide with digital dew point readout and dew point demand controller to initiate regeneration.

2.3.2.4.4 Dryer vessels shall be ASME code stamped for 150 psig minimum design pressure and fitted with internal media supports, media fill port at top, manhole, and ASME/NB safety relief valve.

2.3.2.5 Provide with a mounted post filter (AF-2) with differential pressure gauge. The air filter shall provide the ISO filtration level listed in section 1.2.2 at the rated flow and pressure of AD-1. Filter shall be sized for less than 2 PSID pressure drop at actual air compressor or air dryer capacity, whichever is greater.

2.3.2.6 The dryer vessels, filters and control panel shall be skid mounted.

2.3.2.7 ANSI rated connection for compressed air. All other connections shall be NPT.

2.3.3 One (1) Air Receiver: AR-1

2.3.3.1 AR-1 shall have a minimum capacity of 300 gallons and shall be ASME code stamped for 150 psig MAWP.

2.3.3.2 Air receivers shall be constructed of carbon steel. Each receiver shall be arranged for vertical orientation and provided with supports. The receiver shall not exceed 8'-0" in overall height or 36" in diameter.

2.3.3.3 The air connections on the receivers shall be ANSI flanged. Air inlet and outlet locations/orientation on the receiver will be determined during the submittal process at no additional cost to the Owner. Receiver shall have no less than three (3) 1" NPT connections for instrumentation and one (1) 1" drain connection for Vendor-supplied "zero-loss" drain.

2.3.3.4 The receiver shall be equipped with a 6" dial pressure gauge (0-200 psig), complete with pipe nipple and shutoff valve. Vendor shall supply an adequately sized relief valve set for 150 psig.

2.3.3.5 All internal surfaces are to be painted with FDA-approved food-grade epoxy enamel paint suitable for incidental food contact. All external surfaces are to be painted with white enamel paint. As an alternate, a galvanized vessel is acceptable.

2.3.3.6 Condensate traps: An electronic 120 VAC "zero-loss" drain valve shall be provided with the receiver to automatically drain the collected moisture separated from the air in the vessel.

2.3.4 One (1) Electronic Flow Meter: FM-1 (OPTION)

2.3.4.1 The vendor shall supply one stainless steel thermal mass compressed air flow meter designed to measure the rated flow and pressure of AC-1. The meter will be located within the same utility room as AC-1 and shall be rated for the System Operating Conditions in section 2.2.

2.3.4.2 Meter shall be factory-calibrated for system design conditions.

2.3.4.3 Meter shall include a display for read-out of current compressed air flow in SCFM.

2.3.4.4 The meter's measurement deviation shall be no greater than 2.0%.

2.4 ELECTRICAL/CONTROLS

2.4.1 The electrical classification for areas is as follows:

2.4.1.1 Mechanical Area: Non-Hazardous

2.4.1.2 All control panels, instruments, and vendor supply equipment to be rated NEMA 12 minimum.

2.4.2 All motors shall be 460V/3-phase/60Hz NEMA Premium efficiency, 1.15 SF, with ODP or TEFC enclosures as required by the area in which they will be installed.

2.4.3 All inverter duty motors shall have a motor winding insulation value of 1600 volts or greater.

2.4.4 All control panels shall be designed in compliance with the 2011 NEC Article 409 Industrial Control Panels. Particular attention shall be paid to section 409.110 “Markings”. The system fault current capacity at the incoming line terminal in this facility shall be 65KAIC at 480/277 volts and 22KAIC at 208/120 volts. The industrial control panel SCCR rating shall meet or exceed the available fault current energy at the line terminal of the equipment.

2.4.5 Each component of the system requiring 480V/3-phase/60Hz power will be supplied with an externally mounted power disconnect by Electrical Contractor. Vendor is to recommend proper sizing.

2.4.6 General Control Components Description

2.4.6.1 All control power derived from control power transformer provided by Vendor.

2.4.6.2 No operator assistance shall be required other than pressing a start or stop push button.

2.4.6.3 Control panels shall have exterior-mounted disconnects and shall be pre-wired and pre-tested prior to shipment.

2.4.6.4 As a minimum, each operator control panel shall have:

2.4.6.4.1 System start push-button

2.4.6.4.2 System stop push-button

2.4.6.4.3 System emergency stop button

2.4.6.4.4 Reset push-button and control power pilot light

2.4.6.4.5 Motor starters for compressor and lube oil system

2.4.6.4.6 Hand/Off/Auto switches for each device.

2.4.6.5 Alarm indications, as well as an alarm circuit with an alarm silence and reset button, shall be included. Vendor to indicate alarms furnished in proposal, and indicate alarm purpose and function. Include vibration probe quantity and location.

2.4.6.6 The Vendor must supply all devices and instruments required for stand-alone control of the compressed air system.

2.4.6.7 The control panels shall be UL listed.

2.4.7 Compressor Sequencer

2.4.7.1 Not Applicable

3. TRAINING

Training shall consist of both maintenance training and operator training. All training will take place on site at the Owner’s operating facility onsite. The Vendor is to state the number of days required for complete training along with the pricing estimate. Training personnel will be required to have flexible hours to meet the operating hours of the facility.

3.1 MAINTENANCE TRAINING

3.1.1 Maintenance training is required as a service from the Vendor for these pieces of equipment.

3.1.2 The Vendor shall provide personnel well versed in training and technically competent to train the maintenance staff onsite.

3.1.3 Maintenance training shall include, but is not limited to, the following:

3.1.3.1 Major components maintenance

3.1.3.2 Schedules for preventive maintenance, lubrication, and grease

3.1.3.3 Common troubleshooting

3.1.3.4 Maintenance operators shall be trained in the complete operation of the equipment and understand the operating limits of the unit

3.1.3.5 Vendor shall provide all necessary operating and maintenance manuals for the referenced piece of equipment.

3.2 OPERATOR TRAINING

3.2.1 Operator training as well as maintenance training is required as a service from the Vendor for these pieces of equipment.

3.2.2 The Vendor shall provide personnel well versed in training and technically competent to train the operations staff onsite.

3.2.3 Operator training shall include, but is not limited to, the following:

3.2.3.1 Complete overview of the equipment

3.2.3.2 Technical discussion on the operation of the unit, including start-up and shutdown

3.2.3.3 Emergency procedures

3.2.3.4 Safety precautions

3.2.3.5 Manual and automatic operation modes

3.2.3.6 Vendor's training personnel shall be equipped with the necessary tools such as overheads, handouts, self-tests, etc., for the duration of training.

4. TESTING (OPTION)

A control system checkout is required at the Vendor's shop prior to shipment. The compressed air system shall be guaranteed to provide sufficient compressed air based on the requirements presented in section 2 of this specification. A one-hour witnessed test run shall be performed to check the compressed air system operation. Prior to any such checkout or testing, the Vendor shall coordinate with the Owner to enable the Owner and any representative appointed by the Owner to be present during any such checkout or testing.

In the event the Owner or Owner's representative chooses not to attend the performance test, the Vendor shall submit documentation of performance test of actual machines prior to shipment.

5. SHIPPING AND HANDLING

The system components shall be properly crated for shipment to prevent damage. The units shall be pre-assembled as much as shipping allows.

A single shipping manifest shall be provided that itemizes each shipping container. The containers shall be marked with the corresponding number and have a packing list that describes the items within the container.

All shipping lists shall be made available to the Owner prior to shipping.

5.1 SHIPPING TAGS

The unit and all loose bags and cartons shall be tagged with the following information as a minimum:

5.1.1 Purchaser Name and Project Number

5.1.2 Purchase Order Number

5.1.3 Specification Reference and Item Number.

5.2 NOZZLE PROTECTION & CRATING

Flanged openings shall be protected and made waterproof with bolted full-size steel, plywood, or plastic covers with sponge rubber gaskets. Threaded openings shall be fitted with caps or plugs of the same materials as the equipment part and sealed with suitable sealant. The compressor and dryer shall be skid-mounted for shipment and supplied with suitable attachments for anchoring. It must be possible to rig all components through a 4'-0" W x 7'-8" H opening.

6. DOCUMENTATION/SUBMITTALS

6.1 PROPOSAL

The Vendor shall include the following information with the proposal as a minimum:

6.1.1 Cut sheet of major components detailing manufacturer, dimensions, weight, connections, etc.

6.1.2 Utility requirements:

6.1.2.1 Electrical: V/Hz/phase/KVA (hp)

6.1.2.2 Ambient conditions required: Wet bulb/dry bulb temperatures

6.1.2.3 Cooling air supply flow rate, pressure, pressure drop, and heat load to be rejected.

6.1.3 CAGI data sheet for compressor

6.1.4 Performance curve of compressor and dryer at System Operating Conditions given in Section 2.2.

6.1.5 List the peak and average purge air flow loss of AD-1. Vendor shall also provide the duration of purge and regeneration.

6.1.6 Expected equipment noise level

6.1.7 Milestone schedule indicating documentation preparation and fabrication/delivery timetable

6.1.8 Listing of any components to be provided that are not specifically requested in this specification

6.2 AFTER PURCHASE

6.2.1 WARRANTY

6.2.1.1 The compressor and associated equipment supplied by Vendor shall be under warranty by the manufacturer for a minimum of one year from the first date of use. The warranty shall be for all defective labor, materials and equipment. The warranty shall cover all shipping costs for replacement unit and/or parts.

6.2.2 The Vendor shall confirm the following information within two weeks ARO:

6.2.2.1 Overall dimensional drawings indicating (L x W x H) for all components. Please note that all equipment furnished must fit through a []' W x []' H unfinished wall opening.

6.2.2.2 Connection type, size and location.

6.2.2.3 Operating and controls features.

6.2.2.4 Approximate weight.

6.2.2.5 Utility requirements:

- Power Consumption: hp, V, phase, Amps
- Filters: Clean pressure drop (psid)

6.2.3 Submittals

6.2.3.1 Shop Drawings after Purchase

Vendor shall submit to Purchaser for informational purposes three (3) black line prints and a data file in AutoCAD 2013 (.dwg) format for compressors, receivers and dryer to facilitate layout. The initial submittal shall precede fabrication unless otherwise agreed upon with Purchaser. The submittal procedure shall be repeated until all corrections have been made to Purchaser's satisfaction.

After fabrication and inspection, Vendor shall furnish three (3) sets of reproducible "As Built" drawings for Purchaser's record. The Vendor shall supply a data file in AutoCAD 2013 (.dwg) format for compressors, receivers, and dryer to facilitate layout.

6.2.3.2 Operation and Maintenance Manuals

The Vendor shall furnish two (2) copies of operation and service manuals, submitted to the Owner prior to shipment of equipment. Each manual shall incorporate a full set of "as-built" drawings. An electronic copy in Adobe PDF format is also to be included.

During the training session another four (4) IOM shall be provided to maintenance staff.

6.2.3.3 Spare Parts List

The Vendor shall provide a Recommended Spare Part List that comprises required components for five years of operation from final acceptance of equipment by Customer. This list shall detail:

- Prices
- Delivery times
- Brand name and article number of all components.

IF IN DOUBT, ASK!
IF ANY ASPECT OF THIS DOCUMENT IS NOT CLEAR, PLEASE SEEK CLARIFICATION FROM THE PROJECT MANAGER

+ + END OF SECTION 19800A + +