SECTION 15050
BASIC MATERIALS AND METHODS

PART 1 – GENERAL

1.01 DESCRIPTION
A. THIS SECTION DEFINES THE GENERAL PROVISIONS WHICH ARE COMMON TO ALL SECTIONS OF DIVISION 15.
B. FURNISH ALL LABOR, MATERIALS, TOOLS AND EQUIPMENT; FABRICATE, AND INSTALL COMPLETE AND IN PLACE, ALL THE FIXTURES, EQUIPMENT AND SYSTEMS AS SHOWN ON THE DRAWINGS, SPECIFIED HEREIN, AND AS REQUIRED FOR A COMPLETE AND OPERABLE INSTALLATION.
C. THE CONTRACTOR SHALL PAY FOR ALL PERMITS, FEES AND CHARGES REQUIRED FOR THIS WORK.

1.02 DRAWINGS AND SPECIFICATIONS
A. DESIGN DRAWINGS: THE DRAWINGS ACCOMPANYING THESE SPECIFICATIONS ARE GENERALLY DIAGRAMMATIC. ANY CHANGES FROM THE GENERAL ROUTING SHOWN ON THE DRAWINGS SUCH AS OFFSETS, BENDS OR CHANGES IN ELEVATION DUE TO COORDINATION WITH THE WORK OF OTHER TRADES AND THE BUILDING CONSTRUCTION SHALL BE DONE WITHOUT ADDITIONAL CHARGE TO THE OWNER.
B. SHOP DRAWINGS: SHOP DRAWINGS SHALL BE SUBMITTED FOR EACH AND EVERY ITEM OF MANUFACTURED MATERIAL AND EQUIPMENT.
C. RECORD DRAWINGS:
1. THE CONTRACTOR SHALL KEEP AN ACCURATE RECORD OF ALL CONCEALED PIPES, DUCTS, VALVES, CONDUITS, ETC. IN ADDITION, HE SHALL RECORD, IN A SPECIAL SET OF CONTRACT DRAWINGS, ALL CHANGES AND DEVIATIONS FROM THE DESIGN DRAWINGS THAT OCCURRED DURING THE INSTALLATION OF THE WORK.
2. AT COMPLETION OF THE JOB, THESE DRAWINGS ILLUSTRATING CHANGES OR DEVIATIONS SHOWING BY DIMENSION AND LOCATION THE EXACT POSITION OF ALL CONCEALED PIPES, VALVES, ETC., SHALL BE DELIVERED TO THE ARCHITECT/ENGINEER.
D. SPECIFICATIONS – REFER TO THE FOLLOWING GENERAL SPECIFICATIONS AS THEY ARE A PART OF ALL SECTIONS OF DIVISION 15.
1. DIVISION 1 – GENERAL REQUIREMENTS; REGARDING BUT NOT LIMITED TO: ALTERATION PROJECT PROCEDURES, SUBMITTALS, CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS, CLEANING DURING CONSTRUCTION, AND PRODUCT OPTIONS AND SUBSTITUTIONS.
2. DIVISION 2 – SITEWORK; REGARDING BUT NOT LIMITED TO: SELECTIVE DEMOLITION, EARTHWORK, EXCAVATION AND BACKFILLING.
3. DIVISION 3 – CONCRETE; REGARDING BUT NOT LIMITED TO: CAST-IN-PLACE CONCRETE, FORMWORK AND REINFORCEMENT.
E. IT IS THE INTENTION OF THIS SPECIFICATION SECTION THAT ALL ITEMS OF MATERIAL AND EQUIPMENT HEREIN SPECIFIED OR SHOWN ON THE DRAWINGS FOR EACH SECTION SHALL BE FURNISHED BY THE CONTRACTOR FOR THAT SECTION, AND INSTALLED BY THAT CONTRACTOR, UNLESS IT IS SPECIFICALLY STATED IN THE SECTION SPECIFICATION, OR SHOWN ON THE DRAWINGS, THAT ANY ITEM OF MATERIAL OR EQUIPMENT IS TO BE FURNISHED BY THE CONTRACTOR OF A SECTION AND INSTALLED BY THE CONTRACTORS OF OTHER SECTIONS, OR FURNISHED BY OTHER SECTION CONTRACTORS AND INSTALLED BY THE CONTRACTOR OF THE SECTION.

1.03 CHASES AND RECESSES
A. ALL CHASES, RECESSES AND MAJOR MASONRY OPENINGS AS SHOWN ON THE DRAWINGS WILL BE PROVIDED BY THE ARCHITECTURAL TRADES.

1.04 LUBRICATION
A. PRIOR TO TESTING, ALL EQUIPMENT SHALL BE PROPERLY LUBRICATED IN ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS. ONE SET OF TOOLS NECESSARY FOR LUBRICATION SHALL BE DELIVERED TO OWNER. AFTER PROPER LUBRICATING, ALL UNITS SHALL BE STARTED AND SUCCESSFULLY OPERATED BY THE CONTRACTOR IN THE PRESENCE OF THE ARCHITECT AND/OR ENGINEER.
B. EXCEPT FOR SMALL ELECTRICAL MOTORS WHICH UNDER NEMA STANDARDS ARE EQUIPPED WITH LIFETIME LUBRICATION, ALL BEARINGS ON LARGE MOTORS AND MECHANICAL EQUIPMENT SHALL BE EQUIPPED WITH LUBRICATOR FITTINGS EXTENDED TO THE EXTERIOR OF THE HOUSING.

1.05 POWER WIRING
A. MOTORS UP TO AND INCLUDING 1/3 H.P. SHALL BE 120 VOLT, 60 HERTZ, SINGLE PHASE AND MOTORS 1/2 H.P. AND LARGER SHALL BE BUILT FOR 460 VOLTS, 60 HERTZ, THREE PHASE; UNLESS OTHERWISE INDICATED PER DRAWING SCHEDULES, PLANS AND DETAILS.
B. THE ELECTRICAL CONTRACTOR SHALL PROVIDE COMBINATION MAGNETIC STARTERS WITH H.O.A. SWITCH FOR EACH ITEM OF THREE PHASE EQUIPMENT AND UNFUSED DISCONNECTS FOR EACH ITEM OF SINGLE PHASE EQUIPMENT, EXCEPT WHERE STARTERS ARE FURNISHED AS A PART OF WIRED EQUIPMENT.
C. THE ELECTRICAL CONTRACTOR SHALL DO ALL POWER WIRING INCLUDING CONNECTIONS TO THE MOTORS FURNISHED BY THE CONTRACTORS OF THIS DIVISION.
D. REFER TO SECTION 15900 FOR THE WIRING TO BE PERFORMED BY THE TEMPERATURE CONTROL CONTRACTOR AND THE ELECTRICAL CONTRACTOR AS THEY RELATE TO TEMPERATURE CONTROLS.

1.06 FLUSHING AND TESTING
A. ALL NEW WATER PIPING SYSTEMS SHALL BE FLUSHED USING WATER.
B. ALL OPEN SYSTEMS, CONDENSATE DRAINAGE, ETC., SHALL BE TESTED WITH WATER, AT A HEAD OF FIVE (5) FEET ABOVE FINISHED FLOOR OR GRADE.
C. ALL PIPING SYSTEMS SHALL BE TESTED. IF LEAKS OCCUR, THE PIPE OR FITTING SHALL BE REMOVED AND REPLACED AND THE SYSTEM RETESTED.
D. PIPING SHALL NOT BE BACKFILLED OR INSULATED UNTIL TESTED. TESTS MUST BE OBSERVED BY THE ARCHITECT/ENGINEER.

1.07 GUARANTEE
A. IN ADDITION TO GUARANTEE PROVISIONS OF THE GENERAL CONDITIONS, ALL REFRIGERANT COMPRESSORS SHALL HAVE AN EXTENDED WARRANTY OF FOUR (4) YEARS BEYOND THE FIRST YEAR FOR REPLACEMENT OF PARTS AND LABOR TO REPAIR.

1.08 SUPPORTS
A. CONTRACTOR SHALL FURNISH AND INSTALL ALL ANGLES, CHANNELS, PLATES, OR BEAMS REQUIRED FOR THE SUPPORT OF THE EQUIPMENT OF EACH SECTION, WHETHER SHOWN ON THE DRAWINGS OR NOT.
B. FURNISH AND INSTALL ALL RODS, AUXILIARY STRUCTURAL STEEL FRAMES, ATTACHMENTS, BRACKETS AND PLATFORMS REQUIRED FOR SUPPORT OF EQUIPMENT FROM OVERHEAD CONSTRUCTION FOR THE RESPECTIVE SECTION.
C. VERTICAL PIPE RISERS SHALL BE ANCHORED MIDWAY OF THEIR HEIGHT, AND SHALL BE SUPPORTED AT EACH FLOOR BY 1-1/2" X 1/4" BAR CLAMPS ATTACHED TO PIPES AND RESTING ON THE FLOOR CONSTRUCTION.
D. HORIZONTAL PIPING SHALL BE SUPPORTED BY ADJUSTABLE, WROUGHT, CLEVIS TYPE HANGERS, FEE & MASON, ELCEN, OR CRAWFORD. WHERE PARALLEL PIPES ARE INSTALLED AT THE SAME LEVEL, PROVIDE TRAPEZE HANGERS; THE VARIOUS TRADES SHALL COOPERATE IN THE JOINT USE OF SUCH HANGERS. PIPE HANGERS SHALL BE OF SIZE TO SUIT PIPE COVERING PROTECTION SADDLES.
E. PIPES SHALL BE SUPPORTED ONLY FROM THE STRUCTURAL MEMBERS OF THE BUILDING. THEY SHALL BE SUPPORTED AT SUCH INTERVALS AS WILL PREVENT SAGGING, AND SO THAT EXCESSIVE LOADS WILL NOT BE PLACED UPON ANY ONE SUPPORT. SPACING AND ROD SIZES SHALL BE AS FOLLOWS:

PIPE SIZE	MAXIMUM SPACING	MINIMUM ROD SIZE
1/2"	6'-0" AND AT ALL TURNS	3/8"
3/4", 1"	7'-0" AND AT ALL TURNS	3/8"
1-1/4", 1-1/2", 2"	9'-0" AND AT ALL TURNS	3/8"
2-1/2", 3"	10'-0" AND AT ALL TURNS	1/2"

F. HANGER RODS SHALL BE FULL-DIAMETER STEEL WITH THREADED ENDS FOR FIELD CUTTING AND THREAD EXTENDING AS REQUIRED. WHERE THREADED ROD IS SHORTER THAN 6" IT SHALL BE DIPPED IN RUST RESISTANT PAINT PRIOR TO INSTALLATION.
G. AT THE CONTRACTOR'S OPTION, HANGER RODS SHALL BE CONTINUOUS THREADED STEEL WITH GALVANIZED FINISH.
H. HANGER RODS SHALL NOT BE BENT OR ALTERED IN ANY MATTER AND SHALL BE INSTALLED PLUMB AND TRUE. THE ROD SUPPORTING THE HANGER SHALL BE NO LONGER THAN 1/2" BELOW THE LOWER NUT.
I. ALTERNATE WIRE ROPE HANGER SYSTEM (CONTRACTOR OPTION)
A. GENERAL: AT THE OPTION OF THE CONTRACTOR AND IF APPROVED BY AUTHORITIES HAVING JURISDICTION, WIRE ROPE SYSTEM FOR DUCTWORK MAY BE USED IN LIEU OF CONVENTIONAL HANGERS. HANGER SYSTEMS SHALL BE APPROVED IN ACCORDANCE WITH SMACNA HVAC DUCT CONSTRUCTION STANDARDS (HVAC-DCS) WITH A MINIMUM LOAD SAFETY FACTOR OF 5:1.
B. WIRE ROPE HANGER SYSTEM AND LOCKING DEVICES TO BE ONE OF THE FOLLOWING MANUFACTURED SYSTEMS:
1. DUCTMATE INDUSTRIES, CHARLEROI, PA-CLUTCHER MECHANICAL HANGER SYSTEM WITH ZINC COATED STEEL AIRCRAFT QUALITY ROPE (FIELD CUT TO LENGTH). LOCKING DEVICE TO BE CLUTCHER CAST ZINC HOUSING WITH STAINLESS STEEL SPRINGS.
2. GRIPPLE, INC., BATAVIA, IL-HANG FAST WIRE ROPE HANGING SYSTEM WITH ZINC GALVANIZED STEEL WIRE ROPE. STANDARD LENGTHS OF 5, 10, 15, AND 30 FT WITH A PERFORATED LOOP AT ONE END. LOCKING DEVICE TO BE GRIPPLE ZINC HOUSING WITH STAINLESS STEEL SPRINGS.
3. ERICO, INC., SOLON, OH-CADDY SPEED LINK UNIVERSAL SUPPORT SYSTEM WITH GALVANIZED STEEL AIRCRAFT QUALITY WIRE ROPE. AVAILABLE IN 3.3, 6.6 9.9, 16.4, AND 32.8 FT. LENGTHS WITH FACTORY HOOK AT ONE END. LOCKING DEVICE TO BE ERICO STAINLESS STEEL HOUSING WITH ALL STEEL LOCKING DEVICE.

1.09 EQUIPMENT IDENTIFICATION
A. ALL MECHANICAL EQUIPMENT SHALL BE CLEARLY IDENTIFIED WITH 2" HIGH STENCILED LETTERS, PAINTED ON THE EQUIPMENT (I.E. "RTU-1"). THIS INCLUDES EXTERIOR EQUIPMENT WHERE THE PAINT SHALL BE WEATHER RESISTANT.

PART 2 – PRODUCTS

2.01 DESCRIPTION
A. THIS PART DEFINES THE PIPE AND FITTINGS TO BE USED FOR ALL SERVICES INSTALLED UNDER DIVISION 15.
B. REFER TO THE DRAWING LEGENDS AND SYMBOL SCHEDULES FOR DEFINITION OF THE DESIGNATORS USED IN THE FOLLOWING SPECIFICATION.

2.02 PIPE AND FITTINGS RELATED TO SECTION 15800
A. CONDENSATE DRAIN PIPING:
1. PIPING SHALL BE SCHEDULE 40, ASTM 53 OR ASTM 120, GALVANIZED PIPE AND FITTINGS.
2. POLYVINYL CHLORIDE (PVC), SCHEDULE 40, PIPE AND FITTINGS, ASTM D2665; WITH PRIMER AND SOLVENT CEMENT JOINTS MAY BE USED IF ACCEPTABLE TO LOCAL AUTHORITIES HAVING JURISDICTION.
A. NO CELLULAR CORE OR FOAMED PIPING WILL BE PERMITTED.

2.03 ACCESS DOORS
A. PROVIDE 24" X 24" ACCESS DOORS MANUFACTURED AS AN INTEGRAL UNIT COMPLETE WITH ALL PARTS AND READY FOR INSTALLATION AS MANUFACTURED BY ONE OF THE FOLLOWING:
1. BIRMINGHAM ORNAMENTAL.
2. KARP.
3. MILORD, DIVISION OF INRYCO.
B. PROVIDE FLUSH PANEL DOORS, EXCEPT PROVIDE RECESSED PANEL DOORS WHERE ACCESS DOORS OCCUR IN PLASTER OR ACOUSTICAL TILE GLUED TO GYPSUM LATH.
C. PROVIDE UL "B" LABELED UNITS WHERE ACCESS DOORS OCCUR IN HOUR RATED-CONSTRUCTION.
D. PROVIDE SCREW DRIVER OPERATED CAM LOCKS OF NUMBER REQUIRED BY SIZE OF DOOR.
E. PROVIDE ANCHORAGE APPROPRIATE TO CONSTRUCTION.

PART 3 – EXECUTION

3.01 CUTTING AND PATCHING
A. ALL CUTTING, REPAIRING, FITTING AND REFINISHING OF IN PLACE CONSTRUCTION REQUIRED FOR THE INSTALLATION OF THE WORK OF A SECTION SHALL BE DONE AT THE EXPENSE OF THE CONTRACTOR OF THE SECTION, EXCEPT AS SPECIFICALLY SHOWN ON THE DRAWINGS OR HEREINAFTER SPECIFIED.
B. WORK SHALL BE PERFORMED BY CRAFTSMEN SKILLED IN THEIR RESPECTIVE TRADES.

3.02 OPERATING INSTRUCTIONS
A. THE CONTRACTOR FOR THE SECTION SHALL, WHEN DIRECTED BY THE ARCHITECT/ENGINEER, PROVIDE THE OWNER WITH A COMPETENT TRADESMAN TO INSTRUCT THE OWNER'S PERSONNEL IN THE PROPER OPERATION AND MAINTENANCE OF THE EQUIPMENT HE HAS INSTALLED.
B. PROVIDE COPIES OF OPERATING INSTRUCTIONS, EQUIPMENT MANUALS AND CONTROL DIAGRAMS PER DIVISION-1 CONTRACT CLOSE-OUT.
C. CONTROL DIAGRAMS AND WRITTEN INSTRUCTIONS SHALL BE FRAMED UNDER GLASS.

3.03 CODES AND STANDARDS
A. PIPING AND APPURTENANCES INSTALLED UNDER THIS DIVISION OF THE SPECIFICATIONS SHALL COMPLY WITH THE REQUIREMENTS OF THE FOLLOWING, WHERE APPLICABLE:
ANSI CODES FOR PRESSURE PIPING
ANSI STANDARDS FOR PIPE AND FITTINGS
B. IN ADDITION, THE WORK SHALL CONFORM TO ALL APPLICABLE STATE AND LOCAL CODES AND ORDINANCES.

3.04 WORK CLEANLINESS
A. CONTRACTOR SHALL KEEP STORED MATERIALS, STORAGE AREAS, AND INSTALLED SYSTEMS FREE OF DIRT AND DEBRIS.
B. ALL EXPOSED ENDS OF INCOMPLETE OR UNCOVERED WORK SHALL BE TEMPORARILY PLUGGED AS EACH PHASE OF PIPING WORK AND DUCTWORK IS COMPLETED.
C. PIPING, DUCTWORK AND EQUIPMENT TO BE PAINTED (EXPOSED TO VIEW IN COMPLETED STRUCTURE) SHALL BE CLEANED BY REMOVING RUST, PLASTER, AND DIRT BY WIRE BRUSHING. GREASE, OIL AND SIMILAR MATERIALS SHALL BE REMOVED BY WIPING WITH CLEAN RAGS AND SUITABLE SOLVENTS.
D. MOTORS, PUMPS, FANS AND OTHER ITEMS WITH FACTORY FINISH SHALL BE REMOVED OF GREASE AND OIL AND LEAVE WITH ALL SURFACES CLEANED AND POLISHED.

3.05 ARRANGEMENT AND ALIGNMENT
A. ALL PIPING SHALL BE ARRANGED AND ALIGNED IN ACCORDANCE WITH THE DRAWINGS. ELEVATIONS AS GIVEN MUST BE HELD. FLOOR ELEVATIONS WHERE GIVEN ARE TO HIGH POINTS OF FLOOR. DIMENSIONS MUST BE HELD AS CLOSELY AS POSSIBLE. ALL DIMENSIONS ARE TO BE FIELD CHECKED FOR ACCURACY BEFORE PIPE IS FABRICATED.
B. INSTALL ALL PIPING STRAIGHT AND DIRECT AS POSSIBLE, GENERALLY FORMING RIGHT ANGLES WITH, OR RUNNING PARALLEL WITH, WALLS OR ADJACENT PIPING. ALL PIPING SHALL BE NEATLY SPACED WITH RISERS AND DROPS RUNNING PLUMB AND TRUE.
C. RUN PIPING IN WALL CHASES, PIPE SHAFTS, HUNG CEILINGS, RECESSES, ETC., WHERE SAME ARE PROVIDED. DO NOT RUN SERVICE PIPING IN FLOOR SLAB FILL UNLESS SPECIFICALLY SO NOTED ON DRAWINGS. PIPING SHALL NOT BE COVERED OR CLOSED UNTIL TESTING IS COMPLETED.
D. DRAWINGS, IN GENERAL, ARE MADE TO SCALE. ALL DIMENSIONS SHALL BE CHECKED IN THE FIELD BY THE CONTRACTOR BEFORE FINAL CONNECTIONS ARE FABRICATED
E. DRAWINGS FOR SMALL PIPING ARE, IN GENERAL, DIAGRAMMATIC AND THE EXACT LOCATION OF THESE LINES SHALL BE DETERMINED BY THE CONTRACTOR FROM FIELD MEASUREMENTS TAKEN BY HIM. THE ACTUAL ARRANGEMENT OF THE SMALL SIZE PIPING, WHEN ERECTED, SHALL FOLLOW THE GENERAL LOCATIONS SHOWN ON THE DRAWINGS AS FAR AS PRACTICABLE. THE INSTALLATION MADE IN THIS WAY SHALL BE NEAT IN APPEARANCE AND CONVENIENT TO OPERATE, AND SHALL PROVIDE FOR PROPER EXPANSION AND DRAINAGE.
F. INSTALLATION OF PIPING SYSTEMS SHALL BE COORDINATED WITH OTHER WORK TO AVOID BLOCKING BUILDING OPENINGS, LIGHT FIXTURES, ETC. PIPING SHALL NOT INTERFERE WITH ACCESS TO VALVES OR EQUIPMENT AND SHALL NOT OBSTRUCT PASSAGEWAYS. PIPING SHALL BE INSTALLED TO PROVIDE WORKING CLEARANCE FOR OPERATION AND MAINTENANCE.

3.06 MODIFICATIONS AND INTERFERENCES
A. CONTRACTOR SHALL CAREFULLY CHECK AND BECOME FAMILIAR WITH THE ARCHITECTURAL, STRUCTURAL, ELECTRICAL AND ALL MECHANICAL DRAWINGS AND DETAILS, AND MAKE NOTE OF ALL LOCATIONS WHERE WALLS, PARTITIONS, CEILINGS, STRUCTURAL MEMBERS, ETC., ARE CALLED FOR TO BE FURRED OR CLOSED-IN.
B. MODIFICATIONS TO THE ARRANGEMENT OF THE PIPING SYSTEM MAY BE REQUIRED TO SUIT STRUCTURAL CONDITIONS, OR TO AVOID INTERFERENCE WITH THE WORK OF OTHER TRADES. CONTRACTOR SHALL FURNISH ALL OFFSETS, ADDITIONAL FITTINGS, ETC., AS REQUIRED TO MEET INSTALLATION CONDITIONS WHETHER DETAILED ON THE DRAWINGS OR NOT.
C. ANY QUESTIONABLE INFORMATION IN THE SPECIFICATIONS OR ON THE DRAWINGS SHALL BE CALLED TO THE ATTENTION OF THE ARCHITECT AND/OR ENGINEER FOR CLARIFICATION BEFORE PROCEEDING WITH FABRICATION OR ERECTION OF THE PARTS AFFECTED. IF, IN THE OPINION OF THE CONTRACTOR, ANY ADDITIONAL DETAIL DRAWINGS ARE NECESSARY, HE SHALL PREPARE THEM AT HIS OWN EXPENSE, TOGETHER WITH ALL BILLS OF MATERIAL.

3.07 PIPE CLEARANCES
A. INSTALL PIPING TO PROVIDE MINIMUM CLEARANCE OF AT LEAST ONE INCH BETWEEN EXTREME PROJECTIONS OF PIPING, FLANGES, FITTINGS, VALVES, ALLOWING FOR INSULATION, PIPE EXPANSION AND THE LIKE.

3.08 DRAINAGE AND VENTING
A. WHERE LINES ARE PURPOSELY PITCHED FOR DRAINAGE OR VENTING, AN ACCURATE GRADE SHALL BE MAINTAINED. LINES SHALL BE SUPPORTED IN SUCH A MANNER AS TO PREVENT DEFLECTION OF THE PIPING SUFFICIENT TO POCKET THE LINES.

3.09 PIPE AND FITTINGS
A. ALL PIPE SIZES REFERRED TO IN THESE SECTIONS SHOULD BE INTERPRETED AS IPS (IRON PIPE SIZE) UNLESS SPECIFICALLY DESIGNATED OTHERWISE, SUCH AS "O.D." FOR TUBING.
B. FULL LENGTHS OF PIPE SHALL BE USED WHEREVER POSSIBLE. SHORT LENGTHS OF PIPE WITH COUPLINGS WILL NOT BE PERMITTED.
C. ALL PIPE SHALL BE CUT TO EXACT MEASUREMENT TO BE INSTALLED WITHOUT FORCING (EXCEPT WHERE COLD SPRINGING IS SPECIFICALLY CALLED FOR). AFTER CUTTING, ENDS SHALL BE REAMED AND CLEANED TO ELIMINATE FOREIGN MATTER.
D. CUTTING OR OTHER WEAKENING OF THE BUILDING STRUCTURE TO FACILITATE PIPING INSTALLATION WILL NOT BE PERMITTED.
E. ALL PIPE AND FITTINGS SHALL BE MARKED BY THE MANUFACTURER IN ACCORDANCE WITH THE MARKING SECTIONS OF THE STANDARDS TO WHICH REFERENCE IS MADE IN THIS SPECIFICATION MANUAL. STANDARD MARKING SYSTEM FOR VALVES, FITTINGS, FLANGES AND UNIONS OF THE MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY.
F. MAKE ALL CHANGES IN SIZE AND DIRECTION OF PIPING WITH FITTINGS. DO NOT USE BENDS, MITER FITTINGS, FACE OR FLUSH BUSHINGS, STREET ELBOWS OR FIELD-FABRICATED REDUCERS.
G. CLOSE NIPPLES SHALL NOT BE PERMITTED; USE ONLY SHOULDER NIPPLES. SHOULDER NIPPLE WITH SHOULDER LENGTH LESS THAN 1-1/2" SHALL BE OF HEAVY WALL PIPE; NIPPLES HAVING SHOULDER LENGTH OF 1-1/2" OR GREATER SHALL BE OF SAME SCHEDULE AS CONNECTED PIPE.

3.10 REDUCING FITTINGS
A. USE ECCENTRIC REDUCING FITTINGS OR ECCENTRIC REDUCING COUPLINGS WHERE REQUIRED TO PREVENT POCKETING OF LIQUID.

3.11 CONNECTIONS TO EQUIPMENT AND SPECIALTIES
A. PIPING SYSTEMS SHALL BE INSTALLED COMPLETE TO EQUIPMENT CONNECTIONS OR TERMINAL USE POINTS.
B. PIPING SHALL BE FABRICATED CAREFULLY AND ACCURATELY TO MEET CONNECTIONS ON EQUIPMENT WITHOUT SPRINGING THE PIPE.
C. PROVIDE UNIONS OR FLANGES AT ALL PIPING CONNECTIONS TO EQUIPMENT, ETC., AT ALL LOCATIONS AS SHOWN ON THE DRAWINGS, AND GENERALLY AS REQUIRED TO DISCONNECT PIPING FROM EQUIPMENT AND APPARATUS. ARRANGE CONNECTIONS SO THAT THE EQUIPMENT SERVED MAY BE REMOVED WITHOUT DISTURBING THE PIPING. WHERE VALVES SERVE TO ISOLATE EQUIPMENT OR SPECIALTIES, THE UNIONS OR FLANGES SHALL BE LOCATED BETWEEN VALVES AND EQUIPMENT OR SPECIALTIES. UNIONS SHALL GENERALLY BE USED FOR PIPE SIZES 2" AND SMALLER AND FLANGES FOR PIPE SIZES 2-1/2" AND LARGER.

3.12 DIELECTRIC CONNECTIONS
A. PROVIDE DIELECTRIC FITTINGS BETWEEN FERROUS AND COPPER PIPING.

3.13 PIPE SLEEVES
A. PROVIDE ALL PIPE OPENINGS THROUGH WALLS, PARTITIONS AND SLABS WITH SLEEVES HAVING AN INTERNAL DIAMETER AT LEAST 1" LARGER THAN THE OUTSIDE DIAMETER OF THE PIPE FOR UNINSULATED LINES OR OF THE THICKNESS OF THE INSULATION FOR INSULATED SERVICES.
B. INSTALL SLEEVES THROUGH INTERIOR WALLS AND PARTITIONS FLUSH WITH FINISHED SURFACES; SLEEVES THROUGH OUTSIDE WALLS ARE TO PROJECT 1/2" ON OUTSIDE OF THE FINISHED WALL. FLOOR SLEEVES ARE TO PROJECT 2" ABOVE FINISHED FLOORS.
C. SET SLEEVES IN PLACE BEFORE POURING CONCRETE OR SECURELY FASTEN AND GROUT IN WITH CEMENT.
D. SLEEVE CONSTRUCTION:
1. INTERIOR PARTITIONS: NO. 22 GAUGE GALVANIZED SHEET STEEL WITH SOLDERED JOINT.
2. INTERIOR MASONRY WALLS AND FLOORS: SCHEDULE 40 GALVANIZED STEEL PIPE.
E. INTERIOR WALLS: FILL THE SPACE BETWEEN OUTSIDE OF PIPE OR INSULATION AND THE INSIDE OF THE SLEEVE OR FRAMED OPENING WITH FIBER GLASS.
F. EXTERIOR WALLS: PACK WITH OAKUM, SEAL WITH LEAD AND WATERTIGHT MASTIC OR ASPHALT.
G. PROVIDE ESCUTCHEONS ON BOTH SIDES OF THE PENETRATION THROUGH THE STRUCTURE FOR ALL PIPES EXPOSED TO VIEW PASSING THROUGH WALLS, FLOORS, CEILINGS, AND PARTITIONS, WHETHER OR NOT INSULATED. FOR PIPES PASSING THROUGH FLOORS, ESCUTCHEONS SHALL FIT OVER THE SLEEVES.
H. FIRE-STOPPING SHALL BE PROVIDED AT ALL OPENINGS TO INCLUDE THE ANNULAR SPACE AROUND DUCTS, PIPING, CONDUITS, ETC. AND SHALL BE U.L. RATED MATERIALS AND METHODS PER THE ARCHITECTURAL SPECIFICATION SECTIONS. SUBMIT THROUGH PENETRATION PROTECTION SYSTEMS FOR ALL FIRE RATED ASSEMBLIES TO THE LOCAL AUTHORITIES AND THE ARCHITECT/ENGINEER FOR REVIEW.

3.14 SCREWED JOINTS
A. CUT THREADS FULL AND CLEAN WITH SHARP DIES.
B. REAM ENDS OF PIPE AFTER THREADING AND BEFORE ASSEMBLY, TO REMOVE BURRS.
C. LEAVE NOT MORE THAN THREE PIPE THREADS EXPOSED AT EACH CONNECTION.
D. USE JOINT SEALANT OR TAPE ON MALE THREADS ONLY.

SECTION 15250

INSULATION

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. SECTION 15050, "BASIC MATERIALS AND METHODS", APPLIES TO THE WORK SPECIFIED IN THIS SECTION.

PART 2 – PRODUCTS

2.01 INSULATION – COLD PIPING

A. INSULATION FOR DRAINAGE PIPING SYSTEMS (COOLING COIL CONDENSATE) SHALL BE 1" THICK GLASS FIBER.

B. GLASS FIBER INSULATION SHALL BE UL RATED, NONCOMBUSTIBLE, SECTIONAL PIPE INSULATION OF HEAVY DENSITY GLASS FIBER WITH ALL SERVICE JACKET HAVING A COMPOSITE RATING NOT TO EXCEED 25 FLAME SPREAD AND 50 SMOKE DEVELOPED. INSULATION SHALL BE AS SUPPLIED BY CERTAINTEED, OWENS/CORNING, OR KNAUF.

C. EVERY PACKAGE OR STANDARD CONTAINER OF COVERING, ADHESIVE AND COATING DELIVERED AT THE BUILDING FOR USE MUST HAVE THE MANUFACTURER'S STAMP OR LABEL ATTACHED, GIVING NAME OF MANUFACTURER AND BRAND.

D. JACKET LAPS AND BUTT STRIPS SHALL BE SELF-SEALING TYPE.

E. PROVIDE HALF ROUND GALVANIZED 18 GAUGE SHEET METAL HANGER SHIELDS. SHIELDS SHALL BE 12" LONG FOR PIPE SIZES UP TO 3", 18" FOR PIPE SIZES OVER 3" AND UP TO 6", AND 24" LONG FOR PIPE SIZES OVER 6".

2.02 REFRIGERANT – SUCTION PIPING

A. INSULATION SHALL BE 1/2" THICKNESS OF FLEXIBLE FOAMED PLASTIC.

2.03 INSULATION – AIR SYSTEM COMPONENTS

A. INSULATION SHALL BE [illegible] THICKNESS OF SEMI-RIGID BOARD, 3 PCF DENSITY, FOIL REINFORCED KRAFT FACING.

B. BOARD SHALL BE UL RATED, NONCOMBUSTIBLE GLASS FIBER, 25 FLAME SPREAD, 50 SMOKE DEVELOPED, AS MANUFACTURED BY CERTAINTEED, OWENS/CORNING AND KNAUF.

C. EVERY PACKAGE OR STANDARD CONTAINER OF COVERING, ADHESIVE AND COATING DELIVERED AT THE BUILDING FOR USE MUST HAVE THE MANUFACTURER'S STAMP OR LABEL ATTACHED, GIVING NAME OF MANUFACTURER AND BRAND.

2.04 INSULATION – DUCTWORK

A. INSULATION SHALL BE 2" THICKNESS OF FLEXIBLE INSULATION, 1 PCF DENSITY, FOIL REINFORCED KRAFT FACING, HAVING A COMPOSITE RATING NOT TO EXCEED 25 FLAME SPREAD AND 50 SMOKE DEVELOPED. INSULATION SHALL BE AS SUPPLIED BY OWENS/CORNING, CERTAINTEED OR KNAUF.

B. EVERY PACKAGE OR STANDARD CONTAINER OF COVERING, ADHESIVE AND COATING DELIVERED AT THE BUILDING FOR USE MUST HAVE THE MANUFACTURER'S STAMP OR LABEL ATTACHED, GIVING NAME OF MANUFACTURER AND BRAND.

C. REFER TO SECTION 15800 FOR LINED DUCTS.

PART 3 – EXECUTION

3.01 INSULATED PIPING SYSTEMS

A. PROVIDE INSULATION ON PIPING SYSTEMS AS FOLLOWS:
1. REFRIGERANT SUCTION PIPING.
2. CONDENSATE DRAIN PIPING, AS PER COLD PIPING.

3.02 PIPE HANGER SHIELDS

A. EACH CONTRACTOR INSTALLING HOT OR COLD PIPING SHALL SET THE PIPING UP ON WOOD BLOCKING AT EACH HANGER.

B. THE WOOD BLOCKING THICKNESS SHALL BE THE SAME AS THAT OF THE PIPE INSULATION.

C. THIS CONTRACTOR SHALL REPLACE THE WOOD BLOCKING WITH A FULL SECTION OF HEAVY DENSITY PIPE INSULATION AND A HANGER SHIELD.

3.03 INSTALLATION, GENERAL – COLD PIPING

A. ALL SURFACES MUST BE CLEAN AND DRY AND PIPE LINES TESTED BEFORE APPLYING PIPE INSULATION. IF COVERING IS APPLIED AT THE PIPE COVERER'S OPTION PRIOR TO TESTING, AND DEFECTS IN COVERED WORK APPEAR AT OR BEFORE THE TIME OF INSPECTION AND TESTS, THE COVERING MUST BE REMOVED, AND AFTER DEFECTS HAVE BEEN CORRECTED, MUST BE REINSTALLED WITHOUT EXPENSE TO THE OWNER.

B. COVERING SHALL BE DRY WHEN INSTALLED AND BEFORE AND DURING THE APPLICATION OF ANY FINISH. SURFACES OF COVERING SHALL BE SMOOTH, EVEN AND SUBSTANTIALLY FLUSH WITH ADJACENT PIPE COVERING.

C. MANUFACTURER'S APPLICATION INSTRUCTIONS FOR ALL MATERIALS SHALL BE FOLLOWED.

D. INSULATION SHALL NOT BE APPLIED OVER PIPE PLUGS, BLIND NIPPLES, NAMEPLATES, INSPECTION STAMPS, OR IDENTIFICATION TAGS.
E. INSULATOR MUST EXERCISE EXTREME CAUTION IN THE STORAGE OF FLAMMABLE ADHESIVES AND DURING THEIR APPLICATION.

3.04 INSULATION OF PIPING – COLD PIPING

A. BUTT JOINTS FIRMLY TOGETHER. OVERLAP SEAM SHALL BE DOWNWARD ON SIDE OF PIPE, SEALED TIGHT AND SMOOTH. STAPLE OVERLAP ON 6" SPACING.

B. INSTALL BUTT STRIPS WITH 2" OVERLAP DOWNWARD STAPLE END OF OVERLAP.

C. INSULATION SHALL BE FASTENED WITH 9/16" FLARE TYPE STAPLES.

D. SEAL OVER STAPLES WITH VAPOR-BARRIER MASTIC, CHILDERS NO. CP-32 (WHITE).

3.05 INSULATION OF FITTINGS, VALVES, ETC. – COLD PIPING

A. VALVES AND FITTINGS 3" AND LESS SHALL BE INSULATED BY WRAPPING WITH PRE-CUT FIBER GLASS BLANKET INSULATION AND SECURING WITH JUTE TWINE. A PREFORMED, MOLDED PVC JACKET COVER SHALL BE INSTALLED OVER THE BLANKET INSULATION. THE JACKET SHALL BE FASTENED WITH STAINLESS STEEL TACKS AND BUTT STRIPS OVERLAPPING ONTO THE ADJOINING PIPE INSULATION. A VAPOR-BARRIER MASTIC, CHILDERS NO. CP-32 (WHITE), SHALL BE USED TO SEAL THE JACKET THROAT AND JACKET TO THE PIPE INSULATION PRIOR TO TACK AND BUTT STRIP INSTALLATION.

B. FLANGES SHALL BE INSULATED WITH NESTING PIPE INSULATION. THE FLANGE INSULATION SHALL EXTEND NOT LESS THAN 2" OVER THE ADJACENT PIPE INSULATION ON EACH SIDE OF THE FLANGE. INSULATION ON PIPES IS TO BE STOPPED SHORT OF FLANGES TO PERMIT REMOVAL OF FLANGE BOLTS. THE FLANGE INSULATION SHALL BE APPLIED IN SUCH A MANNER THAT IT MAY BE REMOVED WITHOUT DAMAGE TO THE ADJACENT PIPE INSULATION.

C. UNIONS SHALL BE COVERED WITH NESTING PIPE INSULATION AS SPECIFIED FOR FLANGES.

D. STRAINERS SHALL BE INSULATED AS DESCRIBED ABOVE FOR SMALL VALVES AND FITTINGS. CLEAN-OUT PLUGS SHALL BE LEFT ACCESSIBLE SO THAT THE INSULATION IS NOT DAMAGED BY THEIR REMOVAL.

E. WHEREVER NESTING SIZE SECTIONAL COVERING IS USED, IT SHALL BE CUT TO FIT IN A NEAT WORKMANLIKE MANNER WITH ALL JOINTS BUTTED AND HELD SECURELY IN PLACE WITH JUTE OR GLASS FIBER TWINE. JOINTS SHALL BE POINTED UP WITH INSULATING CEMENT PRIOR TO RECEIVING SURFACE FINISH.

F. FITTINGS, VALVES, STRAINERS, WHERE VAPOR-BARRIER JACKET OR CLOTH TAPE HAS BEEN FITTED FOR NESTED/MITERED APPLICATIONS, AND COLOR DAMAGED JACKETS SHALL BE SEALED AND PAINTED WITH CHILDERS NO. CP-32 (WHITE) AT THE RATE OF 85-100 SQ. FT. PER GALLON.

3.06 INSTALLATION – REFRIGERANT PIPING

A. INSULATION SHALL BE INSTALLED IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS FOR 40EF PIPING.

B. PROVIDE TWO (2) COATS OF WEATHER RESISTANT PAINT FOR EXTERIOR INSTALLATIONS IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS.

3.07 INSULATED DUCT SYSTEMS

A. PROVIDE INSULATION ON THE SUPPLY AND RETURN DUCTWORK SYSTEMS, EXCEPT WHERE DUCTWORK IS INDICATED TO BE LINED.

B. PROVIDE INSULATION ON THE OUTSIDE AIR DUCTWORK OF ALL SYSTEMS FROM THE PLENUM OR HOOD INTAKE TO THE HVAC UNIT, EXCEPT WHERE DUCTWORK IS INDICATED TO BE LINED.

C. PROVIDE INSULATION ON THE EXHAUST AIR DUCTWORK OF ALL SYSTEMS FROM THE SYSTEM EXHAUST AIR CONTROL DAMPER TO THE EXHAUST AIR PLENUM OR HOOD DISCHARGE, EXCEPT WHERE DUCTWORK IS INDICATED TO BE LINED.

D. PROVIDE INSULATION ON THE OUTSIDE AIR INTAKE AND EXHAUST AIR DISCHARGE PLENUMS.

3.08 INSTALLATION, GENERAL – DUCTS

A. NO INSULATION SHALL BE APPLIED UNTIL THE DUCTWORK HAS BEEN TESTED AND PROVEN TIGHT.

B. ALL DUCTWORK SHALL BE CLEANED OF OIL, GREASE, LOOSE DIRT AND OTHER FOREIGN MATTER BEFORE THE INSULATION IS APPLIED.

C. EXPOSED ENDS OF INSULATION SHALL BE BEVELED TO THE INSULATED SURFACE, AND THE JACKET AND/OR VAPOR BARRIER SHALL BE SEALED TO THE SURFACE.

D. CUTOUTS IN THE INSULATION FOR NAMEPLATES AND EQUIPMENT TAGS SHALL HAVE ALL EDGES TAPERED TO THE SURFACE, AND THE JACKET AND/OR VAPOR BARRIER SEALED.

E. SPECIAL CARE MUST BE TAKEN IN APPLYING INSULATION AROUND SUCH ACCESSORIES AS REHEAT COILS, FLEXIBLE CONNECTIONS, ACCESS DOORS, ETC., TO ALLOW REMOVAL OF THESE ITEMS WITHOUT IN ANY WAY REMOVING THE INSULATION OR BREAKING THE VAPOR SEAL.

3.09 INSTALLATION – DUCTS

A. INSULATION WRAP SHALL BE APPLIED TO THE DUCT WITH 6" WIDE BANDS OF ADHESIVE ON 12" CENTERS. THE ADHESIVE SHALL HAVE A FLAME SPREAD INDEX OF 25 OR LESS. WELDING TYPE FASTENERS SHALL BE APPLIED TO THE BOTTOM OF DUCTS OVER 18" IN WIDTH. THE FASTENERS SHALL BE A MAXIMUM OF 12" ON CENTERS AND PLACED CLOSE TO BUTT ENDS OF THE INSULATION. THE PINS SHALL BE CUT OFF FLUSH WITH THE FASTENER WASHER.

B. ALL JOINTS, CRACKS AND BREAKS, INCLUDING HOLES FOR THE FASTENERS, IN THE VAPOR BARRIER SHALL BE SEALED WITH A VAPOR BARRIER MASTIC, CHILDERS NO. CP-32 (GRAY) AND VAPOR BARRIER JACKET MATERIAL. BREAKS IN THE VAPOR BARRIER CAUSED BY THE ATTACHMENT OF TUBING OR OTHER EQUIPMENT SHALL ALSO BE SEALED. VAPOR BARRIER LAPS SHALL BE SEALED WITH ADHESIVE, CHILDERS NO. CP-82. NO STAPLES SHALL BE USED TO SECURE THE VAPOR BARRIER LAPS.

C. WHERE PINS ARE USED, APPLY VAPOR SEAL PATCHES USING ADHESIVE OVER THE PINS.

3.10 INSULATION – AIR SYSTEM COMPONENTS

A. PROVIDE INSULATION ON THE EXTERIOR SURFACES OF SUPPLY SYSTEM COMPONENTS CONVEYING MECHANICALLY COOLED AIR EXCEPT WHERE SUCH COMPONENTS ARE INDICATED TO BE LINED.

B. INSULATED COMPONENTS SHALL INCLUDE FILTER SECTION, SUPPLY FAN, RETURN FAN, DISCHARGE CONE, COIL SECTION AND ATTENUATOR SECTION.

3.11 INSTALLATION – AIR SYSTEM COMPONENTS

A. BOARDS SHALL BE APPLIED USING MECHANICAL FASTENERS. FASTENERS SHALL BE LOCATED NOT LESS THAN 3" FROM EACH EDGE OR CORNER OF THE BOARD. PIN SPACING ALONG THE PANELS NO GREATER THAN 12" ON CENTERS.

B. APPLY ROUND VAPOR SEAL FSK PATCHES USING ADHESIVE OVER THE PINS.

C. ALL INSULATION EDGES AND BUTT JOINTS ARE TO BE SEALED WITH JOINT SEALING TAPE, TYPE FSK, 5" WIDE, USING ADHESIVE, CHILDERS NO. CP-82.

D. FINISH PINS WITH PLASTIC CAPS

SECTION 15800
AIR DISTRIBUTION

PART 1 – GENERAL

1.01 RELATED DOCUMENTS
A. SECTION 15050 BASIC MATERIALS AND METHODS APPLIES TO THE WORK SPECIFIED IN THIS SECTION.
B. IN ADDITION, THE FOLLOWING SECTIONS APPLY: 15250, 15900 AND 15990.

1.02 AIR SYSTEMS
A. PROVIDE HEATING AND COOLING SYSTEMS.
B. PROVIDE VENTILATING SYSTEMS.
C. PROVIDE EXHAUST SYSTEMS.

1.03 SHOP DRAWINGS
A. PROVIDE 1/4" SCALE SHOP DRAWINGS FOR ALL DUCT SYSTEMS.

PART 2 – PRODUCTS

2.01 HVAC UNITS
A. PROVIDE PACKAGE HEATING, COOLING AND VENTILATING UNIT AND ACCESSORIES PER DRAWING SCHEDULE, PLANS, AND DETAILS.
B. HEATING SECTION SHALL BE GAS BURNER.
C. COOLING SECTION SHALL BE SELF-CONTAINED REFRIGERATION SYSTEM WITH DIRECT-EXPANSION COIL.

2.02 AIR FILTERS
A. PROVIDE EACH SYSTEM CENTRAL AIR FILTERS AND ACCESSORIES PER DRAWING SCHEDULES, PLANS AND DETAILS.
B. PROVIDE TWO (2) SETS OF FILTERS FOR EACH SYSTEM.

2.03 PLENUM LINING
A. PROVIDE SYSTEMS PLENUMS WITH FIBERGLASS LINING WHERE SHOWN ON THE DRAWING PLANS AND ELEVATIONS.
B. LINER SHALL BE 2" THICK, 3 PCF OR 6 PCF DENSITY AS INDICATED, SEMI RIGID BOARD BONDED WITH THERMOSETTING RESIN AND COATED ONE SIDE WITH FIRE RESISTANT COATING.
C. LINER SHALL HAVE MINIMUM 9.0 FT2 HR F/BTU THERMAL RESISTANCE.
D. LINER SHALL BE SUPPLIED BY OWENS-CORNING, CERTAINTEED OR KNAUF.

2.04 EXHAUST FAN
A. PROVIDE ROOF MOUNTED FANS WITH ACCESSORIES PER DRAWING SCHEDULE, PLANS AND DETAILS.
B. PROVIDE IN-LINE DUCT MOUNTED FANS WITH ACCESSORIES PER DRAWING SCHEDULE, PLANS AND DETAILS.

2.05 GRILLES AND DIFFUSERS
A. PROVIDE GRILLES AND DIFFUSERS PER DRAWING SCHEDULE, PLANS AND DETAILS.

2.06 FLUES
A. PROVIDE FLUES AND ACCESSORIES FOR THE DOMESTIC WATER HEATERS OF SECTION 15400.
B. FLUES SHALL BE OF THE CLASS, MODEL AND WITH THE ACCESSORIES AS DESCRIBED IN LEGENDS ON DRAWINGS RELATING TO THE ABOVE SECTIONS.

2.07 MOTOR OPERATED DAMPERS
A. PROVIDE MOTOR OPERATED DAMPER PER DRAWING SCHEDULE, PLANS AND DETAILS.

2.08 FIRE DAMPERS
A. PROVIDE FIRE DAMPERS PER DRAWING SCHEDULE, PLANS, DETAILS AND WHERE REQUIRED BY CODE.

2.09 CURBS
A. PROVIDE CURBS FOR ALL ROOF OPENINGS.
B. CERTAIN ITEMS OF EQUIPMENT SHALL HAVE CURBS FURNISHED BY THE EQUIPMENT MANUFACTURER.
C. ALL OTHER OPENINGS SHALL HAVE INSULATED, PREFABRICATED CURBS OF GALVANIZED STEEL CONSTRUCTION, PATE OR THY-CURB.
D. CURBS SHALL BE SIZED TO FIT EQUIPMENT BASE.

2.10 FLEXIBLE DUCTWORK
A. PROVIDE FLEXIBLE DUCTWORK PER DRAWING PLANS AND DETAILS.
B. FLEXIBLE DUCTS SHALL CONFORM TO U1-181 AND WITH A FLAME SPREAD RATING NOT OVER 25 AND A SMOKE DEVELOPED RATING NO HIGHER THAN 50. MAXIMUM LENGTH SHALL BE 6'-0" WHEN FULLY EXTENDED.
C. ACCEPTABLE FLEXIBLE DUCTWORK CONNECTORS ARE AS FOLLOWS:
FLEXMASTER MODEL NO. TL-M;
FLEXMASTER MODEL NO. 4-M
THERMAFLEX MODEL NO. M-KC
TECHNAFLEX MODEL NO. 57K

2.11 FLEXIBLE CONNECTIONS
A. PROVIDE 1 LB. DENSITY LOADED VINYL FLEXIBLE CONNECTORS FOR ALL ITEMS OF ROTATING FAN EQUIPMENT.

2.12 PREFABRICATED DUCTWORK
A. PROVIDE PREFABRICATED ROUND AND OVAL DUCTWORK WITH SPIRAL OR LONGITUDINAL SEAMS.
DUCT CONSTUCTION FOR 2" W.C.

DUCT DIAMETER (INCHES)	SPIRAL SEAM GAUGE GALV. STEEL	SPIRAL SEAM GAUGE ALUM.	ONGITUDINAL SEAM GAUGE GALV. STEEL	ONGITUDINAL SEAM GAUGE ALUM.
UP TO 14"	26	.025"	24	.032"
15" TO 26"	24	.032"	22	.040"
28" TO 36"	22	.040"	20	.050"
38" TO 50"	20	.050"	18	.063"
52" TO 60"	18	.063"	16	.071"

B. SLEEVES, COLLARS, FITTINGS, ETC. SHALL BE OFF A WALL THICKNESS NOT LESS THAN THAT SPECIFIED FOR LONGITUDINAL SEAM STRAIGHT DUCT UNLESS CERTIFIED TESTING DATA INDICATES SUITABILITY AND IS SUBMITTED TO ENGINEER FOR REVIEW.

2.13 DIFFUSER PLENUMS
A. PROVIDE DIFFUSER PLENUMS AS SHOWN ON DRAWING PLANS AND DETAILS.

2.14 DUCT LINING
A. PROVIDE DUCTWORK WITH FIBERGLASS LINING WHERE INDICATED ON THE DRAWINGS.
B. LINING SHALL BE 1.5 INCH THICK, 2.0 PCF DENSITY, FLEXIBLE, WITH FIRE RESISTANT COATING TO BOND THE AIR SIDE SURFACE OF THE FIBERS.
C. LINING SHALL HAVE MINIMUM 3.8 FT2 HR F/BTU THERMAL RESISTANCE.
D. FIRE HAZARD CLASSIFICATION – ASTM E-84 TEST METHOD: 25 FLAME SPREAD, 50 SMOKE DEVELOPED.
E. LINING SHALL BE SUPPLIED BY OWENS-CORNING, CERTAINTEED OR KNAUF.

2.15 VIBRATION ISOLATION
A. PROVIDE VIBRATION ISOLATION FOR ALL FAN EQUIPMENT PER DRAWING PLANS AND DETAILS.

PART 3 – EXECUTION

3.01 HVAC UNITS
A. UNITS SHALL BE MOUNTED ON STRUCTURAL MEMBERS PROVIDED AS PART OF THE BUILDING STRUCTURAL SYSTEM OF PREFABRICATED EQUIPMENT SUPPORTS, SEE DRAWINGS DETAILS AND LEGENDS.
B. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR OF THIS SECTION TO PROVIDE CERTIFIED DIMENSIONS ON EACH UNIT TO THE STRUCTURAL CONTRACTOR FOR PROPER DESIGN OF THE STRUCTURAL MOUNTING.
C. UNITS SHALL BE SEPARATE FROM THE BUILDING STRUCTURAL SYSTEM WITH 95 % EFFICIENT ISOLATORS EITHER BY INTERNAL OR EXTERNAL ISOLATORS.

3.02 FILTERS
A. INSTALL FILTER HOUSINGS IN SYSTEM PLENUMS AND PROVIDE TRANSITIONS OR BAFFLES TO PREVENT AIR BY-PASS.
B. INSTALL FILTERS BEFORE ANY SYSTEM IS PUT IN OPERATION.

3.03 PLENUM LINING
A. ADHERE LINER WITH A FULL COAT OF ADHESIVE AND MECHANICAL FASTENERS.
B. EXPOSED EDGES SHALL BE FINISHED WITH TROWEL APPLIED MASTIC TO PREVENT ANY POSSIBILITY OF EROSION. MASTIC TO HAVE SAME FIRE HAZARD CLASSIFICATION AS LINER.

3.04 EXHAUST FANS
A. FASTEN ROOF MOUNTED FANS TO CURBS SIX (6) INCHES ON CENTERS USING HEX HEAD SCREWS AND WASHERS.
B. MOUNT IN-LINE FANS TO DUCTWORK WITH VIBRATION ISOLATION SUPPORTS.

3.05 GRAVITY DAMPERS
A. WHERE GRAVITY DAMPERS ARE INSTALLED THIS CONTRACTOR SHALL LUBRICATE THE HINGES AND BE RESPONSIBLE FOR OPERATION IN USE.

3.06 GRILLES AND DIFFUSERS
A. INSTALL ACCESSORY DAMPERS IN THE FULL OPEN POSITION.
B. IT SHALL BE THE RESPONSIBILITY OF THIS CONTRACTOR TO ASSURE THAT ALL DAMPERS ARE FULL OPEN BEFORE AIR BALANCING IS PERFORMED.

3.07 ACCESS DOORS
A. INSTALL ACCESS DOORS IN THE BUILDING CONSTRUCTION WHERE SHOWN ON THE DRAWING PLANS AND WHERE REQUIRED TO ACCESS CONCEALED EQUIPMENT.
B. COORDINATE INSTALLATION WITH THE GENERAL CONTRACTOR.

3.08 FLUES
A. SUBMIT DRAWINGS FROM THE MANUFACTURER OF THE FLUE SYSTEM INCLUDING CONNECTIONS TO THE EQUIPMENT, FLUE SUPPORTS, ROOF PENETRATION AND FLUE CAP.
B. DO NOT ORDER FLUES UNTIL DRAWINGS ARE APPROVED.

3.09 MOTOR OPERATED DAMPERS
A. DAMPERS, WHETHER FURNISHED BY THIS CONTRACTOR OR THE CONTROL CONTRACTOR, SHALL BE INSTALLED SQUARE TO THE DUCT OR CONSTRUCTION.
B. DAMPERS SHALL BE MANUALLY TESTED TO ASSURE FREE AND EASY MOVEMENT.
C. ADJUST DAMPER BLADES FOR FULL CLOSURE.

3.10 FIRE DAMPERS
A. INSTALL DAMPERS IN SLEEVE PER DRAWING NOTE.
B. RELEASE DAMPER LINKAGE AND TEST FOR FREE FALLING CLOSURE BEFORE AND AFTER INSTALLATION.
C. RECONNECT LINKAGE.

3.11 CURBS
A. CURBS SHALL BE TAPER TYPE AND MATCH THE PITCH OF THE ROOF. COORDINATE INSTALLATION OF CURBS WITH THE GENERAL CONTRACTOR.
B. INSTALL STEEL PLATES AND ACCESSORIES AS REQUIRED FOR DUCTWORK OR EQUIPMENT CONNECTIONS.
C. GENERAL CONTRACTOR WILL PROVIDE SHIMMING LEVEL OF CURBS, FASTENING OF CURBS TO ROOF CONSTRUCTION AND ROOF FLASHING.

3.12 DIFFUSER PLENUMS
A. PLENUMS WILL BE RECEIVED WITH FACTORY APPLIED FINISH. IT SHALL BE THE RESPONSIBILITY OF THIS CONTRACTOR TO PROTECT THAT FINISH.
B. IF IN THE OPINION OF THE ARCHITECT'S SITE INSPECTOR THE FINISH IS NOT ACCEPTABLE WHEN READY TO BE TURNED OVER TO THE OWNER, THE DAMAGED PLENUM SECTIONS WILL BE REMOVED AND REPLACED.

3.13 FLEXIBLE DUCTWORK
A. APPLY MASTIC DUCT SEALANT TO RIGID DUCT AND DEVICE TO WHICH CONNECTION IS BEING MADE BEFORE INSTALLING FLEXIBLE DUCT.
B. FASTEN ALUMINUM TYPE FLEXIBLE DUCTWORK WITH #8 SCREWS MINIMUM 6" ON CENTER. COAT SCREWS WITH MASTIC SEALER AFTER TIGHTENING.
C. FASTEN REINFORCED VINYL TYPE FLEXIBLE DUCTWORK WITH DRAWBAND TYPE COMPRESSION FASTENERS.
D. APPLY TWO LAYERS OF NASHAU #357 DUCT TAPE OVER JUNCTURE OF FLEXIBLE DUCTWORK TO DEVICE OR RIGID DUCTWORK, AND THE INSULATION SLEEVE TO DEVICE, RIGID DUCTWORK OR BUTTING TO TO OTHER INSULATION.

3.14 FLEXIBLE CONNECTIONS
A. APPLY MASTIC DUCT SEALANT TO RIGID DUCT AND DEVICE TO WHICH CONNECTION IS BEING MADE BEFORE INSTALLING FLEXIBLE DUCT.
B. APPLY CLAMPS, BOTH ENDS, OF THE SCREW DRIVE TIGHTENING TYPE.
C. COAT CLAMP AND JUNCTURE WITH MASTIC SEALER AFTER TIGHTENING.

3.15 PREFABRICATED DUCTWORK
A. WHERE CONNECTIONS IN OVAL AND ROUND DUCTS ARE NOT MADE UP WITH FLANGES, A MALE END COUPLING SHALL BE USED. "UNITED" DUCT SEALER, OR APPROVED EQUAL, SHALL BE APPLIED TO THE MALE END BEFORE INSERTION OR IMMEDIATELY AFTER IT IS STARTED, APPROXIMATELY 1/2 INCH. PUSH FITTING OR PIPE TO COUPLING BEAD STOP. DRILL AND INSTALL SOLID POP RIVETS, AS REQUIRED, A MINIMUM OF 1/2 INCH FROM THE COUPLING BEAD STOP. AFTER OTHER END OF COUPLING IS INSERTED, SEALED AND RIVETED AS ABOVE, APPLY DUCT SEALER IN A MINIMUM OF 2" WIDE BAND, MAKING SURE RIVET HEADS AND THE JOINT GAP ARE COVERED. APPLY A SINGLE WRAP OF NASHUA NO. 357, OR APPROVED EQUAL, DUCT TAPE OVER THE WET SEALER. DO NOT APPLY SEALER OVER THE TAPE. SAMPLES OF THE DUCT SEALER AND TAPE, INCLUDING SPECIFICATION SHEETS, SHALL BE SUBMITTED TO THE ENGINEER FOR APPROVAL.
B. WHERE DUCTWORK IS EXPOSED IN OCCUPIED AREAS, IT SHALL BE INSTALLED NEAT AND CLEAN. FRAGMENTED ENDS, I.E., FIELD CUTS WILL NOT BE ACCEPTED. ALL SUCH DUCTWORK SHALL BE FIELD MEASURED AND FACTORY CUT TO LENGTH. SEALANT WILL BE APPLIED ONLY TO THE INTERIOR SURFACES OF CONNECTING PIECES. ANY SEALANT EXPOSED SHALL BE REMOVED WITH THE PROPER SOLVENT.

3.16 SHOP FABRICATED DUCTWORK
A. DUCTWORK SHALL BE INSTALLED AND SEALED ONLY IN ACCORDANCE WITH THE NOTE ON THE DRAWINGS. ANY OTHER PROCEDURE WHETHER RECOMMENDED BY THE MANUFACTURER OR NOT IS UNACCEPTABLE.
B. SEALANT SHALL BE APPLIED TO JOINTS AND SEAMS DURING FABRICATION. NOT AT THE SITE INSTALLATION.
C. WHERE DUCTWORK IS EXPOSED IN OCCUPIED AREAS, IT SHALL BE INSTALLED NEAT AND CLEAN. FRAGMENTED ENDS, I. E., FIELD CUTS WILL NOT BE ACCEPTED. ALL SUCH DUCTWORK SHALL BE FIELD MEASURED AND SHOP CUT TO LENGTH. SEALANT WILL BE APPLIED ONLY TO THE INTERIOR SURFACES OF CONNECTING PIECES. ANY SEALANT EXPOSED SHALL BE REMOVED WITH THE PROPER SOLVENT.

3.17 DUCT LINING
A. LINING SHALL BE INSTALLED IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS FOR 2000 FPM.
B. A FULL COAT OF ADHESIVE SHALL BE USED WHETHER RECOMMENDED OR NOT. EDGES SHALL BE FINISHED WITH TROWEL APPLIED MASTIC.

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