I. GENERAL PROVISIONS

A. OVERVIEW

1. ALL WORK DONE UNDER THIS CONTRACT SHALL COMPLY WITH ALL STATE AND LOCAL CODES HAVING JURISDICTION AND WITH THE REQUIREMENTS OF THE UTILITY COMPANIES WHOSE SERVICES MAY BE USED. ALL MODIFICATIONS REQUIRED BY THESE CODES SHALL BE MADE BY THE CONTRACTOR WITHOUT ADDITIONAL CHARGES. WHERE CODE REQUIREMENTS ARE LESS THAN THOSE SHOWN ON THE PLANS OR IN THE SPECIFICATIONS, THE PLANS AND SPECIFICATIONS SHALL BE FOLLOWED. WHERE APPLICABLE, NFPA REQUIREMENTS SHALL BE MET.
2. IN CASE OF ANY CONFLICTS BETWEEN CONTRACT DOCUMENTS, THE STRICTER/MORE STRINGENT SHALL GOVERN.
3. THE CONTRACTOR SHALL OBTAIN ALL PERMITS, INSPECTIONS, AND APPROVALS AS REQUIRED BY ALL AUTHORITIES HAVING JURISDICTION AND DELIVER CERTIFICATES OF APPROVAL TO THE ENGINEER. ALL FEES AND COSTS OF ANY NATURE WHATSOEVER INCIDENTAL TO THESE PERMITS, INSPECTIONS AND APPROVALS MUST BE ASSUMED AND PAID BY THE CONTRACTOR.
4. THE CONTRACTOR SHALL COMPLY WITH ALL APPLICABLE PROVISIONS OF O.S.H.A.
5. THE WORKMANSHIP AND MATERIALS COVERED BY THESE SPECIFICATIONS SHALL CONFORM TO ALL ORDINANCES AND REGULATIONS OF THE CITY, COUNTY AND/OR OTHER AUTHORITIES HAVING JURISDICTION.
6. CONTRACTOR SHALL VISIT THE SITE AND EXAMINE EXISTING CONDITIONS BEFORE SUBMITTING BID. NO ALLOWANCE WILL BE MADE FOR LACK OF KNOWLEDGE OF EXISTING CONDITIONS WHEN SUCH CONDITIONS CAN BE DETERMINED BY OBSERVATION.
7. PRIOR TO SUBMITTING DATA FOR OR PURCHASING EQUIPMENT REQUIRING ELECTRICAL SERVICE, THE CONTRACTOR SHALL VERIFY THAT ELECTRICAL CHARACTERISTICS OF EQUIPMENT SUBMITTALS COMPLY WITH ELECTRICAL SERVICE PROVIDED FOR THE SPECIFIED ITEMS OF EQUIPMENT.
8. UPON RECEIPT OF THE CONTRACTOR OF REVIEWED SUBMITTALS FOR EQUIPMENT PROVIDED UNDER THIS DIVISION, THE CONTRACTOR SHALL COORDINATE THE ELECTRICAL SERVICE REQUIREMENTS, I.E., MOTOR HORSEPOWER AND FULL LOAD AMPS, ELECTRICAL SERVICE CHARACTERISTICS (VOLTAGE AND PHASE), AND NUMBER OF SERVICES FOR EACH ITEM OF EQUIPMENT REQUIRING ELECTRICAL CONNECTIONS WITH THE ELECTRICAL DRAWINGS AND SPECIFICATIONS.
9. ITEMS ON OR PROJECTING THROUGH THE CEILING SHALL BE COORDINATED WITH OTHER TRADES.
10. EQUIPMENT MODEL NUMBERS ARE PROVIDED FOR GENERAL GUIDANCE, CONTRACTOR SHALL PROVIDE EQUIPMENT THAT MEETS THE PHYSICAL CAPACITIES AS SCHEDULED AND GENERAL ARRANGEMENT AS INDICATED IN THE DRAWING SET. CONTRACTOR SHALL VERIFY EXACT, CURRENT MODEL NUMBERS WITH THE MANUFACTURERS.

B. OPERATION AND MAINTENANCE INSTRUCTIONS

1. THE CONTRACTOR SHALL PROVIDE TWO OPERATION AND MAINTENANCE MANUALS. THE MANUALS SHALL BE COMPILED IN HARD BACK, THREE RING NOTEBOOKS. O&M MANUALS SHALL HAVE PERMANENT LABELS ON FRONT AND SIDE. THE FOLLOWING INFORMATION SHALL APPEAR IN EACH MANUAL:
2. PROVIDE MANUFACTURER'S PRINTED OPERATING PROCEDURES TO INCLUDE START-UP, BREAK-IN, ROUTINE AND NORMAL OPERATING INSTRUCTIONS; REGULATION, CONTROL, STOPPING, SHUTDOWN AND EMERGENCY INSTRUCTIONS; AND SUMMER AND WINTER OPERATING INSTRUCTIONS. PROVIDE MAINTENANCE PROCEDURES FOR ROUTINE PREVENTATIVE MAINTENANCE AND TROUBLESHOOTING; DISASSEMBLY, REPAIR AND REASSEMBLY; ALIGNING AND ADJUSTING INSTRUCTIONS. SERVICING INSTRUCTIONS AND LUBRICATION CHARTS AND SCHEDULES.

C. INSTRUCTIONS OF OWNER PERSONNEL

1. BEFORE FINAL INSPECTION, AT A TIME DESIGNATED BY THE DESIGNER, PROVIDE A COMPETENT REPRESENTATIVE TO INSTRUCT OWNER'S DESIGNATED PERSONNEL IN OPERATION, ADJUSTMENT AND MAINTENANCE OF PRODUCTS, EQUIPMENT AND SYSTEMS UNDER THIS DIVISION OF THE SPECIFICATIONS. FOR EQUIPMENT REQUIRING SEASONAL OPERATIONS, PERFORM INSTRUCTIONS FOR OTHER SEASONS WITHIN SIX MONTHS UNLESS REQUESTED OTHERWISE.

D. COORDINATION

1. THE PRODUCTS OF PARTICULAR MANUFACTURERS HAVE BEEN USED AS THE BASIS OF DESIGN IN PREPARATION OF THESE DOCUMENTS. ANY MODIFICATIONS TO THE MECHANICAL SYSTEMS AND THEIR COMPONENTS, THE ELECTRICAL SYSTEMS, THE BUILDING STRUCTURE AND ARCHITECTURE, OR ANY OTHER PORTION OF THE BUILDING THAT RESULT FROM THE USE OF ANY OTHER THAN THAT BASIS OF DESIGN EQUIPMENT SHALL BE COORDINATED WITH ALL OTHER TRADES. SUCH COORDINATION SHALL OCCUR BEFORE PURCHASE OR DELIVERY OF PRODUCTS FROM THE MANUFACTURER DRAWINGS OR INSTALLED ACCORDINGLY. ANY RELATED MODIFICATIONS SHALL BE PERFORMED WITHOUT ANY ADDITIONAL COST TO THE CONTRACT.
2. RESIDENTIAL GRADE HVAC COMPONENTS SHALL NOT BE PERMITTED WITHOUT SPECIFIC OWNER INSTRUCTION AND ENGINEER APPROVAL.

E. EXECUTION

1. THE PLANS DO NOT GIVE EXACT ELEVATIONS OR LOCATIONS OF LINES, NOR DO THEY SHOW ALL THE OFFSETS, CONTROL LINES, OR OTHER INSTALLATION DETAILS. THE CONTRACTOR SHALL CAREFULLY LAY OUT HIS WORK AT THE SITE TO CONFORM TO THE STRUCTURAL CONDITIONS, TO PROVIDE PROPER GRADING OF LINES, TO AVOID ALL OBSTRUCTIONS, TO CONFORM TO DETAILS OF INSTALLATION SUPPLIED BY THE MANUFACTURERS OF THE EQUIPMENT TO BE INSTALLED, AND TO THEREBY PROVIDE AN INTEGRATED, COORDINATED AND SATISFACTORY OPERATING INSTALLATION. DO NOT SCALE DRAWINGS.
2. IF THE CONTRACTOR PROPOSES TO INSTALL EQUIPMENT, INCLUDING PIPING AND DUCTWORK, REQUIRING SPACE CONDITIONS OTHER THAN THOSE SHOWN, OR TO REARRANGE THE EQUIPMENT, HE SHALL ASSUME FULL RESPONSIBILITY FOR THE REARRANGEMENT OF THE SPACE AND CONNECT ARRANGEMENT AT NO ADDITIONAL COST TO THE OWNER, AND SHALL HAVE THE ENGINEER REVIEW THE CHANGE BEFORE PROCEEDING WITH THE WORK. THE REQUEST FOR SUCH CHANGES SHALL BE ACCOMPLISHED BY SHOP DRAWINGS OF THE SPACE IN QUESTION.
3. TEMPORARY FILTERS SHALL BE PROVIDED FOR FANS THAT ARE USED DURING CONSTRUCTION. AT THE TIME OF STARTING THE BALANCING OF THE AIR DISTRIBUTION SYSTEM, NEW FILTERS SHALL BE INSTALLED.
4. THE CONTRACTOR IS RESPONSIBLE FOR THE PROPER LOCATION AND SIZE OF ALL SLOT, HOLES OR OPENINGS IN THE BUILDING STRUCTURE PERTAINING TO HIS WORK, AND FOR THE CORRECT LOCATION OF SLEEVES, INSERTS, CORES, ETC.
5. THE CONTRACTOR SHALL SO COORDINATE THE WORK OF THE SEVERAL VARIOUS TRADES THAT IT MAY BE INSTALLED IN THE MOST DIRECT AND WORKMANLIKE MANNER WITHOUT HINDERING OR HANDICAPPING THE OTHER TRADES. PIPING INTERFERENCES SHALL BE HANDLED BY GIVING PRECEDENCE TO PIPE LINES WHICH REQUIRE A STATED GRADE FOR PROPER OPERATION. FOR EXAMPLE SEWER LINES AND CONDENSATE PIPING SHALL TAKE PRECEDENCE OVER WATER LINES IN DETERMINATION OF ELEVATIONS. WHERE THERE IS INTERFERENCE BETWEEN SEWER LINES AND CONDENSATE LINES, THE SEWER LINES SHALL HAVE PRECEDENCE AND PROVISIONS SHALL BE MADE IN THE CONDENSATE LINES FOR LOOPING THEM AROUND THE SEWER LINES. IN ALL CASES, LINES REQUIRING A STATED GRADE FOR THEIR PROPER OPERATION SHALL HAVE PRECEDENCE OVER ELECTRICAL CONDUIT AND DUCTWORK.
6. ALL PIPING AND DUCTWORK IN FINISHED AREAS- EXCEPT WHERE NOTED TO THE CONTRARY- SHALL BE INSTALLED IN A CHASE, FURRED SPACE, OR ABOVE CEILINGS, ETC. IN ALL CASES, PIPES AND DUCTS SHALL BE INSTALLED AS HIGH AS POSSIBLE. RUNS OF PIPING SHALL BE GROUPED WHENEVER IT IS FEASIBLE TO DO SO.
7. PIPING SHALL BE INSTALLED TO PASS INSPECTIONS BY LOCAL PLUMBING INSPECTION DEPARTMENT, STATE AND FEDERAL AUTHORITIES AND INSURANCE COMPANY HAVING JURISDICTION. ANY CHANGES OR ADDITIONS WHICH MAY BE NECESSARY TO OBTAIN SUCH INSPECTIONS AND APPROVAL SHALL BE MADE BY THE CONTRACTOR AS PART OF THIS CONTRACT AND WITHOUT ADDITIONAL COST TO THE OWNER.
8. PIPING, DUCTWORK OR EQUIPMENT SHALL NOT BE INSTALLED IN ELECTRICAL EQUIPMENT ROOMS OR ELEVATOR MACHINE ROOMS EXCEPT AS SERVING ONLY THOSE ROOMS. OUTSIDE OF ELECTRICAL EQUIPMENT ROOMS, DO NOT RUN PIPING OR DUCTWORK OR LOCATE EQUIPMENT, WITH RESPECT TO SWITCHBOARDS, PANEL BOARDS, POWER PANELS, MOTOR CONTROL CENTERS, DRY TYPE TRANSFORMERS OR ROOF TOP AIR CONDITIONING UNIT ELECTRICAL PANELS.
9. PROVIDE ACCESS TO EQUIPMENT AND APPARATUS REQUIRING OPERATION, SERVICE OR MAINTENANCE WITHIN THE LIFE OF THE SYSTEM. INCLUDING, BUT NOT LIMITED TO, MOTORS, VALVES, FILTERS, DAMPERS, SHOCK ABSORBERS, ETC. EQUIPMENT LOCATED ABOVE LAY-IN TYPE CEILINGS IS CONSIDERED ACCESSIBLE.
10. DAMAGED EQUIPMENT SHALL BE REPAIRED OR REPLACED AT THE OPTION OF THE ARCHITECT.

F. ELECTRICAL WORK

1. ALL ELECTRICAL EQUIPMENT PROVIDED UNDER THIS DIVISION SHALL COMPLY WITH THE ELECTRICAL SYSTEM CHARACTERISTICS INDICATED ON THE ELECTRICAL DRAWINGS AND SPECIFIED IN DIVISION 16.
2. EQUIPMENT UNIT MOTOR SPEED CONTROLS, STARTERS, SYSTEM CONTROLS, PILOT LIGHTS, PUSH-BUTTONS, ETC., SHALL BE FURNISHED COMPLETE AS A PART OF THE MOTOR APPARATUS WHICH IT OPERATES. ALL COMPONENTS SHALL BE IN CONFORMANCE WITH THE REQUIREMENTS OF THE NATIONAL ELECTRICAL CODE AND DIVISION 16. ALL MOTOR STARTERS SHALL BE PROVIDED WITH AN H-O-A SWITCH AND CONTROL TRANSFORMER. ALL STARTERS AND DISCONNECT SWITCHES SHALL BE FURNISHED UNDER DIVISION 15. COORDINATE INSTALLATION WITH ELECTRICAL CONTRACTOR PRIOR TO HIS WIRING OF EQUIPMENT.
3. CONTROL WIRING (120V AND LESS) SHALL BE PROVIDED UNDER DIVISION 15 AND EXTENDED FROM THE STARTERS, CONTROL TRANSFORMERS OR 120V POWER CIRCUITS INDICATED ON THE ELECTRICAL DRAWINGS. ALL WIRING FOR 120 VOLTS SHALL BE DONE BY A LICENSED ELECTRICIAN.
4. ALL ELECTRICAL CHARACTERISTICS SHALL BE TAKEN FROM THE ELECTRICAL DRAWINGS AND SPECIFICATIONS AND COORDINATED BEFORE EQUIPMENT IS ORDERED OR PURCHASED.

G. CUTTING AND PATCHING

1. THE CONTRACTOR SHALL ASSUME ALL COST OF, AND BE RESPONSIBLE FOR, ARRANGING FOR ALL CUTTING AND PATCHING REQUIRED TO COMPLETE THE INSTALLATION OF HIS PORTION OF THE WORK. ALL CUTTING SHALL BE CAREFULLY AND NEATLY DONE SO AS NOT TO DAMAGE OR CUT AWAY MORE THAN IS NECESSARY OF ANY EXISTING PORTIONS OF THE STRUCTURE.
2. ALL SURFACES SHALL BE PATCHED TO THE CONDITION OF THE ADJACENT SURFACES.
3. THE CONTRACTOR SHALL MAKE SUITABLE PROVISIONS FOR ADEQUATELY WATERPROOFING AT HIS FLOOR PENETRATIONS OF WATER PROOF MEMBRANE FLOORS. THIS SHALL INCLUDE BUT NOT BE LIMITED TO FLOOR DRAINS, OPEN SIGHT DRAINS, HUB DRAINS, CLEANOUTS, AND SLEEVES FOR THE VARIOUS PIPING. THIS ALSO APPLIES TO MEMBRANE ROOFING SYSTEMS.
4. ALL PENETRATIONS AND WATER PROOFING OF PENETRATIONS IN MEMBRANE ROOFING SYSTEMS SHALL BE COORDINATED WITH AND PERFORMED BY THE MANUFACTURER/INSTALLER.
5. THE CONTRACTOR SHALL INSTALL, AS REQUIRED, IN CONCRETE, CARPENTRY OR MASONRY CONSTRUCTION, ALL NECESSARY HANGERS, SLEEVES, EXPANSION BOLTS, INSERTS AND OTHER FIXTURES AND APPURTENANCES NECESSARY FOR THE SUPPORT OF PIPE, DUCT, EQUIPMENT AND DEVICES FURNISHED UNDER EACH SECTION OF THE SPECIFICATION.
6. FOR WALLS BETWEEN INTERIOR AND BELOW GRADE AREA, THE LINK-SEAL SYSTEM AS MANUFACTURED BY THUNDERLINE CORPORATION SHALL BE USED TO SEAL PIPE TO WALL PENETRATIONS. INSTALL SYSTEM IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS.
7. ESCUTCHEONS SHALL BE INSTALLED ON ALL PIPES WHERE THEY PASS THROUGH FLOORS, CEILINGS, WALLS OR PARTITIONS IN FINISHED AREAS WHERE EXPOSED TO VIEW.
8. WHERE AND HVAC OR PLUMBING REPLACEMENT SCOPE IS INDICATED, MECHANICAL CONTRACTOR SHALL PROVIDE FOR THE DEMOLITION OF EXISTING SYSTEMS THAT ARE BEING REPLACED OR ABANDONED

H. ACCESS DOORS

1. FURNISH AND INSTALL ACCESS DOORS AT EACH POINT REQUIRED TO PROVIDE ACCESS TO CONCEALED VALVES, CLEANOUTS AND OTHER DEVICES REQUIRING OPERATION, ADJUSTMENT OR MAINTENANCE. ACCESS DOORS SHALL BE 16 GAUGE STEEL, PRIME COAT FINISH, WITH MOUNTING STRAPS, CONCEALED HINGES AND SCREWDRIVER LOCKS, DESIGNED FOR THE DOORS TO OPEN 180 DEGREES.
2. ACCESS DOORS INSTALLED IN FIRE WALLS OR PARTITIONS SHALL BE UL LABELED TO MAINTAIN THE FIRE RATING OF THE WALL OR PARTITION.

I. FLAME SPREAD AND SMOKE DEVELOPED PROPERTIES OF MATERIALS

1. MATERIALS AND ADHESIVES USED THROUGHOUT THE MECHANICAL AND ELECTRICAL SYSTEMS FOR INSULATION, AND JACKETS OR COVERINGS OF ANY KIND, OR FOR PIPING OR CONDUIT SYSTEM COMPONENTS, SHALL HAVE A FLAME SPREAD RATING NOT OVER 25 WITHOUT EVIDENCE OF CONTINUED COMBUSTION AND WITH A SMOKE DEVELOPED RATING NOT HIGHER THAN 50. IF SUCH MATERIALS ARE TO BE APPLIED WITH ADHESIVES, THEY SHALL BE TESTED AS APPLIED WITH SUCH ADHESIVES, OR THE ADHESIVES USED SHALL HAVE A FLAME SPREAD RATING NOT OVER 25 AND A SMOKE DEVELOPED RATING NOT HIGHER THAN 50.

II. INSULATION

A. GENERAL PIPE INSULATION

1. FIBERGLASS SHALL BE ACCEPTABLE FOR INDOOR HOT & COLD DOMESTIC; HYDRONIC PIPING; AND INSULATED DRAINAGE PIPING. PROVIDE PREFABRICATED FITTINGS FOR ELBOWS AND TEE'S. PROVIDE PREFAB PVC FITTINGS OR WHITE ALL SERVICE (INTEGRAL TO PREFAB PIPING ELBOW) PIPING ELBOW JACKETING. PROVIDE PIPE LABELING FOR ALL INSULATED, JACKETED INDOOR PIPING. PVC JACKETING SHALL NOT BE PERMITTED IN RETURN PLENUM AREAS. ALL JACKEING SEAMS SHALL BE SEALED AIR-TIGHT FOR CONTINUOUS VAPOR BARRIER.
2. FITTINGS AND VALVES SHALL BE INSULATED WITH PRE-FORMED FITTINGS, FABRICATED SECTIONS OF PIPE INSULATION, TANK INSULATION, BLANKET INSULATION, OR INSULATING CEMENT. THICKNESS SHALL BE EQUAL TO ADJACENT PIPE INSULATION. FINISH SHALL BE WITH PRE-FORMED PVC FITTING COVERS OR AS OTHERWISE SPECIFIED ON CONTRACT DRAWINGS.
3. FLANGES, COUPLINGS AND VALVE BONNETS SHALL BE COVERED WITH AN OVERSIZED PIPE INSULATION SECTION SIZED TO PROVIDE THE SAME INSULATION THICKNESS AS ON THE MAIN PIPE SECTION. AN OVERSIZED INSULATION SECTION SHALL BE USED TO FORM A COLLAR BETWEEN THE TWO INSULATION SECTIONS WITH LOW-DENSITY BLANKET INSULATION BEING USED TO FILL GAPS. JACKETING SHALL MATCH THAT USED ON STRAIGHT PIPE SECTIONS. ROUGH CUT ENDS SHALL BE COATED WITH SUITABLE WEATHER OR VAPOR RESISTANT MASTIC AS DICTATED BY THE SYSTEM LOCATION AND SERVICE. ON HOT SYSTEMS WHERE FITTINGS ARE TO BE LEFT EXPOSED, INSULATION ENDS SHOULD BE BEVELED AWAY FROM BOLTS FOR EASY ACCESS.

B. INSULATION THICKNESS

1. DOMESTIC COLD WATER INSULATION SHALL BE 1” MINIMUM OR AS REQUIRED BY LOCAL ENERGY CODES.
2. FOR MEDIA BELOW 60 DEGREES INSULATION SHALL BE 1” UP TO 1-¼” PIPE SIZE; 1.5” THICK UP TO 3” PIPE SIZE; AND 2” THICK BEYOND 3” PIPE SIZE.
3. CHILLED WATER PIPING INSULATION SHALL BE 1” UP TO 1-1/4” PIPE SIZE, 1.5” UP TO 3”.

C. FIBERGLASS PIPE INSULATION

1. ONE PIECE FIBROUS GLASS PIPE INSULATION WITH FACTORY APPLIED ALUMINUM FOIL AND WHITE KRAFT PAPER FLAME RETARDANT VAPOR BARRIER JACKET.
2. PROVIDE SELF_SEALING LONGITUDINAL JACKET LAPS AND BUTT STRIPS. AVERAGE THERMAL CONDUCTIVITY: 0.23 BTU/IN. PER SQUARE FOOT PER DEGREES F PER HOUR AT 75 DEGREES F MEAN TEMPERATURE.
3. PROVIDE INSULATION CEMENT, FIBERGLASS REINFORCEMENT FABRIC, VAPOR BARRIER COATING, FOR CONTINUOUS, AIR-TIGHT INSULATION WITH VAPOR BARRIER.

D. FOAMGLASS PIPE INSULATION

1. FOAM GLASS TYPE PIPE INSULATION SHALL HAVE MAXIMUM K_FACTOR OF 0.38 AT 50 DEGREES F MEAN TEMPERATURE. MINIMUM DENSITY SHALL BE 8 LB/CU. FT., 1 1/2" THICK MINIMUM. PROVIDE MASTIC, FIBERGLASS REINFORCED STRAPPING TAPE TO ASSURE AIR-TIGHT MOISTURE-PROOF INSULATION. PROVIDE WITH ALUMINUM JACKETING THAT SHALL BE 0.016" THICK WITH FITTING COVERS 0.024" THICK. PROVIDE WITH 5 WATT/FT HEAT TRACING BELOW INSULATION FOR OUTDOOR, ABOVE-GROUND INSTALLATION.
2. PROVIDE FOAM GLASS INSERTS AT PIPE HANGERS, CLAMPS, OR OTHER SUPPORTS IN FIBERGLASS OR ELASTOMERIC PIPE INSULATION INSTALLATIONS INSERTS SHALL BE SAME THICKNESS AS ADJOINING PIPE INSULATION. VAPOR SEAL SHALL BE AS HEREINBEFORE SPECIFIED. ALUMINUM JACKETING SHALL NOT BE REQUIRED FOR INDOOR INSERTS (PVC OR WHITE ALL-SERVICE FOIL/KRAFTJACKETING MEDIA SHALL BE USED).

E. ELASTOMERIC (CLOSED CELL FOAM) PIPE INSULATION

1. ELASTOMERIC SHALL BE PROVIDED FOR ALL REFRIGERANT PIPING AND OUTDOOR INSULATED PIPING AND MAY BE USED FOR INDOOR DOMESTIC OR CONDENSATE PIPING. PIPING WILL REQUIRE JACKETING- ALUMINUM FOR OUTDOOR PIPING OR FOIL/WHITE KRAFT MEDIA OR PVC FOR INDOOR PIPING. PROVIDE WITH FULL ADHESIVE ADHERING SEAMS AND JOINTS FOR CONTINUOUS VAPOR BARRIER. ELBOWS SHALL BE FORMED BY CUTTING SEGMENTS AT 30 DEGREE ANGLES (3 SEGMENTS AT EACH 90 DEGREE BEND) WITH MASTIC AT ALL SEAMS. PROVIDE PREFORMED JACKETING ELBOWS AT ALL PIPING ELBOWS.

F. FIBERGLASS BLANKET INSULATION FOR DUCTWORK (INDOOR DUCT ONLY)

1. INSULATION SHALL BE BLANKET TYPE FIBERGLASS INSULATION WITH AVERAGE THERMAL CONDUCTIVITY NOT EXCEEDING 0.29 BTU_IN. PER SQUARE FEET PER DEGREES F PER HOUR AT MEAN TEMPERATURE OF 75 DEGREES F. WITH A MINIMUM DENSITY OF 1 LB/CU. FT., 2" THICK MINIMUM AND FOIL INSULATION FACE. PROVIDE FIRE RETARDANT ADHESIVE OR FOIL REINFORCED KRAFT TAPE, 3" WIDE AT ALL SEAMS. SECURE INSULATION TO DUCT WITH 18 GAUGE TIE-WIRE OR 1/2" X 0.015" GALVANIZED STEEL STRAPS. PROVIDE COMPLETE AIR-TIGHT VAPOR BARRIER FOR ALL DUCTWORK. STAPLES SHALL NOT BE PERMITTED FOR ANY INSULATION ATTACHMENT. PROVIDE GRAY SEALER FOR SEALING JOINTS, PENETRATION AND PUNCTURES.
2. CONTINUE INSULATION THROUGH WALL AND CEILING OPENINGS AND SLEEVES, EXCEPT TERMINATE DUCT INSULATION AT FIRE DAMPERS AND AT FLEXIBLE DUCT CONNECTIONS AT AIR HANDLING UNITS.
3. PROTECT INSULATION FROM PHYSICAL DAMAGE AT POINTS OF SUPPORT WHERE INSULATION MUST CARRY LOAD IMPOSED BY SUPPORT. COORDINATE THIS REQUIREMENT WITH TYPES OF HANGER AND SUPPORT USED. HANGERS THAT PENETRATE INSULATION SHALL BE SEALED WITH MASTIC TO PRESERVE CONTINUOUS VAPOR BARRIER.

G. ELASTOMERIC (CLOSED CELL FOAM) DUCT LINER

1. INSTALL INSIDE OF DUCT WITH FULL ADHESIVE COVERAGE ATTACHMENT TO THE SURFACE TO WHICH IT IS APPLIED; 1” FOR INDOOR AND 1-1/2” FOR OUTDOOR. R VALUES SHALL BE R-4.2 FOR 1” AND R-6.2 FOR 1-1/2”. FIBERGLASS DUCT LINER SHALL NOT BE PERMITTED UNDER ANY CIRCUMSTANCES. PROVIDE WITH ANTIMICROBIAL PROTECTION. PROVIDE MASTIC AT ALL INTERIOR SEEMS FOR CONTINUOUS VAPOR BARRIER. PROVIDE DUCT LINER AT FIRST FIVE FEET OF SUPPLY DUCT FOR REFRIGERATION/COOLING AIR HANDLING EQUIPMENT, UPSIZING INDICATED DUCT SIZE TO ACCOUNT FOR INSULATION THICKNESS. FIBERGLASS DUCT LINER OR DUCT BOARD SHALL NOT BE PERMITTED.

III. VIBRATION ISOLATION

A. ALL MOTORIZED AIR MOVING AND FLUID MOVING EQUIPMENT PIECE SHALL BE PROVIDED WITH VIBRATION ISOLATION MOUNTING OR SUPPORTS.

B. PAD-TYPE ISOLATORS SHALL BE NEOPRENE IN-SHEAR ISOLATION PADS WITH CROSSED DOUBLE RIBS. A STEEL SHIM PLATE SHALL BE PROVIDED BETWEEN THE TWO LAYERS. PADS SHALL BE MOLDED USING OIL RESISTANT 25,000 PSI TENSILE STRENGTH NEOPRENE.

C. HANGING ISOLATORS FOR ITEMS 300 LBS OR LESS SHALL BE BRIDGE-BEARING NEOPRENE MOUNTINGS AND SHALL HAVE A MINIMUM STATIC DEFLECTION OF 0.2" AND ALL DIRECTIONAL SEISMIC CAPABILITY. THE ELEMENTS SHALL PREVENT THE CENTRAL THREADED SLEEVE AND ATTACHMENT BOLT FROM CONTACTING THE CASTING DURING NORMAL OPERATION. THE SHOCK ABSORBING NEOPRENE MATERIALS SHALL BE COMPOUNDED TO BRIDGE-BEARING SPECIFICATIONS. MASON HD, KINETICS

D. HANGING ISOLATORS FOR EQUIPMENT ABOVE 300 LBS SHALL BE STEEL SPRING-TYPE INCORPORATING STEEL HOUSING, NEOPRENE OR LDS RUBBER SPRING CUP SIZED FOR 1” DEFLECTION. INSTALL SPRING IN PLUMB CONFIGURATION WITH MAXIMUM 1” DEFLECTION FROM ANY HORIZONTAL DISTORTION. THE ELEMENTS SHALL PREVENT THE CENTRAL THREADED SLEEVE AND ATTACHMENT BOLT FROM CONTACTING THE CASTING DURING NORMAL OPERATION. CONTRACTOR SHALL SELECT SPRING COLOR/RATING BASED ON EQUIPMENT WEIGHT. AMBER BOOTH SH, KINETICS SH, MASON 30 OR EQUIVALENT.

IV. DUCTWORK AND FITTINGS

A. MATERIAL AND TYPE

1. DUCT CONSTRUCTION SHALL CONFORM TO THE RECOMMENDATIONS OF THE SMACNA HVAC DUCT CONSTRUCTION MANUAL. DUCTBOARD SHALL NOT BE PERMITTED.
2. RIGID, SQUARE DUCTWORK SHALL BE CONSTRUCTED OF LOCK FORMING QUALITY GALVANIZED STEEL SHEETS PER ASTM A527. GALVANIZED COATING SHALL BE NOT LESS THAN 1.25 OUNCES (TOTAL FOR BOTH SIDES) PER SQUARE FOOT OF SHEET. DUCTWORK SHALL BE CLASSIFIED AND CONSTRUCTED SMACNA PRESSURE CLASSES: +2 FOR SUPPLY AND -2 FOR RETURN AND EXHAUST. DUCTWORK GAUGE SHALL BE 26 GAUGE UP TO 30” AND 22 GAUGE ABOVE 30” IN CROSS SECTIONAL HEIGHT, WIDTH, OR DIAMETER.
3. CONCEALED ROUND DUCTS UP TO 12" IN DIAMETER IN PRESSURE CLASSES 2" AND LOWER SHALL BE LONGITUDINAL SEAM CONSTRUCTION.
4. EXPOSED ROUND DUCTWORK OR ROUND ABOVE 12” SHALL BE SPIRAL LOCK_SEAM CONSTRUCTION. ROUND FITTINGS SHALL BE FUSION WELDED BUT SEAM TYPE WITH ALL WELDS CONTINUOUS ALONG SEAMS. ALL DIVIDED FLOW FITTINGS SHALL BE MANUFACTURED AS SEPARATE FITTINGS _ TAP COLLARS WELDED INTO SPIRAL DUCT SECTIONS WILL NOT BE PERMITTED. ALL DIVIDED FLOW FITTINGS 12" IN DIAMETER AND SMALLER SHALL HAVE RADIUSED ENTRANCE PRODUCED BY MACHINE OR PRESS FORMING; ALL DIVIDED FLOW FITTINGS 14" AND LARGER SHALL HAVE CONICAL ENTRANCE PRODUCED BY MACHINE OR PRESS FORMING. ALL DIVIDED FLOW ENTRANCES SHALL BE FREE OF WELD BUILD_UP, BURRS AND IRREGULARITIES. FITTINGS SHALL BE OF THE SAME MANUFACTURER AS THE DUCTWORK.
5. DUCT SEALANT SHALL BE POLYMERIC RUBBER BASE MASTIC, MINERAL IMPREGNATED WOVEN FIBER TAPE WITH ADHESIVE, OR HEAT_SHRINK WITH ADHESIVE. TAPE THICKNESS UP TO 10” = 2”; UP TO 20” = 3”; OVER 20” = 4”
6. INSULATED FLEXIBLE DUCT SHALL BE CLASS 1 AIR DUCT IN ACCORDANCE WITH UL 181 AND SHALL COMPLY WITH NFPA 90A AND 90B. INSULATED FLEXIBLE DUCT SHALL CONSIST OF AN INNER FILM LAYER FOR MINIMUM WORKING PRESSURE OF 6" WATER GAUGE BONDED TO A STEEL OR ALUMINUM SPRING WIRE HELIX, FIBERGLASS INSULATION, AND A VAPOR BARRIER JACKET. INSULATION SHALL HAVE A MAXIMUM U_VALVE OF .23 BTU/HR/SQFT/DEG F AT 75 DEGREES F MEAN TEMPERATURE. VAPOR BARRIER JACKET SHALL HAVE A MAXIMUM VAPOR TRANSMISSION RATE OF 0.1 GRAINS/SQ. FT./HR/INCH HG (PERM). THE ASSEMBLY SHALL HAVE A MAXIMUM FLAME AND SMOKE RATING OF 25/50 PER ASTM E84 AND NFPA 255. FLEXIBLE DUCTS SHALL BE INSTALLED IN AN EXTENDED CONDITION FREE OF SAGS AND KINKS, USING ONLY THE MINIMUM LENGTH REQUIRED TO MAKE THE CONNECTION. ABRUPT BENDS AND TURNS THAT CRIMP THE DUCT AND RESTRICT AIR FLOW SHALL NOT BE PERMITTED. HORIZONTAL SUPPORTS SHALL BE 3/4" WIDE, 22 GAUGE FLAT GALVANIZED STEEL SHEET BANDING MATERIAL. FLEXIBLE DUCTS SHALL BE SUPPORTED ON 36" CENTERS. MAXIMUM LENGTH OF FLEXIBLE DUCT IN PRESSURE CLASS 2" AND BELOW SHALL BE 12 FEET. FLEXIBLE DUCT SHALL NOT BE USED ABOVE INACCESSIBLE CEILINGS.
7. GREASE DUCT SERVING TYPE I HOODS SHALL BE 16 GAUGE BLACK IRON OR 18 GAUGE STAINLESS STEEL WELDED WITH AIR TIGHT SEAM. PROVIDE DUCT CLEANOUTS AT ALL CHANGES OF DIRECTION. FOR INSTALLATIONS THAT WILL RESULT IN A DUCT OR SECTION OF DUCT WITHIN 18” OF COMBUSTIBLE MATERIAL, PROVIDE FIRE-RATED INSULATION AS REQUIRED FOR A ZERO INCH CLEARANCE TO COMBUSTIBLE INSTALLED PER MANUFACTURER'S AND/OR RATING AGENCY REQUIREMENTS COMPLETE WITH ALL REQUIRED PENETRATION TREATMENTS, NUMBER IF INSULATING LAYERS AND APPROVED PREFABRICATED, RATED ACCESS PANELS. DO NOT PROVIDE VENTED ROOF CURBS FOR FIRE WRAPPED GREASE EXHAUST DUCTS.
8. DISHWASHER EXHAUST DUCT SHALL BE STAINLESS STEEL.

B. DAMPERS

1. DAMPERS SHALL BE SINGLE BLADE BUTTERFLY TYPE IN DUCTS UP TO AND INCLUDING 18" X 12" SIZE; FOR DUCTS LARGER THAN 18" X 12", IN EITHER OR BOTH DIMENSIONS, THE DAMPERS SHALL BE THE MULTI_BLADE TYPE. SINGLE BLADE BUTTERFLY DAMPER SHALL BE CONSTRUCTED OF NOT LESS THAN 16_GAUGE GALVANIZED STEEL BLADE MOUNTED IN A GALVANIZED STEEL FRAME. FOR RECTANGULAR DAMPERS, THE TOP AND BOTTOM EDGES OF THE BLADE SHALL BE CRIMPED TO STIFFEN THE BLADE. DAMPER SHALL BE PROVIDED WITH AN EXTENDED ROD TO PERMIT INSTALLATION OF A DAMPER REGULATOR.
2. MULTI_BLADE DAMPERS SHALL BE THE OPPOSED BLADE TYPE, CONSTRUCTED OF NOT THAN 16_GAUGE GALVANIZED STEEL BLADES MOUNTED IN GALVANIZED STEEL CHANNEL FRAME. BLADE SPACING SHALL NOT EXCEED 6 INCHES AND THE TOP AND BOTTOM EDGES OF THE BLADES SHALL BE CRIMPED TO STIFFEN THE BLADES. DAMPER BLADES SHALL BE INTERCONNECTED BY RODS AND LINKAGES TO PROVIDE SIMULTANEOUS OPERATION OF ALL BLADES. DAMPERS SHALL BE PROVIDED WITH EXTENDED RODS TO PERMIT INSTALLATION OF DAMPER OPERATORS.
3. DUCT MOUNTED DIAL REGULATORS WITH OPERATING HANDLE SHALL BE PROVIDED OR DAMPERS WHICH ARE LOCATED ABOVE HARD CEILINGS OR INACCESSIBLE LOCATIONS. CONCEALED CEILING MOUNTED DIAL REGULATORS SHALL BE PROVIDED ON VOLUME CONTROL DAMPERS WHICH ARE LOCATED ABOVE HARD CEILINGS. CONCEALED REGULATORS SHALL BE PROVIDED WITHIN DIFFUSER FACE WITH SCREW ADJUSTMENT.
4. PROVIDE DAMPERS AT ALL SUPPLY AND RETURN DUCT RUN OUTS TO EACH AIR DISTRIBUTION DEVICE WITH ACCESSIBLE ADJUSTMENT LEVER OR DIAL-TYPE REGULATOR ACTUATOR.

C. DUCT FITTINGS

1. SPIN_IN COLLARS SHALL BE GALVANIZED STEEL FOR USE WITH RECTANGULAR OR SQUARE SHEET METAL DUCTWORK. SPIN-IN COLLARS SHALL HAVE AIR SCOOP (FOR SUPPLY DUCTS) AND DAMPER (SUPPLY AND RETURN).
2. TURNING VANES SHALL BE INSTALLED IN ALL 90 DEGREES SQUARE AND RECTANGULAR ELBOWS AND AT OTHER LOCATIONS SHOWN ON THE DRAWINGS WITH THE EXCEPTION OF KITCHEN EXHAUST.
3. CURVED ELBOWS SHALL HAVE A CENTERLINE RADIUS NOT LESS THAN 1 1/2 TIMES THE DUCT WIDTH.
4. DISSIMILAR METALS SHALL BE ISOLATED TO PREVENT GALVANIC CORROSION. JOINTS NOT PROVIDED WITH GASKETS SHALL BE ISOLATED WITH 1/16 INCH MINIMUM THICKNESS ASPHALT IMPREGNATED BUILDING PAPER.
5. PROVIDE DAMPERS AT RETURN DUCT AND OUTSIDE AIR DUCT CONNECTIONS DOWNSTREAM OF ANY DUCT CONNECTIONS OR TAKE OFFS.
6. FLEXIBLE DUCT CONNECTIONS SHALL BE NON-COMBUSTIBLE GLASS FABRIC DOUBLE COATED WITH NEOPRENE 30 OZ. PER SQUARE YARD.
7. FIRE DAMPERS SHALL BE THE FOLDING BLADE FUSIBLE LINK TYPE CONFORMING TO UL 555 AND LABELED FOR INSTALLATION IN FIRE RATED WALLS AND FLOORS. DAMPERS IN FLOOR SHALL HAVE SPRING OPERATOR. DAMPERS, EXCEPT FOR LOWER SECTIONS OF A MULTIPLE SECTION ASSEMBLY, AND THOSE INSTALLED BEHIND GRILLES AND REGISTERS, SHALL HAVE BLADES OUT OF THE AIR STREAM WHEN DAMPER IS IN THE OPEN POSITION. DAMPERS IN WALLS OR FLOORS RATED 2 HOURS OR LESS SHALL BE RATED FOR 1 1/2 HOURS; DAMPERS IN WALLS RATED 3 OR 4 HOUR SHALL BE RATED FOR 3 HOURS. DAMPERS SHALL BE CONSTRUCTED OF GALVANIZED STEEL. PROVIDE AT EACH FIRE RATED WALL PENETRATION (REFER TO ARCH. DRAWINGS)
8. SMOKE DAMPERS SHALL BE THE MULTI-BLADE TYPE CONFORMING TO UL 555S WITH AN ASSEMBLY TEMPERATURE RATING OF 250 DEGREES F. DAMPER SHALL BE CONSTRUCTED OF GALVANIZED STEEL, AND SHALL BE PROVIDED WITH A FACTORY-MOUNTED ELECTRIC DAMPER OPERATOR, SUITABLE FOR OPERATION ON 120V, 60 HZ SUPPLY. PROVIDE AT EACH SMOKE BARRIER LOCATION (REFER TO ARCH DRAWINGS).
9. DUCT-TO-DUCT JOINTS IN ROUND DUCT UP TO AND INCLUDING 60" IN DIAMETER SHALL BE MADE BY USING SLEEVE COUPLINGS, REINFORCED BY ROLLED BEADS. DUCT-TO-FITTING JOINTS IN ROUND DUCT UP TO AND INCLUDING 60" IN DIAMETER SHALL BE MADE BY SLIP_FIT OF THE PROJECTING COLLAR ON THE FITTING INTO THE DUCT. SLEEVE SHALL BE THE SAME GAUGE GALVANIZED STEEL AS THE DUCT; INSERTION LENGTH OF SLEEVE COUPLING AND FITTING COLLAR SHALL BE NOT LESS THAN 2". AFTER THE JOINT IS SLIPPED TOGETHER, SHEET METAL SCREWS SHALL BE INSTALLED FOR MECHANICAL STRENGTH; SCREWS SHALL BE EQUALLY SPACED, NO MORE THAN 12" ON CENTERS AND WITH A MINIMUM OF 3 SCREWS IN EACH JOINT. SCREWS SHALL BE PLACED AT 1/2" FROM THE JOINT BEAD. DUCT-TO-DUCT JOINTS IN DUCTS UP TO AND INCLUDING 12" IN DIAMETER FOR PRESSURE CLASS 2" AND BELOW MAY BE THE BEADED-CRIMP TYPE AND EACH JOINT SHALL BE FASTENED WITH SHEET METAL SCREWS, EQUALLY SPACED, NOT MORE THAN 12" ON CENTERS AND WITH A MINIMUM OF 3 SCREWS IN EACH JOINT. THE BEADED-CRIMP JOINT SHALL PROVIDE AT LEAST A 1" LAP TO ACCOMMODATE THE SHEET METAL SCREWS.
10. ALL DUCT JOINTS (LONGITUDINAL, TRANSVERSE) AND DUCT PENETRATIONS SHALL BE SEALED USING METHODS OUTLINED IN SMACNA HVAC AIR DUCT LEAKAGE TEST MANUAL.
11. DUCT COLLARS SHALL BE PROVIDED WHERE DUCTS PASS THROUGH MASONRY WALLS AND PARTITIONS WHICH EXTEND FULL HEIGHT TO THE UNDERSIDE OF THE STRUCTURE AND SHALL BE FABRICATED FROM 22 GAUGE GALVANIZED STEEL SHEET. DUCT COLLAR SHALL BE PROVIDED ON BOTH SIDES OF WALLS AND PARTITIONS, EXCEPT COLLAR SHALL BE OMITTED ON THAT SIDE OF THE WALL ON WHICH REGISTERS AND GRILLES ARE INSTALLED. FLANGES SHALL BE INSTALLED TIGHT AGAINST THE WALL. THE SPACE BETWEEN THE DUCT AND THE WALL SHALL BE PACKED WITH FIBERGLASS BLANKET INSULATION.
12. DUCT HANGERS AND SUPPORTS SHALL BE IN ACCORDANCE WITH SMACNA HVAC DUCT CONSTRUCTION STANDARDS. IN ADDITION, HANGERS SHALL BE SPACED NOT OVER 8'_0" ON CENTERS. FOR RECTANGULAR DUCTS, WITH LONGEST DIMENSIONS UP THROUGH 60" HANGERS, THE HANGERS SHALL BE GALVANIZED STEEL STRAP TYPE; WITH LONGEST DIMENSION 61" AND LARGER, HANGERS SHALL BE TRAPEZE TYPE CONSTRUCTED OF GALVANIZED STEEL ANGLES WITH ROUND HANGERS RODS. SIZES FOR STRAP HANGERS AND TRAPEZE ANGLES AND RODS SHALL BE BASED ON DUCT SIZE AS SCHEDULED IN THE SMACNA HVAC DUCT CONSTRUCTION STANDARDS.
13. FOR ROUND DUCTS; THE HANGERS SHALL BE THE GALVANIZED STEEL STRAP HANGERS. SIZES AND NUMBER FOR STRAP HANGERS SHALL BE BASED ON DUCT SIZE AS SCHEDULED IN THE SMACNA HVAC DUCT CONSTRUCTION STANDARDS.

D. ROOF CAPS

1. UNLESS OTHERWISE SPECIFIED, ROOF INTAKE AND EXHAUST CAPS SHALL BE ROUND, MINIMUM 16 GAUGE SPUN-ALUMINUM WITH CONTINUOUSLY WELDED CURB CAP. PROVIDE WITH MANUFACTURER'S ROOF CURB. PROVIDE SLOPED CURB FOR PITCHED ROOFS. EXHAUST ROOF HOODS PROVIDED WITH BACKDRAFT DAMPER. OA HOODS SHALL BE PROVIDED WITH A 120/1 MOTORIZED DAMPER TO CLOSE WHEN EQUIPMENT SERVED IS POWERED DOWN UNLESS INDIVIDUAL MOTORIZED DAMPERS ARE INDICATED AT EQUIPMENT BRANCHES.

E. LOUVERS

1. LOUVERS SHALL BE STATIONARY ALUMINUM, 4” DEEP WITH DRAINABLE BLADES, HIDDEN MULLION, ALL 0.081” ALUMINUM WALL THICKNESS, AND KYNAR FINISH TO BE COORDINATED WITH ARCHITECT FOR COLOR. LOUVER SIZED FOR 50% FREE AREA FOR 800 FPM AIRSPEED TO PREVENT WATER ENTRAINMENT. PROVIDE EACH LOUVER WITH A MINIMUM 18” DEEP FULL SIZE PLENUM WITH DUCT CONNECTION SIZED AS INDICATED. PROVIDE OUTDOOR AIR SUPPLY LOUVERS INLET PLENUMS WITH ELASTOMERIC LINER AND PROVIDE MOTORIZED DAMPER AT CONNECTED DUCT. LAYOUT BASIS IS RUSKIN ELF375DX. PROVIDE WITH INSECT SCREENING AT LOUVER FACE.

V. HVAC EQUIPMENT

A. CONTRACTOR SHALL VERIFY REASONABLE OPERATION OF EXISTING UNIT TO REMAIN IN USE AND MAKE ANY REPAIRS OR COMPONENT REPLACEMENT REQUIRED TO HAVE THE UNITS OPERATE A FULL CAPACITY. ALL RUST AND EXTERIOR DAMAGE SHOULD BE REPAIRED AND PAINTED. A TECHNICIAN'S REPORT SHOULD BE ATTAINED AND DELIVERED TO THE OWNER FOR APPROVAL FOR EXISTING EQUIPMENT REPAIRS.

B. ALL NEW AND REUSED UNIT ACCESS AND CONNECTION OPENINGS SHALL BE SEALED WITH PROVIDED GROMMETS, GASKETS FOR AIR TIGHT CONSTRUCTION WITH CONTINUOUS CASE INSULATION. CONTRACTOR TO REPAIR OR REPLACE DAMAGED DOORS, SEALS, GASKETS, GROMMETS ETC… THAT PREVENT AIR-TIGHT CASING.

C. ALL EXHAUST SHALL BE DUCTED FROM UNIT OUTLET TO ROOF CAP INLET OR LOUVER WITH CONTINUOUSLY SEALED DUCTING. NO EXHAUST SHALL BE OPENED INTO THE BUILDING EXTERIOR. PROVIDE ENCLOSED DUCT TRANSITION TO EACH ROOF CAM OR WALL LOUVER.

D. ALL AIR MOVING EQUIPMENT SHALL BE PROVIDED WITH VIBRATION ISOLATION AND FLEXIBLE DUCT CONNECTIONS.

E. CONTRACTOR SHALL PROVIDE GRAVITY DRAINAGE FOR ALL CONDENSATE-PRODUCING HEATING/COOLING EQUIPMENT VIA GRAVITY DRAINAGE OR CONDENSATE PUMP IF GRAVITY DRAINAGE CANNOT BE ACHIEVED.

F. PROVIDE 2 SETS OF FILTERS FOR EACH FILTERED HVAC EQUIPMENT PIECE. PROVIDE FILTER AT INITIAL START-UP, JUST BEFORE TEST AND BALANCE AND AGAIN AT TURN OVER TO OWNER. ALL AIR INLETS AND OUTLETS SHALL BE SEALED WITH FILTER MEDIA DURING GENERAL CONSTRUCTION PRIOR TO TEST AND BALANCE.

G. ROOFTOP UNITS

1. PROVIDE PACKAGED DX ROOFTOP UNITS MANUFACTURED BY TRANE, LENNOX, AAON, CARRIER, OR YORK. PROVIDE WITH CAPACITIES AND ACCESSORIES PER UNIT SCHEDULE. PROVIDE CUSTOM SLOPED ROOF CURBS FOR ROOFS WITH GREATER THAN 2% SLOPE. PROVIDE VIBRATION ISOLATION TYPE ROOF CURBS FOR UNITS DIRECTLY OVER MUSIC REHEARSAL, PERFORMANCE OR OTHER ASSEMBLY AREAS. ALL UNITS SHALL BE PROVIDED WITH A MOTORIZED OA DAMPER OR ECONOMIZER, COIL GUARDS, HINGED ACCESS PANELS, SUPPLY AND RETURN SMOKE DETECTORS, STAINLESS STEEL DRAIN PAN AND BURNER (FOR GAS UNITS). PROVIDE EACH RTU WITH CONVENIENCE RECEPTACLE (SEPARATE CIRCUIT) AND DISCONNECT. OTHERWISE COORDINATE WITH THE ELECTRICAL CONTRACTOR FOR FIELD-MOUNTED DISCONNECT AND RECEPTACLE. ROUTE ALL CONDENSATE PIPING TO NEAREST ROOF DRAIN OR OTHER LOCALLY APPROVED LOCATION WITH THE REQUIRED AIR GAP. NO PIPING SHALL SIT ON THE ROOF SURFACE. SHIFT EXISTING OR NEW VENTS OR EXHAUST TERMINATIONS OR SHIFT UNITS AS NEEDED TO ASSURE 10' BETWEEN ANY EXHAUST OR FLUE AND THE RTU INTAKE.
2. ADAPTER CURBS MAY BE USED WITH SPECIFIC ENGINEER APPROVAL OF SPECIFICALLY SUBMITTED ROOF CURBS (MAXIMUM OF 18” CURB HEIGHT). CONTRACTOR SHALL BE RESPONSIBLE FOR STRUCTURAL ANALYSIS OF EXISTING CURBS AND UNIT SUPPORTS FOR ADAPTER CURB CONNECTIONS.

G. SPLIT SYSTEMS

1. INDOOR UNITS SHALL BE INSTALLED DEAD LEVEL WITH PROVISIONS FOR POSITION, CONDENSATE DRAINAGE AND REFRIGERANT PIPE CONNECTIONS THAT DO NOT BLOCK EQUIPMENT SERVICE OR FILTER ACCESS. PROVIDE CONDENSERS WITH ANTI-SHORT CYCLE TIMER, CRANKCASE HEATER, LOW AMBIENT CONTROLS, COIL GUARDS. INDOOR AND OUTDOOR PIECES SHALL BE BY IDENTICAL MANUFACTURER LISTED BY THE MANUFACTURE AS COMPATIBLE. CASED COOLING COILS SHALL BE SPECIFICALLY LISTS AND WITH MATCHING SIZE WHEN USED WITH A FURNACE. FURNACES SHALL BE HIGH EFFICIENCY FOR USE WITH PVC FLUE AND INTAKE REQUIRING FLUE CONDENSATE NEUTRALIZER AND DRAIN.
2. REFRIGERANT PIPING SHALL BE RUN PARALLEL TO BUILDING WALLS IN WHICH INSTALLED UNLESS OTHERWISE INDICATED ON THE DRAWINGS WITH CONTINUOUS ELASTOMERIC INSULATION AND JACKETING INDOOR AND OUT. PROVIDE WITH AIR TIGHT VAPOR ENCAPSULATION BY USE OF MASTIC AND JACKETING. PROVIDE PIPE HANGER WITH SADDLES AT PIPE SUPPORTS FOR REFRIGERANT PIPING. TYPE L OR K (UNDERGROUND) COPPER TUBING INTENDED FOR ACR APPLICATIONS- DEHYDRATED, CHARGED WITH NITROGEN, AND PLUGGED BY THE MANUFACTURER. PROVIDE FORMED FITTINGS, SUCH AS ELBOWS (SHALL BE LONG SWEEP) AND TEES, ALL JOINTS SHALL BE BRAZED WITH OXY-ACETYLENE TORCHES BY A QUALIFIED TECHNICIAN. SOFT COPPER TUBING SHALL NOT BE ALLOWED UNLESS NOTED ON THE DRAWINGS.
3. PROVIDE INDOOR UNITS LOCATED ABOVE CEILINGS WITH SLOPED SECONDARY DRAIN PAN WITH A CAPPED VALVE AND THREADED HOSE OUTLET. UNIT AND EXTERIOR DRAIN PAN SUPPORT SHALL BE INDEPENDENT SUCH THAT DRAIN PAN CAN BE REMOVED WITHOUT AFFECTING AIR HANDLING UNIT INSTALLATION.
4. THE PREFERENCE SHALL BE A FLOAT SWITCH IN THE EXTERNAL DRAIN PAN TO SHUT THE UNIT DOWN. IF NOT ALLOWED BY CODE OR INSPECTOR, ROUTE THE CONDENSATE TO A CONSPICUOUS LOCATION- OVER A MOP SINK OR SERVICE SINK IF POSSIBLE.
5. FOR LONG REFRIGERANT LINE LENGTHS ABOVE 100', PROVIDE ALL ACCESSORIES, ACCUMULATORS, RESIZED PISTONS AND LINE SETS PER MANUFACTURER REQUIREMENTS.
6. FLOOR MOUNTED VERTICAL UNITS SHALL BE MOUNTED ON A 24” TALL, FULL SIZE RETURN PLENUM WITH METAL GAUGE SUFFICIENT TO SUPPORT UNIT WEIGHT.

H. FANS -GENERAL

1. FANS SHALL BE TESTED AND RATED IN ACCORDANCE WITH AMCA 210.
2. ALL FANS SHALL BE SUPPORTED INDEPENDENT OF CONNECTED DUCT OR CEILING SUPPORTS AND PROVIDED WITH FLEXIBLE INLET/OUTLET CONNECTIONS.
3. FAN WHEELS SHALL BE STATICALLY AND DYNAMICALLY BALANCED.
4. FANS SHALL BE DIRECT DRIVE WITH SPEED CONTROLLER, DIRECT DRIVE ECM. FANS SHALL NOT BE BELT DRIVE UNLESS SPECIFICALLY NOTED ON PLANS. V-BELT DRIVES SHALL BE DESIGNED FOR NOT LESS THAN 150% OF CONNECTED DRIVING CAPACITY AND MOTOR SHEAVES SHALL BE ADJUSTABLE TO PROVIDE NOT LESS THAN 20% SPEED VARIATION. SHEAVES SHALL BE SELECTED TO DRIVE THE FAN AT A SPEED TO PRODUCE THE SCHEDULED CAPACITY INDICATED ON THE DRAWINGS WHEN SET AT THE APPROXIMATE MIDPOINT OF THE SHEAVE ADJUSTMENT. MOTORS WITH V-BELT DRIVES SHALL BE PROVIDED WITH ADJUSTABLE BASES.
5. SAFETY/DISCONNECT SWITCHES (UNLESS SCHEDULED AS UNIT-INTEGRAL) AND STARTERS SHALL BE PROVIDED
6. BY ELECTRICAL CONTRACTOR AND SHALL CONFORM TO REQUIREMENTS OF ELECTRICAL DRAWINGS AND SPECIFICATIONS. MECHANICAL CONTRACTOR SHALL COORDINATE MOUNTING LOCATION TO MAINTAIN MAINTENANCE CLEARANCES. ALL THREE PHASE FANS SHALL BE PROVIDED WITH STARTER AND/OR CONTACTORS AS REQUIRED TO CONTROL FANS AND AUXILIARY DEVICES SUCH AS CONTROLS SYSTEM TIE-IN OR DAMPER ACTUATION.

I. CENTRIFUGAL ROOF FANS

1. FANS SHALL BE CENTRIFUGAL ROOF EXHAUSTERS WITH WATERPROOF DESIGN SO THAT WATER CANNOT ENTER THE BUILDING THROUGH FAN HOUSING WHETHER OR NOT FAN IS OPERATING. FAN SHALL BE EQUIPPED WITH A BACKDRAFT DAMPER ON INLET, A BIRD SCREEN ON OUTLET AND A FACTORY FABRICATED ROOF CURB. GENERAL EXHAUST LAYOUT BASIS (NON- KITCHEN APPLICATIONS)- COOK ACED
2. FAN SHALL HAVE A ONE-PIECE ALUMINUM HOUSING ENCLOSING THE MOTOR AND DRIVE, AN ALUMINUM SHROUD ENCLOSING THE FAN WHEEL, AND AN ALUMINUM CURB CAP. CURB CAP SHALL HAVE A 1 INCH WIDE BY 1/4 INCH THICK FOAM RUBBER GASKET FACTORY APPLIED TO UNDERSIDE PERIMETER OF CURB CAP. AN INTERNAL POWER WIRING POST SHALL EXTEND FROM MOTOR COMPARTMENT THROUGH CURB CAP. WHERE WIRING POST PENETRATES HOUSING AND CURB CAP, PENETRATION SHALL BE SEALED.
3. FAN WHEEL SHALL BE FORWARD CURVED OR BACKWARD INCLINED CENTRIFUGAL TYPE OF ALUMINUM CONSTRUCTION. FAN WHEEL SHALL BE STATICALLY AND DYNAMICALLY BALANCED. ON BELT DRIVE UNITS, SHAFT BEARINGS SHALL BE SELF-ALIGNING, PILLOW BLOCK BALL TYPE. BEARINGS NOT PERMANENTLY SEALED AND LUBRICATED SHALL HAVE EXTENDED GREASE FITTINGS FOR EASY ACCESS.
4. MOTOR AND DRIVE SHALL BE LOCATED IN A VENTILATED COMPARTMENT OUTSIDE OF THE AIR STREAM. FAN SHALL HAVE FACTORY INSTALLED DISCONNECT SWITCH PRE-WIRED TO MOTOR AND MOUNTED WITHIN MOTOR COMPARTMENT. MOTOR AND DRIVE SHALL BE MOUNTED ON VIBRATION ISOLATORS.
5. KITCHEN EXHAUST FANS SHALL BE UL 762 RATED AND PROVIDED WITH POWER/CONTROL WIRING OUTSIDE OF FAN HOUSING AND CURB. FANS SHALL BE MOUNTED WITH 18” MINIMUM HEIGHT FROM FAN BASE TO ROOF /FLASHING AND DISCHARGE HEIGHT A MINIMUM OF 40” ABOVE ROOF SURFACE. SIDE INLET FANS SHALL BE PROVIDED WITH INLET HEIGHT SUCH THAT ALL ROOF MOUNTED HORIZONTAL DUCT CAN BE MOUNTED 20” ABOVE ROOF. PROVIDE NON-VENTED CURB FOR FIRE-WRAP APPLICATIONS AND VENTED CURB FOR ENCLOSURE SHAFT APPLICATIONS.
6. LOCATE EXHAUST FAN DISCHARGE 10' FROM ANY INTAKE OR BUILDING OPENING OR 2' ABOVE SAID OPENINGS IF CODE ALLOWS.

J. IN-LINE/CEILING FANS

1. FAN SHALL BE IN-LINE CENTRIFUGAL TYPE WITH SQUARE OR RECTANGULAR HOUSING AND BACKDRAFT DAMPER. FANS SHALL BE DESIGNED FOR HORIZONTAL OR VERTICAL MOUNTING. LAYOUT BASIS IS COOK GN/GC.
2. FAN HOUSING SHALL BE STEEL WITH FACTORY APPLIED BAKED ENAMEL PAINT ON EXTERIOR. HOUSING SHALL BE INTERNALLY INSULATED WITH 1/2" THICK (MINIMUM) COATED FIBERGLASS INSULATION. INSULATION SHALL COMPLY WITH ASTM E84 AND NFPA 255 FOR MAXIMUM RATINGS OF FLAME SPREAD RATING OF 25 AND SMOKE DEVELOPED RATING OF 50. HOUSING SHALL HAVE MOUNTING BRACKETS AT EACH CORNER.
3. FAN WHEEL SHALL BE BACKWARD INCLINED CENTRIFUGAL TYPE OF ALUMINUM CONSTRUCTION. ON BELT DRIVE UNITS, SHAFT BEARINGS SHALL BE SELF-ALIGNING, PILLOW BLOCK BALL TYPE. BEARINGS NOT PERMANENTLY LUBRICATED AND SEALED SHALL HAVE EXTENDED GREASE FITTINGS.
4. MOTOR AND DRIVE SHALL BE MOUNTED ON VIBRATION ISOLATORS. FAN SHALL HAVE A FACTORY INSTALLED DISCONNECT SWITCH MOUNTED ON EXTERIOR OF HOUSING AND PRE-WIRED TO FAN MOTOR.
5. PROVIDE ALUMINUM GRILLE OPTION FOR CEILING MOUNTED FANS. FANS SHALL BE ROUTED TO ROOF CAP OR LOUVER SIZED AT 800 FPM OUTLET AIRSPEED.

VI. PIPING

A. USE DIELECTRIC UNIONS WHERE DISSIMILAR METALS ARE JOINED TOGETHER.

B. DOMESTIC WATER & PUMPED CONDENSATE

1. UNDERGROUND WATER SERVICE PIPING 3" IN SIZE AND LARGER SHALL BE CLASS 50 DUCTILE IRON PIPE, AWWA C151, WITH HUB AND SPIGOT, PUSH_ON JOINTS, AND CLASS 50 OR GREATER MECHANICAL JOINT DUCTILE IRON FITTINGS ALL CEMENT LINED PER AWWA C104. MECHANICAL JOINTS FOR DUCTILE IRON PIPE SHALL BE MADE WITH A FOLLOWER GLAND, GASKET, BOLTS AND NUTS. PUSH-ON JOINTS FOR DUCTILE PIPE SHALL BE MADE WITH A ONE PIECE LUBRICATED COMPRESSION RUBBER GASKET AS PER AWWA C111.
2. UNDERGROUND STEEL PIPE AND FITTINGS INCLUDING THE PORTION THROUGH THE FLOOR SHALL BE PROTECTED AGAINST CORROSION BY APPLICATION OF PROTECTIVE COATINGS. PRIOR TO COATING, PIPE AND FITTINGS SHALL BE CLEANED OF ALL RUST, SCALE, DIRT AND OIL. PIPES AND FITTINGS SHALL BE GIVEN TWO COATS OF A COAL-TAR BASE BITUMINOUS PROTECTIVE COATING, EACH HAVING A DRY FILM THICKNESS OF 7-9 MILS. THE COMBINED THICKNESS OF BOTH COATS COMBINED SHALL BE 15-18 MILS.
3. UNDERGROUND WATER SERVICE PIPING 2 1/2" IN SIZE AND SMALLER (TO A POINT 1'-0" ABOVE THE FINISHED FLOOR) SHALL BE. TYPE "K" HARD DRAWN COPPER TUBING, ASTM B88, WITH BRAZED JOINTS AND WROUGHT COPPER, ANSI B16.22, OR CAST BRONZE, ANSI B16.18, SOCKET FITTINGS. . BRAZED JOINTS SHALL BE MADE USING BCUP-5 BRAZING ALLOY WITH A COMPATIBLE FLUX.
4. ABOVE-GROUND WATER PIPING - 4" AND SMALLER SHALL BE. TYPE "L" HARD DRAWN COPPER TUBING, ASTM B88, WITH SOLDERED JOINTS AND WROUGHT COPPER, ANSI B16.22, OR CAST BRONZE, ANSI B16.18, SOCKET FITTINGS. SOLDER JOINTS SHALL BE MADE USING A 95-5 TIN-ANTIMONY SOLDER (NO-LEAD SOLDER) WITH A COMPATIBLE FLUX.
5. UNDERGROUND WATER PIPING TO TRAP PRIMERS OR HVAC CONDENSATE PUMP DISCHARGE SHALL BE. TYPE “L” SOFT DRAWN COPPER TUBING, ASTM B88, WITHOUT FITTINGS.
6. FLANGED JOINT SHALL BE MADE WITH RING TYPE NON-METALLIC GASKETS, BOLTS AND NUTS.
7. THREADED JOINTS AT EQUIPMENT CONNECTIONS SHALL BE MADE UP WITH TEFLON TAPE. AFTER CUTTING BUT PRIOR TO THREADING, PIPE SHALL BE REAMED AND SHALL HAVE BURRS REMOVED.
8. GROOVED MECHANICAL JOINTS: GROOVED JOINTS FOR COPPER AND GALVANIZED STEEL PIPES SHALL BE INSTALLED USING BOLTED MECHANICAL COUPLING, PRESSURE-RESPONSIVE GASKET ALONG WITH GROOVED AND FITTINGS. LAYOUT BASIS SHALL BE ANVIL GRUV-LOCK,
9. DIELECTRIC ADAPTERS SHALL BE PROVIDED BETWEEN COPPER AND IRON PIPE CONNECTIONS AND BETWEEN FERROUS AND NONFERROUS PIPING OR EQUIPMENT.
10. UNDERGROUND WATER PIPING SHALL HAVE A MINIMUM COVER OF 3'- 0" TO THE TOP OF THE PIPE.
11. INSTALL WATER HAMMER ARRESTORS ABOVE CEILING ON THE HOT AND COLD WATER BRANCH LINES SERVING A BATTERY OF FIXTURES; ON THE COLD WATER BRANCH LINES SERVING INDIVIDUAL FLUSH VALVE WATER CLOSETS AND URINALS; AND ELSEWHERE AS INDICATED ON THE DRAWINGS. PROVIDE ACCESS PANEL FOR WHA LOCATED ABOVE HARD CEILINGS.
12. VACUUM BREAKERS SHALL BE PROVIDED ON ALL HOSE OUTLETS, HOSE BIBS AND HYDRANTS UNLESS THE DRAWINGS INDICATE THAT A BACKFLOW PREVENTER IS TO BE PROVIDED ON THE PIPING SERVING THE OUTLET.
13. INSTALL 1/2" CW LINE FROM NEAREST CW MAIN OR BRANCH LINE TO ALL FLOOR DRAINS WITH TRAP PRIMER FOR TRAP PRIMING. UNDERGROUND PIPING FROM TRAP PRIMER TO FLOOR DRAINS SHALL BE INSTALLED WITHOUT FITTINGS. TRAP PRIMERS SHALL BE PROVIDED FOR ALL FLOOR DRAINS AND HUB DRAINS.
14. CONNECT HOT AND COLD WATER PIPING SYSTEM TO EQUIPMENT AS INDICATED, AND COMPLY WITH EQUIPMENT MANUFACTURER'S INSTALLATION INSTRUCTIONS. PROVIDE SHUT-OFF BALL VALVE AND UNION FOR EACH CONNECTION, PROVIDE DRAIN VALVE ON DRAIN CONNECTIONS. PROVIDE SINGLE SHUTOFF BALL VALVE FOR HEADERS SERVING HOT OR COLD WATER TO MULTIPLE FIXTURES WITHIN A SINGLE WALL OR CHASE. PROVIDE ACCESS PANEL FOR VALVES INSTALLED ABOVE HARD CEILINGS.
15. ALL DOMESTIC WATER SERVICE AND SUPPLY PIPING INSTALLED UNDER THIS DIVISION SHALL BE DISINFECTED WITH CHLORINE BEFORE IT IS PLACED INTO OPERATION. THE CHLORINATING MATERIAL SHALL BE LIQUID CHLORINE CONFORMING TO FED. SPEC. BB-C-120 AND SHALL BE INTRODUCED TO THE SYSTEM BY EXPERIENCED OPERATORS ONLY. THE CHLORINE SOLUTION APPLIED TO THE PIPING SECTIONS OR SYSTEM SHALL CONTAIN AT LEAST FIFTY PARTS PER MILLION OF AVAILABLE CHLORINE AND SHALL REMAIN IN THE SECTIONS OR SYSTEM FOR A PERIOD OF NOT LESS THAN SIXTEEN (16) HOURS. DURING THE DISINFECTION PERIOD ALL VALVES SHALL BE OPENED AND CLOSED AT LEAST FOUR TIMES. AT THE END OF THE RETENTION PERIOD, NO LESS THAN 50 PPM OF CHLORINE SHALL BE PRESENT IN THE EXTREME END OF THIS SYSTEM. AFTER THE DISINFECTION PERIOD THE CHLORINATED WATER SHALL BE FLUSHED FROM THE SYSTEM WITH CLEAR WATER UNTIL THE RESIDUAL CHLORINE CONTENT IS NOT GREATER THAN TWO-TENTHS - (0.2) - PARTS PER MILLION. THE CONSTRUCTION MANAGER SHALL SUBMIT TO THE ARCHITECT WRITTEN CERTIFICATION THAT THE SYSTEM WAS DISINFECTED. CERTIFICATION SHALL INCLUDE NAME OF PROJECT, NAME OF OWNER, NAME OF OPERATORS, DATE OF DISINFECTION, TIMES OF DISINFECTION PERIOD, MAXIMUM CHLORINE LEVEL AND RESIDUAL CHLORINE LEVEL.

C. NATURAL GAS

1. ABOVE-GROUND MAXIMUM 2-1/2” GAS PIPING SHALL BE BLACK STEEL PIPE, .SCHEDULE 40, ASTM A53 WITH STANDARD WEIGHT WROUGHT STEEL SOCKET-WELD FITTINGS PER ASTM A234 OR THREADED CONNECTIONS. PIPE SIZES 3" AND UP OR WITH PRESSURE ABOVE 5PSI SHALL ONLY BE PERMITTED WITH SOCKET-WELDED JOINTS (NO THREADED CONNECTIONS).
2. STEEL GAS PIPING TO BE INSTALLED UNDERGROUND SHALL BE FURNISHED WITH A FACTORY APPLIED COATING WHICH SHALL CONSIST OF A RESILIENT, EXTRUDED, POLYETHYLENE SLEEVE WHICH IS SEALED TO THE PIPE. THE PLASTIC COATING SHALL BE NOT LESS THAN 25 MILS THICK AND SEALED TO THE PIPE WITH A HOT APPLIED ADHESIVE WHICH RETAINS ITS ELASTICITY IN HOT AND COLD ENVIRONMENTS.
3. FIELD APPLIED WRAPPING TAPE FOR FITTINGS AND JOINTS SHALL BE COAL TAR WITH HEAVY VINYL OR POLYESTER FILM BACKING MEETING FEDERAL SPECIFICATION HH-T-30A, TAPECOAT CT OR TAPECOAT 20 OR JT JOINT COATINGS, INC., WITH PRIMER, APPLICATION PROCEDURES AND HEATING IN ACCORDANCE WITH THE TAPE MANUFACTURER'S RECOMMENDATIONS.
4. ARRANGE WITH THE UTILITY COMPANY TO PROVIDE GAS SERVICE TO INDICATED LOCATION WITH SHUTOFF AT TERMINATION. MAKE ALL ARRANGEMENTS WITH UTILITY AS TO THE EXTENT OF ITS WORK, AND PAY ALL COSTS, FEES AND SECURE PERMITS INVOLVED TO OBTAIN SERVICE FOR THE BUILDING.
5. PROVIDE SHUTOFF IN GAS SERVICE PIPE AT ENTRY IN BUILDING, EXT/END PIPE TO GAS METER LOCATION INDICATED; PROVIDE PARTS AND ACCESSORIES REQUIRED BY UTILITY TO CONNECT TO METER.
6. PROVIDE VALVE AND UNION SHALL BE PROVIDED AT EACH CONNECTION TO A PIECE OF EQUIPMENT. EQUIPMENT PROVIDED WITH A FLANGED INLET SHALL HAVE A FLANGED CONNECTION.
7. DRIP LEGS, 6-INCHES LONG, SHALL BE PROVIDED IN GAS PIPING AT ENDS OF HORIZONTAL RUNS, AT THE BASE OF RISERS AND AT CONNECTIONS TO EQUIPMENT. DRIP LEG CAP SHALL BE REMOVABLE WITH MINIMUM 4” BETWEEN CAP AND WALL OR ROOF.
8. GAS PIPING WITHIN THE BUILDING SHALL BE RUN ABOVE FLOOR SLAB.
9. PRESSURE REGULATORS ARE TO BE PROVIDED ON ALL EQUIPMENT IF NOT PROVIDED AS PART OF THE EQUIPMENT. COORDINATE INLET/OUTLET PRESSURES WITH ACTUAL DELIVERED PRESSURE AND EQUIPMENT INLET PRESSURES. CONTRACTOR SHALL ARRANGE FOR ADJUSTMENT OF GAS PRESSURE TO PREVENT EXCESSIVE OR INSUFFICIENT GAS PRESSURE TO ALL EQUIPMENT PIECES.
10. PROVIDE FLEX HOSE CONNECTION TO ALL INDOOR APPLIANCES NOT SUPPLIED WITH THE EQUIPMENT PIECE BY THE OWNER OR EQUIPMENT PROVIDER.
11. THREADED JOINTS SHALL BE MADE WITH A MIXTURE OF GRAPHITE AND OIL APPLIED TO MALE THREADS ONLY. AFTER CUTTING AND PRIOR TO THREADING, PIPE SHALL BE REAMED AND SHALL HAVE BURRS REMOVED.
12. WELDED JOINTS SHALL BE FUSION WELDED IN ACCORDANCE WITH ANSI B31, SECTION 6.
13. FLANGED JOINTS SHALL BE FACED TRUE, PROVIDED WITH GASKET AND MADE SQUARE AND TIGHT.
14. BRAZED JOINTS SHALL BE MADE UP USING BCUP-5 BRAZING ALLOY WITH A COMPATIBLE FLUX.
15. ALL STEEL FITTINGS AND JOINTS IN UNDERGROUND PIPING SHALL BE FIELD-COATED USING A PRIMER AND FLEXIBLE POLYETHYLENE TAPE AND THE SAME MANUFACTURER AS THE PIPE COATING. DAMAGED COATING SHALL BE REPAIRED WITH PRIMER AND TAPE AS SPECIFIED FOR FITTINGS AND JOINTS.

D. SANITARY WASTE &VENT, STORM, GREASE WASTE

1. UNDERGROUND SANITARY, WASTE AND VENT PIPING, AND STORM DRAINAGE PIPING, AND INDOOR PIPING ABOVE 8” IN SIZE SHALL BE SERVICE WEIGHT (COATED) CAST IRON SOIL PIPE AND FITTINGS, ASTM A74, WITH GASKET HUB AND SPIGOT JOINTS, ASTM C564. GASKET JOINTS FOR CAST IRON PIPE SHALL BE MADE WITH LUBRICATED NEOPRENE COMPRESSION GASKETS. PVC SHALL BE PERMITTED IF ALLOWED BY LOCAL CODE. UNDERGROUND PVC PIPING SHALL BE SCHEDULE 40 PVC WITH SOLVENT WELD JOINTS MEETING ASTM D-1785 AND ASTM D-2665.
2. ABOVE-GROUND SANITARY, WASTE AND VENT AND STORM DRAINAGE PIPING 8" AND SMALLER SHALL BE SERVICE WEIGHT CAST IRON SOIL PIPE AND FITTINGS, ASTM A888 AND CISPI 301, WITH STANDARD NO-HUB COUPLINGS. PVC SHALL BE PERMITTED OUTSIDE OF RETURN AIR PLENUMS WITH OWNER APPROVAL. NEOPRENE RUBBER GASKET AND MINIMUM 24 GAUGE TYPE 304 STAINLESS STEEL SHIELD AND FOUR STAINLESS STEEL BANDS FOR SIZES 1 1/2" THROUGH 4", SIX BANDS MINIMUM FOR SIZED 5" AND LARGER. 6” PIPE AND UP: NEOPRENE ELASTOMERIC GASKET AND SERIES 300 STAINLESS STEEL SHIELD AND MULTIPLE DRAW BANDS AND SCREW CLAMPS CONFORMING TO ASTM C-564 AND CISPI STANDARD 310-90. ABOVE-GROUND SANITARY PIPING, LOCATED OUTSIDE OF RETURN AIR PLENUMS MAY ALSO BE SCHEDULE 40 PVC WITH SOLVENT WELD JOINTS MEETING ASTM D-1785 AND ASTM D-2665 PER OWNER APPROVAL.
3. ALL WASTE PIPING 1" IN SIZE AND SMALLER SHALL BE TYPE "L" HARD DRAWN COPPER TUBING, ASTM B88, WITH SOLDERED JOINTS AND WROUGHT COPPER, ANSI B16.22, OR CAST BRONZE, ANSI B16.18, SOCKET FITTINGS. SOLDERED JOINTS FOR TYPE 'L' COPPER TUBING AND CAST DMV BRONZE PIPE SHALL BE MADE WITH 95-5 TIN-ANTIMONY (NO LEAD) SOLDER AND COMPATIBLE FLUX.

E. PIPING HANGERS

1. PROVIDE CLEVIS SUPPORTS WITH BEAM CLAMP, CONCRETE ANCHORS (CONCRETE STRUCTURE), SCREWED BRACKET (WOOD STRUCTURE). PROVIDE HANGER OUTSIDE OF INSULATION WITH RIGID FOAM GLASS INSULATION SECTION AT HANGERS. PROVIDE 16 GAUGE PIPING SADDLE AT EACH HANGER. NO WELDING OR CUTTING OF STEEL STRUCTURAL MEMBERS SHALL BE PERMITTED. LAYOUT BASIS SHALL BE ANVIL 260.
2. PROVIDE SEISMIC HANGERS PER DRAWING REQUIREMENTS.
3. HANGER INSTALLATION FOR HOT WATER PIPING SHALL NOT PREVENT MOVEMENT FOR PIPING EXPANSION.
4. SPACING AS FOLLOWS:

STEEL PIPE: 1/2” TO 1-1/4” - 7' ; 1-1/2” TO 2-1/2” - 9' ; 3”&4” - 12' ; 6“&8” - 17' ; 10” AND UP- 22'

COPPER PIPE: 1/2” TO 1” - 5' ; 1-1/4” TO 2” - 7' ; 2-1/2” AND UP - 9'

CAST IRON: 10' WITH SUPPORT AT EACH JOINT, TAKEOFF, AND FITTING.

PVC DRAINAGE (140 DEG F SERVICE UP TO 6”- 80 DEG F ABOVE 6”): UP TO 3” - 3' ; 4” TO 6” - 4' ; ABOVE 6” - 8'

PVC VENT (80 DEG F SERVICE): UP TO 1-1/2” - 5' ; 2”-3” - 6' ; ABOVE 3” 7'

WORKOUT ANYTIME™

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REV. NO.	DATE	DESCRIPTION
1	5.26.2015	LANDLORD COMMENTS

PROJECT NO:
DRAWN BY:
CHECKED BY:
ISSUE DATE: 08-19-15 RELEASED FOR CONSTRUCTION

MECHANICAL SPECIFICATIONS

M0.1