

SPECIFICATIONS FOR HVAC

- SCOPE OF WORK:** WORK SHALL INCLUDE COMPLETE HVAC SYSTEMS. PROVIDE SUPERVISION, LABOR, MATERIAL, EQUIPMENT, MACHINERY, PLANT AND ITEMS NECESSARY FOR COMPLETE SYSTEMS TESTED AND READY FOR OPERATION.
- REGULATIONS:** MATERIALS AND INSTALLATION SHALL COMPLY WITH LOCAL CODES, APPLICABLE PROVISIONS OF LATEST EDITION OF NATIONAL FIRE PROTECTION ASSOCIATION, LOCAL UTILITY REGULATIONS AND GOVERNMENTAL DEPARTMENTS HAVING JURISDICTION.
- DRAWINGS:** THESE DRAWINGS ARE DIAGRAMMATIC AND INDICATE GENERAL ARRANGEMENT OF SYSTEMS AND WORK INCLUDED. WHERE VARIANCES OCCUR INCLUDE THE ITEMS OF BETTER QUALITY, GREATER QUANTITY OR HIGHER COST.
- COORDINATION OF WORK:** THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE COORDINATION AND PROPER RELATION OF HIS WORK TO THE BUILDING STRUCTURE AND TO THE WORK OF OTHER TRADES. CONTRACTOR SHALL PROVIDE DIMENSIONS AND LOCATIONS OF ALL OPENINGS, SHAFTS AND SIMILAR ITEMS TO THE PROPER TRADES AND SHALL INSTALL WORK AS REQUIRED SO AS NOT TO DELAY THE BUILDING CONSTRUCTION. THE CONTRACTOR IS RESPONSIBLE FOR DAMAGE CAUSED BY HIS WORK OR WORKMEN. REPAIRING OF DAMAGED WORK SHALL BE DONE BY THE CONTRACTOR AT NO ADDITIONAL COST.
- VISITING THE SITE:** EACH CONTRACTOR SHALL BE RESPONSIBLE FOR VISITING THE SITE BEFORE PRICING THE JOB TO FAMILIARIZE HIMSELF WITH ALL EXISTING CONDITIONS TO BE MET IN THE EXECUTION OF THE WORK UNDER THIS CONTRACT. NO ADDITIONAL COMPENSATION WILL BE ALLOWED RELATING TO SITE CONDITIONS.
- INTERRUPTION OF SERVICES:** INTERRUPTIONS OF SERVICE TO EXISTING SYSTEMS SHALL BE COORDINATED WITH THE OWNER AS TO TIME AND DURATION. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ANY INTERRUPTIONS TO SERVICE AND SHALL REPAIR ANY DAMAGES TO EXISTING SYSTEMS CAUSED BY HIS OPERATIONS.
- WORK IN OCCUPIED AREAS:** WORK IN OCCUPIED AREAS SHALL BE COORDINATED WITH THE OCCUPANT AND OWNER AS TO TIME AND DURATION. THE CONTRACTOR SHALL PROTECT THE OCCUPIED AREA AND SHALL BE RESPONSIBLE FOR CLEANING AND REPAIRING ANY DAMAGES CAUSED BY HIS WORK. SAFETY OF BUILDING OCCUPANTS SHALL BE ASSURED AT ALL TIMES. TOOLS, MATERIAL, DIRT AND DEBRIS SHALL BE REMOVED FROM OCCUPIED AREAS WHENEVER WORK AREAS ARE LEFT UNATTENDED.
- ACCESSIBILITY:** LOCATE EQUIPMENT WHICH MUST BE SERVICED OR MAINTAINED IN FULLY ACCESSIBLE POSITIONS WHERE POSSIBLE. OTHERWISE, FURNISH ACCESS PANELS OF SUFFICIENT SIZE AND LOCATED SO THAT THE CONCEALED EQUIPMENT CAN BE SERVICED.
- FOUNDATION PADS AND ROUGH-IN:** PROVIDE 4-INCH HIGH CONCRETE FOUNDATION PADS FOR FLOOR-MOUNTED EQUIPMENT. ROUGH-IN OPENINGS SHALL ALIGN VERTICALLY AND HORIZONTALLY WITH BUILDING STRUCTURE. WALL-MOUNTED THERMOSTATS SHALL BE MOUNTED 48" ABOVE FINISHED FLOOR TO THE TOP OF THE THERMOSTAT.
- SLEEVES:** LOCATE SLEEVES DURING NORMAL COURSE OF WORK. PROVIDE SLEEVES FOR PIPING PASSING THROUGH CONCRETE FLOOR SLABS AND CONCRETE, MASONRY, TILE AND GYPSUM WALL CONSTRUCTION. SLEEVES SHALL NOT BE REQUIRED FOR PIPING EMBEDDED IN CONCRETE OR SLAB ON GRADE, EXCEPT THAT COPPER PIPING SHALL REQUIRE SLEEVES THROUGH SLABS ON GRADE. SLEEVES PLACED IN EXTERIOR WALLS BELOW GRADE SHALL BE WATERPROOF. WHERE SLEEVES ARE LOCATED THROUGH FIRE-RATED WALLS OR FLOORS, THE SLEEVE ASSEMBLIES SHALL MAINTAIN THE FIRE RATING OF THE WALL OR FLOOR. SLEEVES SHALL BE CONSTRUCTED OF 3/4 GAUGE GALVANIZED STEEL WITH LOCK SEAM JOINTS FOR ALL SLEEVES SET IN CONCRETE FLOOR SLABS. ALL OTHER SLEEVES SHALL BE CONSTRUCTED OF GALVANIZED STEEL PIPE.
- CUTTING AND PATCHING:** THE CONTRACTOR SHALL PROVIDE ALL CUTTING AND PATCHING NECESSARY TO INSTALL HIS WORK. PATCHING SHALL MATCH ADJACENT SURFACES. NO STRUCTURAL MEMBERS SHALL BE CUT WITHOUT THE APPROVAL OF THE ARCHITECT.
- CLEANING:** EQUIPMENT AND PIPING SHALL BE CLEANED TO REMOVE FOREIGN MATERIALS. PROVIDE TEMPORARY FILTERS FOR AIR UNITS THAT ARE OPERATED DURING CONSTRUCTION. PLUG OR CAP OPENINGS IN EQUIPMENT, DUCTWORK, PIPING AND MATERIALS UNTIL CONNECTION IS MADE TO THE SYSTEM. REMOVE FROM THE PREMISES ALL UNUSED MATERIAL AND DEBRIS RESULTING FROM THE PERFORMANCE OF HVAC WORK.
- WIRING:** STARTERS THAT ARE SPECIFIED TO BE FURNISHED AS AN INTEGRAL PART OF THE MECHANICAL EQUIPMENT SHALL BE COMPLETE WITH PROPERLY SIZED OVERLOAD HEATERS. TEMPERATURE CONTROL WIRING, EQUIPMENT CONTROL WIRING AND CONTROL INTERLOCK WIRING FOR MECHANICAL EQUIPMENT SHALL BE FURNISHED BY THE MECHANICAL CONTRACTOR. CONTROL WIRING SHALL NOT INCLUDE ANY WIRING WHICH CARRIES MOTOR CURRENT. ALL WIRING SHALL BE IN METAL CONDUIT AND SHALL COMPLY WITH THE ELECTRICAL SPECIFICATIONS.
- QUIET OPERATION:** SYSTEMS SHALL OPERATE UNDER CONDITIONS OF LOAD WITHOUT UNUSUAL OR EXCESSIVE NOISE OR VIBRATION. UNUSUAL OR EXCESSIVE NOISE OR VIBRATION SHALL BE CORRECTED.
- TESTING AND BALANCING:** HVAC CONTRACTOR SHALL TEST ALL HVAC EQUIPMENT TO ASSURE THAT THE PROPER SEQUENCE OF CONTROL IS ESTABLISHED AND OPERATING IN A SAFE MANNER. THE AIR QUANTITIES FOR EQUIPMENT, DIFFUSERS AND REGISTERS SHALL BE BALANCED FOR THE CFM AS INDICATED ON THE DRAWING. CONTRACTOR SHALL COORDINATE AND WORK WITH THE OWNER'S COMMISSIONING AGENT AND PROVIDE ALL NECESSARY TESTING AND BALANCING INFORMATION REQUIRED FOR THE COMMISSIONING.
- INSTRUCTIONS TO OWNER:** INSTRUCT THE OWNER IN THE PROPER OPERATION AND MAINTENANCE OF THE MECHANICAL SYSTEMS UNTIL THE OWNER IS FULLY PREPARED TO OPERATE AND MAINTAIN THE SYSTEMS. HOWEVER, LENGTH OF INSTRUCTION TIME SHALL BE LIMITED TO TWO (2) FULL DAYS.
- OPERATING AND MAINTENANCE:** PROVIDE THE OWNER WITH ONE (1) ELECTRONIC VERSION AND TWO (2) BOUND SETS OF OPERATING AND MAINTENANCE INSTRUCTIONS FOR ALL HVAC EQUIPMENT AND CONTROLS.
- WARRANTY:** EQUIPMENT, MATERIALS AND LABOR REQUIRED BY THESE CONTRACT DRAWINGS SHALL BE GUARANTEED TO BE FREE FROM DEFECTIVE MATERIALS OR WORKMANSHIP FOR ONE (1) YEAR AFTER FINAL ACCEPTANCE OF THE PROJECT UNLESS SPECIFIED FOR A LONGER PERIOD IN OTHER PORTIONS OF THE SPECIFICATIONS. DEFECTIVE MATERIALS OR WORKMANSHIP OCCURRING DURING THIS PERIOD SHALL BE CORRECTED AT NO ADDITIONAL COST.
- PAINTING:** GENERAL - PAINT MECHANICAL EQUIPMENT AND MATERIALS (WHERE NOT CONCEALED). PAINTING (IN CONCEALED SPACES) SHALL BE LIMITED TO EQUIPMENT AND MATERIALS NOT OTHERWISE PROTECTED FROM RUSTING SUCH AS HANGERS AND SUPPORTS. PAINT SHALL BE PRODUCTS OF SHERWIN-WILLIAMS, PITTSBURGH, PRANT-LAMBERT OR EQUAL. SURFACE PREPARATION, PRIMING AND PAINT APPLICATION SHALL BE IN ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS. GALVANIZED SURFACES SHALL BE PRE-TREATED WITH A PHOSPHORIC ACID CLEANING SOLUTION AND PRIMED. AFTER PREPARATION EACH ITEM SHALL BE PAINTED, EXCEPT COLOR OF PAINT FOR EQUIPMENT AND MATERIAL WHERE NOT CONCEALED SHALL BE AS SELECTED BY THE ARCHITECT. ITEMS NOT CONCEALED IN ROOMS SHALL BE PAINTED OF THE SAME COLOR TO MATCH ADJACENT WALLS OR CEILINGS. PAINTING IS NOT REQUIRED OF ITEMS WITH A FACTORY-FINISH COAT. PATCH PAINTING IS REQUIRED OF ANY DAMAGED AREAS TO MATCH FACTORY-FINISH COAT. NAMEPLATES ON EQUIPMENT SHALL NOT BE PAINTED.
- IDENTIFICATION OF PIPES AND EQUIPMENT:** EACH MAJOR PIECE OF EQUIPMENT, SUCH AS AIR HANDLING UNITS AND PIPING SHALL BE IDENTIFIED BY MARKING THAT WILL READ THE SAME AS THE IDENTIFICATION SHOWN ON THE DRAWINGS. STENCIL LETTERS SHALL BE 2 INCHES HIGH UPPER CASE PAINTED WITH WHITE ENAMEL ON EQUIPMENT AND BLACK ENAMEL ON PIPING AND CONDUIT. IDENTIFICATION SHALL BE PAINTED ON EACH PIPE OR CONDUIT WHERE EXPOSED OR ACCESSIBLE AND SHALL BE PLACED EVERY 15 FEET ALONG THE PIPE OR CONDUIT.
- AIR DEVICES**
 - DIFFUSERS, REGISTERS AND GRILLES SHALL BE METAL-AIRE OR EQUAL UNLESS NOTED OTHERWISE. CEILING DEVICES SHALL HAVE WHITE BAKED ENAMEL FINISH. ALL OTHER DEVICES SHALL HAVE PRIME FINISH.
 - DIFFUSERS: SQUARE CEILING DIFFUSERS SHALL BE SERIES 8800-6 COMPLETE WITH ROUND NECK AND VOLUME CONTROL UNIT. LAY-IN DIFFUSERS SHALL BE 24" X 24" WITH FULL LOUVER FACE AND ALUMINUM CONSTRUCTION.
 - RETURN AND EXHAUST REGISTERS AND GRILLES SHALL BE MODEL RH ALUMINUM CONSTRUCTION WITH 45 DEGREE DEFLECTING VANES AND SHALL HAVE FREE AREA NOT LESS THAN 75%. REGISTER DAMPERS SHALL BE OPPOSED-BLADE FACE-OPERATED TYPE WITH REMOVABLE KEY.
 - SUPPLY REGISTERS AND GRILLES SHALL BE MODEL 4200 ALUMINUM FRAME WITH REMOVABLE DOUBLE DEFLECTION ALUMINUM REVERS-A-CORE AND SHALL HAVE FREE AREA OF NOT LESS THAN 75%. REGISTER DAMPERS SHALL BE OPPOSED BLADE TYPE, FACE OPERATED WITH REMOVABLE KEY.
 - DOOR GRILLES SHALL BE 300 DG TELESCOPING FRAME WITH V (W LIGHT TIGHT) CORE. FURNISH TO GENERAL CONTRACTOR FOR INSTALLATION BY DOOR MANUFACTURER.
 - FLOOR REGISTERS SHALL BE (LIMA SERIES 40 DELUXE) (METAL-AIR SERIES 2000) COMPLETE WITH DAMPERS (AND 15 DEGREE DEFLECTION).
 - RETURN GRILLES IN WALL SHALL BE METAL-AIRE 300 DG-OF. FINISH SHALL BE WHITE.
 - TRANSFER GRILLES SHALL BE METAL-AIRE SERIES 7000 PERFORATED FACE, LAY-IN OR SURFACE TYPE. FINISH SHALL BE WHITE.
 - WALL LOUVERS SHALL BE GREENHEAT MODEL ESD-403 OR EQUAL STATIONARY DRAINABLE BLADE ALUMINUM LOUVER COMPLETE WITH 12" MESH MATCHING BIRD SCREEN IN REMOVABLE FRAME. FRAME SHALL BE 4" DEEP AND BLADE SPACING SHALL NOT EXCEED 4" O.C. FINISH SHALL MATCH ADJACENT FRAMING. VERIFY WITH ARCHITECT.
- DUCTWORK**
 - GENERAL: DUCTWORK SHALL BE ZINC-COATED SHEET STEEL OR ALUMINUM, CONSTRUCTED AND INSTALLED AS RECOMMENDED BY THE LATEST EDITION OF SMACNA.
 - DUCT CLEARANCE SHALL BE ESTABLISHED AT THE JOB SITE BEFORE ANY DUCTS ARE FABRICATED. THE CONTRACTOR WILL NOT BE ALLOWED ANY EXTRA COSTS FOR DUCTS FABRICATED AND THEN FOUND NOT TO FIT.
 - MANUAL VOLUME CONTROL DAMPERS SHALL HAVE ACCESSIBLE OPERATING MECHANISM. BLADE HEIGHT SHALL NOT EXCEED 8 INCHES.
 - MOTORIZED DAMPERS SHALL BE OPPOSED BLADE CONSTRUCTION FOR MODULATING SERVICE AND PARALLEL BLADE CONSTRUCTION FOR TWO-POSITION SERVICE. MOTORIZED DAMPERS SHALL BE CONSTRUCTED WITH BRASS BEARINGS, CHANNEL IRON FRAME AND INTERLOCKING BLADES WITH AIR-TIGHT FELT SEALS. MOTOR OPERATOR FOR DAMPERS ARE SPECIFIED IN PARAGRAPH 27 - TEMPERATURE CONTROL SYSTEM.
 - AIR DEFLECTORS SHALL BE PROVIDED IN ALL SQUARE ELBOWS AND DUCT-MOUNTED SUPPLY OUTLETS.
 - HINGED ACCESS DOORS SHALL BE PROVIDED IN ACCORDANCE WITH NFPA 90A AT ALL AUTOMATIC DAMPERS, FIRE DAMPERS, HEATERS, THERMOSTATS, ON EACH SIDE OF AIR HANDLING UNIT AND OTHER APPARATUS REQUIRING SERVICE AND INSPECTION IN THE DUCT SYSTEM. ACCESS DOORS SHALL BE 15" X 18" OR AS LARGE AS PRACTICAL.
 - PROVIDE FLEXIBLE DUCT CONNECTIONS TO AIR HANDLING EQUIPMENT.
 - DUCT SUPPORTS SHALL CONSIST OF NOT LESS THAN 1" X 16-GAUGE GALVANIZED STRAP IRON HANGERS SPACED NOT OVER 4' 0" ON CENTER.
 - WATER-TIGHT DUCTS SHALL BE FABRICATED FROM COPPER SHEETS WITH SOLDERED SEAMS OR ALUMINUM (STAINLESS STEEL) SHEETS WITH SOLDERED SEAMS.
 - ACOUSTICAL DUCT LINING SHALL BE 1" THICK, 1-1/2 PCF, FIBERGLASS DUCT LINER WITH A SMOOTH MAT, BONDED SURFACE ON AIR SIDE. LINER SHALL BE ABUSE RESISTANT AND SHALL NOT SUPPORT MOLD OR FUNGUS GROWTH. DUCT LINER SHALL HAVE A MINIMUM THERMAL RESISTANCE (R) OF 4.0 AT A MEAN TEMPERATURE OF 75 DEG. F. NOISE REDUCTION COEFFICIENT SHALL BE NOT LESS THAN 0.5 TO 0.6 WHEN TESTED BY THE ASTM-C 423 B07 OR ASTM C-423-B6. MOUNTING & FLAME SPREAD: FUEL CONTRIBUTION AND SMOKE DEVELOPMENT RATINGS OF LINING AND MATERIALS SHALL COMPLY WITH NFPA STANDARD 90A AND ASTM E84. THE LINING SHALL BE APPLIED IN CUT-TO-SIZE PIECES FASTENED TO THE ENTIRE INTERIOR OF THE DUCT WITH APPROVED ADHESIVE AND SECURED WITH MASTIC, STICK CLIPS AND SPEED WASHERS. EDGES AND JOINTS SHALL BE COATED WITH FIRE-RESISTANT MASTIC.
 - FLEXIBLE DUCTS SHALL BE FLEXIBLE METAL OR METAL AND NEOPRENE-COATED CANVAS OVER INSULATED WITH 1" THICK FIBERGLASS WITH VINYL VAPOR BARRIER. ALL ROUND DUCT TAKE-OFFS SHALL BE MADE WITH SPRING FITTINGS WITH BALANCING DAMPER. THE DUCT DIAMETER SHALL MATCH THE AIR DIFFUSER SIZE UNLESS OTHERWISE INDICATED. FLEXIBLE DUCTS SHALL NOT BE USED IN AREAS WITHOUT A CEILING OR IN AREAS WITH EXPOSED CEILING CEILINGS.
- FIRE DAMPERS:** NOT USED
- PIPING**
 - HEATED OR CHILLED WATER LINES: PIPE 4" AND SMALLER SHALL BE ALL TYPE 1; HARD DRAWN COPPER TUBING OR ALL ASTM A53 SCHEDULE 40 STANDARD WEIGHT BLACK STEEL, EXCEPT UNDERGROUND LINES SHALL BE TYPE "K" HARD DRAWN COPPER TUBING. PIPE OVER 4" SHALL BE ASTM A53 SCHEDULE 40 STANDARD WEIGHT BLACK STEEL. ALL FITTINGS SHALL BE SUITABLE FOR 125 PSI WATER SERVICE.
 - COOLING COIL CONDENSATE DRAIN LINES SHALL BE (PVC) (TYPE "M" HARD DRAWN COPPER TUBING). PROVIDE WATER SEAL FROM EACH AIR HANDLING UNIT OF SUFFICIENT DEPTH TO PREVENT BLOW OUT OR SPINNING OF WATER.
 - REFRIGERANT LINES SHALL BE DEHYDRATED AND SEALED COPPER TUBING AND SHALL BE SIZED IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS. SUCTION LINE SHALL BE INSULATED WITH A MINIMUM OF 1/2" THICK ARMAFLEX VAPOR SEALED. VERIFY ROUTE OF PIPE WITH ARCHITECT BEFORE INSTALLATION.
 - SERVICE VALVES: UP TO AND INCLUDING 2" SHALL BE ALL BRASS, RISING STEM, SOLID WEDGE DISC GATE VALVES. VALVES OVER 2" FOR WATER SERVICE SHALL BE IRON BODY BUTTERFLY DISC TYPE WITH EPDM NORDSEL SEALS. VALVES OVER 2" FOR STEAM SERVICE SHALL BE BUTTERFLY TYPE WITH CARBON STEEL BODY AND DISC AND TEFLOM SEAL RING.
 - GLOBE VALVES SHALL BE ALL BRASS WITH BRASS DISC, EXCEPT GLOBE VALVES OVER 2" SIZE MAY BE BUTTERFLY TYPE.
 - CHECK VALVES SHALL BE BRASS OR IRON BODY, SWING TYPE, REGRINDING SEAT.
 - BALANCING COCKS SHALL BE ALL BRASS, SQUARE HEAD OR SCREWDRIVER HEAD WITH CHECK. BALANCING COCKS OVER 2" SIZE MAY BE IRON BODY.
 - STRAINERS SHALL BE Y TYPE WITH BRONZE BASKET SUITABLE FOR 125 PSI SERVICE.
 - MANUAL AIR VENTS SHALL BE CHROMIUM-PLATED BRASS 1/8" NPT CON-OPERATED TYPE.
 - SAFETY RELIEF VALVES FOR WATER HEATING SYSTEMS SHALL BE WATTS ASME SERIES 740. VALVES FOR HEATING SYSTEMS SHALL BE SIZED TO RELIEVE THE FULL HEATING CAPACITY OF THE SYSTEM. SAFETY RELIEF VALVES FOR COOLING SYSTEMS SHALL BE WATTS ASME SERIES 374, 3/4" X 3/4". PIPE DISCHARGE PORTS FULL SIZE TO FLOOR DRAIN.

L. BYPASS RELIEF VALVE SHALL BE ADJUSTABLE SETTING TYPE, BRONZE BODY, MODULATING ACTION PRESSURE RELIEF VALVE AS MANUFACTURED BY CLA-VAL OR EQUAL. SIZE TO RELIEVE 50% OF PUMP CAPACITY. SET TO RELIEVE WHEN SYSTEM HEAD IS 5 FOOT W.G. ABOVE SPECIFIED SYSTEM PUMP HEAD.

M. PRESSURE GAUGES SHALL BE 4" DIA. ASHCROFT BOURDON TUBE TYPE SUITABLE FOR 125 PSI SERVICE.

N. FLEXIBLE PIPE JOINTS SHALL BE PIPE LINE SIZE, FLANGED, MINIMUM 125 PSI WORKING PRESSURE AT 250 DEG. F. FLEXONICS MODEL P05.

O. AIR CONTROL FITTINGS SHALL BE BELL & GOSSETT AS FOLLOWS:

- AIR SEPARATOR - ASME STAMPED 125 PSI MODEL _____
- BOILER FITTING - ABF OR ABF AS APPLICABLE, TOP OR SIDE OUTLET AS REQUIRED.
- TANK FITTING - ATF OR ATFL AS APPLICABLE WITH DRAIN-O-TANK VALVE.
- COMPRESSION TANKS - ASME STAMPED 125 PSI. GALVANIZED OUTSIDE WITH TAPPED OPENINGS AS REQUIRED.

P. THERMOMETERS SHALL BE WEISS 9" VARI-ANGLE MERCURY TYPE WITH SEPARATE SPOUT.

Q. PIPE SUPPORTS: SUSPENDED HORIZONTAL PIPING SHALL BE SUPPORTED BY ADJUSTABLE WROUGHT STEEL CLEVIS HANGERS. ALL SUPPORTS SHALL BE ATTACHED TO THE BUILDING STRUCTURE SPACES 10' ON CENTER. HANGER ROOS SHALL BE 3/8" DIAMETER SIZE FOR 1-1/2" THROUGH 2", 5/8" DIAMETER SIZE FOR 2-1/2" THROUGH 3", 3/4" DIAMETER SIZE FOR 3-1/2" THROUGH 4", 7/8" DIAMETER SIZE FOR 4" THROUGH 5" AND 7/8" DIAMETER SIZE FOR 6" THROUGH 12". PIPE HANGER ROOS SHALL BE ATTACHED TO THE TOP CHORD ONLY ON STEEL JOISTS AND BEAMS WITH CLAMPS. PIPING SHALL BE INSTALLED IN PRACTICAL ALIGNMENT WITH THE BUILDING.

R. ANCHORS FOR PIPE SHALL BE PROVIDED AS INDICATED OR AS REQUIRED AT THE JOB SITE TO LOCALIZE EXPANSION AND CONTRACTION OF PIPE.

S. VERTICAL PIPING SHALL BE GUIDED OR SUPPORTED IN THE CENTER OF EACH RISER AND NOT OVER 15'-0" ON CENTER AND SHALL BE SUPPORTED AT THE BASE OF EACH RISER.

T. INSTALLATION: ALL PIPING SHALL BE INSTALLED WITH SUFFICIENT PITCH TO INSURE ADEQUATE DRAINAGE AND VENTING. ALL HIGH POINTS IN WATER LINES SHALL BE PROVIDED WITH AUTO-AIR VENTS. ALL LOW POINTS WITH DRAINS, STEAM AND CONDENSATE LINES SHALL SLOPE A MINIMUM OF 1/8" IN 4' IN DIRECTION OF FLOW UNLESS INDICATED OTHERWISE. LOW POINTS IN STEAM LINES SHALL BE PROVIDED WITH DRIP STATION. PIPE SIZE CHANGES IN STEAM LINES SHALL BE MADE WITH ECCENTRIC REDUCERS WITH OUTLET ON BOTTOM. CONDENSATE DRAIN LINES SHALL SLOPE 1/8" PER FOOT IN DIRECTION OF FLOW.

U. DIELECTRIC FITTINGS SUCH AS COUPLINGS, UNIONS OR FLANGES SHALL BE INSTALLED TO ISOLATE PIPES OF NON-FERROUS METAL WHERE CONNECTION IS MADE TO FERROUS METAL.

25. THERMAL COVERING

A. INSULATION SHALL BE JOHNS MANVILLE, OWENS CORNING, ARMSTRONG OR EQUAL. INSULATION SHALL NOT BE APPLIED UNTIL AFTER THE EQUIPMENT, PIPES OR DUCTS TO BE INSULATED HAVE PROVEN SATISFACTORY UNDER TESTS. ALL MATERIALS USED SHALL HAVE COMPOSITE FLAME-SPREAD RATING NOT EXCEEDING 25 AND A SMOKE-DEVELOPED RATING NOT EXCEEDING 50.

B. PIPING: INSULATION SHALL BE INSTALLED IN CONFORMANCE WITH THE MANUFACTURER'S RECOMMENDATIONS.

C. FIBERGLASS PIPE INSULATION SHALL HAVE A WHITE KRAFT BONDED TO ALUMINUM FOIL, REINFORCED WITH FIBERGLASS YARN JACKET. ELASTOMERIC INSULATION SHALL BE CONSTRUCTED OF A CLOSED CELL STRUCTURE TO EFFECTIVELY RETARD THE FLOW OF MOISTURE VAPOR AND SERVE AS A VAPOR BARRIER. INSULATION THICKNESS AND TYPE FOR VARIOUS PIPING SYSTEMS SHALL BE AS INDICATED IN THE FOLLOWING TABLE (PIPE SIZING/INSULATION THICKNESS).

	SYSTEM TEMP. RANGE	LESS THAN					TYPE (4)
		1" 1"	1-1/4" 1"	1-1/2" 1"	2" 1"	2 1/2" 1"	
HEATING WATER	140-200	1.5	1.5	2.0	2.0	2.0	A
DOMESTIC HOT WATER	90-159	1.5	1.5	2.0	2.0	2.0	A
MISC.	80-89	1.0	1.0	1.0	1.0	1.0	AB
DOMESTIC COLD WATER	56-79	1.0	1.0	1.0	1.0	1.0	A
CHILLED WATER	40-55	1.0	1.0	1.5	1.5	2.0	A
CONDENSATE DRAIN	45-75	0.5	0.5	1.0	1.0	1.0	AB
REFRIG./BRINE (6)	BELOW 40	1.0	1.0	1.5	1.5	1.5	B

- NOTES:
- MINIMUM THICKNESS FOR INSULATION LISTED IN PRECEDING TABLE IS BASED ON THERMAL CONDUCTIVITY, "K" NOT EXCEEDING 0.27 BTU PER INCH-HR. X SQ. FT. X DEG. F. BASED ON MEAN TEMPERATURE OF 75 DEG. F. INSULATION WITH GREATER THERMAL CONDUCTIVITY SHALL HAVE INCREASED THICKNESS TO PROVIDE SAME PERFORMANCE CHARACTERISTICS AS SPECIFIED.
 - ALL HORIZONTAL SANITARY PIPING ABOVE KITCHEN OR DINING AREA ONLY.
 - ALL HORIZONTAL STORM PIPING ABOVE LOWEST FLOOR INCLUDING ROOF DRAINS FROM UNDERSIDE OF DECK TO JUST BELOW FITTING AT TOP OF VERTICAL PORTION OF STACK. FITTINGS AT TOP AND BOTTOM OF VERTICAL SECTIONS OF HORIZONTAL OFFSETS SHALL BE INSULATED. LAP JOINTS, TAPE AND SEAL.
 - A. FIBERGLASS TYPE INSULATION B. ELASTOMERIC TYPE INSULATION.
 - RUNOUTS TO INDIVIDUAL TERMINAL UNITS (NOT EXCEEDING 1 FT. IN LENGTH).
 - ALSO INSULATE ALL REFRIGERANT PIPES LOCATED IN HOT SPACES SUCH AS ATTICS.

D. FIBERGLASS PIPE INSULATION FITTINGS SHALL BE COVERED WITH PREMOLDED PVC FITTING COVERS. JACKETS ON FIBERGLASS PIPE INSULATION BELOW 90 DEG. F. SHALL BE VAPOR SEALED USING SELF-SEALING LAP, LAP SEAL OR ADHESIVE. ALL INSULATION JOINTS, LAPS, VOIDS, PUNCTURES AND END TAPERS SHALL BE SEALED WITH 1/2" THICKNESS OF VAPOR ADHESIVE. A 1/2" LONG, 1/2 SECTION OF HYDROUS CALCIUM SILICATE OR FOAMGLAS INSULATION SHALL BE USED BETWEEN HANGERS AND PIPING. ON PIPE SIZES 1-1/2" AND BELOW, HYDROUS CALCIUM SILICATE OR FOAMGLAS WILL NOT BE REQUIRED. ALL PIPING SHALL HAVE LOAD-DISTRIBUTING GALVANIZED 16 GAUGE METAL SHELDS INSTALLED AROUND THE LOWER HALF OF THE INSULATION.

E. ELASTOMERIC PIPE INSULATION SEAMS, VOIDS AND BUTT JOINTS SHALL BE SEALED WITH A VAPOR BARRIER ADHESIVE OR TAPED WITH 1-1/2 INCH WIDE 3M 4471 TAPE. FLEXIBLE ELASTOMERIC INSULATION EXPOSED TO WEATHER SHALL BE COVERED WITH TWO COATS OF ARMSTRONG ARMAFLEX FINISH (VINYL LACQUER).

F. DUCTWORK: INSULATE RETURN DUCTS IN ATTIC SPACES, CRAWL SPACES AND EQUIPMENT ROOMS. ALL SUPPLY DUCTS AND ALL OUTDOOR AIR DUCTS SHALL BE INSULATED. EXHAUST DUCTWORK SHALL BE INSULATED IN ATTIC SPACES AND WITHIN 10 FEET OF CONNECTIONS TO OUTDOORS. INSULATION WHERE DUCTS ARE NOT CONCEALED SHALL BE RIGID DUCT INSULATION MEETING ASTM C 612. ALL OTHER INSULATION SHALL BE FLEXIBLE DUCT INSULATION MEETING ASTM C 533. INSULATION SHALL HAVE A FACTORY-APPLIED FACINGS OF FOL-SCRM-KRAFT PAPER JACKET REINFORCED WITH FIBERGLASS YARN MESH. INSULATION SHALL BE SECURED TO RECTANGULAR DUCTS BY IMPALING OVER METAL STICK CLIPS SPACED 12" CENTER EACH WAY. ROUND DUCT INSULATION SHALL BE SPLICED WITH NO. 18 GAUGE COPPERWOUND WIRE SPLICED NOT OVER 18" ON CENTER. WHERE INSULATION JOINTS OCCUR, FACING TABS SHALL BE LAPPED NOT LESS THAN 4". ALL JOINTS, VOIDS AND PUNCTURES IN FACING SHALL BE EFFECTIVELY VAPOR SEALED WITH FOSTER VAPOR-SAFE OR VAPOR-FAS ADHESIVE. INSULATION FOR ALL OUTDOOR AIR DUCTWORK AND INSULATION FOR SUPPLY AND RETURN DUCTWORK WHERE INSTALLED IN ATTIC SPACES AND CRAWL SPACES SHALL BE 2" THICK AND SHALL HAVE A MINIMUM TOTAL THERMAL RESISTANCE (R) OF 7.4 AT A MEAN TEMPERATURE OF 75 DEG. F. INSULATION FOR ALL OTHER DUCTWORK SHALL BE 1-1/2" THICK AND SHALL HAVE A MINIMUM TOTAL THERMAL RESISTANCE (R) OF 5.6 AT A MEAN TEMPERATURE OF 75 DEG. F. (WHERE DUCTWORK IS PROVIDED WITH ACOUSTIC LINING, EXTERNAL DUCT INSULATION IS NOT REQUIRED.) DUCTWORK WITH ACOUSTIC LINING LOCATED IN ATTIC SPACES, CRAWL SPACES AND EQUIPMENT ROOMS SHALL ALSO BE EXTERNALLY INSULATED WITH 1-1/2" THICK INSULATION WITH A MINIMUM TOTAL OF THERMAL RESISTANCE (R) OF 5.6 AT A MEAN TEMPERATURE OF 75 DEG. F.)

26. SHUT-OFF VARIABLE TERMINAL BOXES

A. SHUT-OFF VARIABLE TERMINAL BOXES SHALL BE JCI. SEE EQUIPMENT NOTES FOR APPLICABLE TERMINAL BOXES.

B. CASING SHALL BE 22-GAUGE GALVANIZED STEEL WITH INTERIOR SURFACE OF UNIT CASING ACOUSTICALLY AND THERMALLY LINED WITH 1" 1.0 LBU (CU FT. MATTE FACE INSULATION WITH R VALUE OF 3.85 THAT MEETS NFPA-90A, UL 181, AND BACTERIOLOGICAL STANDARD ASTM C1398, G31 AND G32. INSULATION SHALL BE FULLY ENCAPSULATED WITH NO EXPOSED EDGES.

C. PRIMARY AIR VALVE SHALL BE A HEAVY GAUGE GALVANIZED STEEL CYLINDER SIZED TO FIT STANDARD ROUND DUCT WITH INTEGRAL ELECTRIC ACTUATOR. MAXIMUM LEAK RATE 1 PERCENT AT 4 INCHES WG. INLET STATIC PRESSURE. INTEGRAL FLOW SENSING RING TO PROVIDE PRIMARY AIR FLOW MEASUREMENT WITHIN +/- 5 PERCENT OF UNIT RATED AIRFLOW WITH 1-1/2 DIAMETERS OF STRAIGHT DUCT UPSTREAM OF UNIT. INTEGRAL FLOW TAPS AND CALIBRATION CHART PROVIDED ON EACH UNIT. DAMPER BLADE SHALL BE CONSTRUCTED OF A CLOSED CELL FOAM SEAL THAT IS MECHANICALLY LOCKED BETWEEN TWO 22-GAUGE, GALVANIZED STEEL DISKS WITH PERMANENT DAMPER POSITION INDICATOR ON THE SHAFT AND MECHANICAL STOP TO PREVENT OVER-STROKING.

D. ELECTRIC COIL SHALL BE FACTORY MOUNTED ON DISCHARGE OUTLET, UL LISTED, RESISTANCE OPEN-TYPE HEATER WITH AUTOMATIC SAFETY DEVICES FOR COMPLETE AND SAFE OPERATION. ELECTRIC COIL SHALL HAVE SCR CONTROL FOR FULL MODULATION, BOXES WITH STAGED ELECTRIC HEATERS WILL NOT BE ACCEPTED.

E. OUTLET CONNECTION SHALL BE INTEGRAL OUTLET SHEET METAL CONNECTION AT UNIT DISCHARGE TO FACILITATE DUCTWORK INSTALLATION. ALL UNITS SHALL BE UL LISTED AND CSA APPROVED.

F. BOXES SHALL BE PROVIDED WITH 24V TRANSFORMERS FACTORY INSTALLED AND WIRED TO POWER DAMPER ACTUATOR, FAN CONTROL, AND DDC CONTROLLER.

27. FAN COIL UNITS

A. GENERAL - BLOWER COIL UNITS SHALL BE TRANE (BCH), ENVIROTECH (HXK) OR IEC (HDY) RECIRCULATING HORIZONTAL TYPE COMPLETE WITH CASING, COOLING AND RE-HEAT COIL ASSEMBLIES, DRAIN PAN, EXTENDED DRAIN PAN, AIR FILTERS, FANS, ECM MOTOR, FAN DRIVE, MODULATING CONTROL VALVE AND ACTUATOR PACKAGE FOR EACH COIL, BACK DUCT COLLAR, MOTOR SWITCH, FACTORY MOUNTED CONTROL TERMINALS FOR FAN AND VALVE CONNECTION TO BAS, AND 24V SECONDARY CONTROL TRANSFORMER. EACH UNIT SHALL BE FASTENED SECURELY TO THE BUILDING STRUCTURE.

B. ENCLOSURE SHALL BE REMOVABLE AND SHALL BE CONSTRUCTED OF NOT LESS THAN HEAVY GAUGE GALVANIZED STEEL, PROPERLY REINFORCED AND BRACED. ENTIRE CASING SHALL BE ACOUSTICALLY AND THERMALLY INSULATED INTERNALLY WITH NOT LESS THAN 1" 1-1/2 LB. DENSITY FIRE RESISTANT, ODORLESS GLASS FIBER INSULATION FASTENED WITH WATERPROOF ADHESIVE. ALL METAL SURFACES SHALL BE GALVANIZED. ACCESS DOORS SHALL BE FLUSH MOUNTED AND SHALL BE PROVIDED FOR ACCESS TO COILS, FAN & MOTOR ASSEMBLY, AND FILTERS.

C. FANS SHALL BE DWDI MULTI-BLADE FORWARD CURVED CENTRIFUGAL TYPE, DYNAMICALLY AND STATICALLY BALANCED AT THE FACTORY AFTER ASSEMBLY. FANS SHALL BE DIRECT DRIVE MOUNTED DIRECTLY TO THE MOTOR SHAFT. BLOWER COIL UNITS SHALL HAVE A SINGLE FAN.

D. HEATING AND CHILLED WATER COILS SHALL BE SINGLE CIRCULATING TYPE, CONSTRUCTED OF SEAMLESS COPPER TUBING EXPANDED INTO ALUMINUM FINN, PROVIDED WITH NOT LESS THAN 1/2" O.D. FLARE CONNECTORS AND NOT LESS THAN 1/8" TAPPED HOLES WITH AUTOMATIC AIR VENT AND DRAIN PLUG. COILS SHALL BE HYDROSTATICALLY TESTED AT 450 PSI AND SHALL BE SUITABLE FOR 300 PSI WORKING PRESSURE. HEATING WATER COIL SHALL BE INSTALLED IN THE RE-HEAT SECTION. COILS SHALL BE MOUNTED ABOVE (NOT IN) THE DRAIN PAN.

E. DRAIN PANS AND EXTENDED DRAIN PANS SHALL BE SIZED AND LOCATED PROPERLY TO COLLECT ALL WATER CONDENSED ON AND DRIPPING FROM ANY ITEM WITHIN THE UNIT. ENCLOSURE OR OUTSIDE THE UNIT (WHEN MOUNTED ABOVE CEILINGS, DRAIN PANS SHALL BE DOUBLE-SLOPED AND CONSTRUCTED OF NON-CORROSIVE POLYMER, INSULATED TO PREVENT CONDENSATION AND COATED WITH A WATERPROOFING MATERIAL ON THE INSIDE. NOT LESS THAN 3/4" NPT DRAIN CONNECTION SHALL BE PROVIDED IN DRAIN PANS.

F. FILTERS SHALL BE PROVIDED FOR EACH UNIT AND SHALL BE 2" MERV-13.

G. MOTOR SHALL BE 50/60 HZ, VARIABLE SPEED, MULTIPLE VOLTAGE ECM MOTOR WITH A PLUS OR MINUS 10% VOLTAGE UTILIZATION RANGE. MOTOR SHALL BE OPEN TYPE WITH PERMANENTLY SEALED BALL BEARINGS, INTERNAL OVERLOAD PROTECTION, AND RADIAL MOUNT. MOTOR SHALL BE FACTORY INSTALLED AND WIRED TO THE UNIT CONTROL PANEL. MOTORS SHALL BE BRUSHLESS DC (BLDC) ELECTRONICALLY COMMUTATED MOTORS (ECM) FACTORY PROGRAMMED AND RUN TESTED IN THE ASSEMBLED UNITS. MOTOR CONTROLLER SHALL BE MOUNTED IN A TOUCH-SAFE CONTROL BOX WITH A BUILT-IN INTEGRATED USER INTERFACE AND LED TACHOMETER. MOTORS SHALL OVER-SOFT-RAMP BETWEEN SPEEDS TO LESSON ACOUSTICS AND SHALL OPERATE WITH SINGLE ZONE VAV CONTROL.

H. CONTROLS: UNIT SHALL HAVE A FACTORY MOUNTED AND WIRED CONTROL TERMINALS FOR FAN, VALVE, HUMIDITY SENSOR AND DRAIN OVERFLOW SWITCH CONNECTION TO BAS, AND 24V SECONDARY CONTROL TRANSFORMER. SEQUENCES SPECIFIED IN DIVISION 25 INSTRUMENTATION AND CONTROL FOR HVAC CONTROL TERMINAL SHALL BE CAPABLE OF RECEIVING SPACE MOUNTED HUMIDITY SENSOR, ECM FAN, AND HEATING AND CHILLED WATER VALVE MODULATION FOR DEHUMIDIFICATION AND AUXILIARY DRAIN OVER-FLOW SWITCH.

I. PROVIDE FACTORY VALVE KIT WITH MODULATING, PRESSURE INDEPENDENT CONTROL VALVES, ACTUATORS AND ACCESSORIES.

28. PACKAGED ROOFTOP HEAT PUMP UNITS

A. GENERAL - EQUIPMENT AND MATERIAL SPECIFIED UNDER THIS HEADING SHALL BE FURNISHED AND INSTALLED BY A CERTIFIED REPRESENTATIVE OF THE UNIT MANUFACTURER. PACKAGED HEAT PUMP SHALL BE YORK/JCI AS SHOWN AND SHALL BE A COMPLETE, SELF-CONTAINED UNIT WITH HERMETIC MOTOR-COMPRESSOR, HEATING-COOLING COIL, CONDENSER-EVAPORATOR COIL, CONDENSER AND EVAPORATOR FANS, FILTERS, CHANGES OVER VALVES, FILTER-DRYER, SIGHT GLASS, ROOF CURB, CONTROLS, AND WIRING ENCLOSED IN A WEATHER-RESISTANT STEEL ENCLOSURE SUITABLE FOR ROOF MOUNTING. PROVIDE HALL GUARDROPS, WELDED ELECTRICAL STARTERS, DISCONNECT AND SINGLE POINT POWER CONNECTION WITH THRU-THE-CURB POWER FEED. THREE PHASE UNIT SHALL BE PROVIDED WITH PHASE LOSS RELAY PACKAGE IN ACCORDANCE WITH SECTION 16.01. LOW VOLTAGE MOTOR CONTROLLERS, SUPPLY FAN MOTOR SHALL BE (DIRECT DRIVE) OR (ADJUSTABLY BELT DRIVE). BELT DRIVES SHALL BE DESIGNED FOR 150% OF THE CONNECTED MOTOR CAPACITY, AND SHAFTS SHALL BE SELECTED TO FEED THE FAN AT A SPEED WHICH WILL PRODUCE THE SPECIFIED CAPACITY WHEN SET AT ITS APPROXIMATE MIDPOINT. AUXILIARY ELECTRIC HEATERS SHALL BE COMPLETE WITH CIRCUIT PROTECTION AND MOUNTED AS RECOMMENDED BY THE UNIT MANUFACTURER. PROVIDE AN OUTDOOR THERMOSTAT FOR EACH STAGE OF ELECTRIC HEAT TO LOCK OUT THE AUXILIARY ELECTRIC HEATERS. PROVIDE A THERMOSTAT IN CONFORMANCE WITH ARI STANDARD 240. PROVIDE COMPRESSOR ANTI-SHORT CYCLING CONTROL, AND LOW AMBIENT CONTROL, FOR COOLING OPERATION TO (55) (0) DEG. F. PROVIDE GUARDS FOR INTAKE AND DISCHARGE OPENINGS TO PROTECT CONDENSER FAN AND COIL.

B. CONTROLS - ALL STAND ALONE INTERNAL CONTROLS SHALL BE PROVIDED TO INTERFACE DIRECTLY WITH THE EXISTING JCI METASYS BACNET MSTP DIGITAL BAS. UNITS UTILIZING A BLACK BOX INTERROGATOR WILL NOT BE ACCEPTABLE.

GENERAL NOTES:

- ALL DUCTWORK AND PIPES SHALL BE COORDINATED WITH (OTHER NEW AND EXISTING DUCTS, PIPES), LIGHTS, STRUCTURAL SYSTEM, CEILING SUPPORTS AND FRAMING BEFORE INSTALLATION. MINOR DUCT AND PIPE OFFSETS AND MINOR DUCT TRANSITIONS SHALL BE PROVIDED AS REQUIRED. WHERE TRANSITIONS ARE REQUIRED, CROSS-SECTIONAL AREA OF DUCT SITE BE REDUCED. MEASUREMENTS FOR VERTICAL CLEARANCES OF DUCTWORK SHALL BE TAKEN AT THE JOB SITE BEFORE FABRICATION OF ANY DUCTWORK.
- ALL EQUIPMENT SHALL BE INSTALLED IN ACCORDANCE WITH MANUFACTURER'S PUBLISHED INSTRUCTIONS.
- MATERIALS AND INSTALLATION SHALL COMPLY WITH LOCAL CODES, APPLICABLE PROVISIONS OF LATEST EDITION OF NATIONAL FIRE PROTECTION ASSOCIATION, LOCAL UTILITY REGULATIONS AND GOVERNMENTAL DEPARTMENTS HAVING JURISDICTION.
- CONTRACTOR SHALL SEAL AND FLASH ALL PENETRATIONS IN EXISTING ROOF AND WALLS.
- VERIFY ROOF AND WALL PENETRATIONS WITH STRUCTURE.
- VERIFY THE LOCATION OF ALL THERMOSTATS, TEMPERATURE SENSORS, PANELS AND CONTROL INSTRUMENTS WITH THE ARCHITECT AND OWNER PRIOR TO ROUGH-IN.
- VERIFY LOCATIONS OF NEW AND EXISTING EQUIPMENT.
- ALL CUTTING AND PATCHING FOR THE INSTALLATION OF NEW WORK IN EXISTING BUILDING SHALL BE DONE BY THE CONTRACTOR.
- CONTRACTOR SHALL PROVIDE ALL SUPPORTS REQUIRED TO MOUNT MECHANICAL EQUIPMENT, PIPING AND DUCTWORK.
- WHERE PIPE AND DUCT CONNECTIONS ARE SHOWN CONNECTING TO EXISTING, CONTRACTOR SHALL DETERMINE EXACT LOCATIONS AND CONNECTION SIZES PRIOR TO INSTALLATION.
- NEW PIPING AND PIPE INSULATION SHALL MATCH EXISTING. INSULATION THAT IS DAMAGED OR REMOVED FOR NEW WORK SHALL BE REPLACED, REPAIRED AND SEALED AS REQUIRED.
- HEATING WATER PIPING SHALL BE TYPE L COPPER OR SCH 40 BLACK STEEL, PIPE FITTINGS SHALL MATCH PIPING.
- HEATING WATER LINES SHALL BE INSULATED WITH 2" THICK, 3-1/2 LB. DENSITY FIBERGLASS FLAME-SAFE PIPE INSULATION WITH 1 MIL FOIL-SCRM-WHITE KRAFT PAPER JACKET. ALL JOINTS, VOIDS AND PUNCTURES IN JACKET SHALL BE SEALED.
- EXPOSED PIPING RUNOUTS SHALL BE INSTALLED IN PRACTICAL ALIGNMENT WITH THE BUILDING AND SHALL BE ADEQUATELY SECURED TO THE BUILDING STRUCTURE.
- ALL REMOTE MOUNTED TEMPERATURE CONTROL DEVICES AND TEMPERATURE CONTROL WIRING SHALL BE FURNISHED AND INSTALLED BY THE MECHANICAL CONTRACTOR.
- ALL EQUIPMENT SHALL BE SECURED TO CONCRETE HOUSEKEEPING PADS WITH HOLD-DOWN BOLTS TO PREVENT MOVEMENT.
- INSTRUCT THE OWNER IN THE PROPER OPERATION AND MAINTENANCE OF THE MECHANICAL SYSTEMS UNTIL THE OWNER IS FULLY PREPARED TO OPERATE AND MAINTAIN THE MECHANICAL SYSTEM. HOWEVER, LENGTH OF INSTRUCTION TIME SHALL BE LIMITED TO ONE-HALF DAY.
- SYSTEMS SHALL OPERATE UNDER CONDITIONS OF LOAD WITHOUT UNUSUAL OR EXCESSIVE NOISE OR VIBRATION. UNUSUAL OR EXCESSIVE NOISE OR VIBRATION SHALL BE CORRECTED.
- EQUIPMENT, MATERIALS AND LABOR REQUIRED BY THESE CONTRACT DRAWINGS SHALL BE GUARANTEED TO BE FREE FROM DEFECTIVE MATERIALS OR WORKMANSHIP FOR ONE YEAR AFTER FINAL ACCEPTANCE OF THE PROJECT UNLESS SPECIFIED OTHERWISE. DEFECTIVE MATERIALS OR WORKMANSHIP OCCURRING DURING THIS PERIOD SHALL BE CORRECTED AT NO ADDITIONAL COST.

DEMOLITION NOTES:

- THE CONTRACTOR SHALL REMOVE OR ALTER AS NECESSARY ALL EXISTING PIPING, EQUIPMENT, EQUIPMENT FOUNDATIONS, AND APPURTENANCES THAT ARE NOT REQUIRED FOR THE EXISTING SYSTEMS TO REMAIN. CONTRACTOR SHALL VISIT THE SITE TO DETERMINE THE SCOPE OF THIS WORK AND VERIFY EXISTING CONDITIONS PRIOR TO SUBMITTING BIDS.
- EXISTING EQUIPMENT SHALL BE TURNED OVER TO THE OWNER, UNLESS DIRECTED OTHERWISE AND LOCATED AS DIRECTED BY THE OWNER. ALL OTHER ITEMS TO BE REMOVED SHALL BECOME THE PROPERTY OF THE CONTRACTOR AND REMOVED FROM THE PREMISES.
- INSULATION ON EXISTING PIPING THAT IS DAMAGED OR REMOVED DUE TO THE DEMOLITION WORK SHALL BE REPLACED AND SEALED AS REQUIRED.
- THE EXISTING LARGE OPEN SPACE WAS ORIGINALLY A SHOP. PRIOR TO ANY SLAB CUTTING, THE CONTRACTOR SHALL SCAN THE FLOOR TO LOCATE AND DOCUMENT EXISTING UTILITIES.

ROOFTOP UNIT NOTES:

- ROOF OPENINGS SHALL BE JUST LARGE ENOUGH TO ACCOMMODATE SUPPLY AND RETURN DUCTWORK. CAULK THE SPACE BETWEEN DUCTWORK AND ROOF OPENINGS AIR-TIGHT.
- PROVIDE MINIMUM 6" THICK, 5# DENSITY INSULATION UNDER UNIT ON TOP OF ROOF AND INSIDE ROOF CURB. COVER INSULATION WITH TWO LAYERS OF 3/4" THICK GYPSUM BOARD AND CAULK BETWEEN GYPSUM BOARD AND ROOF CURB.

CONTRACTOR NOTE:

- CONTRACTORS ARE BEING SELECTED FOR THEIR SPECIAL KNOWLEDGE AND EXPERTISE IN THIS TYPE OF BUILDING CONSTRUCTION AND OF BUILDING CODE REQUIREMENTS. THE DRAWINGS AND SPECIFICATIONS HAVE BEEN PREPARED TO SHOW INTENT AND GENERAL ARRANGEMENT OF WORK. THEY ARE NOT FULLY DETAILED IN ALL RESPECTS BUT ARE COMPLETE ENOUGH FOR AN EXPERT CONTRACTOR TO PRICE AND CONSTRUCT.
- THE CONTRACTORS PRICING THE MECHANICAL PORTION OF THE WORK ARE HERETHWITH ESPECIALLY CAUTIONED THAT THE WORK INCLUDES A COMPLETE SYSTEM AND THAT THE CONTRACTOR WILL BE REQUIRED TO FURNISH AND INSTALL ALL EQUIPMENT, MATERIAL, LABOR AND ANY OTHER ITEMS REQUIRED TO DELIVER TO THE OWNER A SYSTEM THAT IS COMPLETE AND OPERABLE IN ALL RESPECTS.
- WHEN THE DRAWINGS AND SPECIFICATIONS DO NOT COVER PARTICULAR ITEMS, THE CONTRACTOR SHALL ASK FOR THE METHOD AND INTENT OF PERFORMING THIS WORK PRIOR TO FINALIZING HIS PRICE AND COMMENCING CONSTRUCTION. IN THE ABSENCE OF INQUIRIES, IT WILL BE ASSUMED THAT THE CONTRACTOR HAS ACCORDED A CONTINGENCY FACTOR FOR ALL NECESSARY ITEMS TO PROVIDE A MECHANICAL SYSTEM COMPLETE AND IN STRICT ACCORDANCE WITH THE VIRGINIA MECHANICAL CODE 2021 REQUIREMENTS.

SPECIFICATIONS FOR HVAC (CONT.)

SINGLE DUCT VAV TERMINAL UNIT WITH ELECTRIC STAGED REHEAT

- SYSTEM DESCRIPTION - SINGLE DUCT VARIABLE AIR VOLUME (VAV) TERMINAL UNITS CONSIST OF A MODULATING AIRFLOW DAMPER AND ELECTRIC REHEAT SECTION. THE BAS CONTRACTOR SHALL PROVIDE A FULLY PROGRAMMABLE CONTROLLER TO CARRY OUT THE SEQUENCE OF OPERATIONS. THE CONTROLLER SHALL BE CONNECTED TO THE BAS SYSTEM VIA BACNET MSTR TO JCI METASYS BAS COMMUNICATIONS BUT SHALL BE CAPABLE OF FULLY STANDALONE OPERATION IN THE EVENT OF A COMMUNICATION FAILURE.
- SUPERVISORY CONTROL - THE BAS BUILDING CONTROLLER PROVIDES SUPERVISORY CONTROL.
- OCCUPANCY SCHEDULE - BAS PROVIDES ADJUSTABLE OCCUPIED SCHEDULE.
- OPTIMAL START - MORNING WARMUP - THE BAS SHALL BE PROGRAMMED WITH AN OPTIMIZED START ROUTINE, INCORPORATING OUTSIDE AIR TEMPERATURE, SPACE TEMPERATURES, AND PAST HISTORY OF BUILDING RESPONSE TO DETERMINE THE OPTIMUM TIME TO START THE UNITS SO AS TO CONDITION THE SPACE TO THE OCCUPIED SETPOINT BY THE TIME SCHEDULED OCCUPANCY IS REACHED.
- PRESTART AIRFLOW PATH - THE BAS SHALL ENSURE THE VAV BOX DAMPERS SHALL OPEN PRIOR TO SIGNALING THE ASSOCIATED AHU FAN TO START.
- OCCUPIED COOLING - THE VAV CONTROLLER READS THE PRIMARY AIR TEMPERATURE FROM THE BAS BUILDING CONTROLLER AND WILL MAINTAIN THE MINIMUM AIRFLOW IF THE PRIMARY AIR IS NOT COLD ENOUGH FOR COOLING. IF THE PRIMARY AIR IS COLD ENOUGH, THE VAV CONTROLLER MODULATES INLET AIR DAMPER BETWEEN COOLING MINIMUM AND COOLING MAXIMUM AIRFLOW SETPOINT IN ORDER TO MAINTAIN THE OCCUPIED COOLING SPACE TEMPERATURE AT SETPOINT (74°F, ADJ.).
- OCCUPIED HEATING (ELECTRIC HEAT VAVS ONLY) - VAV CONTROLLER MODULATES INLET AIR DAMPER BETWEEN HEATING MIN AND HEATING MAX AIRFLOW SETPOINT (OR REHEAT IF NO MIN AND MAX PROVIDED) AND ELECTRIC HEAT STATES ARE ENABLED (WITH APPROPRIATE ON AND OFF TIME DELAYS TO PREVENT SHORT CYCLING) IN ORDER TO MAINTAIN THE OCCUPIED HEATING SPACE TEMPERATURE AT SETPOINT (68°F, ADJ.).
- UNOCCUPIED OVERRIDE MODE - WHEN ONE (AOJ) ZONE OVERRIDE BUTTON ON THE ZONE SENSORS IS PRESSED, VAV CONTROLLER SIGNALS BAS TO SIGNAL AHU/FAN CONTROLLER TO START AND RUN IN THE OCCUPIED MODE FOR PERIOD OF TWO HOURS (ADJ.). SET ALL VAV ZONES NOT IN OVERRIDE TO REHEAT AIRFLOW SETPOINTS TO ENSURE SUFFICIENT AIRFLOW PATH.
- VAV SYSTEM METRICS - THE BAS BUILDING CONTROLLER SHALL MONITOR / CALCULATE METRICS FOR VAV MODES AND TEMPERATURES AND DISPLAY ON THE BAS GUI AND USE IN THIS SEQUENCE OF OPERATION. REFER TO POINT LIST.
- SMART ZONE SENSOR - THE SMART COMMUNICATING ZONE SENSOR PROVIDES LCD DISPLAY, LOCAL SETPOINT OVERRIDE BUTTON, AND VARIOUS SENSORS INCLUDING TEMPERATURE, RELATIVE HUMIDITY, CO2, AND OCCUPANCY. REFER TO SCHEDULES FOR DETAILED REQUIREMENTS.

WHERE MULTIPLE ROOMS ARE SERVED BY A SINGLE VAV BOX, ONE TEMPERATURE SENSOR SHALL BE PROVIDED FOR EACH ROOM. THE BAS SHALL PROVIDE THE HEATING OR COOLING SIGNAL TO ALL VAV BOXES IN THE SPACE BASED ON THE AVERAGE NEED OF ALL THE ROOMS.

WHERE A SINGLE ROOM IS SERVED BY MULTIPLE VAV BOXES, ONE THERMOSTAT SHALL BE PROVIDED PER VAV BOX. THE BAS SHALL PROVIDE THE SAME HEATING OR COOLING SIGNAL TO ALL VAV BOXES IN THE SPACE BASED ON THE AVERAGE NEED OF ALL THE SENSORS.

- ZONE CO2 SENSOR - SELECT VAV ZONES ARE EQUIPPED WITH CO2 SENSORS TO BE UTILIZED IN THE AHU SEQUENCE OF OPERATION TO CONTROL MINIMUM OUTSIDE AIR FOR VENTILATION.
- GENERATOR HEATING LOCKOUT - THE VAV TERMINAL UNIT HEATING COIL WILL BE LOCKED OUT BY THE BAS ANY TIME A GENERATOR IS RUNNING. THE HEATING WILL BE AVAILABLE ONCE NORMAL POWER RESUMES.

MINI SPLIT

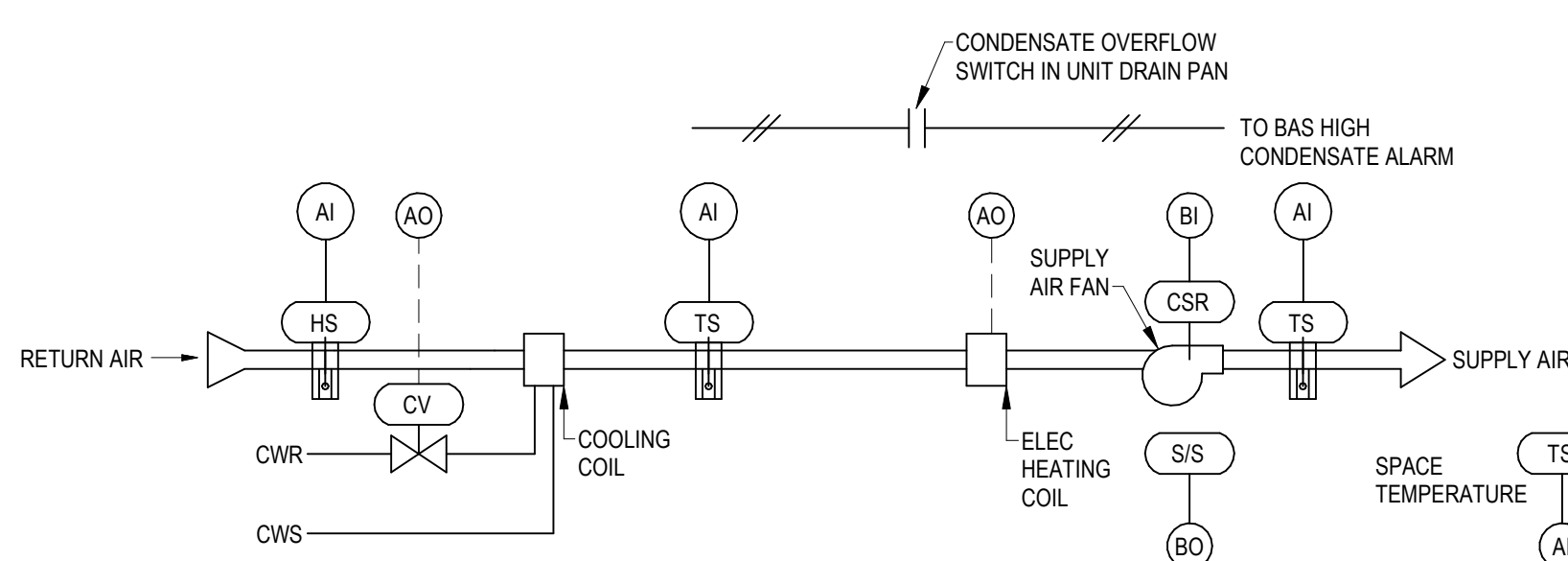
- SYSTEM DESCRIPTION - THE UNITS PROVIDE RECIRCULATION AIR AND INCLUDE DX COILS FOR COOLING. UNITS TYPICALLY SERVE NON-CRITICAL SPACES SUCH AS OFFICES.
- BAS MONITORING - THE BAS WILL MONITOR FAN STATUS VIA CURRENT SWITCH. THE BAS WILL MONITOR THE SPACE TEMPERATURE. IF THE SPACE TEMPERATURE DEVIATES ABOVE OR BELOW THE HIGH OR LOW ALARM THRESHOLDS, AN ALARM WILL BE GENERATED AT THE BAS GRAPHIC.
- OCCUPANCY SCHEDULE - BAS PROVIDES ADJUSTABLE OCCUPIED SCHEDULE.
- OPTIMAL START/STOP - THE UNIT WILL START PRIOR TO SCHEDULED OCCUPANCY BASED ON THE TIME NECESSARY FOR THE ZONES TO REACH THEIR OCCUPIED SETPOINTS.

DX ROOFTOP UNIT (FACTORY CONTROLS)

- SYSTEM DESCRIPTION - UNITS ARE CONSTANT VOLUME WITH EC FAN MOTOR AND DIGITAL SCROLL COMPRESSORS. UNITS IN THE SAME SPACE ARE NETWORKED TOGETHER FOR COM SUPERVISORY CONTROL, AND MONITORED BY BAS VIA BACNET IP COMMUNICATION.
- SUPERVISORY MONITORING & CONTROL - THE BAS SHALL BE PROGRAMMED TO PROVIDE REMOTE ENABLE / DISABLE CAPABILITY AND MONITORING OF EACH UNIT VIA BACNET COMMUNICATION. THE BAS SHALL PROVIDE GRAPHIC DISPLAY SCREENS TO DISPLAY THE OPERATING STATUS AND ALARMS FOR EACH UNIT.
- UNITARY CONTROLLERS - INDIVIDUAL FACTORY CONTROLLERS MANAGE FAN SPEED CONTROL, DIGITAL SCROLL COMPRESSORS AND HEATING CONTROL TO MAINTAIN DISCHARGE AIR TEMPERATURE.
- OPERATING SCHEDULE - UNITS WILL BE ENABLED TO RUN DURING THE OCCUPIED PERIOD.
- TEMPERATURE CONTROL - UNIT CONTROLLER MODULATES THE DX COOLING AND HEATING TO MAINTAIN SPACE TEMPERATURE OR DISCHARGE AIR SETPOINTS.
- FAN SPEED - UNIT CONTROLLERS MODULATE FAN SPEED TO MAINTAIN DUCT STATIC PRESSURE SETPOINT (VAV UNITS ONLY).
- CONDENSING UNIT MONITORING - THE BAS WILL MONITOR COMPRESSOR STATUS. AN ALARM WILL BE GENERATED AT THE BAS IF DX IS COMMAND AND THE COMPRESSOR FAILS TO PROVE STATUS (AFTER A 30 SECOND DELAY).
- REFRIGERANT MONITORING - THE BAS MONITORS PRESSURE ON THE REFRIGERANT LIQUID LINE AND SUCTION LINE. THE BAS SHALL MONITOR FOR REFRIGERANT LEAKS IN THE UNIT.

FAN COIL UNIT (BAS CONTROL)

- SYSTEM DESCRIPTION - FCU SERVES AREAS COMPRISED OF NON-CRITICAL OFFICE SPACES TO PROVIDE SUPPLEMENTAL HEATING AND COOLING TO AREAS SERVED BY VAVS AND AHU-1. FCU IS A CONSTANT VOLUME AIR HANDLING UNIT WHICH PROVIDES GENERAL COMFORT COOLING AND HEATING. THE FCU HAS MODULATING ELECTRIC HEATING SECTION, CHILLED WATER COOLING AND CONSTANT SPEED SUPPLY FAN.
- SUPERVISORY CONTROL - SUPERVISORY CONTROL IS HANDLED BY THE BMS, JCI METASYS AND INCLUDES OPTIMAL START, EQUIPMENT AND SETPOINT COMMANDS, MONITORING, AND ALARMING.
- OCCUPANCY SCHEDULE - BAS PROVIDES ADJUSTABLE OCCUPIED SCHEDULE AND SIGNALS THE UNIT TO START IN OCCUPIED MODE.
- OCCUPANCY OVERRIDE - ROOM TEMPERATURE SENSORS IN THE SPACES ARE EQUIPPED WITH AN OCCUPANCY SENSOR. WHEN ACTIVATED THE AHU SHALL START AND RUN FOR A 1-HOUR PERIOD.
- OPTIMAL START - MORNING WARMUP - THE FCU SHALL START AND RUN IF REQUIRED TO RAISE THE SPACE TEMPERATURE UP TO THE OCCUPIED HEATING SETPOINTS AT THE OCCUPIED START TIME. THIS ALGORITHM IS BASED ON OUTSIDE AIR TEMPERATURE, SPACE TEMPERATURE, PREVIOUS START TIME, AND OTHER ADJUSTABLE FACTORS. DURING THIS MODE THE UNIT RUNS AS IN THE OCCUPIED MODE AND SUPPLY AIR TEMPERATURE SETPOINT IS 80°F. UNIT ENTERS OCCUPIED MODE WHEN THE AVERAGE SPACE TEMPERATURE IS 68°F OR OCCUPANCY START TIME IS REACHED.
- OPTIMAL START - MORNING COOLDOWN (PRE-COOL) - THE FCU SHALL START AND RUN IF REQUIRED TO DECREASE THE SPACE TEMPERATURE TO THE OCCUPIED COOLING SETPOINTS AT THE OCCUPIED START TIME. THIS ALGORITHM IS BASED ON OUTSIDE AIR TEMPERATURE, SPACE TEMPERATURE, PREVIOUS START TIME, AND OTHER ADJUSTABLE FACTORS. DURING THIS MODE THE UNIT RUNS AS IN THE OCCUPIED MODE. SUPPLY AIR TEMPERATURE SETPOINT IS FIRED AT 65°F. UNIT ENTERS OCCUPIED MODE WHEN THE AVERAGE SPACE TEMPERATURE IS 68°F OR OCCUPANCY START TIME IS REACHED.
- OCCUPIED COOLING - CHILLED WATER COOLING IS ALLOWED TO STAGE ONCE THE ASSOCIATED VAV BOXES ARE AT 100% FOR 2 MINUTES.
- OCCUPIED HEATING - SCR ELECTRIC HEATING IS MODULATED USING A PID ALGORITHM TO MAINTAIN THE SUPPLY AIR TEMPERATURE AT SETPOINT ONCE THE ASSOCIATED VAV BOXES ARE A MAX HEATING OUTPUT FOR 2 MINUTES. SIMULTANEOUS COOLING AND HEATING IS NOT PERMITTED.
- SUPPLY FAN - SUPPLY FAN SPEED IS CONSTANT.
- UNOCCUPIED / STANDBY MODE - SUPPLY FAN IS OFF, COOLING IS OFF, AND ELECTRIC HEAT IS OFF.



FAN COIL (FC-1 THRU FC-3) UNIT CONTROL

NO SCALE

FANS: GREENECK					
MARK	AIRFLOW (CFM)	STATIC PRESSURE (IN. W.C.)	MOTOR HP	MODEL NUMBER	ELECTRICAL (V/PH)
CF-1	110	0.1	1/3	SP-A125	115 / 1
EF-2A	880	0.5	1/6	G-099-86	115 / 1

NOTES:
FURNISH WITH INTEGRAL DISCONNECT AND SPEED CONTROLLER.

DUCTLESS SPLIT SYSTEM HEAT PUMP UNIT: LG												
MARK (INDOOR/OUTDOOR)	INDOOR FAN		COOLING CAPACITY		HEATING CAPACITY		INDOOR UNIT ELEC		OUTDOOR UNIT ELEC		MODEL NO. (INDOOR/OUTDOOR)	NOTES
	AIRFLOW (CFM)	TOTAL CAP (MBH)	EER2	MBH	HSPH2	V/PH	MCA	V/PH	MCA			
IL-1/OU-1	424 (MED)	18	13.2	20	9.5	208 / 1	0.25	208 / 1	19.1	19.1	KNJUB181A / KUSXA181A	1, 2
IL-2/OU-2	424 (MED)	18	13.2	20	9.5	208 / 1	0.25	208 / 1	19.1	19.1	KNJUB181A / KUSXA181A	1, 2

NOTES:
1. COOLING AND HEATING CAPACITY BASED ON ARI CONDITIONS
2. FURNISH BACNET INTERFACE FOR CONNECTION TO EXISTING BAS SYSTEM (JCI)

FAN COIL UNIT: JCI													
MARK	AIRFLOW (CFM)	COOLING				HEATING			MOTOR POWER (HP)	VOLTAGE PHASE	MCA / MOP	ROOM SERVED	MODEL NO.
		TOTAL CAP. (MBH)	SENSIBLE CAP. (MBH)	FLOW RATE (GPM)	WPD (FT. H2O)	TOTAL CAP. (KW)	STAGES						
FCU-1	960	19	17	4.1	1.4	3	SCR	0.25 x2	277 / 1	16.5 / 20A	101	FHP-D-12	
FCU-2	960	19	17	4.1	1.4	3	SCR	0.25 x2	277 / 1	16.5 / 20A	101	FHP-D-12	
FCU-3	640	16	13	3.5	4.0	3	SCR	0.25 x2	277 / 1	16.5 / 20A	103	FHP-D-12	

NOTES:
1. FURNISH WITH INTEGRAL DISCONNECT, SINGLE POINT POWER CONNECTION, 24V CONTROL TRANSFORMER, MODULATING CW CONTROL VALVE.
2. FURNISH WITH INTEGRAL CONDENSATE PUMP AND AUXILIARY DRAIN PAN WITH MOISTURE SENSOR.

ROOF TOP PACKAGED HEAT PUMP UNIT: YORK/JCI		
UNIT MARK	RTU-1	RTU-2
CV OR VAV	CV	CV
SUPPLY FAN AIRFLOW, CFM	2,000	1,600
ESP, IN. W.C.	0.6	0.6
MOTOR HP	2.4	2.4
OUTSIDE AIRFLOW, CFM	200	160
COOLING COIL		
TOTAL CAPACITY, MBH	66.5	51.4
SENSIBLE CAPACITY, MBH	47.1	37.8
SEER2	14.3	14.4
EAT, ° F, DB / WB	80.0 / 67.0	80.0 / 67.0
LAT, ° F, DB / WB	58.2 / 56.4	58.1 / 56.8
HEAT PUMP HEATING		
OUTPUT CAPACITY, MBH	56.3	47.6
HSPH2	6.9	7.3
EAT, ° F, DB	60	60
LAT, ° F, DB	86.1	87.5
ELECTRIC BACKUP HEAT, KW	14	14
UNIT ELECTRICAL (V/Hz/Ph)	460 / 60 / 3	460 / 60 / 3
MCA / MOP (A)	37 / 40	34.6 / 35
SCCR (KAC)	10	10
ESTIMATED UNIT WEIGHT (LBS)	800	750
UNIT MODEL	WYED04B1AASG328A1	WYED5A4B1AASG328A2

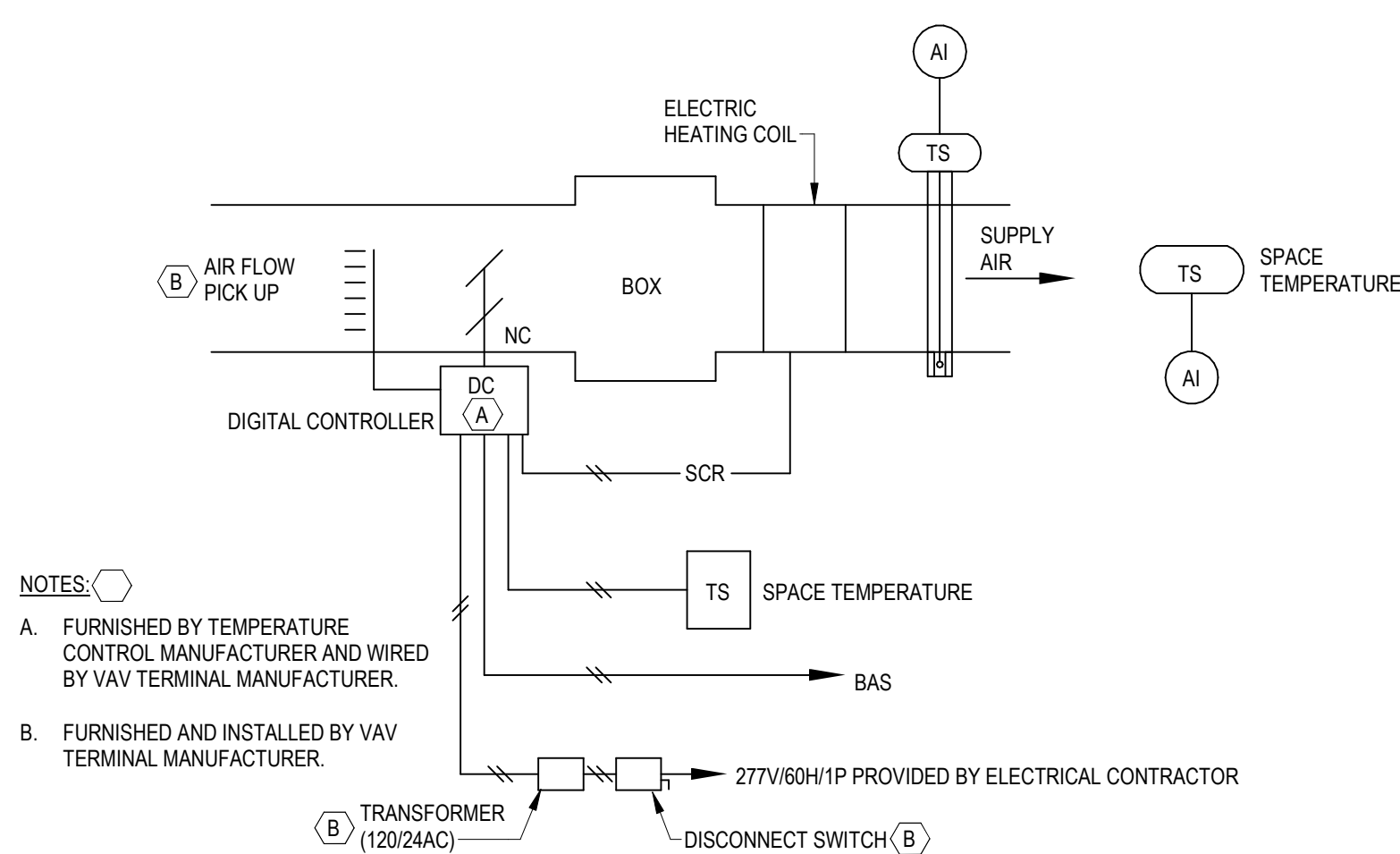
NOTES:
FURNISH WITH INTEGRAL DISCONNECT, SINGLE POINT POWER CONNECTION, BACNET CONTROLLER, 100% OA ECONOMIZER.

VARIABLE AIR VOLUME HEATING BOXES: SHUT-OFF ELEC HEAT										
MARK	SYSTEM	SIZE	MAX COOLING CFM	MIN COOLING CFM	MIN HEATING CFM	HEATING CAPACITY (KW)	MAX P.D. (IN WG)	VOLTAGE/ HASE	HEATING STAGES	
VAV 1-1	AHU-1	6	375	75	125	1.5	0.1	208 / 1	SCR	
VAV 1-2	AHU-1	6	375	110	190	2	0.1	208 / 1	SCR	
VAV 1-3	AHU-1	6	375	110	190	2	0.1	208 / 1	SCR	
VAV 1-4	AHU-1	6	250	75	125	1.5	0.1	208 / 1	SCR	
VAV 1-5	AHU-1	6	250	75	125	1.5	0.1	208 / 1	SCR	
VAV 1-6	AHU-1	10	1335	450	670	6.5	0.1	208 / 1	SCR	
VAV 1-7	AHU-1	10	1040	400	520	5	0.1	208 / 1	SCR	
VAV 1-8	AHU-1	8	600	200	300	3	0.1	208 / 1	SCR	
VAV 1-9	AHU-1	6	300	100	150	1.5	0.1	208 / 1	SCR	
VAV 1-8P	AHU-1	14	2290	0	0	0	0.1	208 / 1	SCR	
VAV 1-10	AHU-1	8	600	200	300	3	0.1	208 / 1	SCR	
VAV 1-11	AHU-1	6	250	75	125	1.5	0.1	208 / 1	SCR	
VAV 1-12	AHU-1	6	250	75	125	1.5	0.1	208 / 1	SCR	
VAV 2-1	AHU-2	8	725	240	365	3	0.1	208 / 1	SCR	
VAV 2-2	AHU-2	4	130	45	65	1	0.1	208 / 1	SCR	
VAV 2-3	AHU-2	4	210	70	105	1	0.1	208 / 1	SCR	
VAV 2-4	AHU-2	12	1750	580	875	10	0.1	208 / 1	SCR	
VAV 2-5	AHU-2	8	540	180	270	2	0.1	208 / 1	SCR	
VAV 2-6	AHU-2	8	584	195	290	2	0.1	208 / 1	SCR	
VAV 2-7	AHU-2	5	300	100	150	1	0.1	208 / 1	SCR	
VAV 2-8	AHU-2	6	400	135	200	2	0.1	208 / 1	SCR	
VAV 2-9	AHU-2	6	400	135	200	2	0.1	208 / 1	SCR	
VAV 3-1	AHU-3	4	100	35	50	1	0.1	208 / 1	SCR	
VAV 3-2	AHU-3	4	100	35	50	1	0.1	208 / 1	SCR	
VAV 3-3	AHU-3	4	100	35	50	1	0.1	208 / 1	SCR	
VAV 3-4	AHU-3	4	100	35	50	1	0.1	208 / 1	SCR	
VAV 3-5	AHU-3	4	100	35	50	1	0.1	208 / 1	SCR	
VAV 3-6	AHU-3	4	150	50	75	1	0.1	208 / 1	SCR	

NOTES:
1. FURNISH WITH INTEGRAL DISCONNECT AND 24V CONTROL TRANSFORMER.

GRILLES, REGISTERS AND DIFFUSERS: PRICE								
MARK	SERVICE	TYPE	FACE SIZE, IN. x IN.	NECK SIZE, IN. x IN.	MAX AIR P.D., IN. H2O	MAX N.C.	MODEL #	NOTES
A	SUPPLY	SQUARE PLAQUE	24x24	6" DIA	0.1	25	SPD	1,2
B	SUPPLY	SQUARE PLAQUE	24x24	8" DIA	0.1	25	SPD	1,2
C	SUPPLY	SQUARE PLAQUE	24x24	10" DIA	0.1	25	SPD	1,2
D	SUPPLY	SQUARE PLAQUE	24x24	12" DIA	0.1	25	SPD	1,2
V	RETURN/EXHAUST	PERFERATED FACE	24X24	22x22	0.05	25	10	2
W	RETURN/EXHAUST	PERFERATED FACE	24X24	18X18	0.05	25	10	2
X	RETURN/EXHAUST	PERFERATED FACE	24X24	16X16	0.05	25	10	2
Y	RETURN/EXHAUST	PERFERATED FACE	12x12	12X12	0.05	25	10	2
Z	RETURN/EXHAUST	PERFERATED FACE	12x12	8X8	0.05	25	10	2

NOTES:
1. DIFFUSER SHALL BE 4-WAY UNLESS OTHERWISE NOTED.
2. PROVIDE SURFACE MOUNT FRAME AS REQUIRED FOR INSTALLATION IN HARD CEILING.

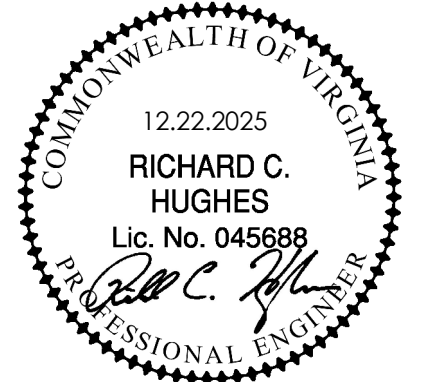


VARIABLE AIR VOLUME TERMINALS

NO SCALE

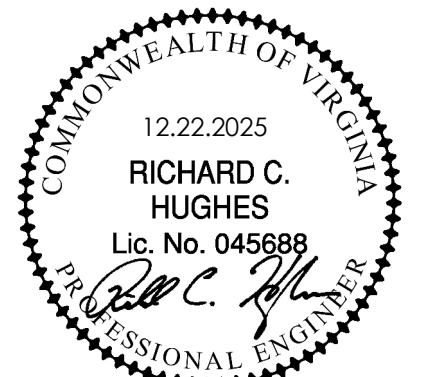
CONTROL LEGEND	
CV	CONTROL VALVE ACTUATOR
CSR	CURRENT SENSING RELAY
SAF	SUPPLY AIR FAN
RAF	RETURN AIR FAN
VFD	VARIABLE SPEED DRIVE
TS	TEMPERATURE SENSOR
PS	PRESSURE SENSOR
DPS	DIFFERENTIAL PRESSURE SENSOR
FZ	FREESTAT
DM	DAMPER MOTOR
SD	SMOKE DETECTOR
AO	ANALOG OUTPUT
AI	ANALOG INPUT
BO	BINARY OUTPUT
BI	BINARY INPUT
S/S	START/STOP
HS	HUMIDITY SENSOR
OAD	OUTDOOR AIR DAMPER
EAD	EXHAUST AIR DAMPER
RAD	RETURN AIR DAMPER
ES	DAMPER END SWITCH
EAF	EXHAUST AIR FAN
CO2	CO2 SENSOR

NOTE: THE CONTROL POINTS SHOWN IN THESE DIAGRAMS ARE INTENDED TO INDICATE THE MINIMUM QUANTITY OF POINTS THAT ARE REQUIRED. THE CONTRACTOR SHALL PROVIDE ALL POINTS, PANELS, SENSORS, AND OTHER CONTROL DEVICES THAT ARE REQUIRED FOR A FULLY FUNCTIONAL BUILDING AUTOMATION SYSTEM THAT IS CAPABLE OF COMMUNICATING WITH OWNER'S FACILITY-WIDE SYSTEM.



**RENOVATIONS TO
JOHN W. VAUGHAN
M+S BUILDING
(METER & STORES)
AMERICAN ELECTRIC POWER**

SPECTRUM DESIGN PROJECT NO.: 25020

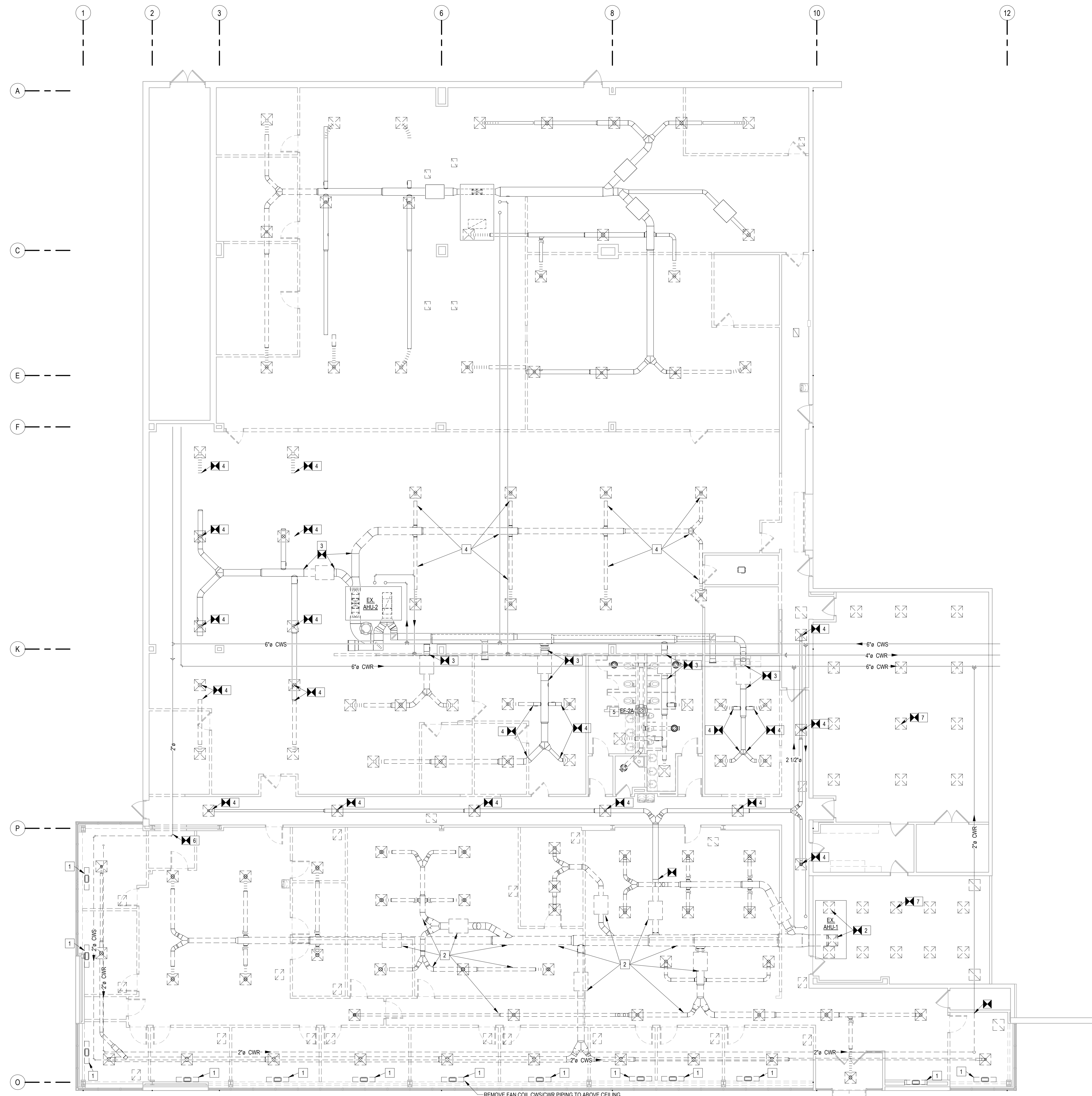


PROJ. MGR.: **MAR** CHECKED BY: **RCH** DRAWN BY: **GEH**

SHEET ISSUE DATE:
12.22.2025

PROJECT PHASE:
PERMIT DOCUMENTS

SHEET REVISIONS:

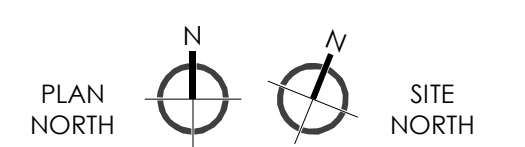


DEMOLITION PLAN - HVAC DUCTWORK & PIPING

SCALE 1/8" = 1'-0"

PLAN NOTES:

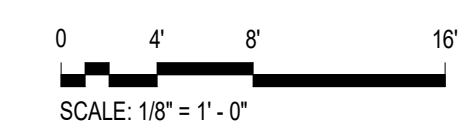
1. REMOVE EXISTING FAN COIL UNIT, ASSOCIATED PIPING (TO ABOVE CEILING), WIRING, CONTROLS AND ACCESSORIES. CAP PIPING AT POINT OF DISCONNECT. INSULATE CAP AND COPE NEW INSULATION WITH EXISTING INSULATION AND VAPOR SEAL.
2. REMOVE ALL EXISTING DUCTWORK, VAV BOXES, ASSOCIATED WIRING, CONTROLS, ACCESSORIES AND SUPPORTS ASSOCIATED WITH EXISTING AHU-1. AHU-1 TO REMAIN. CLEAN AND PREPARE EXISTING SUPPLY AND RETURN DUCTWORK AND INSULATION TO ACCEPT NEW WORK.
3. REMOVE EXISTING VAV BOX, ASSOCIATED DUCTWORK, WIRING, CONTROLS, AND ACCESSORIES TO THE EXTENT SHOWN. CLEAN AND PREPARE DUCTWORK AND INSULATION TO ACCEPT NEW WORK.
4. REMOVE EXISTING DUCTWORK, CEILING DEVICES, ASSOCIATED ACCESSORIES AND SUPPORTS TO THE EXTENT SHOWN. CLEAN AND PREPARE DUCTWORK AND INSULATION TO ACCEPT NEW WORK.
5. REMOVE EXISTING EXHAUST FAN, ASSOCIATED DUCTWORK, WIRING, CONTROLS, ACCESSORIES, AND SUPPORTS.
6. REMOVE EXISTING PIPING TO THE EXTENT SHOWN. CLEAN AND PREPARE EXISTING PIPING AND INSULATION TO ACCEPT NEW WORK.
7. REMOVE EXISTING CEILING DEVICES AND PREPARE FOR CONNECTION TO NEW WORK. ALL EXISTING SUPPLY AND RETURN DUCTWORK IN THIS SPACE TO REMAIN (TYP.)



SHEET NAME:
**DEMOLITION PLAN -
HVAC**

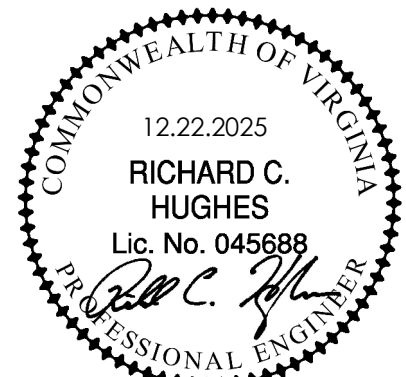
SHEET NUMBER:

M041



**RENOVATIONS TO
JOHN W. VAUGHAN
M+S BUILDING
(METER & STORES)
AMERICAN ELECTRIC POWER**

SPECTRUM DESIGN PROJECT NO.: 25020



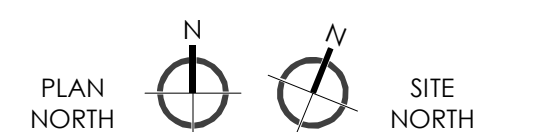
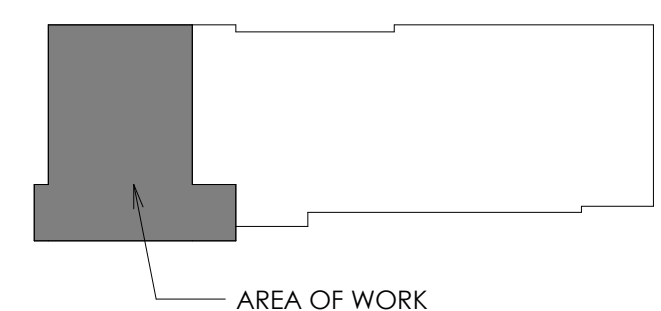
PROJ. MGR.: **MAR** CHECKED BY: **RCH** DRAWN BY: **GEH**

SHEET ISSUE DATE:
12.22.2025

PROJECT PHASE:
PERMIT DOCUMENTS

SHEET REVISIONS:

KEY PLAN:



SHEET NAME:
**FLOOR PLAN - HVAC
PIPING**

SHEET NUMBER:

M201



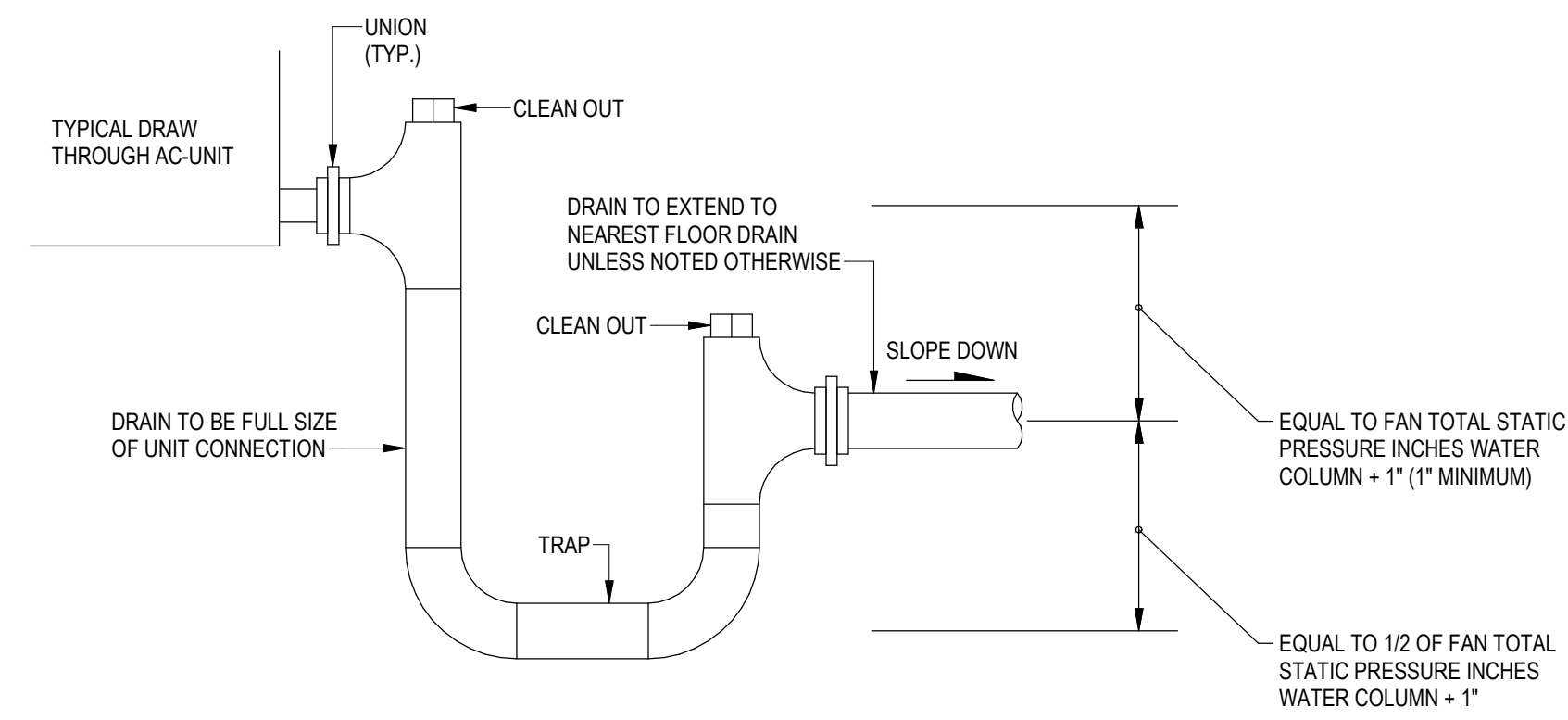
FLOOR PLAN - HVAC PIPING

SCALE: 1/8" = 1'-0"

PLAN NOTES:

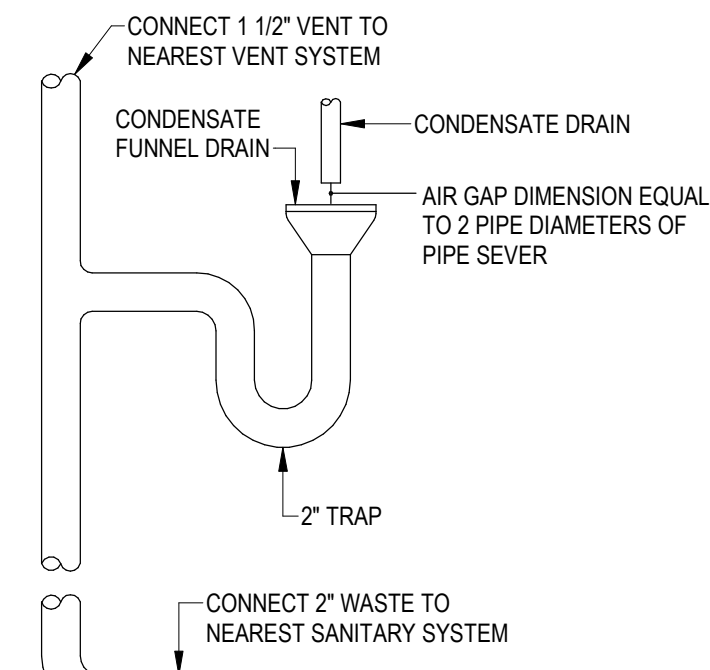
- CONNECT NEW CHILLED WATER PIPING TO EXISTING, CHILLED WATER PIPING. COPE NEW INSULATION WITH EXISTING INSULATION AND VAPOR SEAL.
- REFRIGERANT PIPING SIZED, ROUTED, INSTALLED, INSULATED AND SUPPORTED IN STRICT ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS.
- PROVIDE CONCRETE EQUIPMENT PAD FOR OUL-1.
- CONNECT TO BAS - VAV UNIT IS FIRST STAGE - COOLING ONLY. CONNECT EXISTING DUCTLESS SPLIT SYSTEM TO BAS FOR SECOND STAGE OF COOLING. PROVIDE ALL WIRING, HARDWARE, AND SOFTWARE FOR SEAMLESS CONTROL FROM THE OWNER'S EXISTING JCI BAS SYSTEM.

0 4 8 16
SCALE: 1/8" = 1'-0"



COOLING COIL CONDENSATE DRAIN

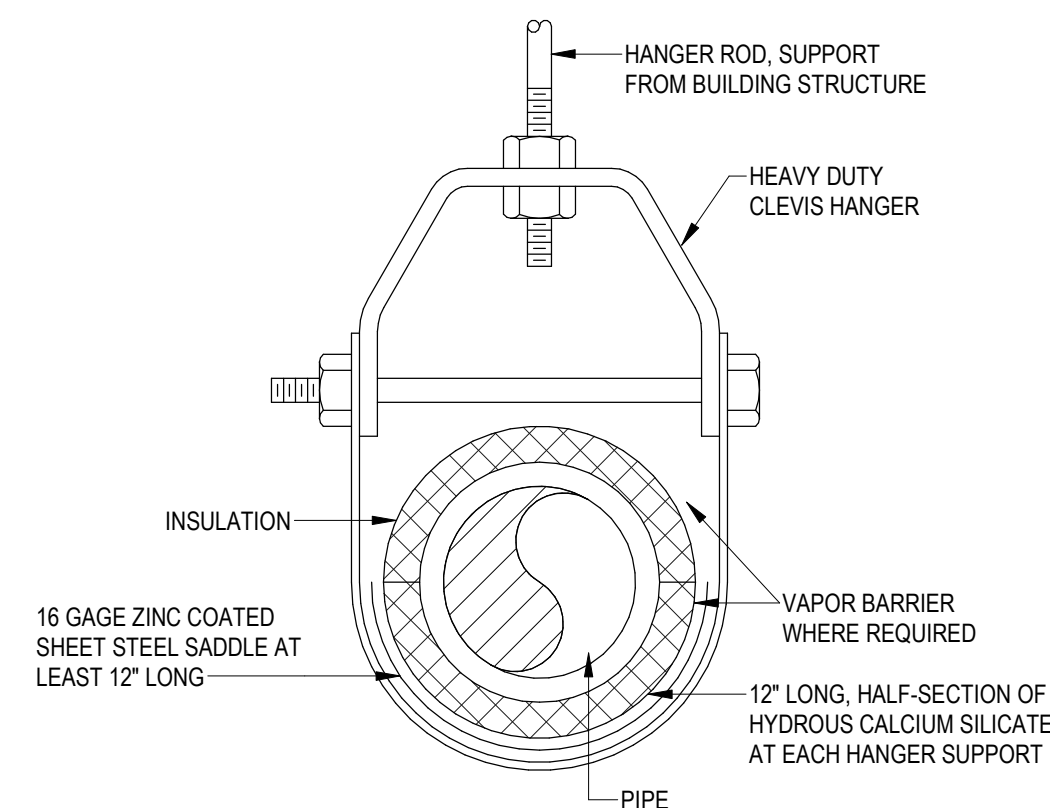
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(COORDINATE WITH MECHANICAL PLANS TO DETERMINE LOCATIONS)

CONDENSATE DRAIN DETAIL

NO SCALE

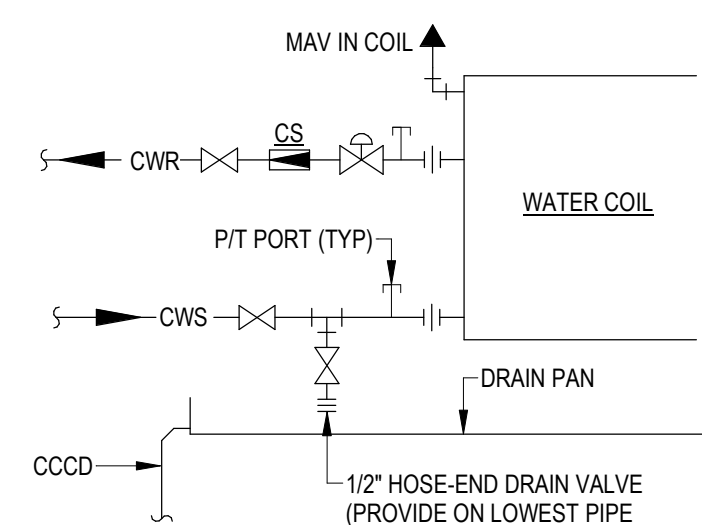


NOTE: SADDLE AND HALF-SECTION OF HYDROUS CALCIUM SILICATE SHALL BE INSTALLED AT THE SAME TIME THAT THE PIPE AND PIPE HANGERS ARE INSTALLED.

SEE SPECIFICATIONS FOR LOCATIONS WHERE HYDROUS CALCIUM SILICATE SHALL BE REQUIRED.

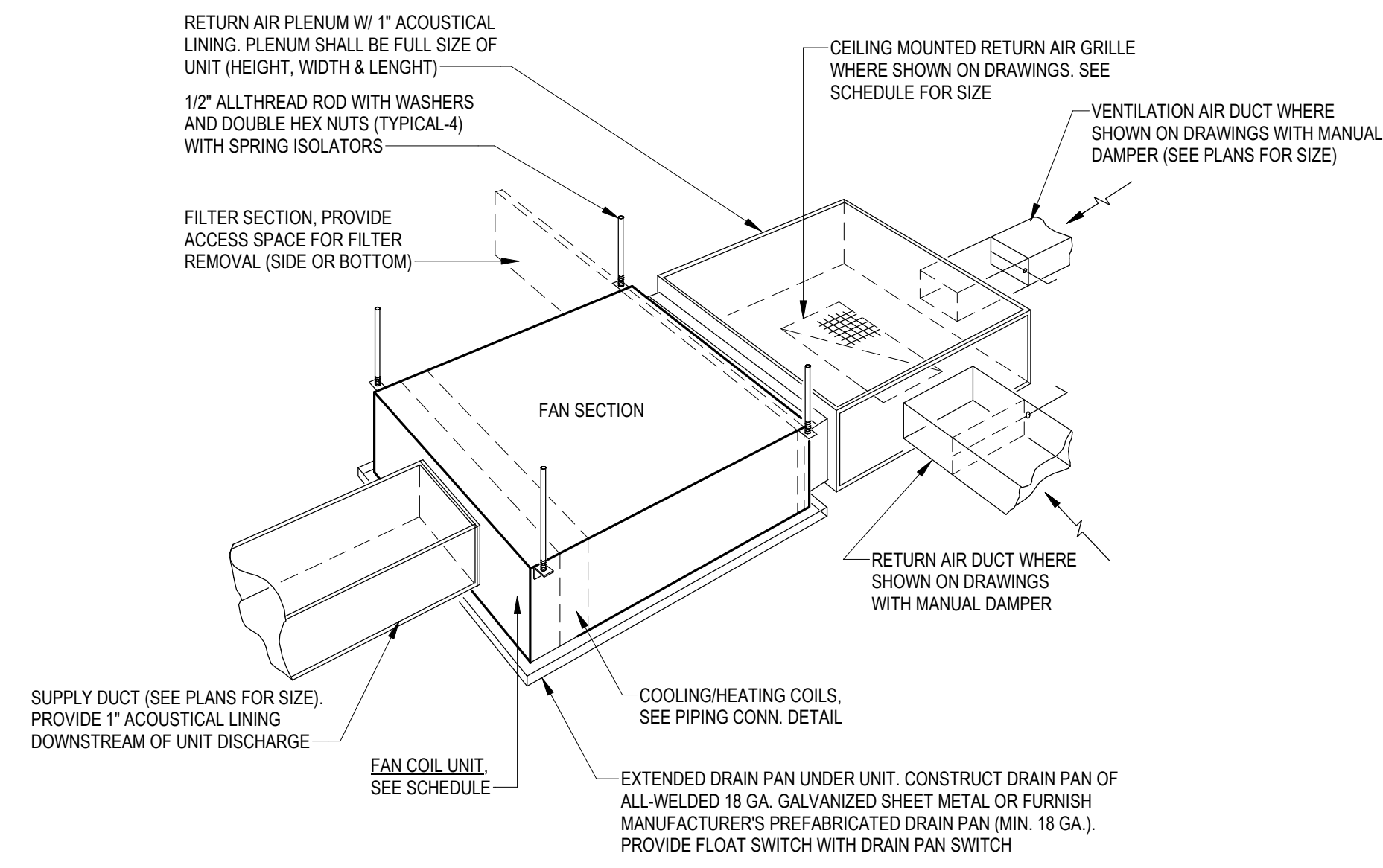
PIPE SUPPORT DETAIL

NO SCALE



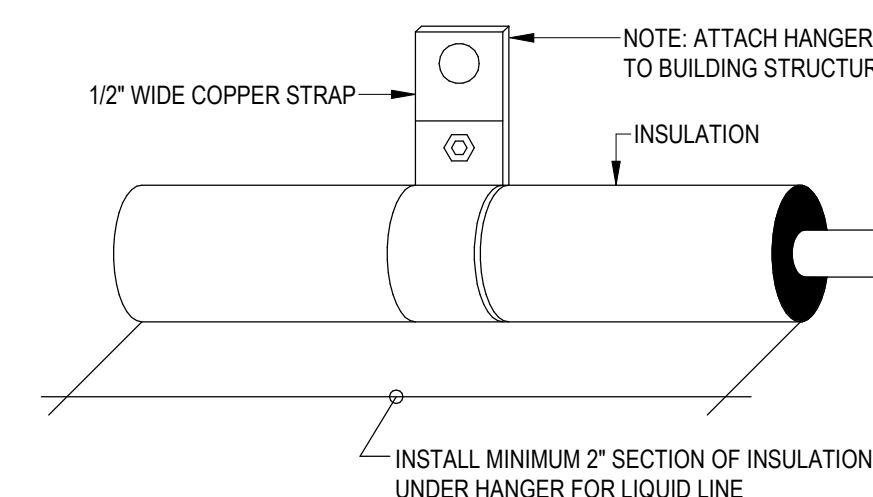
FAN COIL UNIT COIL CONNECTION DETAIL

SCHEMATIC



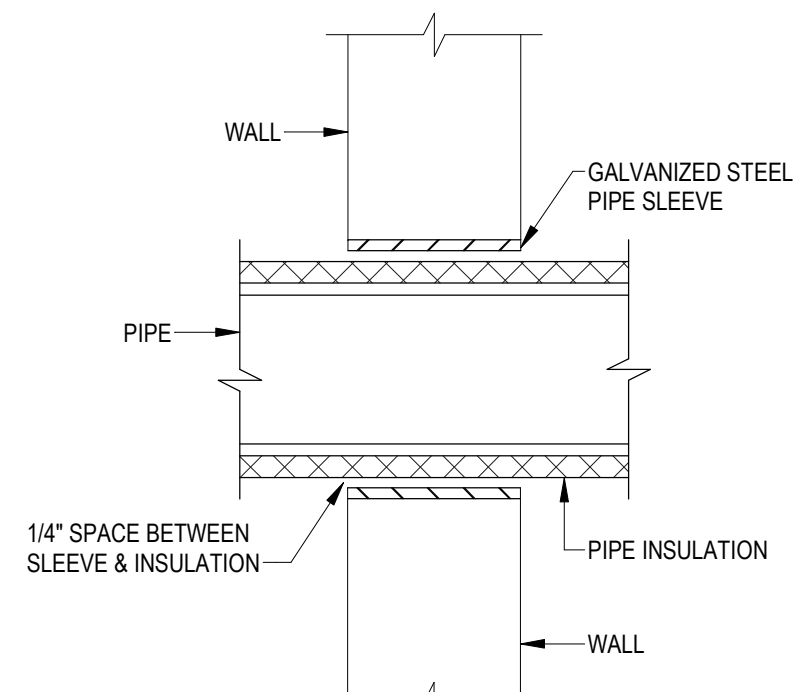
DUCT CONNECTION AT FAN COIL UNIT DETAIL

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REFRIGERANT PIPING HANGER DETAIL

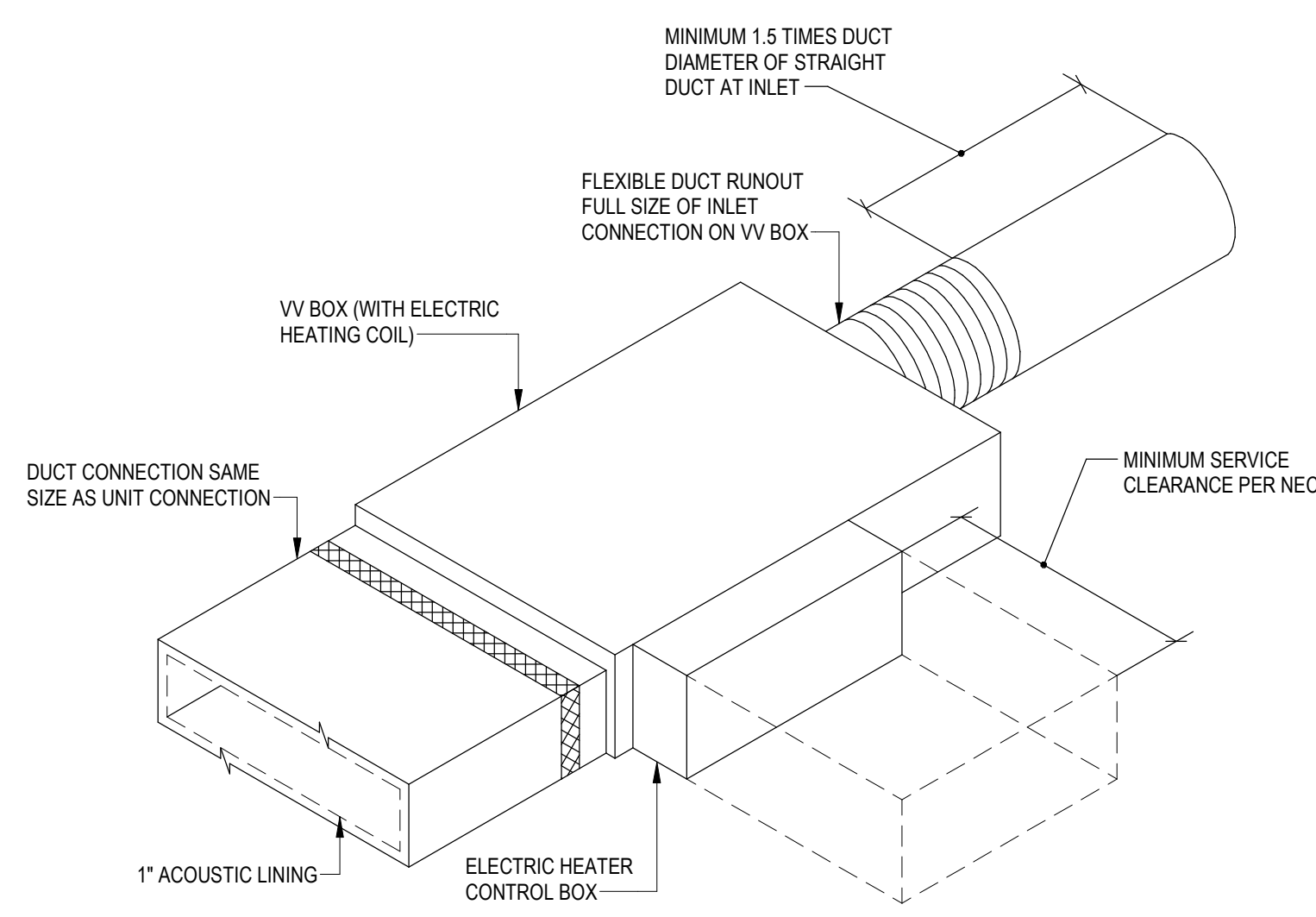
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NOTE: WHERE PIPES PENETRATE FIRE-RATED WALLS, FILL SPACE BETWEEN PIPE & SLEEVE WITH A FIRE-RESISTANT MATERIAL WITH SUFFICIENT RATING TO MAINTAIN THE FIRE RATING OF THE WALL. WHERE PIPES PENETRATE EXTERIOR WALLS, FILL SPACE BETWEEN PIPE & SLEEVE WITH FIBERGLASS INSULATION.

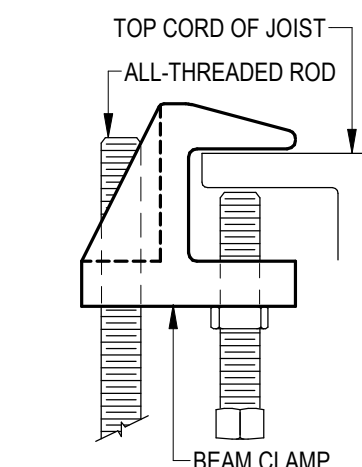
WALL PIPE SLEEVE DETAIL

NO SCALE



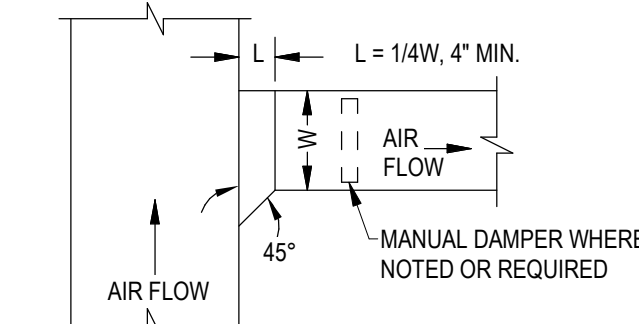
VARIABLE VOLUME SHUT-OFF BOX WITH ELECTRIC HEAT CONNECTION DETAIL

SCHEMATIC



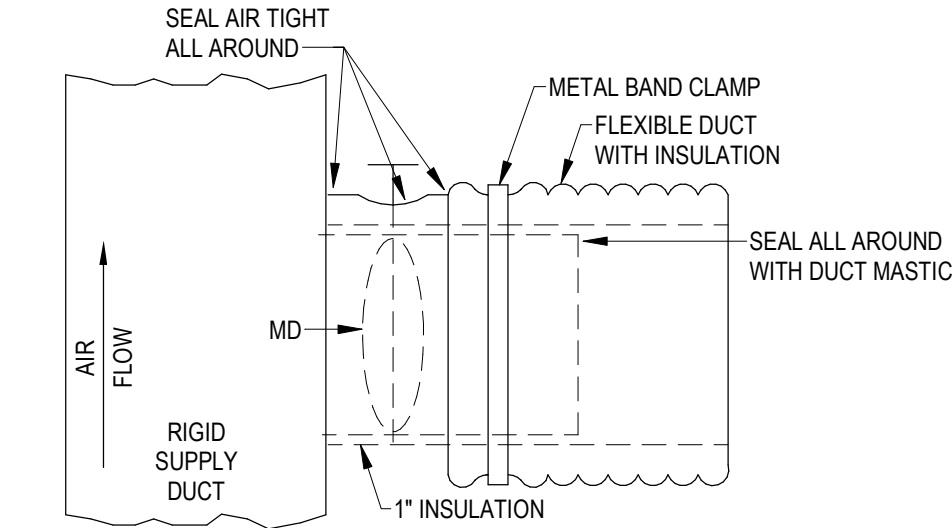
PIPE SUPPORT ATTACHMENT DETAIL

NO SCALE



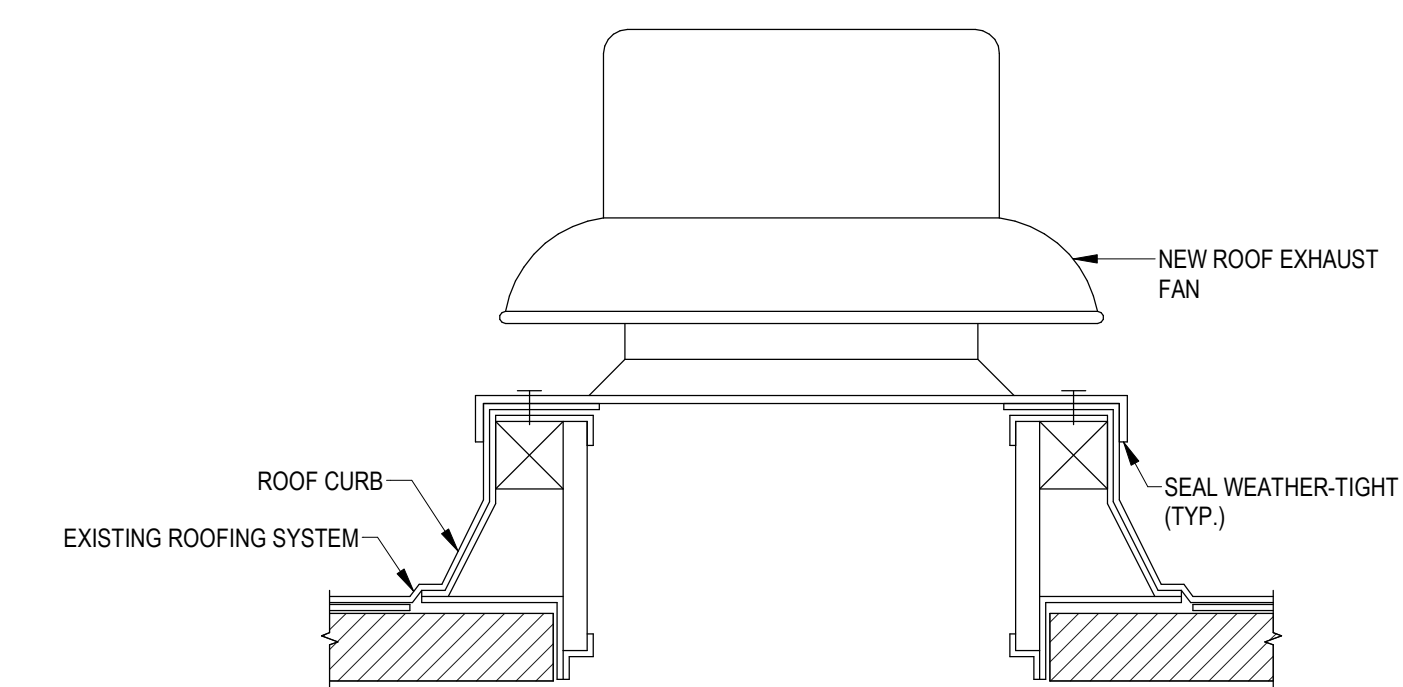
BRANCH DUCT CONNECTION DETAIL

SCHEMATIC



SPIN-IN FITTING DETAIL

NO SCALE



ROOF FAN CONNECTION DETAIL

NO SCALE

