

SECTION 23 00 00 - HVAC SPECIFICATIONS

PART 1 - GENERAL INFORMATION

LEED CERTIFICATION
THE PROJECT WILL NOT BE LEED CERTIFIED.

HVAC SYSTEMS COMMISSIONING
THE BUILDING / PROJECT WILL NOT BE COMMISSIONED BY AN INDEPENDENT THIRD-PARTY COMMISSIONING PARTY.

THE HVAC CONTRACTOR WILL BE RESPONSIBLE FOR SELF-COMMISSIONING ALL HVAC SYSTEM EQUIPMENT AND CONTROLS TO PROVIDE A COMPLETE OPERATING SYSTEM.

THE HVAC CONTRACTOR SHALL WORK WITH THE BUILDING USER TO ESTABLISH ALL SETPOINTS, SET-BACKS, OPERATIONAL HOURS, UNOCCUPIED HOURS, ETC.

DEFINITIONS
FURNISH:
SUPPLY AND DELIVER TO PROJECT SITE READY FOR UNPACKING, ASSEMBLY AND INSTALLATION.

INSTALL:
OPERATIONS AT SITE INCLUDING UNPACKING, ASSEMBLING, ERECTING, PLACING, ANCHORING, APPLYING, FINISHING, CLEANING, AND CONNECTING RELATED DEVICES REQUIRED FOR PRODUCT FULLY FUNCTIONAL FOR INTENDED USE AFTER INSTALLATION.

PROVIDE:
FURNISH AND INSTALL, SUCH THAT PRODUCT IS FULLY FUNCTIONAL FOR INTENDED USE.

BUILDING ACCESS
ARRANGE FOR THE NECESSARY OPENINGS IN THE BUILDING TO ALLOW FOR ADMITTANCE OF ALL EQUIPMENT/MATERIAL. WHEN THE BUILDING ACCESS WAS NOT PREVIOUSLY ARRANGED AND MUST BE PROVIDED BY THIS CONTRACTOR, RESTORE ANY OPENING TO ITS ORIGINAL CONDITION AFTER THE EQUIPMENT/MATERIAL HAS BEEN BROUGHT INTO THE BUILDING.

EQUIPMENT ACCESS
INSTALL, ALL PIPING, CONDUIT, DUCTWORK, AND ACCESSORIES TO PERMIT ACCESS TO EQUIPMENT FOR MAINTENANCE AND SERVICE. COORDINATE THE EXACT LOCATION OF WALL AND CEILING ACCESS PANELS AND DOORS WITH THE GENERAL CONTRACTOR, MAKING SURE THAT ACCESS IS AVAILABLE FOR ALL EQUIPMENT AND SPECIALTIES.

ALL EXPOSED GAS PIPING (EXPOSED PIPING OUTSIDE AND EXPOSED PIPING INSIDE THE BUILDING) SHALL BE PAINTED AFTER INSTALLATION WITH A COMPATIBLE APPLIANCE PRIMER COAT AND A FINISH COAT OF YELLOW PAINT SUITABLE FOR THE APPLICATION. GAS PIPING SHALL BE CLEARLY IDENTIFIED AS SUCH WITH PIPE MARKINGS AS REQUIRED.

PROVIDE COLOR CODED THUMB TACKS OR SCREWS, DEPENDING ON THE SURFACE, FOR USE IN ACCESSIBLE CEILINGS WHICH DO NOT REQUIRE ACCESS PANELS.

COORDINATION OF WORK
COORDINATE ALL WORK WITH OTHER CONTRACTORS PRIOR TO INSTALLATION. ANY INSTALLED WORK THAT IS NOT COORDINATED AND THAT INTERFERES WITH OTHER CONTRACTORS WORK SHALL BE REMOVED OR RELOCATED AT THE INSTALLING CONTRACTORS EXPENSE.

COORDINATE THE LOCATION OF ALL BUILDING SURFACE PENETRATIONS WITH THE APPROPRIATE CONTRACTORS.

FURNISH ELEVATIONS, INSERTS, AND OTHER DEVICES THAT ARE TO BE BUILT INTO THE STRUCTURE TO THE CONTRACTOR PERFORMING THAT WORK. PREPARE SHOP DRAWINGS FOR APPROVAL FOR ALL PENETRATIONS OF STRUCTURAL ELEMENTS, INCLUDING FLOOR SLABS, SHEAR WALLS, AND BEARING WALLS. DO NOT ALLOW PENETRATIONS TO BE MADE UNTIL SHOP DRAWINGS ARE APPROVED.

APPLICABLE CODES, STANDARDS AND GUIDELINES
ALL MECHANICAL SYSTEMS WILL BE DESIGNED IN ACCORDANCE WITH THE FOLLOWING PUBLISHED CODES, GUIDELINES, AND STANDARDS:

- ASHRAE - AMERICAN SOCIETY OF HEATING, REFRIGERATING, AND AIR-CONDITIONING ENGINEERS
- 15 - 2013 - SAFETY STANDARD FOR REFRIGERATION SYSTEMS
- 55 - 2013 - THERMAL ENVIRONMENTAL CONDITIONS FOR HUMAN OCCUPANCY
- 62.1 - 2013 - VENTILATION FOR ACCEPTABLE INDOOR AIR QUALITY
- 90.1 - 2013 - ENERGY STANDARD FOR BUILDINGS, EXCEPT LOW-RISE RESIDENTIAL BUILDINGS.

- INTERNATIONAL CODE COUNCIL (ICC) - 2015
- INTERNATIONAL ENERGY CONSERVATION CODE
- INTERNATIONAL MECHANICAL CODE
- INTERNATIONAL FUEL GAS CODE

- STATE OF WISCONSIN - WISCONSIN ADMINISTRATIVE CODE
- CHAPTER 63 ENERGY CONSERVATION (AMENDMENTS TO TCEC)
- CHAPTER 64 HEATING, VENTILATING, AND AIR-CONDITIONING (AMENDMENTS TO IMC)
- CHAPTER 65 FUEL GAS APPLIANCES.

QUALITY ASSURANCE
WHERE EQUIPMENT OR ACCESSORIES ARE USED WHICH DIFFER IN ARRANGEMENT, CONFIGURATION, DIMENSIONS, RATINGS, OR ENGINEERING PARAMETERS FROM THOSE INDICATED ON THE CONTRACT DOCUMENTS, THE CONTRACTOR IS RESPONSIBLE FOR ALL COSTS INVOLVED IN INTEGRATING THE EQUIPMENT OR ACCESSORIES INTO THE SYSTEM AND FOR OBTAINING THE PERFORMANCE FROM THE SYSTEM INTO WHICH THE ITEMS ARE PLACED. THIS MAY INCLUDE CHANGES FOUND NECESSARY DURING THE TESTING, ADJUSTING, AND BALANCING PHASE OF THE PROJECT.

PLAN REVIEW, PERMITS AND FEES
THE CONTRACTOR SHALL OBTAIN AND PAY FOR ALL REQUIRED LOCAL AND STATE PLAN REVIEWS, FEDERAL, STATE AND LOCAL INSTALLATION INSPECTIONS, CERTIFICATES AND PERMITS REQUIRED.

DELIVER ORIGINALS OF THESE CERTIFICATES TO THE GENERAL CONTRACTOR.

WARRANTY
THE HVAC CONTRACTOR SHALL WARRANT ALL WORK FOR A PERIOD OF (1) YEAR, EFFECTIVE ON THE DATE OF SUBSTANTIAL COMPLETION, AS DETERMINED BY THE OWNER, GENERAL CONTRACTOR AND HVAC CONTRACTOR.

ALL WARRANTY CALLS, AT ANYTIME, SHALL BE AT NO COST TO THE OWNER DURING THE WARRANTY PERIOD.

VALUE ENHANCEMENT PROPOSALS
THE CONTRACTOR SHALL IDENTIFY COST SAVING OPTIONS AND ALTERNATES AT THE CONTRACTORS DISCRETION AS APPLICABLE TO THIS PROJECT FOR ITEMS SUCH AS EQUIPMENT, CONTROLS SYSTEMS, MANUFACTURERS, ETC.

ITEMS PROPOSED SHOULD PROVIDE CONSTRUCTION COST SAVINGS WHILE NOT SIGNIFICANTLY IMPACTING QUALITY OR FUNCTION. IF REVIEW OF THE DOCUMENTS YIELDS NO SUCH OPPORTUNITIES, ADVISE ACCORDINGLY.

SUBMIT VALUE ENHANCEMENT PROPOSALS, INCLUDING A LIST OF ITEMS FOR CONSIDERATION, ALONG WITH THE BID.

UTILITIES
NO NEW GAS SERVICE IS EXPECTED.

EQUIPMENT AND MATERIAL SUBMITTALS
MARK EACH CATALOG SHEETS AND DRAWINGS TO INDICATE SPECIFIC ITEMS BEING SUBMITTED AND PROPER IDENTIFICATION OF EQUIPMENT BY NAME AND/OR NUMBER, AS INDICATED IN THE CONTRACT DOCUMENTS.

BEFORE SUBMITTING ELECTRICALLY POWERED EQUIPMENT, VERIFY THAT THE ELECTRICAL POWER AND CONTROL REQUIREMENTS FOR THE EQUIPMENT ARE IN AGREEMENT WITH THE MOTOR STARTER SCHEDULE ON THE ELECTRICAL DRAWINGS. INCLUDE A STATEMENT ON THE SHOP DRAWING TRANSMITTAL TO THE ARCHITECT/ENGINEER THAT THE EQUIPMENT SUBMITTED AND THE MOTOR STARTER SCHEDULE ARE IN AGREEMENT OR INDICATE ANY DISCREPANCIES.

SUBMIT ELECTRONIC (PDF) COPY OF ALL SUBMITTALS FOR REVIEW BY A/E, ARCHITECT, OWNER, OWNERS REPRESENTATIVE AND BUILDING OPERATOR.

OFF-SITE STORAGE
ANY REQUIRED OFFSITE STORAGE OF MATERIAL IS THE RESPONSIBILITY OF THE CONTRACTOR. MATERIALS OR EQUIPMENT DAMAGED WHILE STORED OFFSITE, OR WHILE TRANSPORTED TO OR FROM OFFSET STORAGE WILL NOT BE ALLOWED TO BE INSTALLED.

CUTTING AND PATCHING
THIS CONTRACTOR SHALL BE RESPONSIBLE FOR ALL CUTTING AND PATCHING OF THE EXISTING GENERAL CONSTRUCTION TO ACCOMMODATE INSTALLATION OF THE NEW HVAC SYSTEM(S) UNLESS OTHERWISE NOTED.

PATCHING INCLUDES REPAIRING THE OPENINGS REMAINING FROM THE REMOVAL OR RELOCATION OF EXISTING SYSTEM COMPONENTS AND PAINTING THE SURFACE TO MATCH EXISTING. PAINTING MENUS COVERING THE ENTIRE WALL, WHERE PATCHING IS TO BE DONE UNLESS INDICATED TO BE DONE BY OTHER TRADES.

DO NOT Pierce BEAMS OR COLLUMS WITHOUT PERMISSION OF THE ARCHITECT/ENGINEER AND THEN ONLY AS DIRECTED. IF ANY PIPING IS REQUIRED THROUGH WALLS OR FLOORS WHERE NO SLEEVE HAS BEEN PROVIDED, USE A CORE DRILL TO AVOID ALL UNNECESSARY DAMAGE AND STRUCTURAL WEAKENING.

SURFACE COMPATIBILITY
VERIFY THAT ALL DEVICES ARE COMPATIBLE FOR THE SURFACES ON WHICH THEY WILL BE USED. THIS INCLUDES, BUT IS NOT LIMITED TO, DIFFUSERS, REGISTERS, GRILLES, AND RECESSED OR SEMI-RECESSED HEATING TERMINAL UNITS INSTALLED IN/ON ARCHITECTURAL SURFACES.

DEVICES AT / ON THE INTERIOR AND EXTERIOR EXPOSED TO PUBLIC VIEW ARE TO BE PAINTED TO MATCH THE ADJACENT WALL SURFACE.

CLEANING
KEEP THE PREMISES BROOM CLEAN AND FREE OF SURPLUS MATERIALS, RUBBISH AND DEBRIS.

CONCRETE EQUIPMENT AND HOUSEKEEPING PADS
THE HVAC CONTRACTOR SHALL PROVIDE ALL CONCRETE EQUIPMENT PADS (INDOOR AND OUTDOOR) FOR HVAC EQUIPMENT MOUNTING.

TEMPORARY HEAT
EQUIPMENT INSTALLED IN THE FACILITY SHALL NOT BE USED FOR TEMPORARY HEATING. THE HVAC CONTRACTOR SHALL PROVIDE ALL EQUIPMENT FOR TEMPORARY HEATING AND PAY FOR ALL TEMPORARY HEATING COSTS.

PROJECT CLOSEOUT
THE CONTRACTOR SHALL COMPLETE AND PROVIDE ALL ITEMS AND MATERIALS, TRAINING, START-UP, ETC. ASSOCIATED WITH PROJECT CLOSEOUT. IN ADDITION TO THESE ITEMS, THE CONTRACTOR SHALL COMPLETE AND/OR PROVIDE THE FOLLOWING ITEMS PRIOR TO ACCEPTANCE OF THE INSTALLATION:

- FINAL AIR AND WATER SYSTEM BALANCING.
- SUBMISSION OF OPERATING AND MAINTENANCE INSTRUCTIONS.
- SUBMISSION OF START-UP REPORT FOR THE TEMPERATURE CONTROL SYSTEM.
- OWNERS TRAINING.
- WARRANTY STATEMENT.

ALL HVAC FILTERS SHALL BE CHANGED AFTER FINAL BUILDING CLEANING AND PRIOR TO BUILDING TURNOVER TO OWNER.

OPERATION AND MAINTENANCE MANUALS
PROVIDE OPERATION AND MAINTENANCE MANUALS. MANUALS SHALL INCLUDE, AT A MINIMUM, ALL APPROVED SHOP DRAWINGS, TEST REPORTS, RECORD DRAWINGS, CERTIFICATES OF COMPLIANCE AND EQUIPMENT MAINTENANCE MANUALS.

PROVIDE THE MANUAL IN THE FOLLOWING FORMATS:

- ELECTRONIC COPY (IN Adobe PDF FORMAT). PROVIDE (3) PORTABLE FLASH DRIVES, EACH WITH A COPY OF THE MANUAL.
- HARD COPY. PROVIDE (3) COPIES, EACH IN A SEPARATE 3-RING BINDER WITH COVER LABELED SPECIFIC TO THIS PROJECT.

OPERATION AND MAINTENANCE MANUALS TO INCLUDE:

- RECORDS OF TESTS PERFORMED TO CERTIFY COMPLIANCE WITH SYSTEM REQUIREMENTS.
- RECORDS OF INSPECTION BY REGULATORY AGENCIES.
- VALVE SCHEDULES.
- LUBRICATION INSTRUCTIONS, INCLUDING LIST/FREQUENCY OF LUBRICATION.
- COPIES OF ALL APPROVED SHOP DRAWINGS.
- MANUFACTURER'S WIRING DIAGRAMS FOR ELECTRICALLY POWERED EQUIPMENT.
- TEMPERATURE CONTROL RECORD DRAWINGS AND CONTROL SEQUENCES.
- PARTS LISTS FOR MANUFACTURED EQUIPMENT.
- WARRANTIES.
- RECORD DRAWINGS.

OWNER TRAINING
INSTRUCT OWNER/FACILITY PERSONNEL IN THE PROPER OPERATION AND MAINTENANCE OF SYSTEMS AND EQUIPMENT PROVIDED AS PART OF THIS PROJECT.

INCLUDE NOT LESS THAN 4 HOURS OF INSTRUCTION, USING THE OPERATING AND MAINTENANCE MANUALS DURING THIS INSTRUCTION. DEMONSTRATE STARTUP AND SHUTDOWN PROCEDURES FOR ALL EQUIPMENT. ALL TRAINING TO BE DURING NORMAL WORKING HOURS.

VIDEO TAPE ALL TRAINING SESSIONS IN DIGITAL (DVD) MEDIA FORMAT. THE CONTRACTOR SHALL PROVIDE THE CAMERA, CAMERA OPERATOR AND DVDS. PROVIDE (3) COPIES OF TRAINING DVD TO OWNER. ALL TRAINING SHALL BE DURING NORMAL WORKING HOURS.

RECORD DRAWINGS
MAINTAIN RECORD "AS-BUILT" DRAWINGS ON SYSTEM INSTALLATION. SCAN "AS-BUILT" DRAWINGS INTO PDF FORMAT. INCLUDE BOTH HARD COPY AND ELECTRONIC COPY OF THE RECORD DRAWINGS WITH THE OPERATING AND MAINTENANCE MANUALS.

SYSTEM START UP
PROVIDE THE SERVICES OF FACTORY TRAINED SERVICE TECHNICIANS TO APPROVE INSTALLATIONS; STARTUP, TEST AND ADJUST FOR PROPER OPERATION; AND INSTRUCT AND TRAIN THE OWNERS REPRESENTATIVE IN THE OPERATION AND MAINTENANCE OF EQUIPMENT.

ACCESS PANELS
PROVIDE ACCESS PANELS AT ALL CONCEALED CEILING THUMB TACKS OR SCREWS, DEPENDING ON THE SURFACE, FOR USE IN ACCESSIBLE CEILINGS. PANELS SHALL HAVE A 16 GAUGE FRAME WITH NOT LESS THAN A 20 GAUGE HINGED DOOR PANEL, PRIME COATED. PROVIDE COLOR CODED THUMB TACKS OR SCREWS, DEPENDING ON THE SURFACE, FOR USE IN ACCESSIBLE CEILINGS. PANELS SHALL BE TURNED OVER TO THE GENERAL CONTRACTOR FOR INSTALLATION.

IDENTIFICATION
IDENTIFY ALL HVAC EQUIPMENT, PIPING AND VALVES.

- EQUIPMENT
- LABEL ALL EQUIPMENT.

- PIPING
- LABEL ALL HOT WATER, REFRIGERANT, CONDENSATE AND NATURAL GAS PIPING.
- INCLUDE FLOW DIRECTION ARROWS ON PIPE LABELS.
- PROVIDE 1" HIGH STENCILS OR SNAP-ON PIPE MARKERS.
- LABEL PIPING A MINIMUM OF EVERY 10'-0" AND IN EVERY ROOM.

- VALVE TAGS
- PROVIDE METAL ENGRAVED VALVE TAG FOR SYSTEM VALVE. PROVIDE VALVE CHART IN OPERATION AND MAINTENANCE MANUALS.

EQUIPMENT IDENTIFICATION
IDENTIFY EQUIPMENT BY STENCILING EQUIPMENT NUMBER AND SERVICE WITH ONE COAT OF BLACK ENAMEL AGAINST A LIGHT BACKGROUND OR WHITE ENAMEL AGAINST A DARK BACKGROUND. DO NOT LABEL EQUIPMENT SUCH AS CABINET HEATERS AND CEILING FANS IN OCCUPIED SPACES. WHERE STENCILING IS NOT APPROPRIATE FOR EQUIPMENT IDENTIFICATION, ENGRAVED NAME PLATES SHALL BE USED.

IDENTIFY PIPING NOT LESS THAN ONCE EVERY 30 FEET, NOT LESS THAN ONCE IN EACH ROOM, ADJACENT TO EACH ACCESS DOOR OR PANEL, AND ON BOTH SIDE OF THE PARTITION WHERE EXPOSED PIPING PASSES THROUGH WALLS, FLOORS OR ROOFS. PLACE FLOW DIRECTIONAL ARROWS AT EACH PIPE IDENTIFICATION LOCATION.

IDENTIFY VALVES WITH BRASS TAGS BEARING SYSTEM IDENTIFICATION AND A VALVE SCHEDULE NUMBER. PROVIDE A TYPENWRITTEN VALVE SCHEDULE INDICATING THE VALVE NUMBER AND THE EQUIPMENT OR AREAS SUPPLIED BY EACH VALVE; LOCATE SCHEDULES IN EACH MECHANICAL ROOM AND IN EACH OPERATIONAL MAINTENANCE MANUAL.

SEALING AND FIRE STOPPING
SEALING AND FIRE STOPPING OF SLEEVES/OPENINGS BETWEEN DUCTWORK, PIPING, ETC. AND THE SLEEVE, STRUCTURAL OR PARTITION OPENING SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR WHOSE WORK PENETRATES THE OPENING. PROVIDE ALL FIRE STOPPING OF FIRE RATED PENETRATIONS AND SEALING OF SMOKE RATED PENETRATIONS.

NON-RATED PENETRATIONS
PIPE PENETRATIONS THROUGH BELOW GRADE WALLS

- IN EXTERIOR WALL OPENINGS BELOW GRADE, USE A MODULAR MECHANICAL TYPE SEAL CONSISTING OF INTERLOCKING SYNTHETIC RUBBER LINKS SHAPED TO CONTINUOUSLY FILL THE ANNULAR SPACE BETWEEN DRYWALL, PLASTER OR WOOD WALLS WHERE SLEEVE IS NOT REQUIRED USE URETHANE CAULK IN ANNULAR SPACE BETWEEN PIPE INSULATION AND WALL MATERIAL.

PIPE PENETRATIONS

- AT PIPE PENETRATIONS OF NON-RATED INTERIOR WALLS, FLOORS AND EXTERIOR WALLS ABOVE GRADE, USE URETHANE CAULK IN ANNULAR SPACE BETWEEN PIPE INSULATION AND SLEEVE. FOR NON-RATED DRYWALL, PLASTER OR WOOD WALLS WHERE SLEEVE IS NOT REQUIRED USE URETHANE CAULK IN ANNULAR SPACE BETWEEN PIPE INSULATION AND WALL MATERIAL.

DUCT PENETRATIONS

- ANNULAR SPACE BETWEEN DUCT (WITH OR WITHOUT INSULATION) AND THE NON-RATED WALLS OR FLOOR OPENING SHALL NOT BE LARGER THAN 2" WHERE EXISTING OPENINGS HAVE AN ANNULAR SPACE LARGER THAN 2". THE SPACE SHALL BE PATCHED TO MATCH EXISTING CONSTRUCTION TO WITHIN 2" AROUND THE DUCT.
- WHERE SHOWN OR SPECIFIED, PACK ANNULAR SPACE WITH FIBERGLASS BATT INSULATION OR MINERAL WOOL INSULATION. PROVIDE 4" SHEET METAL ESCUTOCHON AROUND DUCT ON BOTH SIDES OF PARTITION OR FLOOR TO COVER ANNULAR SPACE.

PART 2 - PRODUCT DATA - EQUIPMENT, MATERIAL, AND EXECUTION REQUIREMENTS

NATURAL GAS PIPING & PIPING SPECIALTIES
NATURAL GAS PIPING:
2" AND SMALLER: ASTM A53, TYPE E OR S, STANDARD WEIGHT (SCHEDULE 40) BLACK STEEL PIPE WITH ASTM A197/ANSI B16.3 CLASS 150 BLACK MALLEABLE IRON THREADED FITTINGS OR ASTM A234 GRADE WPB/ANSI B16.9 STANDARD WEIGHT, SEAMLESS, CARBON STEEL, WELD FITTINGS.

PITCH HORIZONTAL PIPING DOWN 1" IN 60 FEET IN THE DIRECTION OF FLOW. INSTALL A 4" MINIMUM DEPTH DIRT LEG AT THE BOTTOM OF EACH VERTICAL RUN AND AT EACH APPLIANCE. WHEN INSTALLING MAINS AND BRANCHES, GAS CAP TIGHT EACH TEE OR PIPE END WHICH WILL NOT BE IMMEDIATELY EXTENDED. ALL BRANCH CONNECTIONS TO THE MAIN SHALL BE FROM THE TOP OR SIDE OF THE MAIN.

EACH GAS PRESSURE REDUCING VALVE VENT AND RELIEF VALVE VENT SHALL BE RUN SEPARATELY TO A POINT OUTSIDE OF THE BUILDING, TERMINATED WITH A SCREENED VENT CAP, AND LOCATED ACCORDING TO GAS UTILITY REGULATIONS. IF AN ABOVE GROUND VENT TERMINATES IN AN AREA SUBJECT TO SNOW ACCUMULATION, TERMINATE THE LINE AT LEAST FIVE FEET ABOVE GRADE.

INSTALL A PRESSURE REGULATOR, SHUT OFF VALVE, UNION AND DIRT LEG AT EACH APPLIANCE. PROVIDE A VALVED CONNECTION AT THE MAIN FOR EQUIPMENT AND APPLIANCES FURNISHED BY OTHERS.

TRAP EACH COOLING COIL, DRAIN PAN CONNECTION WITH TRAP SEAL. DEPTH OF TRAP SEAL SHALL PREVENT CONDITIONED AIR FROM MOVING THROUGH PIPING. EXTEND DRAIN PIPING TO NEAREST CODE APPROVED DRAIN LOCATION. CONSTRUCT TRAP WITH PLUGGED TEE FOR CLEANOUT PURPOSES. DO NOT PROVIDE LOOP SEALS FOR AIR HANDLING SYSTEMS WITH INTERNAL TRAPS.

NATURAL GAS SHUT OFF VALVES:
2" AND SMALLER: BALL VALVE, BRONZE BODY, THREADED ENDS, STAINLESS STEEL BALL, FULL OR CONVENTIONAL, PORT, TEFLON SEAT, BLOWOUT-PROOF STEM, TWO-PIECE CONSTRUCTION, SUITABLE FOR 150 PSIG WORKING PRESSURE, UL LISTED FOR USE AS NATURAL GAS SHUT-OFF.

NATURAL GAS PRESSURE REGULATORS:
2" AND SMALLER: CAST IRON BODY, ALUMINUM SPRING, NITRILE DIAPHRAGM, THREADED ENDS, 150 PSIG W.O.G., .20F TO 1.00F.

HYDRONIC PIPING & FITTINGS
HOT WATER:
2" AND SMALLER:
ASTM A53, TYPE F, STANDARD WEIGHT (SCHEDULE 40) BLACK STEEL PIPE WITH ASTM A126/ANSI B16.3, CLASS 125, STANDARD WEIGHT CAST IRON THREADED FITTINGS.

VENTS AND RELIEF VALVES:
USE PIPE AND PIPE FITTINGS SPECIFIED FOR SYSTEM TO WHICH RELIEF VALVE OR VENT IS CONNECTED.

COOLING COIL CONDENSATE:
ASTM B88, TYPE L HALF HARD COPPER TUBING WITH ASTM B145/ANSI B16.23 CAST RED BRONZE OR ASTM B75/ANSI B16.29 WROUGHT SOLDER-TYPE DRAINAGE FITTINGS.

FOR COOLING COIL CONDENSATE LOCATED OUTDOORS, PVC IS ACCEPTABLE.

TRAP EACH COOLING COIL, DRAN PAN CONNECTION WITH TRAP SEAL. DEPTH OF TRAP SEAL SHALL PREVENT CONDITIONED AIR FROM MOVING THROUGH PIPING. EXTEND DRAIN PIPING TO NEAREST CODE APPROVED DRAIN LOCATION. CONSTRUCT TRAP WITH PLUGGED TEE FOR CLEANOUT PURPOSES. DO NOT PROVIDE LOOP SEALS FOR AIR HANDLING SYSTEMS WITH INTERNAL TRAPS.

UNIONS AND FLANGES:
2" AND SMALLER:
ASTM A197/ANSI B16.3 MALLEABLE IRON UNIONS WITH BRASS SEATS, USE BLACK MALLEABLE IRON ON BLACK STEEL PIPING AND GALVANIZED MALLEABLE IRON ON GALVANIZED STEEL PIPING. USE UNIONS OF PRESSURE CLASS EQUAL TO OR HIGHER THAN THAT SPECIFIED FOR FITTINGS OF RESPECTIVE PIPING SERVICE BUT NOT LESS THAN 250 PSI.

FLANGES SMALLER THAN 2'-10" MAY BE USED AS NEEDED FOR CONNECTING TO EQUIPMENT AND PIPING SPECIALTIES. USE RAISED FACE FLANGES ANSI B16.5 FOR MATING WITH OTHER RAISED FACE FLANGES ON EQUIPMENT WITH FLAT RING OR FULL FACE GASKETS. USE ANSI B16.1 FLAT FACE FLANGES WITH FULL FACE GASKETS FOR MATING WITH OTHER FLAT FACE FLANGES ON EQUIPMENT. GASKET MATERIAL TO BE NON-ASBESTOS AND RATED FOR WORKING PRESSURE AND TEMPERATURE OF PIPING SYSTEM.

INSTALL UNION OR FLANGE AT EACH AUTOMATIC CONTROL VALVE AND AT EACH PIPING SPECIALTY OR PIECE OF EQUIPMENT THAT MAY REQUIRE REMOVAL FOR MAINTENANCE. REPAIR, OR REPLACEMENT WHERE VALVE IS LOCATED AT EQUIPMENT, LOCATE FLANGES OR UNION CONNECTION ON EQUIPMENT SIDE OF VALVE. PIPING SHALL BE ARRANGED TO PERMIT COALS AND EQUIPMENT TO BE REMOVED WITHOUT DISASSEMBLING PIPING BEYOND UNIONS, CONCEALED UNIONS OR FLANGES ARE NOT ACCEPTABLE.

PRESS FITTINGS:
THE USE OF PRESS TYPE FITTINGS SHALL NOT BE ACCEPTABLE ON THIS PROJECT.

INSTALLATION:
CAREFULLY INSPECT ALL PIPE, FITTINGS, VALVES, EQUIPMENT AND ACCESSORIES BEFORE INSTALLATION. ANY ITEMS THAT ARE UNSUITABLE, CRACKED OR OTHERWISE DEFECTIVE SHALL BE REJECTED AND REMOVED FROM THE JOB SITE IMMEDIATELY. EXCLUDING MINOR SURFACE RUST, PIPING THAT EXHIBITS SIGNIFICANT OXIDATION OR CORROSION WILL BE REJECTED.

EXERCISE CARE AT EVERY STAGE OF STORAGE, HANDLING, LAYING AND ERECTING TO PREVENT ENTRY OF FOREIGN MATTER INTO PIPING, FITTINGS, VALVES, EQUIPMENT AND ACCESSORIES. DO NOT ERECT OR INSTALL ANY ITEM THAT IS NOT SUBSTANTIAL.

REMOVE ALL LOSE DIRT, SCALE, OIL, CHIPS, BURRS AND OTHER FOREIGN MATERIAL FROM THE INTERNAL AND EXTERNAL SURFACES OF ALL PIPE AND PIPING COMPONENTS PRIOR TO ASSEMBLY, INCLUDING DEBRIS ASSOCIATED WITH CUTTING, DRANDING AND WELDING.

DURING FABRICATION AND ASSEMBLY, REMOVE SLAG AND WELD SPATTER FROM INTERNAL PIPE SURFACES AT ALL JOINTS BY PEENING, CHIPPING AND WIRE BRUSHING.

DURING CONSTRUCTION, UNTIL SYSTEM IS FULLY OPERATIONAL, KEEP ALL OPENINGS IN PIPING AND EQUIPMENT CLOSED EXCEPT WHEN ACTUAL WORK IS BEING PERFORMED ON THAT ITEM OF THE SYSTEM. USE PLUGS, CAPS, BLIND FLANGES OR OTHER ITEMS DESIGNED FOR THIS PURPOSE.

REMOVE FOREIGN MATERIAL FROM INTERIOR AND EXTERIOR OF PIPE AND FITTINGS.

INSTALL PIPING PARALLEL TO BUILDING WALLS AND CEILINGS AND AT HEIGHTS THAT DO NOT OBSTRUCT ANY PORTION OF A WINDOW, DOORWAY, STAIRWAY, OR PASSAGEWAY.

WHERE INTERFERENCES DEVELOP IN FIELD, OFFSET OR REROUTE PIPING TO CLEAR INTERFERENCES. CONSULT DRAWINGS FOR EXACT LOCATION OF PIPE SPACES, CEILING HEIGHTS, DOOR AND WINDOW OPENINGS, OR OTHER ARCHITECTURAL DETAILS BEFORE INSTALLING PIPING.

PROVIDE ANCHORS, EXPANSION JOINTS, SWING JOINTS AND EXPANSION LOOPS SO PIPING MAY EXPAND AND CONTRACT WITHOUT DAMAGE TO ITSELF, EQUIPMENT, OR BUILDING.

MITERED ELLS, NOTCHED TEES, AND ORANGE PEEL REDUCERS ARE NOT ACCEPTABLE. ON THREADED PIPING, BUSHINGS ARE NOT ACCEPTABLE.

"WELDOLETS" AND "THREADOLETS" MAY BE USED FOR BRANCH TAKEOFFS UP TO 1/2 THE DIAMETER OF MAIN.

INSTALL DRAINS THROUGHOUT THE SYSTEMS TO PERMIT COMPLETE DRAINAGE.

DO NOT ROUTE PIPING THROUGH TRANSFORMER WALLS OR ABOVE TRANSFORMERS, PANELBOARDS, OR SWITCHBOARDS, INCLUDING REQUIRED SERVICE SPACE FOR EQUIPMENT, UNLESS PIPING IS SERVING EQUIPMENT ROOM.

INSTALL MANUAL VALVES, CONTROL VALVES, AND PIPING SPECIALTIES, INCLUDING ITEMS FURNISHED UNDER OTHER SECTIONS OF WORK AS SPECIFIED AND DETAILED. PROVIDE CONNECTIONS TO EQUIPMENT INSTALLED UNDER OTHER SECTIONS OF WORK WHERE EQUIPMENT REQUIRES THE PIPING SPECIALTIES INDICATED IN THIS SECTION.

RUN WATER MAINS LEVEL OR PITCH HORIZONTAL MAINS UP 1 INCH IN 40 FEET IN DIRECTION OF FLOW. INSTALL MANUAL AIR VENTS AT HIGH POINTS WHERE AIR MAY COLLECT. IF VENT IS NOT IN AN ACCESSIBLE LOCATION, EXTEND AIR VENT PIPING TO NEAREST CODE ACCEPTABLE DRAIN LOCATION WITH VENT VALVE LOCATED AT DRAIN.

LOW POINTS SHALL HAVE DRAIN VALVE AND CAPPED HOSE TRAP OUTLET.

MAIN BRANCHES AND RUNOUTS TO TERMINAL EQUIPMENT MAY BE MADE AT TOP, SIDE, OR BOTTOM OF MAIN PROVIDED THERE ARE DRAIN VALVES SUITABLY LOCATED FOR COMPLETE SYSTEM DRAINAGE AND MANUAL AIR VENTS LOCATED AS DESCRIBED ABOVE.

CONNECTIONS AT MAIN MAY BE MADE FROM BOTTOM WITH TEE AND 45 DEGREE ELBOW.

USE MINIMUM OF 3 ELBOWS IN EACH PIPE LINE TO A PIECE OF TERMINAL EQUIPMENT TO PROVIDE FLEXIBILITY FOR EXPANSION AND CONTRACTION OF PIPING SYSTEMS. OFFSET PIPE CONNECTIONS AT EQUIPMENT TO ALLOW FOR SERVICE OR REMOVAL OF TERMINAL DEVICE.

USE ECCENTRIC FITTINGS FOR CHANGES IN HORIZONTAL PIPE SIZES WITH FITTINGS INSTALLED FOR PROPER AIR VENTING. CONCENTRIC FITTINGS MAY BE USED FOR CHANGES IN VERTICAL PIPE SIZES.

PROVIDE CONNECTIONS TO HOT WATER COLLS, AND TERMINAL HEATING DEVICES AS SHOWN ON DRAWINGS FOR FULLY FUNCTIONAL SYSTEM.

THREADED PIPE JOINTS:
USE THREAD LUBRICANT OR TEFLON TAPE WHEN MAKING JOINTS; NO HARD SETTING PIPE THREAD CEMENT OR CAULKING IS ALLOWED.

COPPER PIPE JOINTS:
REMOVE OXIDATION AND BURRS REMAINING FROM THE CUTTING OPERATION BY REAMING AND FINING BOTH PIPE SURFACES. CLEAN FITTING AND TUBE WITH EMERY CLOTH OR SANDPAPER. REMOVE RESIDUE FROM THE CLEANING OPERATION, APPLY FLUX, AND ASSEMBLE JOINT. USE 95-SOLDER OR BRAZING TO SECURE JOINT AS SPECIFIED FOR THE SPECIFIC PIPING SERVICE.

WHERE MECHANICALLY FORMED TEE FITTINGS ARE ALLOWED, FORM MECHANICALLY EXTRACTED COLLARS IN A CONTINUOUS OPERATION, CONSISTING OF DRILLING A PILOT HOLE AND DRAWING OUT THE TUBE SURFACE TO FORM A COLLAR HAVING A HEIGHT OF NOT LESS THAN THREE TIMES THE THICKNESS OF THE TUBE WALL, USE AN ADJUSTABLE COLLARING DEVICE. NOTCH AND Dimple THE BRANCH TUBE. REMOVE ALL DEBRIS CREATED BY THE FORMING PROCESS FROM THE INSIDE OF THE PIPE. BRAZE THE JOINT, APPLYING HEAT PROPERLY SO THAT PIPE AND TEE DO NOT DISTORT. REMOVE DISTORTED CONNECTIONS.

GASKETS:
STORE HORIZONTALLY IN COOL, DRY LOCATION AND PROTECT FROM SUNLIGHT, WATER AND CHEMICALS. INSPECT FLANGE SURFACES FOR WARPING, RADIAL SCORING OR HEAVY TOOL MARKS. INSPECT FASTENERS, NUTS AND WASHERS FOR BURRS OR CRACKS. REPLACE DEFECTIVE MATERIALS.

ALIGN FLANGES PARALLEL AND PERPENDICULAR WITH BOLT HEADS CENTERED WITHOUT USING EXCESSIVE FORCE. CENTER GASKET IN OPENING. LUBRICATE FASTENER THREADS, NUTS AND WASHERS WITH LUBRICANT FORMULATED FOR APPLICATION.

DRAW FLANGES TOGETHER EVENLY TO AVOID PINCHING GASKET. TIGHTEN FASTENERS IN CROSS PATTERN SEQUENCE (12 - 6 O'CLOCK, 3 - 9 O'CLOCK, ETC.) ONE PASS BY HAND AND FOUR PASSES BY TORQUE WRENCH AT 30% FULL TORQUE, 60% FULL TORQUE AND TWO PASSES AT FULL TORQUE PER ASME B16.5.

T-OR-L, CONNECTIONS:
IN USE OF GREAT FITTINGS, CONTRACTOR MAY USE T-OR-L PIPE FABRICATION SYSTEMS CONFORMING TO THE FOLLOWING REQUIREMENTS FOR BRANCH TAKEOFF UP TO 1/2 THE DIAMETER OF MAIN. MECHANICALLY EXTRACTED COLLARS SHALL BE FORMED IN CONTINUOUS OPERATION CONSISTING OF DRILLING PILOT HOLE AND DRAWING OUT TUBE SURFACE TO FORM COLLAR HAVING HEIGHT OF NOT LESS THAN 3 TIMES THE THICKNESS OF THE WALL. COLLARING DEVICE SHALL BE FULLY ADJUSTABLE TO INSURE PROPER TOLERANCE AND COMPLETE UNIFORMITY OF JOINT.

BRANCH SHALL BE NOTCHED TO CONFORM WITH INNER CURVE OF RUN TUBE, AND DIMPLED TO INSURE PENETRATION OF BRANCH TUBE INTO COLLAR HAS ADEQUATE DEPTH FOR BRAZING AND BRANCH TUBE DOES NOT OBSTRUCT FLOW IN MAIN LINE TUBE.

JOINTS SHALL BE BRAZED IN ACCORDANCE WITH COPPER DEVELOPMENT ASSOCIATION COPPER TUBE HANDBOOK USING B-CUP SERIES FILLER METAL. NOTE: SOFT SOLDERED JOINTS ARE NOT ACCEPTABLE.

MECHANICALLY FORMED BRANCH COLLARS SHALL BE LISTED BY NATIONAL STANDARD PUBLISHING CODE: BOCA, IAPMO, SBCC, HUD, VA, US ARMY CORPS OF ENGINEERS AND UL.

WATER SYSTEM:
RUN WATER MAINS LEVEL OR PITCH HORIZONTAL MAINS UP 1 INCH IN 40 FEET IN THE DIRECTION OF FLOW. INSTALL MANUAL AIR VENTS AT ALL HIGH POINTS WHERE AIR MAY COLLECT. IF VENT IS NOT IN AN ACCESSIBLE LOCATION, EXTEND AIR VENT PIPING TO THE NEAREST CODE ACCEPTABLE DRAIN LOCATION WITH VENT VALVE LOCATED AT DRAIN.

MAIN BRANCHES AND RUNOUTS TO TERMINAL EQUIPMENT MAY BE MADE AT THE TOP, TOP 45 DEGREE, SIDE, AND/OR BOTTOM 45 DEGREE OF THE MAIN PROVIDED THAT THERE ARE DRAIN VALVES SUITABLY LOCATED FOR COMPLETE SYSTEM DRAINAGE AND MANUAL AIR VENTS ARE LOCATED AT ALL TOP AND TOP 45 DEGREE CONNECTIONS.

USE TOP OR TOP 45 DEGREE CONNECTION TO MAN FOR UPFEED RISERS AND BOTTOM 45 DEGREE CONNECTION TO MAN FOR DOWNFEED RISERS. BOTTOM CONNECTIONS ARE NOT ACCEPTABLE UNLESS APPROVED BY THE O&M MECHANICAL INSPECTOR.

USE A MINIMUM OF TWO ELBOWS IN EACH PIPE LINE TO A PIECE OF TERMINAL EQUIPMENT TO PROVIDE FLEXIBILITY FOR EXPANSION AND CONTRACTION OF THE PIPING SYSTEMS. OFFSET PIPE CONNECTIONS AT EQUIPMENT TO ALLOW FOR SERVICE, SUCH AS REMOVAL OF THE TERMINAL DEVICE.

USE ECCENTRIC FITTINGS FOR CHANGES IN HORIZONTAL PIPE SIZES WITH THE FITTINGS INSTALLED FOR PROPER AIR VENTING. CONCENTRIC FITTINGS MAY BE USED FOR CHANGES IN VERTICAL PIPE SIZES.

PIPING SYSTEM TEST LEAKS:
CONDUCT PRESSURE TEST WITH TEST MEDIUM WATER FOR CHILLED AND HOT WATER SYSTEMS. IF LEAKS ARE FOUND, REPAIR AREAS WITH NEW MATERIALS AND REPEAT TEST. CAULKING IS NOT ACCEPTABLE.

DO NOT INSULATE PIPE UNTIL SUCCESSFULLY TESTED.

USE CLEAN WATER AND REMOVE AIR FROM PIPING BEING TESTS BY MEANS OF AIR VENTS OR LOOSENING OF FLANGES/UNIONS.

TEST HOT AND CHILLED WATER SYSTEMS FOR A MINIMUM OF 8 HOURS AT 100 PSIG.

HYDRONIC VALVES & ACCESSORIES
VALVE MANUFACTURERS:
THE FOLLOWING MANUFACTURERS AND MODELS ARE CONSIDERED ACCEPTABLE SUBJECT TO COMPLIANCE WITH SPECIFIED REQUIREMENTS.

STANDARD VALVES:
STANDARD VALVES ARE BASED ON MODELS AND STYLES MANUFACTURED BY NIBCO. EQUIVALENT VALVES AS MANUFACTURED BY THE FOLLOWING ARE ACCEPTABLE: APOLLO, BRAY, CENTERLINE, CRANE, DEZURK, HAMMOND, JAMESBURY, KEYSTONE, MILWAUKEE, POWELL, OR STOCKHAM.

SPECIALTY VALVES:
SPECIALTY VALVES ARE BASED ON MANUFACTURERS AND MODELS SPECIFIED UNDER EACH SECTION OF VALVES, OR AS SPECIFIED IN THE FOLLOWING LIST.

CALIBRATED BALANCING VALVES: ARMSTRONG, BELL & GOSSETT, FLOWSET, MUELLER, NIBCO, TACO, OR TOUR AND ANDERSON.

BALL VALVES:
2" AND SMALLER:
NIBCO 125 869, 70; 2-PIECE BRONZE BODY, THREADED OR SOLDERED ENDS TO MATCH APPROPRIATE PIPE MATERIAL; STAINLESS STEEL, OR CHROME PLATED BRASS/BRONZE BALL, CONVENTIONAL PORT; GLASS FILLED TEFLON SEAT, THREADED PACKING GLAND FOLLOWER, BLOWOUT PROOF STEM; 600 PSIG WOG. PROVIDE VALVE STEM EXTENSIONS FOR VALVES INSTALLED IN INSULATED PIPING.

2 1/2" AND OVER:
BALL VALVES WILL NOT BE ACCEPTED IN SIZES OVER 2 INCH.

BUTTERFLY VALVES:
2" AND SMALLER:
USE BALL VALVES; BUTTERFLY VALVES WILL NOT BE ACCEPTED IN SIZES 2 INCH AND SMALLER.

DRAIN VALVES:
USE 3/4 INCH BALL VALVE WITH THREADED HOSE ADAPTER.

PROVIDE DRAIN VALVES FOR COMPLETE DRAINAGE OF SYSTEMS.

BALANCING VALVES:
2" AND SMALLER:
B

DUCT FLEXIBLE CONNECTIONS:
MATERIAL TO BE FIRE RETARDANT, BE UL 214 LISTED, AND MEET THE REQUIREMENTS OF NFPA 90A.

CONNECTIONS TO BE A MINIMUM OF 3 INCHES WIDE, CRIMPED INTO METAL EDGING STRIP, AND AIR TIGHT. CONNECTIONS TO HAVE ADEQUATE FLEXIBILITY AND WIDTH TO ALLOW FOR THERMAL EXPANSION/CONTRACTION, VIBRATION OF CONNECTED EQUIPMENT, AND OTHER MOVEMENT.

USE COATED GLASS FIBER FABRIC FOR ALL APPLICATIONS. MATERIAL FOR INDOOR APPLICATIONS TO BE DOUBLE COATED WITH NEOPRENE, AIR AND WATER TIGHT, SUITABLE FOR TEMPERATURES BETWEEN - 10F AND 200F, AND HAVE A NOMINAL WEIGHT OF 30 OUNCES PER SQUARE YARD.

MATERIAL USED FOR OUTDOOR APPLICATIONS TO BE DOUBLE COATED WITH HYPALON, AIR AND WATER TIGHT, SUITABLE FOR TEMPERATURES BETWEEN - 10F AND 250F, AND HAVE A NOMINAL WEIGHT OF 26 OUNCES PER SQUARE YARD.

INSTALL AT ALL DUCT CONNECTIONS TO PACKAGED ROOFTOP UNITS IN ACCORDANCE WITH SMACNA FIGURE 2_19. INSTALL THRUST RESTRAINTS TO PREVENT EXCESS STRAIN ON DUCT FLEXIBLE CONNECTIONS AT FAN INLETS AND OUTLETS, SEE RELATED WORK.

INSULATION
GENERAL:
FURNISH AND INSTALL ALL INSULATING MATERIALS AND ACCESSORIES AS SPECIFIED OR AS REQUIRED FOR A COMPLETE INSTALLATION.

INSTALL ALL INSULATION IN ACCORDANCE WITH THE LATEST EDITION OF MICA (MIDWEST INSULATION CONTRACTORS ASSOCIATION) STANDARD AND MANUFACTURER'S INSTALLATION INSTRUCTIONS.

EXCEPTIONS TO THESE STANDARDS WILL ONLY BE ACCEPTED WHERE SPECIFICALLY MODIFIED IN THESE SPECIFICATIONS, OR WHERE PRIOR WRITTEN APPROVAL HAS BEEN OBTAINED FROM THE ENGINEER.

MATERIALS OR ACCESSORIES CONTAINING ASBESTOS WILL NOT BE ACCEPTED.

USE COMPOSITE INSULATION SYSTEMS (INSULATION, JACKETS, SEALANTS, MASTICS, AND ADHESIVES) THAT HAVE A FLAME SPREAD RATINGS OF 25 OR LESS AND SMOKE DEVELOPED RATINGS OF 50 OR LESS EXCEPT THAT OUTDOOR MECHANICAL INSULATION MAY HAVE A FLAME SPREAD RATING OF 75 AND A SMOKE DEVELOPED RATING OF 150.

INSULATING MATERIALS SHALL BE FIRE RETARDANT, MOISTURE AND MILDEW RESISTANT, AND VERMIN PROOF. INSULATION SHALL BE SUITABLE TO RECEIVE JACKETS, ADHESIVES AND COATINGS AS INDICATED.

ADHESIVES, SEALANTS, AND PROTECTIVE FINISHES SHALL BE AS RECOMMENDED BY INSULATION MANUFACTURER FOR APPLICATIONS SPECIFIED.

FLEXIBLE FIBERGLASS INSULATION:
OWENS CORNING "ALL-SERVICE DUCT WRAP" WITH A MINIMUM DENSITY OF 0.75 LB. PER CU. FT., THERMAL CONDUCTIVITY OF NOT MORE THAN 0.35 AT 75F MEAN TEMPERATURE, AND BE SUITABLE FOR AN OPERATING TEMPERATURE UP TO 250F.

VAPOR RETARDER FACING SHALL BE A FOL-SCRM-KRAFT LAMINATE JACKET, FACTORY APPLIED TO THE INSULATION. PERFORMANCE SHALL NOT EXCEED 0.02 PERMS WHEN TESTED IN ACCORDANCE WITH ASTM E 96. BEACH PUNCTURE RESISTANCE SHALL BE 50 UNITS MINIMUM.

DUCTWORK:
FOL-SCRM-KRAFT VAPOR BARRIER JACKET, FACTORY APPLIED TO INSULATION, MAXIMUM PERMEANCE OF 0.02 PERMS AND MINIMUM BEACH PUNCTURE RESISTANCE OF 50 UNITS.

RIGID FIBERGLASS INSULATION:
OWENS CORNING 700 SERIES WITH A FOIL KRAFT FACING, HAVING A THERMAL CONDUCTIVITY OF NOT MORE THAN 0.23 AT 75F MEAN TEMPERATURE AND SUITABLE FOR OPERATING TEMPERATURES UP TO 450F.

INSIDE APPLICATIONS: MINIMUM NOMINAL WEIGHT OF 3 LBS. PER CU. FT..

PIPING:
WHITE KRAFT REINFORCED FOIL VAPOR BARRIER ALL SERVICE JACKET, FACTORY APPLIED TO INSULATION WITH A SELF-SEALING PRESSURE SENSITIVE ADHESIVE LAP, MAXIMUM PERMEANCE OF 0.02 PERMS AND MINIMUM BEACH PUNCTURE RESISTANCE OF 50 UNITS.

DUCTWORK:
FOL-SCRM-KRAFT VAPOR BARRIER JACKET, FACTORY APPLIED TO INSULATION, MAXIMUM PERMEANCE OF 0.02 PERMS AND MINIMUM BEACH PUNCTURE RESISTANCE OF 50 UNITS.

SELF-ADHERING JACKETS:
INSTALL ACCORDING TO MANUFACTURER'S RECOMMENDATIONS. CUT ALLOWING MINIMUM 4" OVERLAP ON ENDS AND 6" ON LONGITUDINAL JOINTS. ALIGN PARALLEL TO SURFACE. REMOVE RELEASE PAPER AND PRESS FLAT TO SURFACE TO AVOID WRINKLES. RUB ENTIRE SURFACE FOR FULL ADHESION AND SEALING AT JOINT OVERLAPS. ON EXTERIOR APPLICATIONS, PROVIDE A BEAD OF COMPATIBLE CAULK ALONG EXPOSED EDGES.

INSTALLATION:
DO NOT INSULATE SYSTEMS OR EQUIPMENT WHICH IS SPECIFIED TO BE PRESSURE TESTED OR INSPECTED. UNTIL TESTING AND INSPECTION HAVE BEEN SUCCESSFULLY COMPLETED.

INSULATION, JACKETS, OR ACCESSORIES SHALL ONLY BE INSTALLED UNDER AMBIENT TEMPERATURES OR CONDITIONS RECOMMENDED BY THE MANUFACTURER OF THE MATERIAL.

INSULATION AND JACKETS SHALL BE PROVIDED AS INDICATED IN INSULATION SCHEDULES. SCHEDULES APPLY TO BOTH EXPOSED AND CONCEALED APPLICATIONS UNLESS NOTED OTHERWISE.

INSTALL INSULATION WITH SMOOTH AND EVEN SURFACES, AND ON CLEAN AND DRY SURFACES. PROVIDE NEATLY BEVELED TERMINATIONS AT ALL NAMEPLATES, UNINSULATED FITTINGS, OR AT OTHER LOCATIONS WHERE INSULATION TERMINATES.

INSULATION SHALL BE CONTINUOUS THROUGH SLEEVES AND OPENINGS EXCEPT WHERE PARTITIONS OR ASSEMBLIES ARE FIRE RATED.

PROVIDE A COMPLETE VAPOR BARRIER FOR INSULATION ON REFRIGERATION PIPING, INSULATED DUCTS AND ALL EQUIPMENT WITH A SURFACE TEMPERATURE BELOW 65 F.

GLASS FABRIC REINFORCING SHALL BE INSTALLED IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS, AND FITTED WITHOUT UNNECESSARY WRINKLES OR SEAMS. ALL SEAMS SHALL OVERLAP A MINIMUM OF 2 INCHES.

ALL JOINTS SHALL BE COVERED WITH FACTORY FURNISHED TAPE (2" MINIMUM WIDTH) TO MATCH THE JACKET, FIRMLY CEMENTED WITH LAP ADHESIVE.

WHERE ANCHORS OR SUPPORTS ARE SECURED DIRECTLY TO THE PIPE, EXTEND INSULATION UP THE ANCHOR OR SUPPORT FOR A DISTANCE OF 4 TIMES THE INSULATION THICKNESS. MAINTAIN VAPOR BARRIER WHERE INSULATION IS TERMINATED.

DUCT INSULATION SHALL BE APPLIED EVENLY OVER THE DUCT SURFACE, SECURED WITH BONDING ADHESIVE IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS.

WHERE VAPOR BARRIER JACKETS ARE SPECIFIED, PINS SHALL BE COVERED WITH JACKET MATERIAL MATCHING THAT OF DUCT INSULATION, SEALED VAPOR TIGHT, AND COVERED WITH VAPOR BARRIER MASTIC.

VAPOR BARRIERS SHALL BE MAINTAINED CONTINUOUS.

CONSTRUCTION SHALL BE PROTECTED AS SPECIFIED FOR KITCHEN EXHAUST DUCTS ABOVE.

WHERE EQUIPMENT IS SPECIFIED TO BE LEAK TESTED PRIOR TO OPERATION, DO NOT INSTALL INSULATION UNTIL TESTING AND NECESSARY REPAIRS HAVE BEEN SUCCESSFULLY COMPLETED.

INSULATION SHALL BE APPLIED TO EQUIPMENT SHELLS WITH BONDING ADHESIVE, AND WIRED IN PLACE. FILL JOINTS AND SEAMS WITH INSULATING CEMENT, COVERING SURFACES WITH A WIRE REINFORCING MESH, AN ADDITIONAL COAT OF INSULATING CEMENT WITH GLASS CLOTH SHALL THEN BE APPLIED, AND FINISHED TO A SMOOTH, HARD SURFACE.

WHERE A VAPOR BARRIER IS REQUIRED, APPLY 2 COATS OF VAPOR BARRIER MASTIC AFTER APPLICATION OF THE INSULATING CEMENT.

WHERE A VAPOR BARRIER IS NOT REQUIRED, APPLY 2 COATS OF WEATHERPROOF MASTIC AFTER APPLICATION OF THE INSULATING CEMENT.

PROVIDE INSULATED BOXES WITH METAL PROTECTIVE JACKET WHERE ACCESS IS REQUIRED FOR CLEANING, REPAIR, OR INSPECTION. BOXES MUST BE EASILY REMOVABLE WITHOUT CAUSING DAMAGE TO INSULATION OR EQUIPMENT.
DO NOT INSULATE EQUIPMENT THAT IS FACTORY INSULATED.

DO NOT INSULATE OVER EQUIPMENT NAMEPLATES OR ASME STAMPS. BEVEL AND SEAL INSULATION AT THESE LOCATIONS.

DUCT INSULATION SCHEDULE:

SERVICE	INSULATION TYPE	INSULATION THICKNESS
EXPOSED SUPPLY DUCTS (IN MECH. ROOMS)	FLEXIBLE FIBERGLASS	R-6 MINIMUM*
CONCEALED SUPPLY DUCTS	FLEXIBLE FIBERGLASS	R-6 MINIMUM*
EXHAUST DUCTS DOWNSTREAM OF MOTORIZED BACKDRAFT DAMPERS	FLEXIBLE FIBERGLASS	R-6 MINIMUM*

* CONTRACTOR TO PROVIDE MINIMUM THICKNESS TO ACHIEVE CODE REQUIRED INSTALLED R-VALUE LISTED.

PIPE INSULATION SCHEDULE:

SERVICE	INSULATION TYPE	INSULATION THICKNESS
HOT WATER (1-1/2" AND SMALLER)	RIGID FIBERGLASS	1-1/2"
HOT WATER (2" AND GREATER)	RIGID FIBERGLASS	2"
COOLING COIL CONDENSATE	RIGID INSULATION	1"

AIR TERMINAL UNITS
MANUFACTURERS: CARNES, ENVIROTEC, GREENHECK, TITUS, PRICE OR APPROVED EQUAL.

CASING:
MINIMUM 22 GAUGE GALVANIZED STEEL WITH 1" FOIL-FACED FIBROUS GLASS LINER. VOLUME DAMPER SHALL BE GALVANIZED STEEL WITH PERIPHERAL GASKET AND SELF-LUBRICATING BEARINGS. AIR INLET SHALL BE ROUND STUB CONNECTION WITH MULTIPoint ARRAY VELOCITY INLET SENSORS.

HYDRONIC HEATING COILS:
COPPER TUBE, WITH MECHANICALLY BONDED ALUMINUM FINS. INCLUDE MANUAL AIR VENT AND DRAIN VALVE.

INSTALL AIR TERMINAL UNITS LEVEL AND PLUMB. MAINTAIN SUFFICIENT CLEARANCE FOR NORMAL SERVICE AND MAINTENANCE.

PROVIDE AT LEAST 24" OF CLEARANCE ON CONTROLLER SIDE OF THE AIR TERMINAL UNIT. THE CLEARANCE AREA SHALL EXTEND THE FULL LENGTH OF THE SUPPLY AIR TERMINAL UNIT AND THE FULL LENGTH (INCLUDING THE ACCESS DOOR) OF THE EXHAUST/RETURN AIR TERMINAL UNIT.

MAINTAIN A MINIMUM OF 3'-0" CLEARANCE IN FRONT OF ALL ELECTRIC REPEAT COIL CONTROL POWER PANELS.

AIR GRILLES AND REGISTERS
MANUFACTURERS: CARNES, KRUEGER, METALAIRE, TITUS, PRICE OR APPROVED EQUAL.

ALL GRILLES, REGISTERS AND DIFFUSERS SHALL BE PROVIDED WITH THE APPROPRIATE FRAMES SUITABLE FOR THE CEILING TYPES. COORDINATE CEILING TYPES WITH OTHER TRADES.

ALL REGISTERS SHALL BE PROVIDED WITH OPPOSED BLADE MANUAL VOLUME DAMPERS.

REFER TO DRAWINGS FOR AIR GRILLE, DIFFUSER, AND REGISTER TYPE.

COORDINATE EXACT LOCATIONS OF GRILLES AND REGISTERS WITH OTHER TRADES TO MINIMIZE INTERFERENCE.

PAINT DUCTWORK VISIBLE BEHIND AIR OUTLETS AND INLETS FLAT BLACK WITH FLAT BLACK ENAMEL SPRAY PAINT.

PACKAGED ROOFTOP AIR-CONDITIONING UNITS
MANUFACTURERS: TRANE, CARRIER, DAIKIN, YORK, OR APPROVED EQUAL.

CABINET:
SINGLE WALL UNITS TO HAVE 1" THICK NEOPRENE COATED FIBERGLASS.

PROVIDE FULL LENGTH PIANO HINGED ACCESS DOORS WITH QUARTER TURN LOCKABLE HANDLES.

COOLING COIL DRAIN PAN TO BE STAINLESS STEEL.

SUPPLY FAN:
MOTOR TO BE EITHER FORWARD CURVED BELT (OR DIRECT DRIVE) CENTRIFUGAL FAN OR DIRECT DRIVE PLENUM FAN.

SUPPLY FAN MOTORS FOR VAV SYSTEM UNITS SHALL BE CONTROLLED BY A FACTORY PROVIDED, INTERNALLY MOUNTED AND WIRED VARIABLE FREQUENCY DRIVE.

HEATING SECTION:
ALUMAGARD HEAT EXCHANGER WITH MULTIPLE CONVEXITIES, AN INDUCED DRAFT BLOWER AND AN ELECTRONIC PRESSURE SWITCH TO LOCKOUT THE GAS VALVE UNTIL THE COMBUSTION CHAMBER IS PURGED AND COMBUSTION AIRFLOW IS ESTABLISHED. BURNER SHALL BE MINIMUM 2 STAGE OR MODULATING.

COMBUSTION BLOWERS AND GAS VALVES SHALL BE CAPABLE OF MODULATION. ELECTRONIC CONTROLLER INCLUDES A FACTORY WIRED, FIELD INSTALLED SUPPLY AIR TEMPERATURE SENSOR. SENSOR SHALL BE FIELD INSTALLED IN THE SUPPLY AIR DUCTWORK. SUPPLY AIR TEMPERATURE SETPOINT SHALL BE ADJUSTABLE ON THE ELECTRONIC CONTROLLER WITHIN THE CONTROLS COMPARTMENT. GAS HEATER SHALL BE CAPABLE OF CAPACITY TURNDOWN RATIO AS SHOWN ON THE UNIT RATING SHEET. HEAT TRACE SHALL BE INCLUDE ON THE CONDENSATE DRAIN.

EVAPORATOR COIL:
COILS SHALL BE FULL FACE AND OF NON-FERROUS CONSTRUCTION WITH ALUMINUM PLATE FINS MECHANICALLY BONDED TO SEAMLESS COPPER TUBES WITH BRAZED JOINTS.

HOT GAS REHEAT COIL:
COILS SHALL BE FULL FACE AND OF NON-FERROUS CONSTRUCTION WITH ALUMINUM PLATE FINS MECHANICALLY BONDED TO SEAMLESS COPPER TUBES WITH BRAZED JOINTS. PROVIDE SUCTION DISCHARGE BYPASS VALVE AND MODULATING HOT GAS REHEAT SOLENOID VALVE WITH A REPLACEABLE MAGNETIC COIL.

REFRIGERATION SYSTEM:
REFRIGERATION SYSTEM SHALL BE FACTORY CHARGED AND DESIGNED FOR USE WITH R454B REFRIGERANT.

COMPRESSORS SHALL BE STAGED CAPACITY HERMETIC SCROLL TYPE WITH THERMAL OVERLOAD PROTECTION.

UNIT SHALL BE FURNISHED WITH A2L REFRIGERANT LEAK DETECTION SYSTEM FROM THE UNIT MANUFACTURER.

AIR COOLED CONDENSERS:
COILS SHALL BE MULTI-PASS AND FABRICATED WITH ALUMINUM MICROCHANNEL TUBES.

CONDENSER FANS SHALL USE ELECTRONICALLY COMMUNICATED FAN MOTORS CONTROLLED VIA HEAD PRESSURE. FANS SHALL CONTINUALLY MODULATE BASED ON HEAD PRESSURE WITH MECHANICAL COOLING OPERATION TO A MINIMUM OF 35 DEG. F. PROVIDE ADJUSTABLE LOCKOUT.

CONDENSER SECTION SHALL BE PROVIDED WITH HAIL GUARDS.

CONTROLS:
MANUFACTURER TO PROVIDE DDC CONTROLLER FOR UNIT WITH BACNET INTERFACE.

UNIT SHALL BE EQUIPPED WITH A FACTORY INSTALLED ECONOMIZER FAULT AND DIAGNOSTICS MODULE. THE FAULT DETECTION AND DIAGNOSTICS MODULE SHALL PROVIDE DETECTION OF THE FOLLOWING FAULTS: AIR TEMPERATURE SENSOR FAILURE/FAULT, NOT ECONOMIZER WHEN THE UNIT SHOULD BE ECONOMIZING, ECONOMIZER DAMPER NOT MODULATING AND EXCESS OUTDOOR AIR.

THE ECONOMIZER FAULT AND DIAGNOSTICS MODULE SHALL ANNUNCIATE THE ALARM/FAULT TO THE BUILDING AUTOMATION SYSTEM.

FURNISH UNIT WITH DUCT MOUNTED HUMIDITY SENSOR. TCC TO FIELD INSTALL AND WIRE SENSOR TO RTU CONTROLLER FOR DEHUMIDIFICATION SYSTEM CONTROL.

UNIT ELECTRICAL:
PROVIDE SINGLE POINT POWER CONNECTION. INCLUDE A NON-FUSED DISCONNECT WITH LOCK-OUT/TAG-OUT PROVISIONS.

PROVIDE A FACTORY INSTALLED AND FUSED 15V CONVENIENCE UNPOWERED OUTLET TO FACILITATE SERVICING OF UNIT.

PROVIDE WITH FACTORY MOUNTED FREEZE/STAT.

UNIT FILTER SECTION:
FURNISH UNIT WITH DISPOSABLE 2" THICK FIBERGLASS MEDIA WITH ASHRAE 52.2 MERV RATING OF 8 OR HIGHER.

ECONOMIZER:
UNIT SHALL INCLUDE OUTDOOR AIR MODULATING CONTROL FOR "FREE COOLING" OPERATION. ECONOMIZER CONTROL SHALL CONTAIN LOW LEAK DAMPER, SPRING CLOSE MOTORIZED DAMPER, 100% OUTSIDE AIR DURING INTEGRATED, SIMULTANEOUS ECONOMIZER AND MECHANICAL COOLING WHEN ENTHALPY PERMITS, DISCHARGE AIR SENSOR AND ENTHALPY CHANGE OVER FOR DAMPER CONTROL AND ADJUSTABLE OUTDOOR AIR THERMOSTAT TO LOCK OUT MECHANICAL COOLING WHEN OUTDOOR AIR IS BELOW THE SETPOINT.

POWER EXHAUST:
SHALL INCLUDE INTEGRAL EXHAUST FAN WITH FAN DRIVE, 1750 RPM MOTOR, OVERLOAD PROTECTION AND BACKDRAFT DAMPER. EXHAUST SHALL BE PERMITTED TO OPERATE ONLY IN CONJUNCTION WITH THE UNIT ECONOMIZER TO MAINTAIN PROPER BUILDING PRESSURE. STATIC PRESSURE CONTROLLER SHALL STOP FANS IF BUILDING STATIC PRESSURE BELOW SETTING.

SMOKE DETECTOR:
SMOKE DETECTOR SHALL BE FACTORY MOUNTED AND WIRED, LOCATED IN RETURN AIR DUCTWORK.

ROOF CURBS:
UNITS SHALL BE INSTALLED ON A 18" HIGH FULL PERIMETER INSULATED ROOF CURB.

EXECUTION:
PROVIDE A WEATHERPROOF FUSIBLE ELECTRICAL DISCONNECT SWITCH WITH FUSES TO DISCONNECT ALL ELECTRICAL POWER TO UNIT.

PROVIDE FLEXIBLE CONNECTIONS AT EACH DUCT CONNECTION.

BUILDING AUTOMATION SYSTEM
QUALITY ASSURANCE:
THE TEMPERATURE CONTROLS CONTRACTOR SHALL BE:

ENVIRONMENTAL CONTROL SOLUTIONS
210 SPRING STREET
PEORIA, IL 61603

CONTACT: MIKE LAWLESS
C 309-414-2760
D 309-685-5232

ELECTRICAL STANDARDS:
PROVIDE ELECTRICAL PRODUCTS, WHICH HAVE BEEN TESTED, LISTED AND LABELED BY UNDERWRITERS LABORATORIES (UL) AND COMPLY WITH NEMA STANDARDS.

DDC STANDARDS: DDC MANUFACTURER SHALL PROVIDE WRITTEN PROOF WITH SHOP DRAWINGS THAT THE EQUIPMENT BEING PROVIDED IS IN COMPLIANCE WITH F.C.C. RULES GOVERNING THE CONTROL OF INTERFERENCE CAUSED BY DIGITAL ELECTRONIC EQUIPMENT TO RADIO COMMUNICATIONS (PART 15, SUBPART J, CLASS A).

APPROVED MANUFACTURERS:
PRODUCTS BY AUTOMATED LOGIC SHALL BE UTILIZED.

GENERAL:
PROVIDE DDC CONTROL PRODUCTS IN SIZES AND OF CAPACITIES AS REQUIRED, CONFORMING TO MANUFACTURER'S STANDARD MATERIALS AND COMPONENTS AS PUBLISHED IN THEIR PRODUCT INFORMATION, DESIGNED AND CONSTRUCTED AS RECOMMENDED BY THE MANUFACTURER AND AS REQUIRED FOR APPLICATION INDICATE.

SYSTEM SHALL BE CAPABLE OF OPERATING WITH 120 VAC POWER SUPPLY, FULLY PROTECTED WITH A SHUTDOWN-RESTART CIRCUIT, AND ASSOCIATED HARDWARE AND SOFTWARE.

ALL DDC CONTROLLERS SHALL USE SCREW TERMINALS FOR TERMINATION OF INDIVIDUAL WIRES. SPADE LUGS ARE NOT

LOCAL CONTROL PANELS:
FABRICATE PANELS OF 1/4 GAUGE FURNITURE GRADE STEEL OR 6063-T5 EXTRUDED ALUMINUM ALLOY, TOTALLY ENCLOSED ON SIX SIDES, HINGED DOOR AND KEVED LOCK, WITH MANUFACTURER'S STANDARD SHOP PAINTED FINISH AND COLOR.

PROVIDE UL LISTED CABINETS FOR USE WITH LINE VOLTAGE DEVICES.

PROVIDE CONTROL PANELS FOR ALL DDC CONTROLLERS, ASC'S AND ASSOCIATED FUNCTION MODULES.

ALL WIRING FOR CONTROLLERS SHALL BE MANAGED IN A NEAT AND WORKMANLIKE MANNER.

PERMANENTLY LABEL ALL CONTROLS, TAG ALL CONTROL WIRING AND DOCUMENT BOTH ON CONTROL DRAWINGS.

DIRECT DIGITAL CONTROLS:
SYSTEM TO BE CAPABLE OF INTEGRATING MULTIPLE BUILDING FUNCTIONS, INCLUDING EQUIPMENT SUPERVISION AND CONTROL, ALARM MANAGEMENT, ENERGY MANAGEMENT, AND TREND DATA COLLECTION.

DDC TO CONSIST OF SUPERVISORY CONTROLLERS, PROGRAMMABLE CONTROLLERS, STAND-ALONE APPLICATION SPECIFIC CONTROLLERS (ASC'S), OPERATORS TERMINALS, OPERATOR WORKSTATIONS, DDC SYSTEM SERVERS, AND OTHER OPERATOR INTERFACE DEVICES.

THE VENDOR OF THE SYSTEM SHALL PROVIDE ALL SOFTWARE AND COMMUNICATION INTERFACE HARDWARE NECESSARY TO PROGRAM AND UPLOAD/DOWNLOAD PROGRAMMABLE AND APPLICATION SPECIFIC CONTROLLERS FROM A LAPTOP COMPUTER AND MAKE ADDITIONAL COPIES AND FUTURE SOFTWARE REVISIONS AVAILABLE FOR SALE DIRECTLY TO THE USER AGENCY.

THE SYSTEM SHALL BE MODULAR IN NATURE, AND SHALL PERMIT EXPANSION OF BOTH CAPACITY AND FUNCTIONALITY THROUGH THE ADDITION OF SENSORS, ACTUATORS, ASC'S, AND OPERATOR DEVICES.

THE FAILURE OF ANY SINGLE COMPONENT OR NETWORK CONNECTION SHALL NOT INTERRUPT THE EXECUTION OF CONTROL STRATEGIES AT OTHER OPERATIONAL DEVICES.

BACNET REQUIREMENTS:
EACH OF HIGHEST LEVEL NETWORK COMMUNICATIONS SHALL BE CAPABLE OF BACNET/TP OVER ETHERNET AND FIELD LEVEL COMMUNICATIONS SHALL UTILIZE BACNET MSTP.

ALL CONTROLLERS SHALL PROVIDE A PROTOCOL IMPLEMENTATION CONFORMANCE STATEMENT (PICS) AND BACNET INTEROPERABILITY BUILDING BLOCKS (BIBB'S) AS REQUIRED BY THE AMERICAN NATIONAL STANDARDS INSTITUTE/AMERICAN SOCIETY OF HEATING, REFRIGERATING, AND AIR-CONDITIONING ENGINEERS (ASHRAE) STANDARD 105-2001, BACNET PROTOCOL.

THE CONTRACTOR SHALL PROVIDE ALL LABOR TO BUILD THE SUPERVISORY CONTROLLER DATABASE IN CONJUNCTION WITH AND UNDER THE SUPERVISION OF THE AGENCY CONTROL PERSONNEL. NAMING CONVENTIONS, DATABASE STRUCTURE, AND GLOBAL APPLICATION STRATEGIES SHALL BE REVIEWED AND APPROVED BY THE AGENCY CONTROL PERSONNEL BEFORE IMPLEMENTATION.

THE SYSTEM SHALL BE MODULAR IN NATURE, AND SHALL PERMIT EASY EXPANSION THROUGH THE ADDITION OF FIELD CONTROLLERS, SENSORS, AND ACTUATORS.

SUPERVISORY CONTROLLERS SHALL PROVIDE AT LEAST TWO RS-232C OR USE SERIAL COMMUNICATION PORTS OR ETHERNET PORTS FOR SIMULTANEOUS OPERATION OF MULTIPLE OPERATOR DEVICES, SUCH AS LAPTOP COMPUTERS, PERSONAL COMPUTERS, AND VIDEO DISPLAY TERMINALS.

SUPERVISORY CONTROLLER SHALL MONITOR THE STATUS OF ALL OVERRIDES AND INCLUDE THIS INFORMATION IN THE LOGS AND SUMMARIES TO INFORM THE OPERATOR THAT AUTOMATIC CONTROL HAS BEEN INHIBITED.

EACH SUPERVISORY CONTROLLER SHALL CONTINUOUSLY PERFORM SELF-DIAGNOSTICS, COMMUNICATIONS DIAGNOSTICS, AND DIAGNOSTICS OF ALL SUBSIDIARY EQUIPMENT. SUPERVISORY CONTROLLERS SHALL PROVIDE BOTH LOCAL AND REMOTE ANNUNCIATION OF ANY DETECTED COMPONENT FAILURES, OR REPEATED FAILURE TO ESTABLISH COMMUNICATION. INDICATION OF THE DIAGNOSTIC RESULTS SHALL BE PROVIDED AT EACH SUPERVISORY CONTROLLER.

ISOLATION SHALL BE PROVIDED AT ALL NETWORK TERMINATIONS, AS WELL AS ALL FIELD POINT TERMINATIONS, TO SUPPRESS INDUCED VOLTAGE TRANSIENTS CONSISTENT WITH IEEE STANDARD 587-1980. ISOLATION LEVELS SHALL BE SUFFICIENTLY HIGH TO ALLOW ALL SIGNAL WIRING TO BE RUN IN THE SAME CONDUIT AS HIGH VOLTAGE WIRING ACCEPTABLE BY ELECTRICAL CODE.

IN THE EVENT OF THE LOSS OF NORMAL POWER, THERE SHALL BE AN ORDERLY SHUTDOWN OF THE SUPERVISORY CONTROLLER TO PREVENT THE LOSS OF DATA BASE OR OPERATING SYSTEM SOFTWARE. NON-VOLATILE MEMORY SHALL BE INCORPORATED FOR ALL CRITICAL CONTROLLER CONFIGURATION DATA, AND BATTERY BACKUP SHALL BE PROVIDED TO SUPPORT THE REAL-TIME CLOCK AND ALL VOLATILE MEMORY FOR A MINIMUM OF 72 HOURS.

UPON RESTORATION OF NORMAL POWER, THE SUPERVISORY CONTROLLER SHALL AUTOMATICALLY RESUME FULL OPERATION WITHOUT MANUAL INTERVENTION. SHOULD SUPERVISORY CONTROLLER MEMORY BE LOST FOR ANY REASON, THE SUPERVISORY CONTROLLER SHALL HAVE THE CAPABILITY OF RELOADING ITS PROGRAMMING VIA HIGH SPEED LOCAL AREA NETWORK FROM THE CONTROL SYSTEM ARCHIVE WORKSTATION OR SERVER, THE LOCAL RS-232C PORT, OR TELEPHONE LINE DIAL-IN.

SYSTEM SOFTWARE FEATURES:
ALL NECESSARY SOFTWARE TO FORM A COMPLETE OPERATING SYSTEM, AS DESCRIBED IN THIS SPECIFICATION, SHALL BE PROVIDED AS AN INTEGRAL PART OF THE SUPERVISORY CONTROLLER, AND SHALL NOT BE DEPENDENT UPON HIGHER LEVEL COMPUTER FOR EXECUTION.

CONTROL SOFTWARE SHALL INCLUDE A PROVISION FOR LIMITING THE NUMBER OF TIMES THAT EACH PIECE OF EQUIPMENT MAY BE CYCLED WITHIN ANY ONE-HOUR PERIOD.

THE SYSTEM SHALL PROVIDE PROTECTION AGAINST EXCESSIVE DEMAND SITUATIONS DURING START-UP PERIODS BY AUTOMATICALLY INTRODUCING TIME DELAYS BETWEEN SUCCESSIVE START COMMANDS TO HEAVY ELECTRICAL LOADS.

ALL PROGRAMS TO BE EXECUTED AUTOMATICALLY WITHOUT THE NEED FOR OPERATOR INTERVENTION, AND BE FLEXIBLE ENOUGH TO ALLOW USER CUSTOMIZATION.

SUPERVISORY CONTROLLERS SHALL BE ABLE TO EXECUTE CONFIGURED PROCESSES DEFINED BY THE USER TO AUTOMATICALLY PERFORM CALCULATIONS AND CONTROL ROUTINES.

A SINGLE PROCESS SHALL BE ABLE TO INCORPORATE MEASURED OR CALCULATED DATA FROM ANY AND ALL OTHER ASCS.

A SINGLE PROCESS SHALL BE ABLE TO ISSUE COMMANDS TO POINTS IN ANY AND ALL OTHER PROGRAMMABLE CONTROLLERS AND ASC'S ON THE LOCAL NETWORK.

ALARM MANAGEMENT SHALL BE PROVIDED TO MONITOR, BUFFER, AND DIRECT ALARM REPORTS TO OPERATOR DEVICES AND MEMORY FILES. EACH SUPERVISORY CONTROLLER SHALL PERFORM DISTRIBUTED, INDEPENDENT ALARM ANALYSIS AND FILTERING TO MINIMIZE NETWORK TRAFFIC AND PREVENT ALARMS FROM BEING LOST. AT NO TIME SHALL THE ABILITY OF SUPERVISORY CONTROLLERS TO REPORT ALARMS BE AFFECTED BY EITHER OPERATOR ACTIVITY AT THE LOCAL TO DEVICE OR COMMUNICATIONS WITH OTHER ASC'S ON THE NETWORK.

ALL ALARM OR POINT CHANGE REPORTS SHALL INCLUDE THE ENGLISH LANGUAGE DESCRIPTION OF EACH POINT AND THE TIME AND DATE OF THE OCCURRENCE.

THE USER SHALL BE ABLE TO DEFINE THE SPECIFIC SYSTEM REACTION FOR EACH POINT. ALARMS SHALL BE PRIORITIZED TO MINIMIZE NUISANCE REPORTING AND TO SPEED OPERATOR RESPONSE TO CRITICAL ALARMS. A MINIMUM OF THREE PRIORITY LEVELS SHALL BE PROVIDED. USERS SHALL HAVE THE ABILITY TO MANUALLY INHIBIT ALARM REPORTING FOR EACH POINT.

THE USER SHALL ALSO BE ABLE TO DEFINE CONDITIONS UNDER WHICH POINT CHANGES NEED TO BE ACKNOWLEDGED BY AN OPERATOR AND/OR LOGGED FOR ANALYSIS AT A LATER DATE.

ALARMS REPORTS AND MESSAGES SHALL BE DIRECTED TO AN OPERATOR DEVICE.

IN ADDITION TO THE POINT'S DESCRIPTION AND THE TIME AND DATE, THE USER SHALL BE ABLE TO PRINT, DISPLAY OR STORE A 60-CHARACTER ALARM MESSAGE TO MORE FULLY DESCRIBE THE ALARM CONDITION OR DIRECT OPERATOR RESPONSE.

EACH SUPERVISORY CONTROLLER SHALL BE CAPABLE OF STORING A LIBRARY OF AT LEAST 100 MESSAGES. EACH MESSAGE MAY BE ASSIGNABLE TO ANY NUMBER OF POINTS IN THE PANEL.

A DATA COLLECTION UTILITY SHALL BE PROVIDED TO AUTOMATICALLY SAMPLE, STORE, AND DISPLAY SYSTEM DATA.

MEASURED AND CALCULATED ANALOG AND BINARY DATA SHALL BE ASSIGNABLE TO USER DEFINABLE TRENDS FOR THE PURPOSE OF COLLECTING OPERATOR SPECIFIED PERFORMANCE DATA OVER EXTENDED PERIODS OF TIME. SAMPLE INTERVALS OF 1 MINUTE TO 24 HOURS, IN ONE MINUTE OR ONE HOUR INTERVALS, SHALL BE PROVIDED. EACH SUPERVISORY CONTROLLER SHALL HAVE A DEDICATED BUFFER FOR TREND DATA AND SHALL BE CAPABLE OF STORING 16 TREND LOGS.

EACH TREND LOG SHALL HAVE UP TO FOUR POINTS TRENDED AT 48 DATA SAMPLES EACH. DATA SHALL BE STORED AT THE SUPERVISORY CONTROLLER AND UP-LOADED TO THE DDC SYSTEM SERVER WHEN ARCHIVING IS DESIRED.

SUPERVISORY CONTROLLERS SHALL AUTOMATICALLY ACCUMULATE AND STORE RUNTIME HOURS FOR BINARY INPUT AND OUTPUT POINTS.

SUPERVISORY CONTROLLERS SHALL AUTOMATICALLY SAMPLE, CALCULATE AND STORE CONSUMPTION TOTALS ON A DAILY, WEEKLY, OR MONTHLY BASIS, USER DEFINED, FOR USER-SELECTED ANALOG AND BINARY PULSE INPUT TYPE POINTS.

TOTALIZATION SHALL PROVIDE CALCULATION AND STORAGE ACCUMULATIONS OF UP TO 9,999,999 UNITS (E.G. KWH, GALLONS KBTU, TONS, ETC.).

THE TOTALIZATION ROUTINE SHALL HAVE A SAMPLING RESOLUTION OF ONE MINUTE.

THE USER SHALL HAVE THE ABILITY TO DEFINE A WARNING LIMIT. UNIQUE, USER SPECIFIED MESSAGES SHALL BE GENERATED WHEN THE LIMIT IS REACHED.

SUPERVISORY CONTROLLERS SHALL HAVE THE ABILITY TO COUNT EVENTS, SUCH AS THE NUMBER OF TIMES A PUMP OR FAN SYSTEM IS CYCLED ON AND OFF.

THE EVENT TOTALIZATION FEATURE SHALL BE ABLE TO STORE THE RECORDS ASSOCIATED WITH A MINIMUM OF 9,999,999 EVENTS BEFORE RESET.

PROGRAMMABLE CONTROLLERS:
PROGRAMMABLE CONTROLLERS SHALL BE PROVIDED WITH A SOFTWARE PROGRAM THAT SHALL ALLOW THE USER TO DESIGN FLEXIBLE SOFTWARE ALGORITHMS.

PROGRAMMABLE CONTROLLERS SHALL SUPPORT ALL NECESSARY POINT INPUTS AND OUTPUTS TO PERFORM THE SPECIFIED CONTROL SEQUENCE IN A TOTALLY STAND-ALONE FASHION.

EACH PROGRAMMABLE CONTROLLER SHALL PERFORM ITS OWN LIMIT AND STATUS MONITORING AND ANALYSIS TO MAXIMIZE NETWORK PERFORMANCE BY REDUCING UNNECESSARY COMMUNICATIONS.

EACH PROGRAMMABLE CONTROLLER SHALL SUPPORT THE USE OF A LOCALLY MOUNTED STATUS AND ADJUST PANEL INTERFACE TO ALLOW FOR THE LOCAL ADJUSTMENT OF ALL SETPOINTS. TEMPORARY OVERRIDE OF ANY INPUT OR OUTPUT POINTS AND STATUS OF ALL POINTS DIRECTLY AT THE CONTROLLER.

ALL SYSTEM SETPOINTS, PROPORTIONAL BANDS, CONTROL ALGORITHMS, AND ANY OTHER PROGRAMMABLE PARAMETERS SHALL BE STORED SUCH THAT A POWER FAILURE OF ANY DURATION DOES NOT NECESSITATE REPROGRAMMING THE CONTROLLER.

APPLICATION SPECIFIC CONTROLLERS - HVAC APPLICATIONS.
EACH SUPERVISORY CONTROLLER SHALL BE ABLE TO EXTEND ITS MONITORING AND CONTROL THROUGH THE USE OF STAND-ALONE APPLICATION SPECIFIC CONTROLLERS (ASC'S).

EACH ASC SHALL OPERATE AS A STAND-ALONE CONTROLLER CAPABLE OF PERFORMING ITS SPECIFIED CONTROL RESPONSIBILITIES INDEPENDENTLY OF OTHER CONTROLLERS IN THE NETWORK. EACH ASC SHALL BE A MICROPROCESSOR BASED, MULTI-TASKING, REAL-TIME DIGITAL CONTROL PROCESSOR.

EACH ASC SHALL HAVE SUFFICIENT MEMORY TO SUPPORT ITS OWN OPERATING SYSTEM AND DATABASES.

THE OPERATOR INTERFACE TO ANY ASC POINT OR PROGRAM SHALL BE THROUGH THE SUPERVISORY CONTROLLER CONNECTION TO ANY ASC ON THE NETWORK.

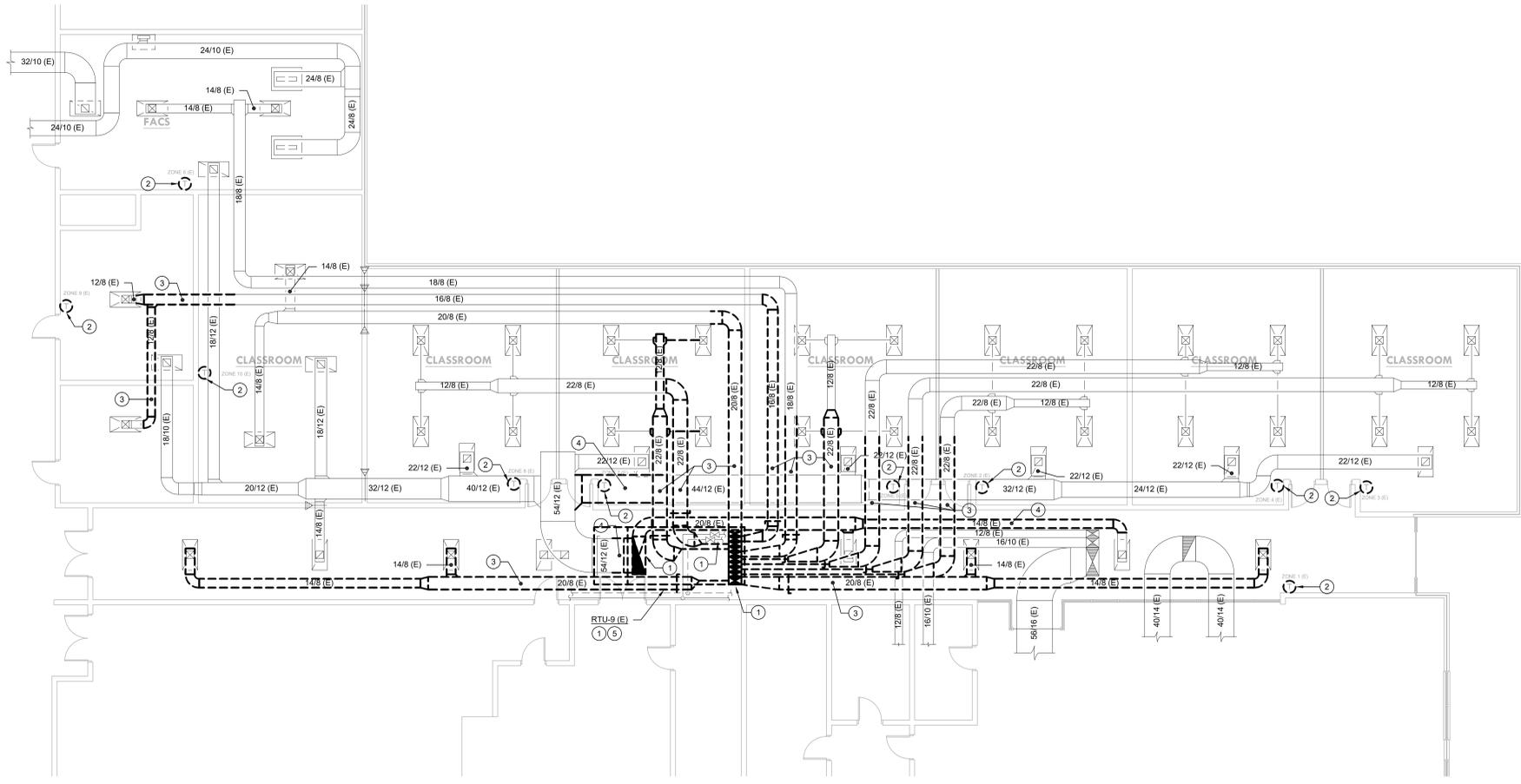
ASC'S SHALL DIRECTLY SUPPORT THE TEMPORARY USE OF A PORTABLE SERVICE TERMINAL THAT CAN BE CONNECTED TO THE ASC VIA ZONE TEMPERATURE OR DIRECTLY AT THE CONTROLLER.

ALL SYSTEM SETPOINTS, PROPORTIONAL BANDS, CONTROL ALGORITHMS, AND ANY OTHER PROGRAMMABLE PARAMETERS SHALL BE STORED SUCH THAT A POWER FAILURE OF ANY DURATION DOES NOT NECESSITATE REPROGRAMMING THE ASC.

ALL SYSTEM SETPOINTS, PROPORTIONAL BANDS, CONTROL ALGORITHMS, CALIBRATION CONSTANTS, AND ANY OTHER PROGRAMMABLE PARAMETERS SHALL BE STORED SUCH THAT A POWER FAILURE OF ANY DURATION DOES NOT NECESSITATE REPROGRAMMING THE ASC.

ALL APPLICATION SPECIFIC CONTROLLERS SHALL BE FULLY PROGRAMMABLE. QUESTION AND ANSWER OR TEMPLATE PROGRAMMING IS NOT ACCEPTABLE UNLESS THIS IS USED TO GENERATE THE INITIAL APPLICATION PROGRAM AND THE RESULT IS ABLE TO BE FREELY MODIFIED WITHOUT RESTRICTION.

CONTROL SEQUENCES FOR TERMINAL UNIT CONTROL THAT UTILIZE DEVICES WIRED DIRECTLY TO THE TERMINAL UNIT APPLICATION CONTROLLER SHALL BE PROGRAMMED IN THE APPLICATION SPECIFIC CONTROLLER AND SHALL BE STAND-ALONE IN FUNCTION, I.E. OCCUPANCY SENSING, TEMPERATURE SETPOINT SETBACK, ETC. SUPERVISORY CONTROLLERS SHALL NOT BE INVOLVED IN THE CONTROL SEQUENCE LOGIC UNLESS IT INVOLVES SHARING DATA BETWEEN OR FROM INDIVIDUAL TERMINAL UNIT



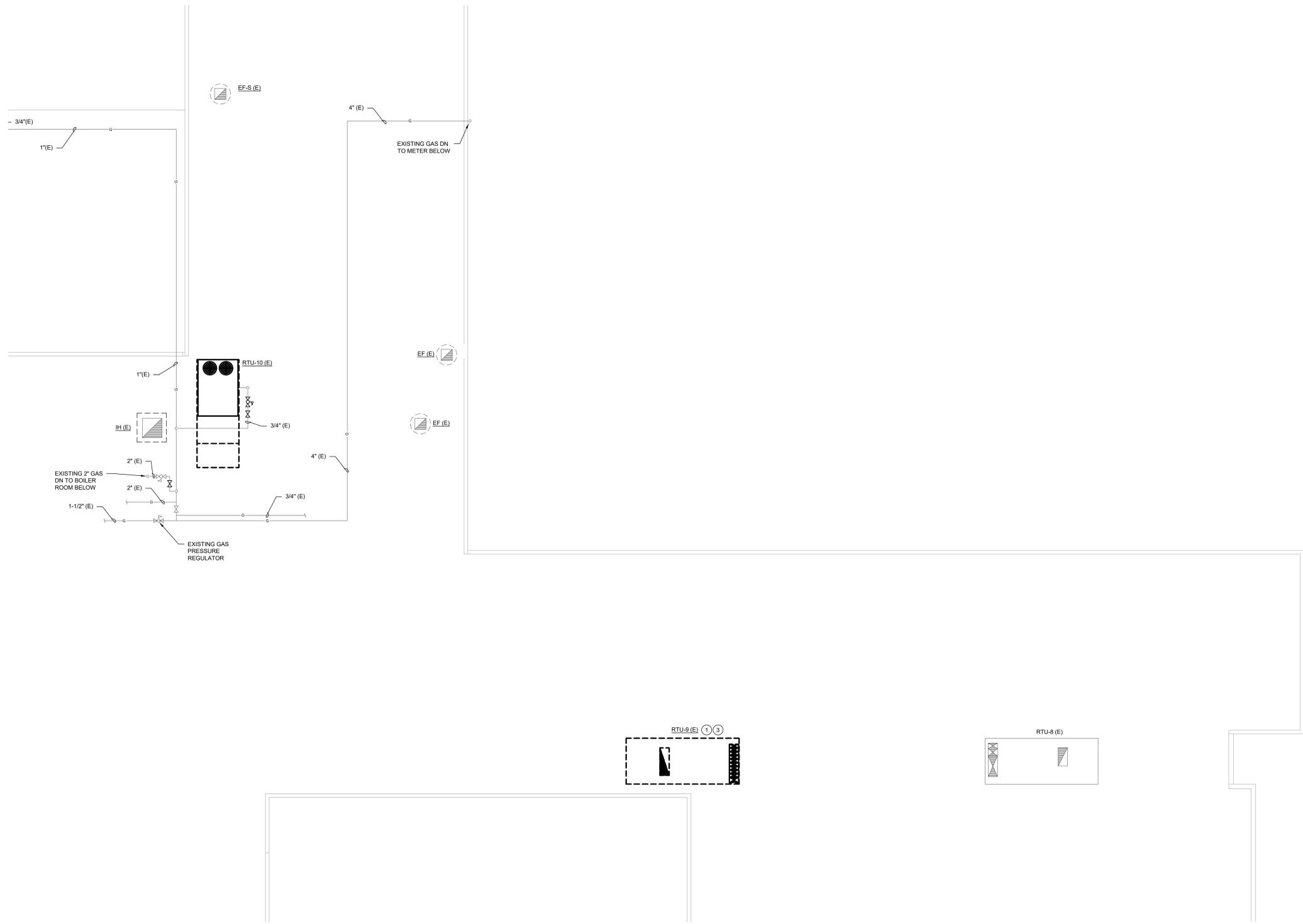
1 FIRST FLOOR DEMOLITION PLAN HS - HVAC
 M1.1 SCALE: 1/8"=1'-0"



- GENERAL NOTES:**
- HVAC CONTRACTOR SHALL VISIT SITE AND BECOME FAMILIAR WITH EXISTING CONDITIONS PRIOR TO CONSTRUCTION. FIELD VERIFY ALL EXISTING CONDITIONS AND REPORT ANY DISCREPANCIES TO THE A/E PRIOR TO COMMENCING WORK.
 - THE FACILITY WILL REMAIN IN OPERATION THROUGHOUT CONSTRUCTION. CONTRACTOR SHALL COORDINATE ALL SERVICE INTERRUPTIONS WITH THE OWNER'S REPRESENTATIVE IN ADVANCE.
 - COORDINATE ALL ROOFING WORK WITH THE GC. VERIFY IF THE ROOF IS UNDER WARRANTY AND COMPLY WITH ALL REQUIREMENTS FOR CUTTING AND PATCHING TO MAINTAIN THE WARRANTY.
 - ALL ELECTRICAL WORK SHALL COMPLY WITH ALL EXISTING BUILDING STANDARDS/MINIMUM REQUIREMENTS.
 - ALL ELECTRICAL WORK SHALL COMPLY WITH THE NATIONAL ELECTRICAL CODE AND ALL LOCAL AND STATE CODES.
 - ALL CONDUCTORS SHALL BE COPPER.
 - ALL EQUIPMENT SHALL BE LABELED TO MATCH THE BUILDING STANDARDS.
 - ALL ELECTRICAL BOXES SHALL BE LABELED WITH THE PANEL AND CIRCUIT NUMBER(S) TO MATCH THE BUILDING STANDARDS.
 - FIELD VERIFY ALL ELECTRICAL REQUIREMENTS WITH EXISTING CONDITIONS.

- KEYED NOTES:**
- DEMOLISH EXISTING SUPPLY AIR AND RETURN AIR DROPS FROM ROOF-MOUNTED MULTIZONE UNIT. DISCONNECT HOT WATER SUPPLY/RETURN PIPING AND REMOVE BACK TO ISOLATION VALVES. EXISTING ROOF OPENINGS SHALL BE PATCHED AND ROOFING REPAIRED. COORDINATE WITH THE GC FOR ROOF REPAIR. COORDINATE POWER DISCONNECT WITH EC. REMOVE CONTROLS AND ASSOCIATED SENSORS COMPLETE. REFER TO NEW WORK PLAN FOR ADDITIONAL REQUIREMENTS.
 - DEMOLISH EXISTING TEMPERATURE SENSOR AND ASSOCIATED WIRING COMPLETE.
 - DEMOLISH EXISTING SUPPLY DUCT TO THE EXTENT SHOWN. REFER TO NEW WORK PLANS FOR ADDITIONAL REQUIREMENTS.
 - DEMOLISH EXISTING RETURN DUCT TO THE EXTENT SHOWN. REFER TO NEW WORK PLANS FOR ADDITIONAL REQUIREMENTS.
 - DISCONNECT EXISTING ELECTRICAL TO ROOFTOP UNIT #RTU-9 TO BE REMOVED (BY OTHERS). SALVAGE EXISTING 400A FEED FROM MAIN SWITCHBOARD BSB AND EXTEND TO NEW UNIT. REFER TO NEW WORK PLAN.

ISSUED FOR:	DATE:



1 ROOF DEMOLITION PLAN HS - HVAC
M1.3 SCALE: 1/8"=1'-0"



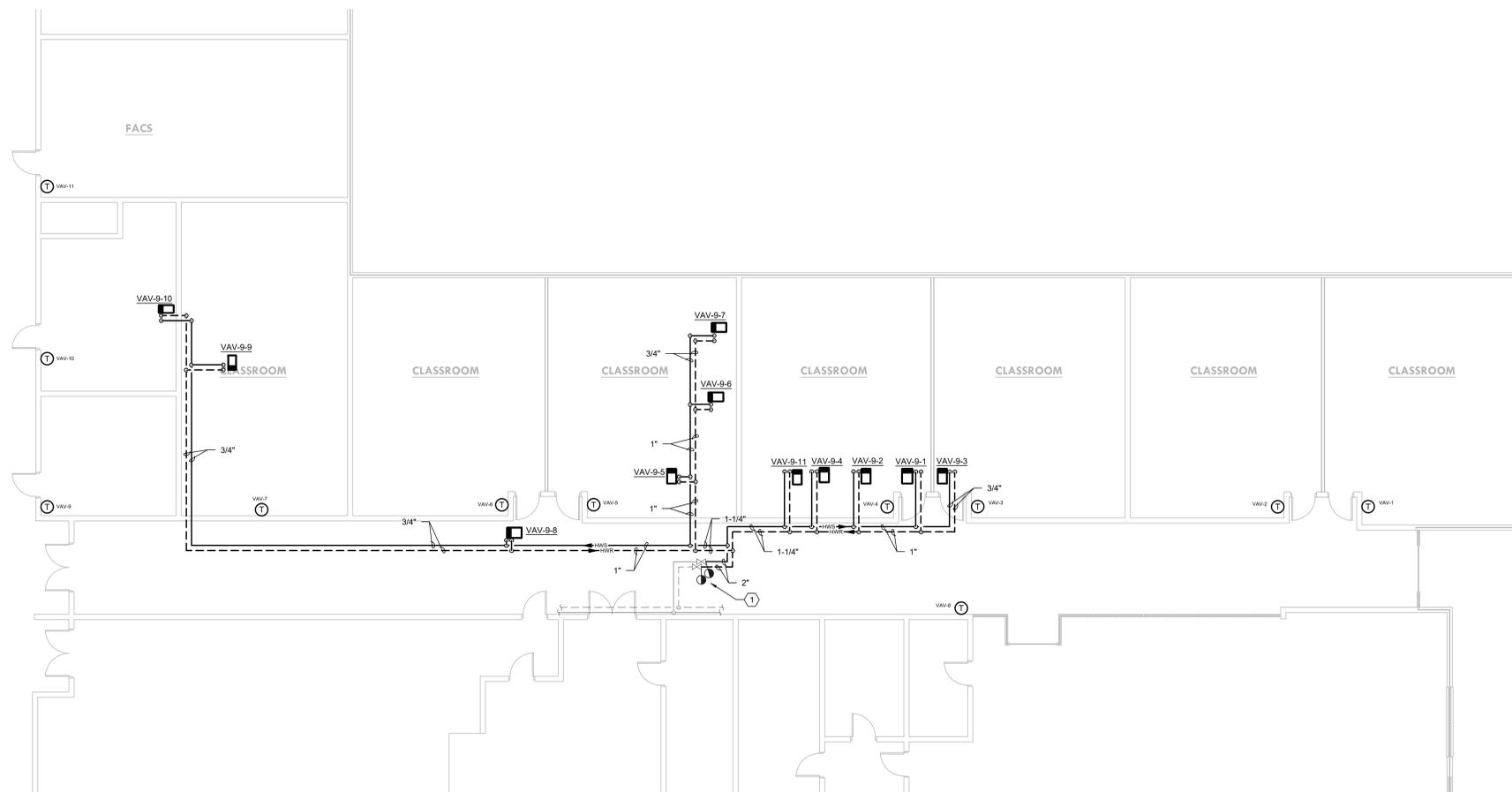
GENERAL NOTES:

- HVAC CONTRACTOR SHALL VISIT SITE AND BECOME FAMILIAR WITH EXISTING CONDITIONS PRIOR TO CONSTRUCTION. FIELD VERIFY ALL EXISTING CONDITIONS AND REPORT ANY DISCREPANCIES TO THE A/E PRIOR TO COMMENCING WORK.
- THE FACILITY WILL REMAIN IN OPERATION THROUGHOUT CONSTRUCTION. CONTRACTOR SHALL COORDINATE ALL SERVICE INTERRUPTIONS WITH THE OWNER'S REPRESENTATIVE IN ADVANCE.
- COORDINATE ALL ROOFING WORK WITH THE GC. VERIFY IF THE ROOF IS UNDER WARRANTY AND COMPLY WITH ALL REQUIREMENTS FOR CUTTING AND PATCHING TO MAINTAIN THE WARRANTY.
- ALL ELECTRICAL WORK SHALL COMPLY WITH ALL EXISTING BUILDING STANDARDS/MINIMUM REQUIREMENTS.
- ALL ELECTRICAL WORK SHALL COMPLY WITH THE NATIONAL ELECTRICAL CODE AND ALL LOCAL AND STATE CODES.
- ALL CONDUCTORS SHALL BE COPPER.
- ALL EQUIPMENT SHALL BE LABELED TO MATCH THE BUILDING STANDARDS.
- ALL ELECTRICAL BOXES SHALL BE LABELED WITH THE PANEL AND CIRCUIT NUMBER(S) TO MATCH THE BUILDING STANDARDS.
- FIELD VERIFY ALL ELECTRICAL REQUIREMENTS WITH EXISTING CONDITIONS.

KEYED NOTES:

- DEMOLISH EXISTING PACKAGED, ROOF-MOUNTED MULTIZONE UNIT AND CURB. DISCONNECT HOT WATER SUPPLY/RETURN PIPING AND REMOVE BACK TO ISOLATION VALVES IN CEILING SPACE BELOW. DEMOLISH THE SUPPLY AND RETURN DUCT DROPS THRU ROOF. EXISTING ROOF OPENINGS SHALL BE PATCHED AND ROOFING REPAIRED. COORDINATE WITH THE GC FOR ROOF REPAIR. COORDINATE POWER DISCONNECT WITH EC. REMOVE CONTROLS AND ASSOCIATED SENSORS COMPLETE. REFER TO NEW WORK PLAN FOR ADDITIONAL REQUIREMENTS.
- REMOVE AND RELOCATE EXISTING GAS PRESSURE REGULATOR. REFER TO NEW WORK PLANS FOR ADDITIONAL INFORMATION.
- DISCONNECT EXISTING ELECTRICAL TO ROOFTOP UNIT #RTU-9 TO BE REMOVED (BY OTHERS.) SALVAGE EXISTING 400A FEED FROM MAIN SWITCHBOARD BSB AND EXTEND TO NEW UNIT. REFER TO NEW WORK PLAN.

ISSUED FOR:	DATE



1 FIRST FLOOR PIPING PLAN HS - HVAC
 M2.2 SCALE: 1/8"=1'-0"



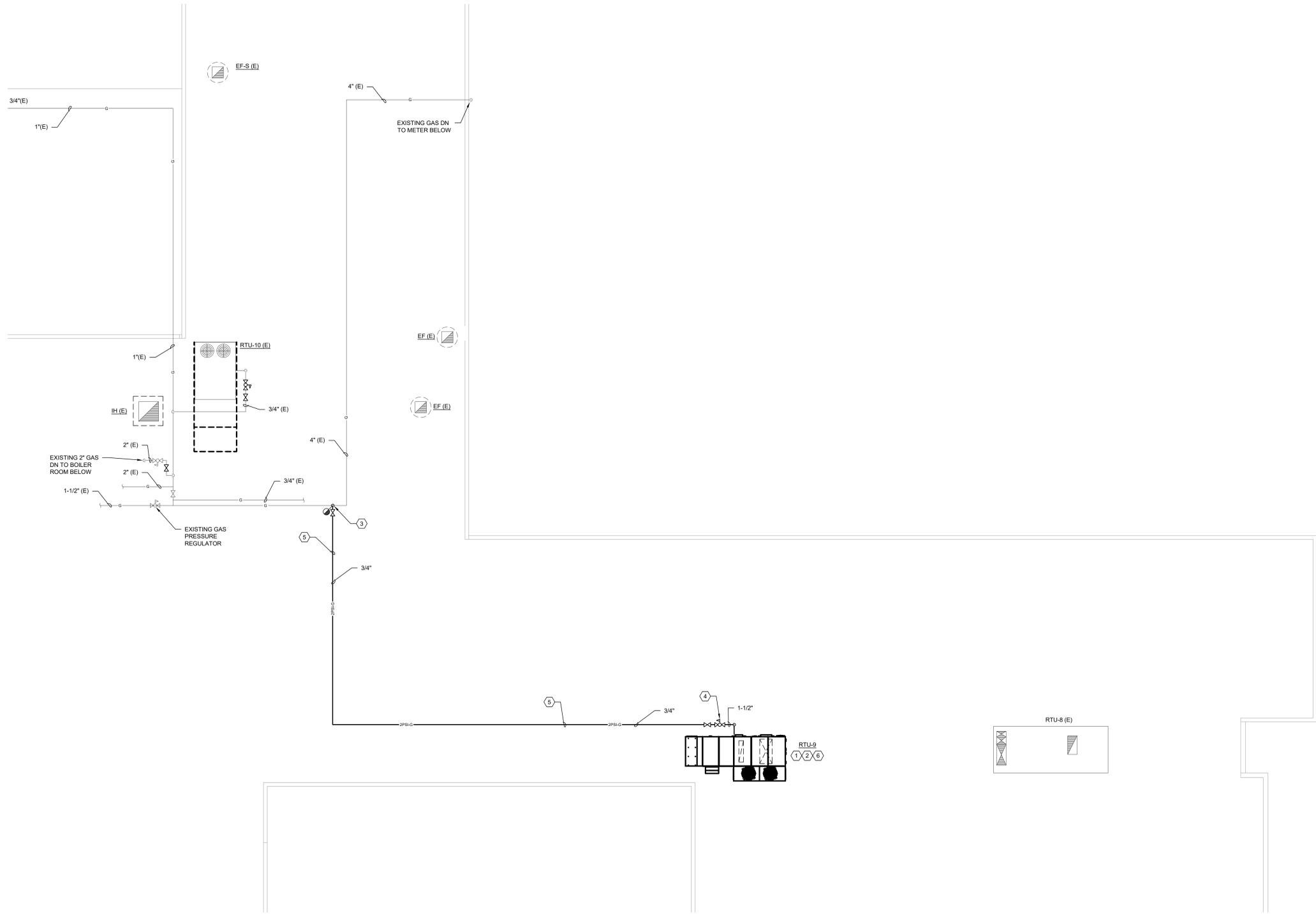
GENERAL NOTES:

1. HVAC CONTRACTOR SHALL VISIT SITE AND BECOME FAMILIAR WITH EXISTING CONDITIONS PRIOR TO CONSTRUCTION. FIELD VERIFY ALL EXISTING CONDITIONS AND REPORT ANY DISCREPANCIES TO THE A/E PRIOR TO COMMENCING WORK.
2. THE FACILITY WILL REMAIN IN OPERATION THROUGHOUT CONSTRUCTION. CONTRACTOR SHALL COORDINATE ALL SERVICE INTERRUPTIONS WITH THE OWNER'S REPRESENTATIVE IN ADVANCE.
3. COORDINATE ALL ROOFING WORK WITH THE GC. VERIFY IF THE ROOF IS UNDER WARRANTY AND COMPLY WITH ALL REQUIREMENTS FOR CUTTING AND PATCHING TO MAINTAIN THE WARRANTY.
4. ALL ELECTRICAL WORK SHALL COMPLY WITH ALL EXISTING BUILDING STANDARDS/MINIMUM REQUIREMENTS.
5. ALL ELECTRICAL WORK SHALL COMPLY WITH THE NATIONAL ELECTRICAL CODE AND ALL LOCAL AND STATE CODES.
6. ALL CONDUCTORS SHALL BE COPPER.
7. ALL EQUIPMENT SHALL BE LABELED TO MATCH THE BUILDING STANDARDS.
8. ALL ELECTRICAL BOXES SHALL BE LABELED WITH THE PANEL AND CIRCUIT NUMBER(S) TO MATCH THE BUILDING STANDARDS.
9. FIELD VERIFY ALL ELECTRICAL REQUIREMENTS WITH EXISTING CONDITIONS.

KEYED NOTES:

- ① MAKE NEW CONNECTION TO EXISTING 2" (FIELD VERIFY SIZE) HOT WATER SUPPLY AND RETURN AT EXISTING ISOLATION/BALANCE VALVES. EXTEND NEW PIPING AS SHOWN AND CONNECT NEW REHEAT COILS. COORDINATE ROUTING WITH NEW DUCTWORK AND EXISTING CONDITIONS.

ISSUED FOR:	DATE



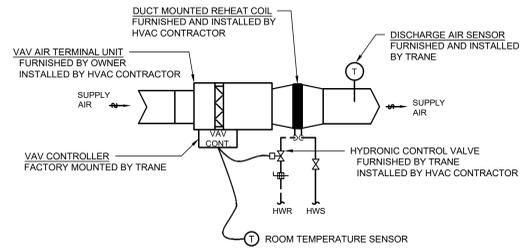
1 ROOF PLAN HS - HVAC
SCALE: 1/8"=1'-0"



- GENERAL NOTES:**
- HVAC CONTRACTOR SHALL VISIT SITE AND BECOME FAMILIAR WITH EXISTING CONDITIONS PRIOR TO CONSTRUCTION. FIELD VERIFY ALL EXISTING CONDITIONS AND REPORT ANY DISCREPANCIES TO THE A/E PRIOR TO COMMENCING WORK.
 - THE FACILITY WILL REMAIN IN OPERATION THROUGHOUT CONSTRUCTION. CONTRACTOR SHALL COORDINATE ALL SERVICE INTERRUPTIONS WITH THE OWNER'S REPRESENTATIVE IN ADVANCE.
 - COORDINATE ALL ROOFING WORK WITH THE GC. VERIFY IF THE ROOF IS UNDER WARRANTY AND COMPLY WITH ALL REQUIREMENTS FOR CUTTING AND PATCHING TO MAINTAIN THE WARRANTY.
 - ALL ELECTRICAL WORK SHALL COMPLY WITH ALL EXISTING BUILDING STANDARDS/MINIMUM REQUIREMENTS.
 - ALL ELECTRICAL WORK SHALL COMPLY WITH THE NATIONAL ELECTRICAL CODE AND ALL LOCAL AND STATE CODES.
 - ALL CONDUCTORS SHALL BE COPPER.
 - ALL EQUIPMENT SHALL BE LABELED TO MATCH THE BUILDING STANDARDS.
 - ALL ELECTRICAL BOXES SHALL BE LABELED WITH THE PANEL AND CIRCUIT NUMBER(S) TO MATCH THE BUILDING STANDARDS.
 - FIELD VERIFY ALL ELECTRICAL REQUIREMENTS WITH EXISTING CONDITIONS.

- KEYED NOTES:**
- FURNISH AND INSTALL ROOF CURB FOR NEW ROOF MOUNTED EQUIPMENT. ROUTE NEW SUPPLY DUCT WITHIN CURB TO EXISTING ROOF OPENING - FIELD VERIFY LOCATION. MODIFY EXISTING ROOF OPENINGS AS REQUIRED TO SUIT NEW DUCT DROPS. PATCH UNUSED OPENING(S) AND COORDINATE ROOF REPAIR/PATCH WITH THE GC. COORDINATE FINAL LOCATION WITH G.C. AND EXISTING FIELD CONDITIONS.
 - INSTALL NEW PACKAGED ROOFTOP UNIT. PROVIDE COOLING COIL CONDENSATE TRAP. EXTEND AND CONNECT NATURAL GAS WITH ISOLATION VALVE, GAS PRESSURE REGULATOR (AS REQUIRED), AND DIRT LEG. UNIT SHALL BE INSTALLED TO MAINTAIN MINIMUM 10'-0" FROM ROOF EDGE AND EXHAUST OUTLETS.
 - MAKE NEW CONNECTION TO EXISTING 4" (2-PSI) GAS AND EXTEND NEW PIPING AS SHOWN.
 - FURNISH AND INSTALL SHUT-OFF VALVE, GAS PRESSURE REGULATOR, AND DIRT LEG. GAS PRESSURE REGULATOR SHALL BE SUITABLE FOR REDUCING INLET PRESSURE TO EQUIPMENT OPERATING PRESSURE AT 300 CFH CONNECTED LOAD.
 - PROVIDE 4" HIGH (MINIMUM) SUPPORTS FOR GAS PIPING EQUAL TO DURA-BLOK WITH UNISTRUT INSERT AND PIPE CLAMPS. PROVIDE SUPPORTS AT INTERVALS AS SPECIFIED.
 - PROVIDE CONNECTION TO NEW ROOFTOP UNIT RTU-8 VIA NON-FUSED DISCONNECT PROVIDED WITH UNIT. EXTEND EXISTING FEEDER FROM EXISTING PANEL PHD TO ROOFTOP UNIT. FORMERLY FEEDING ROOFTOP UNIT RTU-8. PROVIDE JUNCTION BOX AT ROOF TO TERMINATE NEW CONDUCTORS TO EXISTING. CONNECT NEW DUCT MOUNTED SMOKE DETECTOR TO EXISTING SIMPLEX FIRE ALARM SYSTEM IN BUILDING. PROVIDE CONNECTION TO INTEGRAL CONVENIENCE OUTLET FROM A LOCAL 120V CIRCUIT.

ISSUED FOR:	DATE



1 VAV CONTROL DIAGRAM
 ME.0 SCALE: NONE VAV-9-1 THRU VAV-9-11

VAV BOX WITH REHEAT COIL SEQUENCE OF OPERATION
 PROVIDE FOR EACH VAV TERMINAL UNIT THE FOLLOWING:

- A DDC VAV UNIT CONTROLLER PROVIDED BY TCC
- A DDC VAV DAMPER ACTUATOR PROVIDED BY TCC
- A WALL MOUNTED DDC CONTROL TEMPERATURE SENSOR FURNISHED & INSTALLED BY TCC
- ALL REQUIRED CONTROL INTERLOCK WIRING (FURNISHED & INSTALLED BY TCC)
- DISCHARGE AIR TEMPERATURE SENSOR DOWNSTREAM OF REHEAT COIL FURNISHED & INSTALLED BY TCC
- TCC TO ROUGH-IN WALL TEMPERATURE SENSORS; TCC TO FURNISH AND INSTALL SENSOR AND CONTROL WIRING.

TCC SHALL FURNISH FOR EACH BOOSTER COIL THE FOLLOWING:

- A NORMALLY OPEN, MODULATING 2-WAY DDC CONTROL VALVE FOR THE BOOSTER COIL.
- TRANE SHALL FURNISH CONTROL VALVE TO HC; HC TO INSTALL VALVE.

BASED UPON INPUT FROM THE WALL MOUNTED TEMPERATURE SENSOR, THE VAV BOX CONTROLLER SHALL MODULATE THE VAV UNIT DAMPER OPEN/CLOSED AND MODULATE THE HOT WATER REHEAT COIL CONTROL VALVE AS REQUIRED TO MAINTAIN ROOM TEMPERATURE SETPOINT.

OCCUPANCY MODES:

THE VAV AIR TERMINAL UNIT SHALL BE INDEXED INTO OCCUPIED AND UNOCCUPIED MODES THROUGH THE BUILDING AUTOMATION SYSTEM.

OCCUPIED MODE:

ON A RISE IN SPACE TEMPERATURE ABOVE THE ROOM SETPOINT OF 74° (ADJUSTABLE) AS SENSED BY THE ROOM TEMPERATURE SENSOR, THE VAV BOX CONTROLLER SHALL MODULATE THE VAV BOX DAMPER FROM ITS MINIMUM POSITION TO ITS MAXIMUM OPEN POSITION AS REQUIRED TO MAINTAIN ROOM SETPOINT. THE VAV TERMINAL HOT WATER REHEAT COIL CONTROL VALVE SHALL BE CLOSED. UPON A DROP IN SPACE TEMPERATURE BELOW SPACE SETPOINT, THE VAV BOX DAMPER SHALL MODULATE FROM MAXIMUM TO MINIMUM AIRFLOW.

SHOULD THE VAV DAMPER BE AT ITS MINIMUM POSITION AND SPACE TEMPERATURE CONTINUES TO DROP BELOW THE ROOM SETPOINT OF 70° (ADJUSTABLE), THE VAV BOX DAMPER SHALL REMAIN AT ITS MINIMUM POSITION AND THE VAV TERMINAL DDC CONTROLLER SHALL MODULATE OPEN THE HOT WATER REHEAT COIL CONTROL VALVE TO MAINTAIN SCHEDULED DISCHARGE AIR TEMPERATURE. WHERE APPLICABLE, ON A CONTINUED DROP BELOW SETPOINT, THE VAV BOX DAMPER SHALL MODULATE FROM ITS MINIMUM POSITION TO ITS DESIGNATED HEATING QFM. CONTROL VALVE SHALL MODULATE TO MAINTAIN SCHEDULED DISCHARGE AIR TEMPERATURE.

THE REVERSE SHALL OCCUR ON A RISE IN SPACE TEMPERATURE TOWARD ROOM TEMPERATURE SETPOINT.

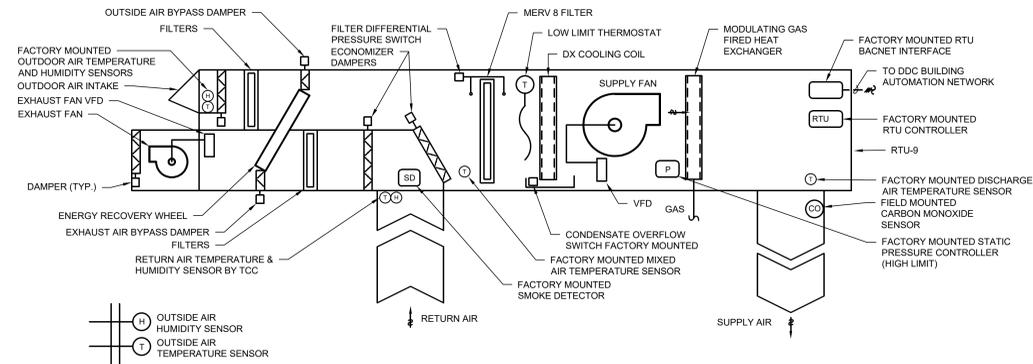
UNOCCUPIED MODE:

THE VAV DAMPER SHALL REMAIN AT ITS MINIMUM POSITION, AND SHOULD THE SPACE TEMPERATURE DROP BELOW THE ROOM THERMOSTAT SETBACK SETPOINT (ADJUSTABLE), THE VAV BOX DAMPER SHALL REMAIN AT ITS MINIMUM POSITION, RTU-10 SUPPLY FAN TO START, AND THE VAV TERMINAL DDC CONTROLLER SHALL MODULATE OPEN THE HOT WATER REHEAT COIL CONTROL VALVE.

THE REVERSE SHALL OCCUR ON A RISE IN SPACE TEMPERATURE TOWARD ROOM TEMPERATURE SETPOINT.

REFRIGERANT MITIGATION MODE:

REFER TO ASSOCIATED ROOFTOP UNIT SEQUENCE OF OPERATION FOR VAV TERMINAL CONTROL REQUIREMENTS DURING OCCUPIED AND UNOCCUPIED MODE FOR REFRIGERANT MITIGATION.



1 ROOFTOP UNIT CONTROL DIAGRAM - RTU-9
 ME.0 SCALE: NONE

- GENERAL NOTES:**
1. REFER TO PLANS, SPECIFICATIONS, AND DETAILS FOR ADDITIONAL REQUIREMENTS.
 2. ALL VALVES AND ACCESSORIES ARE NOT REFLECTED. REFER TO PLANS, DETAILS, AND SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS.

ROOFTOP UNIT SYSTEM (RTU-9) SEQUENCE OF OPERATION

UNITS SHALL BE CONTROLLED BY THE PACKAGED ELECTRONIC CONTROLS INTERFACED WITH THE BUILDING AUTOMATION SYSTEM. THE BAS SHALL PLACE THE ROOFTOP UNIT INTO THE DESIRED MODE OF OPERATION. ON A LOSS OF COMMUNICATION WITH THE BAS, UNIT CONTROLLER SHALL OPERATE USING DEFAULT MODES AND SETPOINTS.

OCCUPIED/UNOCCUPIED MORNING WARM-UP MODE:
 OCCUPIED/UNOCCUPIED MORNING WARM-UP CYCLES CHANGE OVER SHALL BE CONTROLLED BY BAS SYSTEM.

IN MORNING WARM-UP CYCLE: CONTROLS SHALL ACTIVATE RTU-9 AND BUILDING HOT WATER SYSTEM TO OCCUPIED MODE WITH 100% RA. WARM-UP CYCLE IS TERMINATED WHEN RETURN AIR TEMPERATURE REACHES SETPOINT. SYSTEM THEN REVERTS TO OCCUPIED CYCLE.

IN OCCUPIED MODE: RTU-9 SHALL START AND RUN CONTINUOUSLY. OA DAMPER ON THE ROOFTOP UNIT SHALL OPEN TO THE MINIMUM POSITION. OA DAMPER POSITION SHALL MODULATE SUBJECT TO THE (INTEGRATED) DIFFERENTIAL ENTHALPY ECONOMIZER. THE ROOFTOP UNIT CONTROLLER SHALL CONTROL THE SUPPLY FAN SPEED TO MAINTAIN THE CURRENT DUCT STATIC PRESSURE SETPOINT (ADJ.). THE DX COOLING AND GAS HEAT WILL STAGE TO MAINTAIN THE CURRENT DISCHARGE AIR TEMPERATURE SETPOINT. IF ECONOMIZING IS ENABLED, THE RTU SHALL MONITOR DISCHARGE AIR TEMPERATURE (DAT), OUTSIDE AIR ENTHALPY, AND RETURN AIR ENTHALPY FOR DIFFERENTIAL ENTHALPY CONTROL. IF ECONOMIZER CAN NO LONGER MAINTAIN SPACE AIR TEMPERATURE, COMPRESSOR SHALL BE STAGED TO MAINTAIN DAT SETPOINT. ECONOMIZER MODE WILL DISABLE WHEN OA ENTHALPY EXCEEDS HIGH-LIMIT SHUTOFF OF 28 BTU/LB/DA.

FAN CONTROL: THE SUPPLY FAN SHALL BE ENABLED DURING THE OCCUPIED MODE AND CYCLED ON DURING THE UNOCCUPIED MODE. A DIFFERENTIAL PRESSURE SWITCH WILL MONITOR THE DIFFERENTIAL PRESSURE ACROSS THE FAN. IF THE SWITCH DOES NOT OPEN WITHIN 40 SECONDS AFTER A REQUEST FOR FAN OPERATION, A FAN FAILURE ALARM WILL BE ANNOUNCED AT THE BAS, THE UNIT WILL STOP, REQUIRING A MANUAL RESET. THE UNIT CONTROLLER WILL MODULATE THE SUPPLY FAN OUTPUT AS REQUIRED TO MAINTAIN THE DUCT STATIC PRESSURE SETPOINT. IF THE DUCT STATIC PRESSURE FALLS BELOW THE SUPPLY AIR STATIC SETPOINT, THE UNIT CONTROLLER WILL INCREASE THE OUTPUT TO THE SUPPLY FAN TO MAINTAIN SETPOINT. IF THE DUCT STATIC PRESSURE RISES ABOVE THE SUPPLY AIR STATIC SETPOINT, THE UNIT CONTROLLER WILL DECREASE THE OUTPUT TO THE SUPPLY FAN TO MAINTAIN SETPOINT.

IF FOR ANY REASON THE SUPPLY AIR STATIC PRESSURE EXCEEDS THE FIXED SUPPLY AIR PRESSURE LIMIT OF 2.5" OF WC (ADJ.), THE SUPPLY FAN WILL SHUT DOWN. THE UNIT SHALL BE ALLOWED TO RESTART THREE TIMES BEFORE LOCKOUT REQUIRING MANUAL RESET.

HEATING CYCLE: THE INTEGRAL GAS HEAT WITHIN THE PACKAGED EQUIPMENT SHALL ONLY BE USED FOR MORNING WARM-UP AND BACK-UP/EMERGENCY HEAT. ON A DROP IN DISCHARGE TEMPERATURE 5 DEGREES F (ADJ) BELOW SETPOINT, FIRST STAGE GAS HEAT SHALL BE FIRED. ON A CONTINUED DROP IN DISCHARGE TEMPERATURE, SECOND STAGE GAS HEAT SHALL BE FIRED. ON A RISE IN DISCHARGE TEMPERATURE ABOVE SETPOINT, GAS HEAT SHALL BE DISABLED. NORMAL SPACE HEATING SHALL BE VIA HOT WATER REHEAT COILS LOCATED AT EACH VAV TERMINAL. REFER TO AIR TERMINAL/REHEAT COIL OPERATION FOR ADDITIONAL REQUIREMENTS.

COOLING CYCLE: THE INTEGRAL DX COOLING SHALL BE STAGED AND MODULATED BASED UPON DISCHARGE AIR TEMPERATURE (DAT) SETPOINT. DAT SHALL BE SUBJECT TO RESET BASED UPON TRIM AND RESPOND APPLICATION. ON A CALL FOR COOLING, SUBJECT TO ECONOMIZER OPERATION, THE VARIABLE SPEED COMPRESSOR SHALL BE MODULATED FROM MINIMUM TO MAXIMUM SPEED TO MAINTAIN DAT. ONCE THE LEAD COMPRESSOR IS AT MAXIMUM SPEED, AND THERE IS A CONTINUED CALL FOR COOLING, THE FIRST CONSTANT SPEED COMPRESSOR SHALL START. VARIABLE SPEED COMPRESSOR SHALL MODULATE (AGAIN) FROM MINIMUM TO MAXIMUM. THIS SHALL CONTINUE THRU ALL STAGES OF COOLING AVAILABLE. ON A DECREASED CALL FOR COOLING, COMPRESSORS SHALL MODULATE DOWN IN REVERSE ORDER AND DE-ENERGIZE.

ECONOMIZER CYCLE: PROVIDE INTEGRATED ECONOMIZER CONTROL. RTU TO MONITOR DISCHARGE AIR TEMPERATURE (DAT), OUTSIDE AIR ENTHALPY, AND RETURN AIR ENTHALPY FOR DIFFERENTIAL ENTHALPY CONTROL WHILE ECONOMIZING. IN OCCUPIED MODE, IF OA ENTHALPY IS LOWER THAN INDOOR ENTHALPY AND THERMOSTAT CALLS FOR FIRST STAGE COOLING, OA DAMPER SHALL MODULATE BETWEEN MINIMUM AND MAXIMUM POSITION TO MAINTAIN 52 TO 56 DEG F DAT. IF OUTDOOR AIR IS NOT ABLE TO SATISFY MIXED AIR TEMPERATURE SETPOINT, COMPRESSOR SHALL BE STAGED TO MAINTAIN DAT SETPOINT. ECONOMIZER MODE WILL DISABLE WHEN OA ENTHALPY EXCEEDS HIGH-LIMIT SHUTOFF OF 28 BTU/LB/DA.

IN UNOCCUPIED MODE: SYSTEM SHUTS DOWN AND DAMPERS GO TO SAFE POSITION. OUTSIDE AIR AND RELIEF DAMPERS CLOSE AND RETURN AIR DAMPER OPENS. ON A CALL FOR HEATING FROM ANY ASSOCIATED VAV ZONE, SUPPLY FAN SHALL START. ONCE ALL VAV ZONES ARE SATISFIED, SUPPLY FAN SHALL STOP.

ECONOMIZER FAULT DETECTION:
 UNIT SHALL BE EQUIPPED WITH FACTORY INSTALLED ECONOMIZER FAULT DETECTION AND DIAGNOSTICS MODULE. THE FDD MODULE SHALL PROVIDE DETECTION OF THE FOLLOWING FAULTS:

- AIR TEMPERATURE SENSOR FAILURE/FAULT
- NOT ECONOMIZING WHEN THE UNIT SHOULD BE ECONOMIZING
- ECONOMIZING WHEN THE UNIT SHOULD NOT BE ECONOMIZING
- DAMPER NOT MODULATING
- EXCESS OUTDOOR AIR

FDD SHALL ANNUNCIATE THE ALARM/FAULT TO THE BUILDING AUTOMATION SYSTEM.

DEHUMIDIFICATION CYCLE: PROVIDE A WALL-MOUNTED HUMIDITY SENSOR TO MONITOR SPACE HUMIDITY LEVEL. ON A RISE IN SPACE HUMIDITY ABOVE SETPOINT (50% ADJUSTABLE), THE BAS SHALL ENABLE DEHUMIDIFICATION MODE OF OPERATION TO REDUCE DISCHARGE AIR SUPPLY TEMPERATURE TO 55 F REGARDLESS OF RESET SCHEDULE OR SPACE TEMPERATURE. DURING DEHUMIDIFICATION SEQUENCE, THE REHEAT COILS SHALL MODULATE TO MAINTAIN SPACE SETPOINTS. OPERATION SHALL CONTINUE UNTIL SPACE HUMIDITY SETPOINT IS SATISFIED.

ENERGY RECOVERY WHEEL OPERATION:
 WHEN THE OUTSIDE AIR ENTHALPY IS HIGHER THAN THE RETURN AIR ENTHALPY, THE WHEEL SHALL BE TURNED ON AND BOTH OUTSIDE AIR AND RELIEF AIR BYPASS DAMPERS SHALL BE CLOSED.

WHEN THE OUTSIDE AIR ENTHALPY IS LESS THAN THE RETURN AIR ENTHALPY AND THE RTU IS COOLING (OR AIRSIDE ECONOMIZING), THE WHEEL SHALL BE TURNED OFF AND BOTH OUTSIDE AIR AND RELIEF AIR BYPASS DAMPERS SHALL BE OPEN. THE RETURN AIR DAMPER SHALL CLOSE AND THE BYPASS DAMPER BETWEEN THE RETURN AND EXHAUST AIR PATHS SHALL OPEN.

WHEN THE RTU IS HEATING, THE WHEEL SHALL BE TURNED ON AS THE FIRST STAGE OF HEAT. THE OUTSIDE AIR BYPASS DAMPER SHALL BE CLOSED, AND THE RELIEF AIR BYPASS DAMPER SHALL MODULATE (AS NECESSARY) TO MAINTAIN DISCHARGE AIR TEMPERATURE AT SETPOINT (ADJ.). IF THE OUTSIDE AIR TEMPERATURE DROPS BELOW THE FROST THRESHOLD SETPOINT (ADJ.), THE OUTSIDE AIR BYPASS DAMPER SHALL MODULATE TO MAINTAIN THE RELIEF-SIDE LEAVING TEMPERATURE AT SETPOINT.

MIXED AIR LOW LIMIT DIAGNOSTIC:
 IF THE MIXED AIR TEMPERATURE FALLS BELOW 45 DEG F, THE MIXED AIR TEMPERATURE LOW LIMIT IS ACTIVE AND THE ECONOMIZER ACTUATOR WILL CLOSE TO THE ACTIVE MINIMUM POSITION. AN AUTO RESET DIAGNOSTIC WILL BE SENT TO THE BAS WHEN THE MIXED AIR TEMPERATURE LOW LIMIT IS ACTIVE. THE DIAGNOSTIC WILL BE RESET WHEN THE MIXED AIR TEMPERATURE LOW LIMIT IS INACTIVE.

FILTER ALARM:
 BUILDING AUTOMATION SYSTEM TO SIGNAL AN ALARM WHEN FILTERS NEED CHANGING. ALARM INTEGRATED FROM RTU CONTROLLER. HC TO INSTALL TUBING ACROSS FILTER AND CONNECT TO MAGNAHELIC TUBING PROVIDED.

SMOKE DETECTION:
 THE RETURN AIR MOUNTED SMOKE DETECTOR SHALL BE WIRED THROUGH MOTOR STARTER AT THE FACTORY. THE SUPPLY, RETURN, AND EXHAUST FANS SHALL START ONCE DUCTWORK IS DETERMINED TO BE FREE OF PRODUCTS OF COMBUSTION.

UPON AN ACTIVATION FROM THE SMOKE DETECTOR, THE SUPPLY, RETURN, AND EXHAUST FANS SHALL SHUT DOWN. AN AUXILIARY CONTACT(S) SHALL BE PROVIDED TO NOTIFY THE DDC SYSTEM AND FIRE ALARM SYSTEM OF SMOKE DETECTOR ACTIVATION.

EC TO PROVIDE MONITOR MODULE NEAR THE TEMPERATURE CONTROL PANEL TO INTERLOCK SMOKE DETECTORS WITH FIRE ALARM CONTROL PANEL. INTERLOCK BY EC.

CARBON MONOXIDE DETECTION:
 THE SUPPLY AIR MOUNTED CARBON MONOXIDE DETECTOR SHALL BE WIRED THROUGH MOTOR STARTER. THE SUPPLY, RETURN, AND EXHAUST FANS SHALL START ONCE DUCTWORK IS DETERMINED TO BE FREE OF PRODUCTS OF COMBUSTION.

UPON AN ACTIVATION FROM THE CARBON MONOXIDE DETECTOR, THE SUPPLY, RETURN, AND EXHAUST FANS SHALL SHUT DOWN. AN AUXILIARY CONTACT(S) SHALL BE PROVIDED TO NOTIFY THE DDC SYSTEM OF CARBON MONOXIDE DETECTOR ACTIVATION.

REFRIGERANT MITIGATION SEQUENCE:
 THE DX COOLING ASSOCIATED WITH THIS EQUIPMENT IS CHARGED WITH AN A2L REFRIGERANT. THE UNIT IS EQUIPPED WITH A FACTORY INSTALLED REFRIGERANT LEAK DETECTION SYSTEM. THE LEAK DETECTION SYSTEM WILL INITIATE THE REFRIGERANT MITIGATION SEQUENCE UPON DETECTION OF A LEAK IN ACCORDANCE WITH THE FOLLOWING:

RTU - REFRIGERANT MITIGATION MODE:
 THE UNIT CONTROLLER WILL MONITOR THE LEAK DETECTION SYSTEM. WHEN A LEAK IS DETECTED, AN ALARM WILL PROMPTLY ALERT THE BAS VIA BACNET CHANGE-OF-VALUE (COV) AND MITIGATION WILL BE ACTIVATED.

IN OCCUPIED MODE: THE SUPPLY FAN WILL REMAIN OPERATIONAL, AND THE COMPRESSOR(S), FUEL-FIRED HEATING, DEVICES, AND ANY OTHER IGNITION DEVICE STARTERS SHALL BE DISABLED, AND ACTIVATE MECHANICAL VENTILATION (IF IT'S REQUIRED BY SECTION 7.6.4 OF THE ASHRAE STANDARD). FOR THE DURATION OF THE MITIGATION PROCESS PLUS AN ADDITIONAL 5 MINUTES.

IN UNOCCUPIED MODE: THE SUPPLY FAN WILL BE ENABLED (IF CURRENT STATE IS DISABLED), AND THE COMPRESSOR(S), FUEL-FIRED HEATING, DEVICES, AND ANY OTHER IGNITION DEVICE STARTERS SHALL BE DISABLED. MECHANICAL VENTILATION SHALL BE ACTIVATED IF IT'S REQUIRED BY SECTION 7.6.4 OF THE ASHRAE STANDARD). FOR THE DURATION OF THE MITIGATION PROCESS PLUS AN ADDITIONAL 5 MINUTES.

REFRIGERANT MITIGATION MODE:
 UPON MITIGATION ACTIVATION, THE VARIABLE AIR SYSTEM (VAS) APPLICATION IN THE BAS WILL OVERRIDE ALL VAV TERMINALS TO FULLY OPEN DURING MITIGATION WHILE DISABLING HEAT IN ANY VAV TERMINALS EQUIPPED WITH IT.

IN OCCUPIED MODE: THE VAS WILL RELEASE ALL OVERRIDES ONCE THE MITIGATION ACTION HAS CONCLUDED.

IN UNOCCUPIED MODE: AFTER THE MITIGATION ACTION HAS CONCLUDED, THE VAS APPLICATION WILL RELEASE ALL OVERRIDES, EXCEPT FOR THE VAV TERMINALS SHALL REMAIN OVERRIDDEN (FULL OPEN) IN UNOCCUPIED MODE IN PREPARATION FOR FUTURE LEAK DETECTION AND MITIGATION.

DDC INPUT / OUTPUT SUMMARY TABLE	HARDWARE				SOFTWARE				ENERGY MANAGEMENT SYSTEM FUNCTIONS	Comments
	OUTPUT		INPUT		ALARMS		FUNCTIONS			
	DIGITAL	ANALOG	DIGITAL	ANALOG	DIGITAL	ANALOG				
RTU-9	Control Relay	4-20 mA	4-20 mA	4-20 mA	4-20 mA	4-20 mA	4-20 mA	4-20 mA	4-20 mA	
POINT DESCRIPTION										
Outdoor Temperature										Globally Shared Point
Outdoor Humidity										Globally Shared Point
Space Airflow										Determined from sum of VAV Air
Space Relative Humidity										
RTU Start/Stop										
Unit State										Integrated from RTU Controller
Occupied Mode										
Outside Air Damper Position										Integrated from RTU Controller
Outside Air Flow										
Cooling Status										Integrated from RTU Controller
Heating Status										Integrated from RTU Controller
Economizer Status										Integrated from RTU Controller
Supply Fan Status										Integrated from RTU Controller
Supply Fan VFD Speed										Integrated from RTU Controller
Supply Fan VFD Status										Integrated from RTU Controller
Supply Air Static Pressure										Integrated from RTU Controller
Supply Air Static Pressure Setpoint										Integrated from RTU Controller
Return Air Temperature										
Discharge Air Temperature										Integrated from RTU Controller
Mixed Air Temperature										Integrated from RTU Controller
Dirty Filter Alarm										Integrated from RTU Controller
Dirty Filter Switch										Integrated from RTU Controller
High Press Static Shutdown Alarm										Integrated from RTU Controller
Carbon Monoxide Detector Activation										Integrated from Building Fire Alarm Panel - Where Required
Fire Alarm Shutdown										Integrated from RTU Controller
Smoke Detector Activation										Integrated from RTU Controller
Fault Alarm										Integrated from RTU Controller
Fire Alarm Reset										
VAV Box with Booster Coil										
Space Temperature										
Discharge Air Temperature										
Booster Coil Control Valve										
Supply Air Damper										
Supply Air Flow										

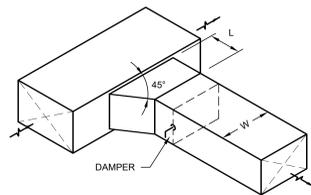
DATE	ISSUED FOR:
02-12-2026	PROJECT NUMBER
2025-201	SHEET NUMBER
M6.0	

PACKAGED ROOFTOP AIR CONDITIONING UNIT SCHEDULE	
UNIT NO.	RTU-9
LOCATION	ROOF
SERVICE	HIGH SCHOOL
SYSTEM TYPE	DX/GAS/ERV
MANUFACTURER	TRANE
MODEL NO.	OADG025C3
ARI RATED CAPACITY (TONS)	25.0
SUPPLY AIR CFM	7,800
EXHAUST AIR CFM	3,150
OUTSIDE AIR CFM	3,150
SUPPLY FAN TYPE	PLENUM
EXT. SP (IN WC)	1.5
TOTAL SP (IN WC)	4.6
RETURN / EXHAUST FAN TYPE	PLENUM
EXT. SP (IN WC)	0.5
TYPE	TE WHEEL
SUPPLY AIR CFM	3,150
EXHAUST AIR CFM	3,150
EFFECTIVENESS (%) WINTER / SUMMER	64 / 88
AIR PRESSURE DROP (IN WC)	0.88
EAT (°F) DB	74
EAT (°F) WB	79.7
LAT (°F) DB	67.3
EAT (°F) DB	-4
EAT (°F) WB	-4
LAT (°F) DB	42.5
LAT (°F) WB	40.2
EAT (°F)	58
LAT (°F)	87.6
INPUT (MBH)	300
OUTPUT (MBH)	243
FUEL TYPE	NATURAL GAS
STAGES OF CAPACITY	10
HEAT EXCHANGER MATERIAL	STAINLESS STEEL
EAT (°F) DB / WB	76.9 / 64.8
LAT (°F) DB / WB	52.5 / 51.6
SENSIBLE CAPACITY (MBH)	179.6
TOTAL CAPACITY (MBH)	273.1
AMBIENT TEMP. (°F)	95
REFRIGERANT TYPE	R-454B
NO. OF CIRCUITS	2
COOLING STAGES	VARIABLE
PRE-FILTER TYPE	2" THROWAWAY
PRE-FILTER EFFICIENCY	MERV 8
POST-FILTER TYPE	N/A
POST-FILTER EFFICIENCY	N/A
SUPPLY FAN HP	10.0
EXHAUST FAN HP	2.0
SCOR RATING	22
VOLTS	480
PHASE	3
MCA	67.8
MOCP	80
REMARKS	1, 2, 3, 4, 5, 6

- KEYED NOTES:**
1. PROVIDE NON-FUSED DISCONNECT, UNPOWERED CONVENIENCE OUTLET, AND RETURN
 2. UNIT TO BE EQUIPPED WITH BACNET INTERFACE.
 3. PROVIDE 24" TALL ROOF CURB AND CONDENSER COIL HAIL GUARDS
 4. PROVIDE INTEGRATED ENTHALPY ECONOMIZER AND FAULT DETECTION AND DIAGNOSTICS
 5. PROVIDE FACTORY MOUNTED REFRIGERANT LEAK DETECTION AND INTEGRATE WITH THE BAS
 6. PROVIDE CARBON MONOXIDE DETECTOR PER 105 ILCS 910-20.57.

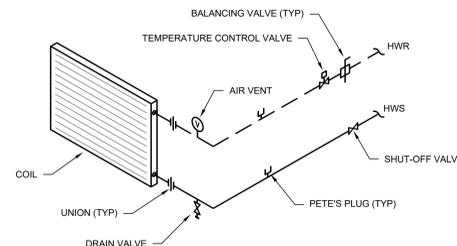
VAV TERMINAL UNIT WITH REHEAT SCHEDULE											
UNIT NO.	VAV-9-1	VAV-9-2	VAV-9-3	VAV-9-4	VAV-9-5	VAV-9-6	VAV-9-7	VAV-9-8	VAV-9-9	VAV-9-10	VAV-9-11
LOCATION	SEE PLANS	SEE PLANS	SEE PLANS	SEE PLANS	SEE PLANS	SEE PLANS	SEE PLANS	SEE PLANS	SEE PLANS	SEE PLANS	SEE PLANS
AHU SYSTEM	AHU-9	AHU-9	AHU-9	AHU-9	AHU-9	AHU-9	AHU-9	AHU-9	AHU-9	AHU-9	AHU-9
MANUFACTURER	PRICE	PRICE	PRICE	PRICE	PRICE	PRICE	PRICE	PRICE	PRICE	PRICE	PRICE
MODEL NO.	SDV	SDV	SDV	SDV	SDV	SDV	SDV	SDV	SDV	SDV	SDV
INLET SIZE	12	10	10	10	10	10	10	12	6	6	10
OUTLET SIZE	16/12.5	14/12.5	14/12.5	14/12.5	14/12.5	14/12.5	14/12.5	16/15	12/8	12/8	14/12.5
MAX AIR PD (WC)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
MIN. INLET SP (IN WG)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
AIR FLOW (CFM)	MAXIMUM	980	800	800	800	800	800	855	1080	140	200
	MINIMUM	300	240	240	240	240	240	255	320	65	65
	HEATING CFM	980	800	800	800	800	800	800	700	1060	120
	COIL	FLUID	WATER								
		GLYCOL (%)	40	40	40	40	40	40	40	40	40
		EWI (°F)	180.0	180.0	180.0	180.0	180.0	180.0	180.0	180.0	180.0
		LWT (°F)	130.8	145.9	145.9	145.5	145.0	146.1	138.5	146.6	164.3
		EAT (°F)	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0
		LAT (°F)	108.5	95.7	95.7	95.5	95.3	95.8	94.9	96.9	94.2
		ROWS	3	2	2	2	2	2	2	1	2
		CAPACITY (MBH)	56.8	35.3	35.3	35.2	35.0	35.4	30.3	48.1	5.2
		GPM	2.6	2.3	2.3	2.3	2.4	1.6	3.2	0.7	0.5
		MAX WATER PD (F)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
REMARKS											

- GENERAL NOTES:**
1. NEITHER RADIATED NOR DISCHARGE SOUND LEVELS SHALL EXCEED 35 NC AT 1.5' STATIC PRESSURE WHEN TESTED PER ARI STANDARD 885-98
 2. FIELD COORDINATE LEFT/RIGHT HAND CONNECTIONS AND LEFT/RIGHT HAND CONTROL ENCLOSURE LOCATIONS. MAINTAIN 3'-0" CLEARANCE IN FRONT OF ALL CONTROL ENCLOSURES.

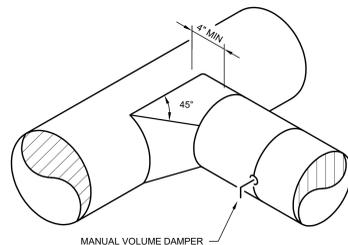


NOTE: L = 1/4W (4" MINIMUM)

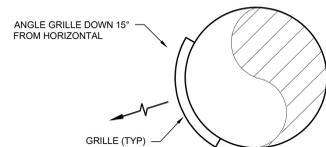
7 BRANCH DUCT TAKEOFF
SCALE: NONE (REVERSE FLOW ARROWS FOR EXHAUST AND RETURN)



4 BOOSTER COIL HOT WATER COIL PIPING DETAIL
SCALE: NONE (WITH 2-WAY TCV)



5 BRANCH DUCT TAKEOFF DETAIL
SCALE: NONE

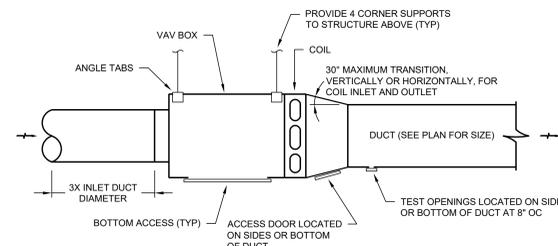


NOTE: PAINT ALL VISIBLE INTERIOR SURFACES OF DUCTWORK FLAT BLACK.

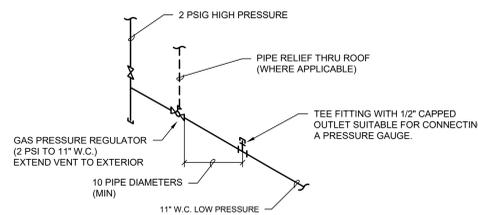
6 GRILLE CONNECTION TO ROUND DUCT DETAIL
SCALE: NONE

AIR DEVICE SCHEDULE			
EG - 1 (3)	THROW (IF OTHER THAN NORMAL)	SG = SUPPLY GRILLE	LD = LINEAR DIFFUSER (SUPPLY)
300	UNIT NUMBER	RG = RETURN GRILLE	CD = CEILING DIFFUSER (SUPPLY)
L	CFM	EG = EXHAUST GRILLE	TG = TRANSFER GRILLE
UNIT NO.	RG-1		
SERVICE	RETURN		
MANUFACTURER	PRICE		
MODEL NO.	80		
FACE STYLE	EGG CRATE		
PATTERN	-		
FINISH	-		
MATERIAL	STEEL		
SIZE (FACE/NECK)	24x48 / 12x12		
CFM RANGE	0-2500		
MOUNTING	LAY-IN		
DAMPER	NO		
REMARKS	-		

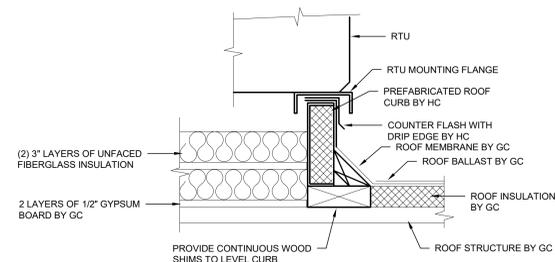
- GENERAL NOTES:**
1. CONTRACTOR SHALL VERIFY MOUNTING SURFACE / FRAME REQUIREMENTS.
 2. BRANCH DUCT SIZE TO DIFFUSER SHALL BE THE NECK SIZE OF THE DIFFUSER UNLESS NOTED OTHERWISE.
 3. SEE SPECIFICATION FOR GRILLE, REGISTER, AND DIFFUSER FINISHES.
 4. MAXIMUM STATIC PRESSURE DROP THROUGH GRILLE, REGISTER OR DIFFUSER SHALL NOT EXCEED 0.1".
 5. MAXIMUM NC LEVELS FOR GRILLES, REGISTERS OR DIFFUSERS SHALL NOT EXCEED 25.
 6. UNLESS THROW IS NOTED OTHERWISE, ALL DIFFUSERS SHALL BE 4-WAY THROW.



1 VAV BOOSTER COIL DETAIL
SCALE: NONE



2 GAS PRESSURE REGULATOR DETAIL
SCALE: NONE



NOTE: CAULK AND SEAL AROUND DUCT PENETRATIONS AND PROVIDE FLEXIBLE CONNECTION BY HC.

3 RTU ROOF CURB DETAIL
SCALE: NONE



DATE	
ISSUED FOR:	