MECHANICAL SCOPE OF WORK SUMMARY

1. PROVIDE AND INSTALL HVAC AND RELATED PIPING SYSTEMS AS SHOWN ON THESE PLANS AND AS SPECIFIED IN THE PROJECT MANUAL.

2. DEMOLISH & REMOVE ALL EXISTING EQUIPMENT, DUCTWORK, PIPING, CONTROLS, SUPPORTS, ETC FOR A 100% RENOVATION.

   THE AIR-COOLED CHILLER SHALL BE REMOVED AND TURNED OVER TO LCS FOR USE ANOTHER SCHOOL. TAKE CARE TO NOT DAMAGE, AND PROTECT CHILLER FOR RELOCATION.

3. PROVIDE AND INSTALL NEW HVAC EQUIPMENT AND APPURTENANCES AS SCHEDULED OR INDICATED INCLUDING DUCTWORK, VAV TERMINALS, HYDRONIC PIPING, SUPPLY AND RETURN GRILLES, INSULATION, SUPPORTS, SEALING PENETRATIONS, ETC. TO MAKE THE JOB COMPLETE AND FULLY FUNCTIONAL IN ACCORDANCE WITH THE DESIGN INTENT.

   NOTE: THE CHILLER, AIR HANDLER, VENTILATION PROCESSING UNITS, FAN COILS, AND BLOWER COIL WERE PURCHASED BY LEON COUNTY SCHOOLS AND WILL BE PROVIDED TO THE CONTRACTOR FOR INSTALLATION.

4. CONTROLS SHALL BE PERFORMED UNDER A SEPARATE CONTRACT BY LEON COUNTY SCHOOLS. THE MECHANICAL CONTRACTOR SHALL COORDINATE WITH THE CONTROLS CONTRACTOR AND INSTALL VALVES, DAMPERS AND CONTROLS INTO THE MECHANICAL EQUIPMENT.

5. TEST & BALANCE SHALL BE PERFORMED UNDER A SEPARATE CONTRACT BY LEON COUNTY SCHOOLS.

6. WORK INCLUDES OBTAINING PERMITS, PROCUREMENT OF EQUIPMENT, MATERIALS, ETC. ; COORDINATING BETWEEN TRADES; DEMOLITION, INSTALLATION, STARTUP, REPORTING, SYSTEMS CHECKOUT; ASSISTING THE TEST, ADJUST AND BALANCE CONTRACTOR, AND RESOLVING DISCREPANCIES; PERFORMING SUBSTANTIAL AND FINAL COMPLETION ACTIVITIES, TRAINING, DEVELOPING AND SUBMITTING THE OPERATION AND MAINTENANCE MANUALS, AND PERFORMING PROJECT CLOSEOUT.

7. A COMMISSIONING AUTHORITY, HIRED UNDER SEPARATE CONTRACT, WILL COMMISSION THE EQUIPMENT PER THE SPEC AND PLAN. CM, MECHANICAL CONTRACTOR, AND T&B CONTRACTOR WILL SUPPORT THESE EFFORTS.

GENERAL NOTES:

- FURNISH ALL LABOR, MATERIALS, EQUIPMENT AND INCIDENTALS REQUIRED TO COMPLETE ALL WORK SHOWN ON THE CONTRACT DRAWINGS.

- ALL CONSTRUCTION SHALL CONFORM TO APPLICABLE CODE STANDARDS INCLUDING:

  NFPA 51B, FIRE PREVENTION DURING WELDING, CUTTING, AND OTHER HOT WORK
  NFPA 70, NATIONAL ELECTRIC CODE
  NFPA 90 A, AIR CONDITIONING & VENTILATION SYSTEMS
  NFPA 101, LIFE SAFETY CODE
  FLORIDA BUILDING CODE BUILDING (2020)
  FLORIDA BUILDING CODE MECHANICAL (2020)
  FLORIDA BUILDING CODE PLUMBING (2020)
  FLORIDA BUILDING CODE FUEL GAS (2020)
  FLORIDA FIRE PREVENTION CODE (2020 EDITION)
  STATE REQUIREMENTS FOR EDUCATIONAL FACILITIES - 2014 EDITION
  STATE AND LOCAL CODES AND ORDINANCES

- SHOULD CONFLICT OCCUR BETWEEN PROJECT SPECIFICATIONS & DRAWING NOTES, THE DRAWING NOTES WILL TAKE PRECEDENCE.

- THE CONTRACTOR IS EXPECTED TO PROVIDE PROFESSIONAL WORK PERFORMED IN ACCORDANCE WITH INDUSTRY STANDARDS AND BEST PRACTICES.

- THE WORK SHALL BE COMPLETE, FULLY OPERATIONAL, AND SUITABLE IN EVERY WAY FOR THE SERVICE REQUIRED.

- DRAWINGS INDICATE SCOPE AND DO NOT SHOW ALL DETAILS, DEVICES AND INCIDENTAL MATERIALS NECESSARY TO ACCOMPLISH THE WORK. THEREFORE, IT SHALL BE UNDERSTOOD THAT SUCH DEVICES AND INCIDENTAL MATERIALS REQUIRED SHALL BE FURNISHED AT NO COST TO THE OWNER.

- CONTRACTOR SHALL TAKE INTO ACCOUNT FIELD CONDITIONS AND COORDINATE IN ORDER TO AVOID CONFLICTS WITH EXISTING CONDITIONS AND INTERFERENCE BETWEEN TRADES.

- EQUIPMENT SHALL BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURER'S REQUIREMENTS FOR PROPER OPERATION, MAINTENANCE, AND SERVICE. IF CHANGES TO THE CONTRACT DOCUMENTS ARE NECESSARY TO AVOID CONFLICTS, THE CONTRACTOR IS RESPONSIBLE FOR REQUESTING CLARIFICATION IN A TIMELY FASHION.

- CONTRACTOR SHALL VERIFY SIZE, FLOW DIRECTION, AND LOCATION OF EXISTING DUCTS/PIPING TO REMAIN, RELATED BUILDING INFRASTRUCTURE/SERVICES, PRIOR TO COMMENCING WORK. ADVISE THE ENGINEER IN WRITING IF MATERIALLY DIFFERENT THAN SHOWN.

- ALL PIPING AND DUCT SHALL BE INSTALLED PARALLEL OR PERPENDICULAR TO WALLS, AND SHALL PASS THROUGH WALLS AT 90 DEGREES. UNLESS SHOWN OR APPROVED, PIPING AND DUCT INSTALLED DIAGONALLY IS NOT ALLOWED.

- THE CONTRACTOR SHALL TAKE DUE CARE DURING ALL PHASES OF WORK TO PROTECT BUILDING FINISHES, FURNISHINGS, EQUIPMENT, ETC. THE CONTRACTOR SHALL BEAR ALL COSTS TO REPAIR ANY DAMAGED ITEMS, FINISHES, ETC. RESULTING FROM HIS OR HIS SUBCONTRACTORS' WORK.

- THE CONTRACTOR SHALL PROVIDE DAILY CLEANUP OF HIS WORK AREAS. UPON COMPLETION OF THE WORK THE CONTRACTOR SHALL THOROUGHLY CLEAN SPACES THAT WERE OCCUPIED BY TEMPORARY WORK AND TEMPORARY FACILITIES. REMOVE ALL DEBRIS, RUBBISH, AND EXCESS MATERIAL FROM THE SITES.

- REPAIR DAMAGE CAUSED BY INSTALLATION OR USE OF TEMPORARY FACILITIES. THIS INCLUDES HARDSCAPING, LANDSCAPING, FINISHES, ETC.

- THE CONTRACTOR SHALL DELIVER TO THE OWNER, UPON SUBSTANTIAL COMPLETION OF THE WORK, TWO COPIES OF DESCRIPTIVE LITERATURE RELATED TO THE EQUIPMENT INSTALLED UNDER THIS CONTRACT, INCLUDING PARTS LISTS, WIRING DIAGRAMS, MAINTENANCE AND OPERATION MANUALS AND WARRANTIES CUSTOMARILY SUPPLIED BY MANUFACTURERS FOR EQUIPMENT INCORPORATED IN THIS WORK.

- THE CONTRACTOR SHALL LABEL NEW EQUIPMENT AND ANCILLARY SYSTEMS INCLUDED IN THE SCOPE OF THIS PROJECT

- THE CONTRACTOR SHALL GIVE PHYSICAL DEMONSTRATION AND VERBAL INSTRUCTIONS FOR PROPER OPERATION AND MAINTENANCE OF EQUIPMENT TO THE OWNER OR HIS DESIGNATED REPRESENTATIVE. SCHEDULE THESE DEMONSTRATIONS AND INSTRUCTIONS AT THE OWNER'S CONVENIENCE.

TEST, ADJUST AND BALANCE (TAB) SCOPE OF WORK AND COORDINATION

1. LEON COUNTY SCHOOLS WILL CONTRACT WITH A PROFESSIONAL/AABB CERTIFIED TAB COMPANY TO TEST, ADJUST AND BALANCE THE NEW HVAC SYSTEMS. CONSTRUCTION MANAGER & MECHANICAL CONTRACTOR WILL ASSIST IN COORDINATING THIS WORK.

2. THE MECHANICAL CONTRACTOR SHALL FULLY TEST THE OPERATION OF THE HVAC SYSTEM AND RESOLVE ALL KNOWN DISCREPANCIES PRIOR TO REQUESTING TAB SERVICES VIA THE CONSTRUCTION MANAGER.

3. THE MECHANICAL CONTRACTOR SHALL PARTICIPATE AND ASSIST THE TAB WORK , INCLUDING RESOLUTION OF TAB DISCREPANCIES.

4. TEST AND BALANCE CONTRACTOR SHALL PERFORM THE FOLLOWING TASKS:

   A. MARK EQUIPMENT/DAMPER POSITIONS TO SHOW FINAL SETTINGS. MARK WITH PAINT OR OTHER SUITABLE/PERMANENT IDENTIFICATION MATERIALS.

   B. COMPLETE TESTING, ADJUSTING, AND BALANCING OF NEW HVAC SYSTEMS, INCLUDING HYDRONIC PIPING AND RELATED SYSTEMS INCLUDED IN THE SCOPE OF WORK.

   C. MEASURE PRESSURE DROP ACROSS EACH AHU SECTION. REPORT SHALL INCLUDE AN AHU DIAGRAM AND PRESSURE MEASUREMENTS FOR EACH AHU.

   D. MEASURE RETURN AIR, OUTSIDE AIR, MIXED AIR, COIL LEAVING AND UNIT LEAVING AIR CONDITIONS OF EACH AHU.

   E. BALANCE OUTSIDE AIR FANS WITH 0.15" ADDITIONAL PRESSURE DROP (I.E. ABOVE CLEAN PRESSURE DROP) TO ACCOUNT FOR AVERAGE/DIRTY FILTER PRESSURE DROP. SET POTENTIOMETER TO PROVIDE THE DESIGN FLOWRATE AT THE HIGHER PRESSURE DROP.

   F. MEASURE AND BALANCE CHILLED WATER & CONDENSER WATER TO CENTRIFUGAL CHILLERS. MEASURE & BALANCE HOT WATER TO BOILERS.

5. TEST AND BALANCE CONTRACTOR SHALL PROVIDE ONE (1) PAPER AND ELECTRONIC COPY OF THE PRELIMINARY REPORT TO THE ENGINEER FOR REVIEW/COMMENTS. DISCREPANCIES SHALL BE RESOLVED, THE TAB CONTRACTOR SHALL RETEST SYSTEMS AS NEEDED AND ISSUE THREE (3) FINAL SIGNED AND SEALED REPORTS PLUS ONE ELECTRONIC COPY AFTER ALL ISSUES ARE RESOLVED TO THE SATISFACTION OF THE ENGINEER. ITERATIVE PRELIMINARY COPIES MAY BE REQUIRED.

PIPING:

- ALL NEW MECHANICAL SYSTEMS PIPING SERVING AIR HANDLERS SHALL BE SCHEDULE 40, ASTM A53B CARBON STEEL PIPE. PIPING 2-1/2" & LARGER WILL BE WELDED CONSTRUCTION; PIPING 2" & SMALLER WILL BE THREADED CONSTRUCTION.

- ALL WELDED PIPE SHALL HAVE BEVELED ENDS. SMALL-BORE PIPE WILL HAVE THREADED ENDS.

- BUTT-WELD FITTINGS SHALL CONFORM TO ASTM A234 WPB AND THREADED FITTINGS TO BE MALLEABLE IRON, A197, ANSI B16.3, CLASS 150.

- STEEL FLANGES SHALL CONFORM TO ANSI B16.5 150# RAISED FACE. ALL FLANGES LARGER THAN 2" SHALL BE A105 SLIP-ON, UNLESS ATTACHING DIRECTLY TO A FITTING. FLANGES THAT ARE 2" AND SMALLER SHALL BE THREADED.

- PROVIDE DIELECTRIC COUPLINGS/NIPPLES TO ISOLATE DISSIMILAR MATERIALS.

- CHILLED/HOT WATER FLEXIBLE PIPING CONNECTIONS SHALL BE CORRUGATED RUBBER.

- HEATING HOT WATER FLEXIBLE PIPING CONNECTIONS SHALL BE RUBBER WITH STAINLESS STEEL BRAID.

- AIR VENT WASTE PIPING SHALL BE 1/4" SOFT COPPER.

GENERAL PIPING INSTALLATION:

- SUPPORT PIPING: 1" & SMALLER - 8' MAX SPACING; 11/2" & 2" - 12' MAX SPACING; 3" & LARGER - 20' SPACING

- INSTALL VALVES, INSTRUMENTATION AND DEVICES AS INDICATED ON THE SCHEMATIC DIAGRAMS.

- PIPE DISCHARGE FROM AUTOMATIC AIR VENTS TO THE NEAREST FLOOR OR HUB DRAIN.

- PROVIDE VALVE AND WELL EXTENSIONS TO ACCOMMODATE INSULATION THICKNESS.

- INSTALL DEVICES SHIPPED LOOSE WITH EQUIPMENT. LOCATE AND ORIENT VALVES FOR EASY ACCESS AND MAINTENANCE. INSTALL ALL GAUGES AND THERMOMETERS AS NEAR TO EYE LEVEL AS PRACTICAL. INSTALL MISCELLANEOUS DEVICES IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS AND THE SCHEMATIC DIAGRAMS.

- PROTECT OPEN PIPING WITH TEMPORARY COVERS/CAPS. CLEAN NEW PIPING OF LOOSE SCALE, RUST AND WELD SPATTER.

- PROTECT SYSTEM CONTROL VALVES AND CIRCULATE SYSTEM FLUID AT THE GREATEST FLOW POSSIBLE. CLEAN SYSTEM STRAINERS.

- CAPS SHALL BE PERMANENT AND OF THE SAME MATERIAL AS THE BASE PIPE. USE WELD CAPS FOR WELDED PIPING.

  NOTE: NOT ALL NEEDED PIPE SUPPORTS ARE SHOWN ON THE PLANS. CONTRACTOR SHALL SELECT AND INSTALL REQUIRED PIPE SUPPORTS.

WELDING STEEL PIPE/FITTINGS:

- WELDING SHALL BE PERFORMED IN ACCORDANCE WITH ANSI B31.1. BEVEL PIPE THAT IS FIELD CUT IN ACCORDANCE WITH RECOGNIZED STANDARDS.

- WELDERS SHALL BE CERTIFIED WITHIN THE LAST 12 MONTHS FOR THE PIPE SIZE REQUIRED BY THIS PROJECT. AT LEAST TWO WEEKS PRIOR TO COMMENCING WELDING, THE CONSTRUCTION MANAGER SHALL OBTAIN CERTIFICATIONS AND PHOTO ID COPIES FOR EACH WELDER PROPOSED FOR THE PROJECT. THE CONSTRUCTION MANAGER SHALL VERIFY THE INFORMATION TO ENSURE WELDER IS AS NAMED ON THE CERTIFICATION AND THAT THE CERTIFICATION IS ACCEPTABLE.

- BEFORE PERFORMING WELDING OPERATIONS, REMOVE DIRT, SCALE AND OTHER FOREIGN MATTER FROM PIPING. SET JOINTS TRUE AND SQUARE WITH PROPER ROOT PASS GAP FOR SIZE PIPE. ROOT BEAD WILL PROVIDE FOR COMPLETE PENETRATION INTO THE ROOT OF THE JOINT, PROVIDE ROOT BEAD AND MULTIPLE FILLER LAYERS AND A FINAL COVER PASS. WELDERS SHALL PROVIDE IDENTIFYING MARK AT EACH WELD.

- CONTRACTOR SHALL REMOVE SUSPECT WELDS AND SUBMIT FOR DESTRUCTIVE TESTS AS REQUESTED BY THE ENGINEER. CONTRACTOR SHALL PAY FOR DESTRUCTIVE TESTS THAT FAIL.

- ALL WELDING SHALL BE PERFORMED BY WELDERS ADEQUATELY FAMILIAR WITH WELDING SAFETY PRACTICES INCLUDING NFPA 51B.

- INSTALL PIPING PARALLEL TO WALLS. SLOPE PIPING AT 1 INCH PER 40 FEET BACK TOWARDS PUMPS OR TO DRAINAGE POINTS. INSTALL DRAINS AT ANY LOW POINT THAT WILL TRAP OVER 5 GALLONS OF WATER. INSTALL BLOWDOWN PIPING WITH VALVE FOR ALL STRAINERS.

- LEAK TEST ALL PIPING IN ACCORDANCE WITH NORMAL PRACTICE BUT NO LESS THAN 1.5 TIMES OPERATING PRESSURE AND NOT LESS THAN 100 PSI.

- PROTECT BUILDING FINISHES FROM WELD SPATTER WITH FIRE RETARDANT SHIELDS. MAINTAIN A FIRE EXTINGUISHER AT HAND AT ALL TIMES WHEN WELDING. PROVIDE ADEQUATE VENTILATION FOR WELDING OPERATIONS.

CONDENSATE PIPING

- CONDENSATE DRAIN SHALL INCLUDE A P-TRAP, SEE DETAIL. DISCHARGE SHALL BE INTO A CONDENSATE PUMPING UNIT (CPU-1, SEE SCHEDULE). MECHANICAL CONTRACTOR SHALL PROVIDE THE CPU AND PIPE CONDENSATE INTO THE CPU. THE PLUMBING CONTRACTOR SHALL PIPE THE CPU DISCHARGE TO THE POINT OF TERMINATION INTO THE STORM SYSTEM (EXISTING STORM DRAIN IN CHILLER YARD).

- PIPING SHALL BE SAME SIZE AS DISCHARGE CONNECTION, D-W-V COPPER AND FITTINGS. MINIMUM SIZE IS 3/4". SUPPORT PIPING AT P-TRAP AND ON 4' CENTERS AND SLOPE 1/8" PER FOOT TOWARD DRAIN.

- PROVIDE CLEANOUTS WITH SCREW CAPS/PLUGS AT TRAPS, ON VERTICAL DROPS, AND IN HORIZONTAL DIRECTION CHANGES.

MISCELLANEOUS METALS:

- INTERIOR EQUIPMENT/PIPING SUPPORTS, HARDWARE, BRACKETS, FRAMING CHANNEL, ETC. SHALL BE GALVANIZED STEEL AND EQUAL TO B-LINE.

- METAL/ELECTRICAL FRAMING/CHANNEL, SUPPORTS, ETC. IN CONTACT WITH CONCRETE OR INSTALLED OUTDOORS SHALL BE HOT-DIPPED GALVANIZED.

- MISCELLANEOUS INTERIOR SUPPORTS SHALL BE 12 GA, 1-5/8" SQ. ELECTRO-GALVANIZED FRAMING CHANNEL. (MINIMUM).

PIPE/EQUIPMENT INSULATION:

INTERIOR COLD PIPING - INSULATE CHILLED WATER PIPING WITH 2" THICKNESS OF CELLULAR GLASS PIPE INSULATION AND FINISH WITH ALL-SERVICE JACKETING. USE 1-1/2" THICKNESS FOR PIPES 4" AND SMALLER; AND 1" THICKNESS FOR PIPES 1-1/2" AND SMALLER. USE BEDDING MASTIC ON PIPING AND JOINTS AND FINISH ELBOWS WITH GLASS FABRIC AND MASTIC.

INTERIOR HOT PIPING - INSULATE HEATING HOT WATER PIPING WITH 1" PREFORMED FIBERGLASS INSULATION WITH ALL-SERVICE JACKET. PROVIDE PVC COVERS AT ELBOWS.

EXTERIOR COLD PIPING - INSULATE CHILLED WATER PIPING WITH 2" THICKNESS OF CELLULAR GLASS PIPE INSULATION AND FINISH WITH ALL-SERVICE JACKETING. USE 1-1/2" THICKNESS FOR PIPES 4" AND SMALLER; AND 1" THICKNESS FOR PIPES 1-1/2" AND SMALLER. COVER WITH ALUMINUM CLADDING. INSULATION SHALL EXTEND A MINIMUM OF 2 FEET INTO BUILDING.

EXTERIOR WATER PIPING - INSULATE EXTERIOR DOMESTIC WATER, FIRE WATER, ETC. WITH 1" PREFORMED FIBERGLASS WITH ASJ. COVER WITH ALUMINUM CLADDING. INSULATION SHALL EXTEND A MINIMUM OF 2 FEET INTO BUILDING.

INTERIOR WATER PIPING - INSULATE INTERIOR DOMESTIC WATER PIPING WITH 1" CLOSED CELL FOAM INSULATION. SEAL ALL JOINTS & SEAMS AIR TIGHT.

EXTERIOR HOT PIPING - INSULATE HEATING HOT WATER PIPING WITH FOAM GLASS PER SPECIFICATION. ABOVE GROUND PIPE TO HAVE ALUMINUM JACKETING; BELOW GROUND PIPE TO HAVE POLYGUARD JACKETING.

VALVES/EQUIPMENT/HYDRONIC DEVICES - INSULATE VALVES, FLEXIBLE CONNECTORS, PORTS, ITEMS REQUIRING MAINTENANCE ACCESS, ETC. WITH 1" THICKNESS OF FLEXIBLE CLOSED CELL ELASTOMERIC INSULATION AND INSTALL TO FACILITATE REMOVAL/ACCESS. PROVIDE ACCESS TO ALL PORTS, VALVE SHAFTS, PETE'S PLUGS, ETC.

CONDENSATE PIPING - INSULATE CONDENSATE PIPING WITH 3/4" CLOSED CELL FOAM INSULATION WITHIN BUILDING. SEAL ALL JOINTS, SEAMS, ETC. AIR TIGHT. PROVIDE ACCESS PLUGS/CAPS TO FITTINGS THAT REQUIRE MAINTENANCE.

CONDENSATE PIPING, EXTERIOR - INSULATE CONDENSATE PIPING WITH 3/4" CLOSED CELL FOAM INSULATION. COVER INSULATION WITH ALUMINUM CLADDING

INSULATION

ALL INSULATION SHALL BE INSTALLED BY PROFESSIONAL INSULATORS WITH ADEQUATE EXPERIENCE AND ABILITY TO INSURE A SUCCESSFUL JOB. INSTALL INSULATION PRODUCTS IN ACCORDANCE WITH MANUFACTURER'S WRITTEN INSTRUCTIONS, AND IN ACCORDANCE WITH RECOGNIZED INDUSTRY PRACTICES TO ENSURE THAT INSULATION SERVES ITS INTENDED PURPOSE.

PROVIDE COMPOSITE MECHANICAL INSULATION (INSULATION, JACKETS, COVERINGS, SEALERS, MASTICS AND ADHESIVES) HAVING FLAME SPREAD INDEX OF 25 OR LESS, AND SMOKE DEVELOPED INDEX OF 50 OR LESS, AS TESTED BY ASTM E 84 (NFPA 255) METHODS.

VAPOR BARRIER SHALL BE MAINTAINED COMPLETE AND CONTINUOUS. GAPS AND OPENINGS IN COLD PIPE OR DUCT INSULATION VAPOR BARRIER WILL NOT BE TOLERATED.

INSULATION IS NOT TO BE INSTALLED UNTIL THE PIPING SYSTEMS HAVE BEEN CHECKED AND FOUND FREE OF ALL LEAKS. SURFACES SHALL BE CLEAN AND DRY BEFORE ATTEMPTING TO APPLY INSULATION.

HYDRONIC DEVICES:

INSTALL MISCELLANEOUS DEVICES IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS AND THE SCHEMATIC DIAGRAMS.

COORDINATE WITH THE CONTROL PROVIDER AND MAKE PIPING PREPARATIONS FOR BAS CONTROL DEVICES.

INSTALL VALVES, INSTRUMENTATION AND DEVICES AS INDICATED ON THE SCHEMATIC DIAGRAMS. INSTALL DEVICES SHIPPED LOOSE WITH THE CHILLERS. LOCATE AND ORIENT VALVES FOR EASY ACCESS AND MAINTENANCE. INSTALL ALL GAUGES AND THERMOMETERS AS NEAR TO EYE LEVEL AS PRACTICAL.

INSTALL METERS TO CONFORM TO MANUFACTURER'S RECOMMENDATIONS FOR UP AND DOWN STREAM STRAIGHT LENGTHS OF PIPE. INSTALL BACKFLOW PREVENTERS WITH PRESSURE TEST PORTS VERTICAL TO AVOID ACCUMULATION OF TRASH. INSTALL COMPRESSION TANKS, SHOT FEEDERS, AND MISCELLANEOUS DEVICES IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS AND THE SCHEMATIC DIAGRAMS.

TAKE CARE TO PROTECT EXISTING PIPING FROM INTRODUCTION OF FOREIGN DEBRIS. CLEAN NEW PIPING OF LOOSE SCALE, RUST AND WELD SPATTER. REMOVE TIGHTLY ADHERING DEBRIS WITH WIRE BRUSH OR BY GRINDING AS NECESSARY. PROTECT SYSTEM CONTROL VALVES AND CIRCULATE SYSTEM FLUID AT THE GREATEST FLOW POSSIBLE. CLEAN SYSTEM STRAINERS. PROVIDE INITIAL CHEMICAL TREATMENT.

PAINTING

CARBON STEEL PIPING AND SUPPORTS THAT WILL NOT BE INSULATED ARE TO BE CLEANED, PRIMED, AND PAINTED TO PROTECT THE CARBON STEEL FROM OXIDATION AND CORROSION. THE PAINT SYSTEM SHALL BE SUITABLE FOR THE ENVIRONMENT.

NATURAL GAS PIPING TOPCOAT SHALL BE SAFETY YELLOW.

TOPCOAT COLOR FOR SUPPORT STEEL, DRAIN PIPING, ETC., SHALL BE WHITE.

DUCTWORK:

- ALL WORK SHALL COMPLY WITH SMACNA HVAC DUCT CONSTRUCTION STANDARDS - METAL AND FLEXIBLE. CONSTRUCT SUPPLY DUCTWORK FOR VAV SYSTEMS TO WITHSTAND 3" (MIN) AND RETURN DUCT -2" STATIC PRESSURES.

- USE EITHER ROUND OR RECTANGULAR DUCT WITH EQUAL OR GREATER EQUIVALENT FREE AREA TO ACCOMMODATE EXISTING STRUCTURE.

- CROSS BREAK DUCTS AND OTHER SHEET METAL OVER 24" WIDE.

- INTERIOR - USE GALVANIZED SHEET METAL FOR RECTANGULAR WITH EXTERIOR INSULATION, UOS. USE GALVANIZED SPIRAL SEAM ROUND DUCT WITH EXTERIOR INSULATION.

- FOR HIGH PRESSURE TAKE-OFF, USE A BELLMOUTH OR MITERED FITTING TO CONNECT ROUND DUCT TO RECTANGULAR. USE A MITERED FITTING WHEN CONNECTING RECTANGULAR TO RECTANGULAR DUCT.

- FLEXIBLE DUCT ON RUNOUTS SHALL NOT EXCEED 15'. USE ROUND SPIRAL DUCT FOR LONGER RUNS.

- PROVIDE SHEET METAL CLOSURE ANGLES, ESCUTCHEONS, OR FLASHING ON BOTH SIDES OF WALL PENETRATIONS (NON RATED) AND SEAL AIR TIGHT. MINIMUM WIDTH IS 1" OR AS REQUIRED TO COVER OPENING.

- PROVIDE SMOKE TIGHT SEAL WHEN PENETRATING SMOKE COMPARTMENT WALLS.

- PROVIDE DOUBLE-THICKNESS TURNING VANES IN ALL RECTANGULAR ELBOWS AND OFFSETS.

- DUCT SIZES MAY BE CHANGED TO ACCOMMODATE CONDITION AS LONG AS THE INTERNAL FREE AREA IS NOT DIMINISHED.

- RUN-OUT DUCTS TO DIFFUSERS SHALL BE EQUAL TO DIFFUSER NECK SIZE, SEE GRILLE/FLOW SCHEDULES.

- ALL FABRICATED DUCTWORK LONGITUDINAL AND TRANSVERSE JOINTS, TAPS, AND CONNECTIONS SHALL BE SEALED WITH DUCT MASTIC REGARDLESS OF PRESSURE CLASS.

- PAINT ALL REFLECTIVE SURFACES SEEN THRU GRILLE FLAT BLACK.

- TAG ALL DAMPER LOCATIONS WITH ORANGE FLAG TAPE.

- PERMANENTLY MARK ALL DAMPER SHAFTS TO INDICATE DAMPER POSITION.

DUCT ACCESSORIES:

- ACCESSORIES, GRILLES, ETC. SHALL BE INSTALLED PER THE MANUFACTURER'S RECOMMENDATIONS.

- MANUAL VOLUME DAMPERS IN RECTANGULAR DUCTS SHALL BE OPPOSED-BLADE TYPE, HANDLES SHALL HAVE LOCKING QUADRANTS, AND EXTENSIONS TO ACCOMMODATE EXTERNAL INSULATION. ROUND DUCTS SHALL HAVE BUTTERFLY TYPE DAMPERS.

- RECTANGULAR TAKEOFFS SHALL BE MITERED TYPE WITH MANUAL VOLUME DAMPERS AND INSULATION STANDOFFS TO ACCOMMODATE THE INSULATION THICKNESS, UOS. DAMPERS SHALL INCLUDE A LOCKING QUADRANT AND HARDWARE TO FIX/LOCK FINAL DAMPER POSITION. USE A PERMANENT MARKER ON THE DAMPER SHAFT TO INDICATE DAMPER POSITION.

- ROUND TAKEOFFS SHALL HAVE A MANUAL VOLUME DAMPER, INSULATION STANDOFF, AND LOCKING QUADRANT, UOS. USE A PERMANENT MARKER ON THE DAMPER SHAFT TO INDICATE DAMPER POSITION.

VAV AIR TERMINALS:

- INSTALL AND ORIENT TERMINALS TO OPTIMIZE AVAILABLE SPACE FOR ACCESS AND NOT HIGHER THAN 12" ABOVE CEILING. SUPPORT UNITS FROM EXISTING STRUCTURE USING ELECTRICAL FRAMING CHANNEL. RELOCATED ANY CONDUITS BELOW EACH UNIT.

DAMPERS:

- ELECTRIC/MOTOR OPERATED CONTROL DAMPERS SHALL BE OPPOSED-BLADE TYPE WITH NEOPRENE BLADE EDGE SEALS EQUAL TO RUSKIN.

- ELECTRIC MOTOR OPERATED DAMPERS SHALL HAVE 120VAC, 18 IN-LB TORQUE (MINIMUM) ACTUATORS EQUAL TO BELIMO "TF" SERIES WITH SPRING RETURN. OPERATORS SHALL BE SIZED ACCORDING TO DAMPER SIZE AND TORQUE REQUIREMENTS PER THE DAMPER/OPERATOR REQUIREMENTS (WHICHEVER IS HIGHER).

- DURING DAMPER INSTALLATION, PERMANENTLY MARK OR ENGRAVE EACH DAMPER SHAFT TO INDICATE DAMPER POSITION.

DUCTWORK INSULATION:

- INSULATION IN CONCEALED/ACCESSIBLE INTERIOR SPACES SHALL BE BLANKET TYPE. SECURE INSULATION WITH IMPALE PINS WHEN DUCT IS OVER 24" WIDE.

- BLANKET INSULATION SHALL BE 2.2" THICK (OUT OF PACKAGE) FOIL BACKED R-6 (INSTALLED) INSULATION. SEAL ALL JOINTS, SEAMS, ETC. PER THE MANUFACTURER'S RECOMMENDATIONS. SEALING TAPE SHALL BE UL 181 LISTED PRESSURE-SENSITIVE TYPE.

- INSULATION IN MECHANICAL ROOMS AND ON DUCTS PENETRATING WALLS (WITHOUT FIRE DAMPERS) SHALL BE RIGID FIBERGLASS. EXTEND INSULATION 6" BEYOND WALL THEN TRANSITION TO DUCT WRAP (WHEN CONCEALED). USE CLIP ANGLES AT WALL TO SEAL OPENING (BOTH SIDES) UOS. SEAL PENETRATION TO COMPLY WITH THE WALL RATING, SEE ARCHITECTURAL SHEETS.

- RIGID INSULATION ON SUPPLY DUCTWORK SHALL BE 1.5" THICK TO PROVIDE AN R-VALUE EQUAL TO 6 (MINIMUM).

- RIGID INSULATION ON RETURN AND OUTSIDE AIR DUCTWORK SHALL BE 1" THICK.

- INSULATE OUTSIDE AIR PLENUMS, LOUVER COVERS, OA DUCTS, ETC. WITH 1" RIGID INSULATION. SECURE INSULATION WITH MECHANICAL FASTENERS (IMPALE PINS) ON DUCTS OVER 24" WIDE. SEAL ALL RIGID EDGES WITH ALUMINUM TAPE AND MASTIC AT TAPE EDGES.

- MECHANICAL FASTENERS (IMPALE PINS) SHALL BE ADHERED WITH MASTIC SPACED ON 18" CENTERS. NOTE: SELF-ADHESIVE TYPE IMPALE PINS ARE PROHIBITED.

- INSULATE THE BACKS OF NEW SUPPLY AIR GRILLES - SEE DETAIL.

- ALL DUCTWORK CONVEYING CONDITIONED OR OUTSIDE AIR AIR SHALL BE EXTERNALLY INSULATED UNLESS SPECIFIED OTHERWISE.

- PROVIDE INCOMPRESSIBLE INSULATION/INSERTS AT ALL TRAPEZE-TYPE SUPPORTS TO PREVENT INSULATION COMPRESSION.

- INSTALL INSULATION PRODUCTS IN ACCORDANCE WITH MANUFACTURER'S WRITTEN INSTRUCTIONS AND IN ACCORDANCE WITH RECOGNIZED INDUSTRY BEST PRACTICES FOR THE INTENDED PURPOSE.

- PROVIDE COMPOSITE MECHANICAL INSULATION (INSULATION, JACKETS, COVERINGS, SEALERS, MASTICS AND ADHESIVES) HAVING FLAME SPREAD INDEX OF 25 OR LESS, AND SMOKE DEVELOPED INDEX OF 50 OR LESS, AS TESTED BY ASTM E 84 (NFPA 255) METHODS.

- VAPOR BARRIERS SHALL BE MAINTAINED COMPLETE AND CONTINUOUS. SEAL ALL GAPS, JOINTS, SEAMS, ETC.

- INSTALL INSULATION AFTER THE DUCT SYSTEMS HAVE BEEN SEALED WITH MASTIC, PRESSURE TESTED AND FOUND FREE OF ALL LEAKS.

- SURFACES SHALL BE CLEAN AND DRY BEFORE APPLYING INSULATION MASTICS OR INSULATION.

- RATED PARTITIONS & WALLS SHALL BE PENETRATED ONLY WITH INSULATION MATERIALS AND TECHNIQUES THAT ARE UL LISTED TO MAINTAIN FIRE RATING. ANY QUESTIONS SHALL BE REFERRED TO THE ARCHITECT/ENGINEER.

AIR HANDLER UNIT INSTALLATION:

- COORDINATE WITH THE SUPPLIER TO UNDERSTAND WHICH FEATURES AND OPTIONS MUST BE FIELD INSTALLED.

- COORDINATE CONTROLS AND POWER WIRING INSTALLATION. PROVIDE ALL PENETRATIONS INTO UNIT CABINET FOR ELECTRICAL AND POWER WIRING INSTALLATION.

- LOCATE UNIT TO PROVIDE PROPER CLEARANCE TO ACCESS PANELS, PIPING, CONTROLS, ETC. OPTIMIZE AVAILABLE SPACE.

- SET UNIT ON 1/2" THICK NEOPRENE VIBRATION-ISOLATION PADS ON 2' CENTERS UNDER MAIN SUPPORTS.

- PROVIDE EXTERNAL CONDENSATE PUMP WITH AUTOMATIC SHUTOFF CAPABILITIES AND AN ALARM IN CASE OF SHUTDOWN. ROUTE PUMPED CONDENSATE TO EXISTING CONDENSATE DRAIN LINE ABOVE CEILING.

- PROVIDE HEATING COIL DRAIN PIPING WITH NORMALLY CLOSED BALL VALVE (FOR FUTURE COIL CLEANING) AND ELBOW AND SHORT PIPE FOR HOSE CONNECTION.

- INSTALL DUCTWORK.

- INSTALL HEATING AND CHILLED WATER PIPING, SEE COIL PIPING DETAILS. PROVIDE PIPING SUPPORTS AT COIL CONNECTIONS WITHIN 12" OF LAST ELBOW WHERE VERTICAL PIPING SERVES COIL.

- REMOVE ALL DEBRIS, DUST, METAL SHAVINGS, ETC. FROM INTERIOR OF UNIT PRIOR TO STARTUP.

- PERFORM START-UP IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS AND COMPLETE A STARTUP REPORT.

- PROGRAM AND TEST CONTROLS, DAMPERS, AND SAFETIES.

- CLEAN FACTORY-FINISHED SURFACES. REPAIR ANY MARRED OR SCRATCHED SURFACES WITH MANUFACTURER'S TOUCH-UP PAINT.

- PROVIDE NEW FILTERS AT SUBSTANTIAL COMPLETION.

FANS:

- INSTALL FANS WITH REQUISITE LENGTH OF STRAIGHT FULL SIZE DUCTS ON INLET AND DISCHARGE TO MINIMIZE SYSTEM EFFECT. MINIMUM LENGTH IS 3 TIMES THE WHEEL DIAMETER UOS. LOCATE TAPS/BRANCHES BEYOND MINIMUM LENGTHS.

- PROVIDE FLEXIBLE DUCT CONNECTIONS AT FAN.

- SUPPORT FAN FROM STRUCTURE OR WALL.

DUCT SMOKE DETECTORS:

- DUCT SMOKE DETECTORS ARE PROVIDED AND WIRED TO THE FIRE ALARM BY DIVISION 16.

- THE MECHANICAL SUBCONTRACTOR WILL BE RESPONSIBLE FOR MOUNTING DUCT SMOKE DETECTORS AND WIRING TO THE AHU FOR SYSTEM SHUTDOWN ON ANY GENERAL FIRE ALARM.

CONTROLS SCOPE OF WORK & COORDINATION:

- CONTROLS SHALL BE PERFORMED UNDER A SEPARATE CONTRACT BY LEON COUNTY SCHOOLS. ALL WORK SHALL BE COORDINATED WITH THE CONTROLS VENDOR JUST AS IF THEY WERE UNDER THE PRIME OR MECHANICAL SUBCONTRACTOR.

- CONTROL WIRING OF THIS CONTRACT IS LIMITED TO THAT SPECIFICALLY REQUIRED BY THESE DRAWINGS AND SPECIFICATIONS.

- MECHANICAL CONTRACTOR SHALL INSTALL MISCELLANEOUS, SENSORS, ACTUATORS, AND OTHER DEVICES PROVIDED BY THE CONTROLS' SUBCONTRACTOR FOR INSTALLATION IN THE MECHANICAL SYSTEM.

- LOW-VOLTAGE WIRE MUST BE IN CONDUIT THROUGHOUT ITS ENTIRE LENGTH. COORDINATE CONTROL WIRING IN GENERAL AND FOR SENSORS IN WALLS DURING ELECTRICAL ROUGH IN.

- PROVIDE WIRING AND DEVICES AS NECESSARY TO PROVIDE FOR CONTROL OF FANS AS INDICATED ON THE FAN SCHEDULE.

DUCT SMOKE/FIRE DAMPERS, COMMON DAMPERS, AND DETECTORS:

- SMOKE AND FIRE DAMPERS, WHERE INDICATED, SHALL BE INSTALLED IN STRICT CONFORMANCE WITH THE MANUFACTURER'S INSTRUCTIONS. PROVIDE SLEEVES AND ANGLES WHERE REQUIRED. PROVIDE DUCT ACCESS PANELS FOR INSPECTION AND RESETTING OF FIRE DAMPERS.

- DUCT SMOKE DETECTORS ARE PROVIDED AND WIRED TO THE FIRE ALARM BY DIVISION 16.

- THE MECHANICAL SUBCONTRACTOR WILL BE RESPONSIBLE FOR MOUNTING DUCT FIRE/SMOKE DAMPERS/ DETECTORS AND WIRING TO THE AHU FOR SYSTEM SHUTDOWN ON ANY GENERAL FIRE ALARM.

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P.I.C.	JMS
Design	JB
Drawn	MH
Reviewed	JB
Job Number	

Revisions #	Date	Description

Mechanical - General Notes

M-100

08.28.2023

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DOAS W/ENERGY RECOVERY WHEEL SCHEDULE

DESIGNATION		VPU-1
AREA SERVED		UPPER LEVELS
MANUFACTURER		DAIKIN
UNIT MODEL		CAH020GDGM
CONFIGURATION (SEE BELOW)		STACKED W/ HEAT WHEEL
VENTILATION AIR	CFM	9000 (2250 MIN)
EXHAUST AIR	CFM	7650
MAX COIL FACE VELOCITY	FPM	500
CC ENTERING AIR CONDITIONS	°FDB/°FWB	80 / 69.8
CC LEAVING AIR CONDITIONS	°FDB/°FWB	53.6 / 53.2
UNIT TOTAL COOLING CAPACITY	MBH	476.1
UNIT LATENT COOLING CAPACITY	MBH	215
UNIT SENSIBLE COOLING CAPACITY	MBH	261.3
CHILLED WATER FLOW RATE	GPM	95
CHILLED WATER HEAD LOSS	FT H2O	8.8
CHILLED WATER TEMP ENT/LEAV	°F / °F	44 / 54
CHILLED WATER COIL ROWS & FINS/INCH		6 / 10
CHILLED WATER COIL FACE VELOCITY	FPM	480
PRE-HEAT COIL HEATING CAPACITY	MBH	244
PRE-HEAT COIL ENTERING AIR CONDITIONS	°F DB	25
PRE-HEAT COIL LEAVING AIR CONDITIONS	°F DB	50
PRE-HEAT COIL WATER FLOW RATE	GPM	25
PRE-HEAT COIL WATER HEAD LOSS	FT H2O	3.8
PRE-HEAT COIL WATER TEMP ENT/LEAV	°F / °F	160 / 140
PRE-HEAT COIL ROWS & FINS PER INCH		1 / 11
WHEEL DIAMETER	IN	72"
OUTSIDE AIR CONDITIONS	°FDB/°FWB	95 / 80
SUMMER: WHEEL EAT	°F DB	72 / 63
SUMMER: WHEEL LAT	°F DB	80 / 69.8
WHEEL EFFICIENCY (SUMMER)	%	74.2%
TOTAL ENERGY RECOVERED - SUMMER	MBH	375,211
OUTSIDE AIR CONDITIONS	°FDB/°FWB	50 / 49.9
WINTER WHEEL EAT	°F DB	68 / 59
WINTER WHEEL LAT	°F DB	61.8 / 56
WHEEL EFFICIENCY -WINTER	%	77.5%
TOTAL ENERGY RECOVERED - WINTER	MBH	114,289
EXTERNAL STATIC - OUTSIDE AIR	IN WG	1
EXTERNAL STATIC - EXHAUST AIR	IN WG	1
TOTAL STATIC PRESS. DROP (CLEAN/DIRTY)	IN WG	3.67
AHU FAN BRAKE HORSEPOWER (DIRTY)	BHP	2 @ 4.25
OUTSIDE AIR FAN MOTOR HORSEPOWER	HP	2 FANS @ 7.5 HP
MOTOR FLA / MOP	AMPS	2 @ 8.7 / 2 @ 20
EXHAUST FAN MOTOR HORSEPOWER	HP	1 FAN @ 7.5 HP
MOTOR FLA / MOP	AMPS	8.7 / 20
MOTOR ELECTRICAL CHARACTERISTICS	V/Ø/HZ	480 / 3 / 60
ENERGY WHEEL MOTOR HORSEPOWER	HP	1
MOTOR FLA / MOP	AMPS	6.8 / 15
MOTOR ELECTRICAL CHARACTERISTICS	V/Ø/HZ	208 / 1 / 60
CABINET NOMINAL DIMENSIONS (LXWXH)	IN	232 x 88 x 92

NOTES:

1. AIR HANDLER WILL BE FOR 100% OUTSIDE AIR SERVICE WITH ENERGY RECOVERY FROM EXHAUST AIR.
2. COOLING COIL SECTION SHALL HAVE STAINLESS STEEL IAQ DRAIN PAN.
3. RIGHT HAND CONFIGURATION FOR ALL CONNECTIONS AND ACCESS - FIELD VERIFY
4. FILTER SECTION TO ACCOMMODATE 4" THICK FILTERS (MERV 11).
5. GALVANIZED DOUBLE-WALL UNIT WITH 2" THICK FOAM FILLED INSULATION, MINIMUM R = 13.
6. MOTOR SHALL BE PREMIUM EFFICIENCY, OPEN DRIP PROOF, 1.15 SERVICE FACTOR, AND RATED FOR INVERTER DUTY.
7. PROVIDE BASE RAIL INTEGRAL TO UNIT. CONDENSATE CONNECTION SHALL BE HIGH ENOUGH TO ALLOW FOR P-TRAP AND NO STANDING WATER IN PAN.
8. ACCESS DOORS SHALL BE HINGED WITH ROTATING DOOR LOCK AND GASKETS, AND MANUFACTURED OF THE SAME CONSTRUCTION OF THE CABINET.
9. VFD IS BY OTHERS, SEE SCHEDULE
10. MEAN FILTER PRESSURE DROP USED IN TSP AND BHP CALCULATIONS.
11. FC FAN, FACTORY BALANCED ACROSS OPERATING RPM, MOUNTED ON SPRING ISOLATORS.
12. HEAT WHEEL REQUIRES SEPERATE 115V SINGLE PHASE CIRCUIT
13. EQUIPMENT SECTIONS SHALL FIT THROUGH 11'-0" x 3'-4" OPENING INTO THE BUILDING. UNIT CAN BE 'KNOCKED DOWN' BY CONTRACTOR ON SITE.

DOAS SCHEDULE

DESIGNATION		VPU-2	VPU-3
AREA SERVED		LOWER LEVEL	LOWER LEVEL
MANUFACTURER		DAIKIN	DAIKIN
UNIT MODEL		CAH004GDGM	-
CONFIGURATION (SEE BELOW)		STACKED DRAW THROUGH	HORIZ. DRAW THROUGH
ORIENTATION / HANDING		RIGHT (TBD)	RIGHT (TBD)
SUPPLY AIR - CONSTANT VOLUME	CFM	1600	1600
VENTILATION AIR	CFM	1600	1600
MAX COIL FACE VELOCITY	FPM	500	500
PRE-HEAT COIL HEATING CAPACITY	MBH	44.7	44.7
PRE-HEAT COIL ENTERING AIR CONDITIONS	°F DB	25	25
PRE-HEAT COIL LEAVING AIR CONDITIONS	°F DB	50	50
PRE-HEAT COIL WATER FLOW RATE	GPM	4.4	4.4
PRE-HEAT COIL PRESSURE DROP	FT WG	0.4	0.4
PRE-HEAT COIL WATER TEMP ENT/LEAV	°F / °F	160 / 140	160 / 140
PRE-HEAT COIL ROWS & FINS PER INCH		1 / 7	1 / 7
CC ENTERING AIR CONDITIONS	°FDB/°FWB	95 / 80	95 / 80
CC LEAVING AIR CONDITIONS	°FDB/°FWB	53.2 / 53.0	53.2 / 53.0
UNIT TOTAL COOLING CAPACITY	MBH	155	155
UNIT LATENT COOLING CAPACITY	MBH	81.8	81.8
UNIT SENSIBLE COOLING CAPACITY	MBH	73.2	73.2
CHILLED WATER FLOW RATE	GPM	31	31
CHILLED WATER PRESSURE DROP	FT WG	7.6	7.6
CHILLED WATER TEMP ENT/LEAV	°F / °F	44 / 54	44 / 54
CHILLED WATER COIL ROWS & FINS/INCH		6 / 12	6 / 12
CHILLED WATER COIL FACE VELOCITY	FPM	406	406
RE-HEAT COIL CAPACITY	MBH	43.4	43.4
RE-HEAT ENTERING AIR CONDITIONS	°F DB	50	50
RE-HEAT LEAVING AIR CONDITIONS	°F DB	75	75
RE-HEAT WATER FLOW RATE	GPM	4.4	4.4
RE-HEAT COIL PRESSURE DROP	FT WG	0.4	0.4
RE-HEAT WATER TEMP ENT/LEAV (MAX/MIN)	°F / °F	160 / 140	160 / 140
RE-HEAT COIL ROWS & FINS PER INCH		1 / 7	1 / 7
FILTER STATIC (CLEAN/DIRTY)	IN WG	0.3 / 1	0.3 / 1
PRE- & RE-HEAT COIL STATIC	IN WG	0.07	0.07
COOLING COIL STATIC	IN WG	0.6	0.6
EXTERNAL STATIC	IN WG	1.5	1.5
TOTAL STATIC PRESS. DROP (CLEAN/DIRTY)	IN WG	3.4	3.4
AHU FAN BRAKE HORSEPOWER (DIRTY)	BHP	1.6	1.6
AHU FAN MOTOR HORSEPOWER	HP	3	3
AHU ELECTRICAL CHARACTERISTICS	V/Ø/HZ	480 / 3 / 60	480 / 3 / 60
MOTOR FLA	AMPS	3.8	3.8
BREAKER SIZE (MOCP)	AMPS	15	15
CABINET NOMINAL DIMENSIONS (LXWXH)	IN	84 x 40 x 60	84 x 40 x 60
NOTES		SEE BELOW	SEE BELOW

NOTES:

1. AIR HANDLER WILL BE FOR 100% OUTSIDE AIR SERVICE; CONSTANT VOLUME DURING OCCUPIED HOURS.
2. COOLING COIL SECTION SHALL HAVE STAINLESS STEEL IAQ DRAIN PAN.
3. RIGHT HAND CONFIGURATION FOR ALL CONNECTIONS AND ACCESS.
4. FILTER SECTION TO ACCOMMODATE 4" THICK FILTERS (MERV 11).
5. GALVANIZED DOUBLE-WALL UNIT WITH 2" THICK FOAM FILLED INSULATION, MINIMUM R = 13.
6. MOTOR SHALL BE PREMIUM EFFICIENCY, OPEN DRIP PROOF, 1.15 SERVICE FACTOR, AND RATED FOR INVERTER DUTY.
7. 6" HIGH BASE RAIL INTEGRAL TO UNIT. CONDENSATE CONNECTION SHALL BE HIGH ENOUGH TO ALLOW FOR P-TRAP AND NO STANDING WATER IN PAN.
8. ACCESS DOORS SHALL BE HINGED WITH ROTATING DOOR LOCK AND GASKETS, AND MANUFACTURED OF THE SAME CONSTRUCTION OF THE CABINET.
9. VFD IS BY OTHERS.
10. MEAN FILTER PRESSURE DROP USED IN TSP AND BHP CALCULATIONS.
11. FC FAN, FACTORY BALANCED ACROSS OPERATING RPM, MOUNTED ON ISOLATION PLATFORM.
12. EQUIPMENT SECTIONS SHALL FIT THROUGH 3'-0"x7'-0" DOOR.

CONDENSATE PUMP SCHEDULE

DESIGNATION		CPU-2, CPU-3
SYSTEMS SERVED		VPU-2 & VPU-3
MANUFACTURER		LITTLE GIANT
MODEL		VCL-45ULS
PUMP TYPE		CENTRIFUGAL
FLOW RATE	GPH	320
DYNAMIC HEAD	FT	20
DISCHARGE SIZE	NPS	3/8" COPPER
SHUT OFF HEAD	FT	45
MOTOR ELECTRICAL CHARACTERISTICS	V/Ø/HZ	115/1/60
MOTOR HORSEPOWER & CURRENT	HP (AMPS)	1/5 (3.5)
OVERALL DIMENSIONS (LxWxH)	IN	12x6x10

NOTES:

1. MOTOR SHALL INCLUDE THERMAL OVERLOAD, AND PERMANENTLY LUBRICATED BEARINGS.
2. VOLUTE AND IMPELLER SHALL BE NYLON.
3. SHAFT SEAL SHALL BE NITRILE.
4. INLET SCREEN SHALL BE POLYETHYLENE.
5. RESERVOIR SHALL BE 1 GAL CAPACITY AND CONSTRUCTED OF ABS PLASTIC, AND INCLUDE FLOAT SWITCHES FOR PUMP ACTIVATION.
6. INCLUDE COPPER CHECK VALVE ON DISCHARGE AND 6' POWER CORD.

AHU SCHEDULE - VARIABLE AIR VOLUME (VAV)

DESIGNATION		AHU-1	
AREA SERVED		GYM & LOBBY	
MANUFACTURER		DAIKIN	
UNIT MODEL		CAH040GDGM	
CONFIGURATION (SEE BELOW)		HORIZONTAL VAV	
ORIENTATION/HANDING		RIGHT (T.B.D)	
MAX SUPPLY AIR (COOLING/HEATING)	CFM	18000	
VENTILATION AIR	CFM	9000 (FROM VPU-1)	
MAX COIL FACE VELOCITY	FPM	500	
CC ENTERING AIR CONDITIONS	°FDB/°FWB	65.9 / 61.4	
CC LEAVING AIR CONDITIONS	°FDB/°FWB	53 / 52.7	
UNIT TOTAL COOLING CAPACITY	MBH	457.7	
UNIT LATENT COOLING CAPACITY	MBH	201.5	
UNIT SENSIBLE COOLING CAPACITY	MBH	256.2	
CHILLED WATER FLOW RATE	GPM	90	
CHILLED WATER PRESSURE DROP	FT WG	10.0	
CHILLED WATER COIL FACE VELOCITY	FPM	473	
CHILLED WATER TEMP ENT/LEAV	°F / °F	44 / 54	
CHILLED WATER COIL ROWS & FINS/INCH		4 / 12	
HEATING COIL CAPACITY (MINIMUM)	MBH	500	
HC ENTERING AIR CONDITIONS	°F DB	55	
HC LEAVING AIR CONDITIONS	°F DB	80	
HOT WATER FLOW RATE	GPM	50	
HOT WATER COIL PRESSURE DROP	FT WG	3.9	
HOT WATER TEMP ENT/LEAV (MAX/MIN)	°F / °F	160 / 140	
HOT WATER COIL ROWS & FINS PER INCH		1 / 12	
PRE & FINAL FILTER STATIC (CLEAN/DIRTY)	IN WG	0.6 / 1.0	
HEATING COIL STATIC	IN WG	0.1	
COOLING COIL STATIC	IN WG	0.7	
EXTERNAL STATIC	IN WG	2.3	
TOTAL STATIC PRESS. DROP (CLEAN/DIRTY)	IN WG	3.7 / 4.1	
AHU FAN BRAKE HORSEPOWER (DIRTY)	BHP	2 @ 10.6	
AHU FAN MOTOR HORSEPOWER	HP	2 FANS @ 15 HP	
AHU ELECTRICAL CHARACTERISTICS	V/Ø/HZ	480/3/60	
MOTOR F.L.A.	AMPS	2 @ 17.5	
BREAKER SIZE (MOCP)	AMPS	2 @ 30	
MAXIMUM CABINET DIMENSIONS (LxWxH)	IN	162 x 96 x 78	
NOTES		1 THRU 14	

NOTES:

1. VENTILATION AIR FLOW RATE SHALL VARY BASED ON INDOOR CO2 CONCENTRATION (DCV) WITH A PAIR OF BALANCING DAMPERS (BY CONTROLS).
2. COOLING COIL SECTION SHALL HAVE STAINLESS STEEL IAQ DRAIN PAN AND FLOAT SWITCH.
3. FILTER SECTION TO ACCOMMODATE 2" THICK PRE-FILTERS (FUTURE) WITH 4" THICK FINAL FILTERS (MERV 11).
4. THE COOLING COIL SHALL NOT HAVE MORE THAN 8 ROWS.
5. G-60 GALVANIZED DOUBLE-WALL UNIT WITH 2" THICK FOAM FILLED INSULATION, MINIMUM R = 13.
6. MOTOR SHALL BE PREMIUM EFFICIENCY, OPEN DRIP PROOF, 1.15 SERVICE FACTOR, AND RATED FOR INVERTER DUTY.
7. ACCESS DOORS SHALL BE HINGED WITH ROTATING DOOR LOCK AND GASKETS, AND MANUFACTURED OF THE SAME CONSTRUCTION OF THE BASE.
8. VFD IS BY OTHERS, SEE SCHEDULE.
9. MEAN FILTER PRESSURE DROP USED IN TSP AND BHP CALCULATIONS.
10. FC FAN, FACTORY BALANCED ACROSS OPERATING RPM, MOUNTED ON SPRING ISOLATORS..
11. PROVIDE A 1-YEAR MANUFACTURER'S WARRANTY ON PARTS AND LABOR
12. PROVIDE BASE RAIL INTEGRAL TO UNIT. CONDENSATE CONNECTION SHALL BE HIGH ENOUGH TO ALLOW FOR P-TRAP AND NO STANDING WATER IN PAN.
13. ENTERING AIR TEMPERATURES ARE CALCULATED WITH ERV SYSTEM
14. EQUIPMENT SECTIONS SHALL FIT THROUGH 11'-0" x 3'-4" OPENING INTO THE BUILDING. UNIT CAN BE 'KNOCKED DOWN' BY CONTRACTOR ON SITE.

DRAW -THRU CONFIGURATION:

1. INLET SECTION, END INLET, WITH FILTERS
2. HOT WATER COIL
3. COOLING COIL
4. FAN SECTION, END OUTLET
5. PROVIDE ACCESS DOORS ON ONE SIDE.

FAN COIL / BLOWER COIL

DESIGNATION		FCU-1, 2, 3, 4, 5	BCU-6
AREA SERVED		LOWER LEVEL	OFFICE 207 & GYM STORAGE
MANUFACTURER		ENVIRO-TEC	ENVIRO-TEC
UNIT MODEL		HPP-12	VDD-12
CONFIGURATION (SEE BELOW)		HORIZONTAL FAN COIL	VERTICAL BLOWER COIL
ORIENTATION/HANDING		LEFT	RIGHT
MAX SUPPLY AIR (COOLING/HEATING)	CFM	1200	700
VENTILATION AIR	CFM	N/A	110
MAX COOLING COIL FACE VELOCITY	FPM	500	500
CC ENTERING AIR CONDITIONS	°FDB/°FWB	74 / 63	77.1 / 64.4
CC LEAVING AIR CONDITIONS	°FDB/°FWB	54 / 54	53.6 / 52.5
UNIT TOTAL COOLING CAPACITY	MBH	33	24
UNIT LATENT COOLING CAPACITY	MBH	8	6.6
UNIT SENSIBLE COOLING CAPACITY	MBH	25	17.4
CHILLED WATER FLOW RATE	GPM	6.7	5
CHILLED WATER CONNECTION	INCHES	1-1/8	7/8
CHILLED WATER TEMP ENT/LEAV	°F / °F	44 / 54	44 / 54
CHILLED WATER COIL ROWS & FINS/INCH		4 / 10	4 / 10
CHILLED WATER COIL FACE VELOCITY	FPM	-	-
CHILLED WATER PRESSURE DROP	FT WG	5.22	6.67
HEATING COIL CAPACITY (MINIMUM)	MBH	26	15
HC ENTERING AIR CONDITIONS	°F DB	65	60
HC LEAVING AIR CONDITIONS	°F DB	85	80
HOT WATER FLOW RATE	GPM	4	2
HOT WATER CONNECTION	INCHES	7/8	7/8
HOT WATER TEMP ENT/LEAV (MAX/MIN)	°F / °F	160 / 140	160 / 140
HOT WATER COIL ROWS & FINS PER INCH		1 / 10	1 / 8
HOT WATER PRESSURE DROP	FT WG	4.13	0.11
FILTER STATIC (CLEAN/DIRTY)	IN WG	0.3 / 1.0	0.3 / 1.0
HEATING COIL STATIC	IN WG	0.1	0.1
COOLING COIL STATIC	IN WG	0.1	0.1
EXTERNAL STATIC	IN WG	1	1.0
TOTAL STATIC PRESS. DROP (CLEAN/DIRTY)	IN WG	1.26	1.26
AHU FAN BRAKE HORSEPOWER (DIRTY)	BHP	-	-
AHU FAN MOTOR HORSEPOWER	HP	2 FANS @ 1/3	1/2
AHU ELECTRICAL CHARACTERISTICS	V/Ø/HZ	277/1/60	277/1/60
MOTOR F.L.A.	AMPS	5.9	5.1
BREAKER SIZE (MOCP)	AMPS	15	15
MAXIMUM CABINET DIMENSIONS (LxWxH)	IN	-	-
NOTES		1 - 13	1 - 10, 14, 15

NOTES:

1. COOLING COIL SECTION SHALL HAVE STAINLESS STEEL IAQ DRAIN PAN AND FLOAT SWITCH.
2. FILTER SECTION TO ACCOMMODATE 2" THICK FILTERS (MERV 11).
3. FANS SHALL HAVE ECM MOTORS FOR BAS FOR SPEED CONTROL.
4. PROVIDE LINE VOLTAGE TO 24VAC, 50VA TRANSFORMER.
4. UNIT SHALL INCLUDE REMOVABLE ACCESS PANEL. PANEL SHALL BE INSULATED.
5. VFD IS BY OTHERS, SEE SCHEDULE.
6. MEAN FILTER PRESSURE DROP USED IN TSP AND BHP CALCULATIONS.
7. FC FAN, FACTORY BALANCED ACROSS OPERATING RPM, DIRECT DRIVE.
8. PROVIDE A 1-YEAR MANUFACTURER'S WARRANTY ON PARTS AND LABOR
9. PIPING AND INLINE DEVICES ARE TO BE PROVIDED BY CONTRACTOR
10. CONTRACTOR WILL SUPPLY AND INSTALL IONIZATION SYSTEM FOR COMBATING ODORS.
11. GALVANIZED SINGLE-WALL UNIT WITH 1" THICK CLOSED CELL FOAM INSULATION.
12. UNIT TO INCLUDE BRACKETS FOR SUPPORTING FROM ABOVE.
13. GALVANIZED DOUBLE-WALL UNIT WITH 1" THICK CLOSED CELL FOAM INSULATION.
14. PROVIDE 3" BASE RAIL FOR VERTICAL UNITS.

FAN COIL CONFIGURATION:

1. END INLET, WITH FILTER
2. COOLING COIL
3. REHEAT COIL
4. FAN SECTION, END OUTLET
5. PROVIDE ACCESS DOORS ON ONE SIDE OR BOTTOM.

BLOWER COIL CONFIGURATION:

1. SIDE INLET, WITH FILTER
2. COOLING COIL
3. REHEAT COIL
4. FAN SECTION, TOP OUTLET
5. PROVIDE ACCESS DOORS ON ONE SIDE OR BOTTOM.

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Mechanical - Schedules

Revisions #	Date	Description

P.I.C. JMS
Design JB
Drawn MH
Reviewed JB
Job Number

M-101

08.28.2023

AIR COOLED ROTARY SCREW CHILLER

DESIGNATION		CH-1	
MANUFACTURER		DAIKIN	
MODEL		AWV008B	
REFRIGERANT / OPERATING CHARGE		R134a / 209 LBS	
COOLING CAPACITY (NOMINAL)	TONS	135	
UNIT POWER CONSUMPTION	KW	170.9	
FULL LOAD EFFICIENCY / EER (MIN)	BTUH / W	9.482	
INTEGRATED PART LOAD VALUE (MIN)	kW / TON	17.17	
AMBIENT CONDITIONS	°F	95°	
EVAPORATOR FLOW RATE (NOMINAL)	GPM	323 (197 MIN)	
SYSTEM PRESSURE DROP (MAX)	FT	4.6	
ENTERING WATER TEMPERATURE	°F	54°	
LEAVING WATER TEMPERATURE	°F	44°	
AVAILABLE HEAD PRESSURE for CHWS	TDH	N/A	
EXPANSION TANK	GAL	N/A	
BUFFER TANK	GAL	N/A	
FOULING FACTOR	HR-SF-°F/ BTU	0.00010	
INDEPENDENT REFRIGERANT CIRCUITS	MIN	2	
COMPRESSORS	MAX	2	
CAPACITY CONTROL DOWN TO	MIN. %	20%	
CHILLER ELECTRICAL CHARACTERISTICS	V/Ø/HZ	460 / 3 / 60	
UNIT POWER REQUIREMENT (MAX)	MCA/MOP	303 / 350	
SHORT CIRCUIT CURRENT RATING (MIN)	kA	65	
EVAP HEAT POWER ELECTRICAL	V/Ø/HZ	N/A	
EVAP HEAT POWER REQUIREMENT	MCA	N/A	
A-WEIGHTED SOUND PRESSURE 100/75/50/25	dBA	69 / 66 / 64 / 60	(at 30 FEET)
SHIPPING WEIGHT	LBS	11431	
UNIT DIMENSIONS L x W x H	IN	179 x 88 x 100	

NOTES:
1. HIGH-EFFICIENCY AIR-COOLED SCREW CHILLER; INCLUDES VARIABLE SPEED COMPRESSORS & VARIABLE SPEED PERMANENT MAGNET MOTORS FOR CONDENSER FANS. VFDs ARE FACTORY SUPPLIED, MOUNTED AND WIRED.
2. SYSTEM TO BE VARIABLE PRIMARY, WITH REDUNDANT PUMP. PUMPS BY OTHERS.
2. SINGLE-POINT POWER CONNECTION.
3. FACTORY CONTROL PANEL WITH LCD DISPLAY & BACNET CARD. BACNET OVER MS/TP OR IP.
4. LOW AMBIENT TEMPERATURE OPERATION: 0°-105°F
5. FREEZE PROTECTION TO -20°F.
6. INCLUDE EVAPORATOR INSULATION FOR HIGH HUMIDITY CLIMATE, MIN. 1.5" THICK; AND EVAP HEATER FOR FREEZE PROTECTION.
7. PROVIDE EVAPORATOR INLET STRAINER FOR FIELD INSTALLATION.
8. PROVIDE FACTORY MOUNTED AND WIRED FLOW SWITCH AT EVAP OUTLET.
9. PROVIDE NECESSARY SOUND ATTENUTAION TO MEET SCHEDULED SOUND PRESSURES.
10. PROVIDE ELASTOMERIC ISOLATORS FOR MOUNTING TO CONCRETE PAD.
11. PROVIDE FACTORY MOUNTED CIRCUIT BREAKER.
12. PROVIDE COMPLETE MANUFACTURER 5-YEAR PARTS, LABOR & REFRIGERANT WARRANTY.

BOILER SCHEDULE

DESIGNATION		B-1 & B-2
SERVICE		HYDRONIC HEAT
BOILER TYPE		CONDENSING
VENT TYPE		MFR STD
MANUFACTURER		PATTERSON KELLY
MODEL		ST1250
MAX PRESSURE	PSIG	160
MAX TEMPERATURE	°F	210
LEAVING WATER TEMP (DESIGN)	°F	160
ENTERING WATER TEMP	°F	140
FUEL TYPE		NATURAL GAS
OUTPUT CAPACITY (LOW/HIGH)	MBH	121 / 1212
HEATING EFFICIENCY	%	97
INPUT (LOW/HIGH)	MBH	125 / 1250
WATER FLOW RATE (DESIGN / MIN)	GPM	121 / 38
TEMPERATURE DIFF (DESIGN)	°F	20
WATER PRESSURE DROP (MAX)	FT WG	18
INLET GAS PRESSURE RANGE	IN WG	4" - 14"
ELECTRICAL CHARACTERISTICS	V/Ø/Hz	208 / 1 / 60
POWER REQUIREMENTS (MAX)	AMPS	20
DIMENSIONS (LxWxH)	IN	58x34x55
OPERATING WEIGHT	#	1112

FEATURES:
1. BOILERS WILL BE INSTALLED OUTDOORS IN A VARIABLE PRIMARY CONFIGURATION.
2. PROVIDE FACTORY STACK & NEUTRALIZATION KIT FOR INSTALLATION BY CONTRACTOR.
3. FULL MODULATION, 10:1 TURNDOWN
4. ASME CSD-1 RATED
5. FACTORY INTEGRATED CONTROLS
6. PROVIDE A BACNET PROTOCOL CONVERTER ON THE MASTER CONTROLLER (B-1) INCLUDING ENCLOSURE AND 24VDC POWER.
7. HIGH LIMIT AND OPERATING THERMOSTATS,
8. LOW WATER CUT-OFF, 100 PSIG PRESSURE RELIEF VALVE W/ TEMP INDICATOR.
9. PROVIDE GAS TRAIN WITH VALVES
10. HIGH EXHAUST BACK PRESSURE SWITCH
11. DP COMBUSTION AIR SWITCH
12. COMBUSTION BLOWER, VARIABLE SPEED. PROVIDE FILTER AND SPARE FILTER FOR START-UP.

GYM EQUIPMENT	COOLING LOADS		HEATING LOADS	
	MBH	GPM @ 10° DT	MBH	GPM @ 20° DT
INDUSTRIAL ARTS	284	56	369	37
CAFETERIA ANNEX	-	-	548	55
VPU-1	480	96	244	25
AHU-1	458	91	500	50
VPU-2	155	30	87	9
VPU-3	155	30	87	9
FCU-1	33	6.7	26	3
FCU-2	33	6.7	26	3
FCU-3	33	6.7	26	3
FCU-4	33	6.7	26	3
FCU-5	33	6.7	26	3
BCU-6	24	5	15	2
TOTALS	1721	342	1980	202
TONS	143.4			

VARIABLE FREQUENCY DRIVE SCHEDULE

DESIGNATION		VFD-AHU-1A & B	VFD-VPU-1A & B	VFD-VPU-1C	VFD-VPU-2	VFD-VPU-3	VFD-CHWP-1	VFD-HHWP-1
SERVICE		AHU SUPPLY FANS	VPU-1 SUPPLY FANS	VPU-1 EXHAUST FAN	AHU SUPPLY FAN	AHU SUPPLY FAN	CHILLED WATER PUMP	HOT WATER PUMP
QTY.		2	2	1	1	1	1	1
DRIVE RATED HORSEPOWER CAPACITY (MIN)	HP	15	7.5	7.5	3	3	15	10
DRIVE MOTOR FULL LOAD AMPACITY (MIN)	AMP	23	12	12	4.8	4.8	23	14
DRIVE AMBIENT OPERATING TEMP (MAX)	°F	104	104	104	104	104	104	104
MOTOR ELECTRICAL SERVICE	V/PH/HZ	480/3/60	480/3/60	480/3/60	480/3/60	480/3/60	480/3/60	480/3/60
SPEED CONTROL SIGNAL		0-10vDC	0-10vDC	0-10vDC	0-10vDC	0-10vDC	0-10vDC	0-10vDC
DRIVE EFFICIENCY (MINIMUM AT FULL LOAD)		95%	95%	95%	95%	95%	95%	95%
POWER FACTOR (MINIMUM)		0.95	0.95	0.95	0.95	0.95	0.95	0.95
DISCONNECT		YES	YES	YES	YES	YES	YES	YES
BYPASS		NO	NO	NO	NO	NO	NO	NO
ENCLOSURE TYPE		TYPE 1	TYPE 1	TYPE 1	TYPE 1	TYPE 1	TYPE 1	TYPE 1
BASIS OF DESIGN MANUFACTURER/MODEL		ABB ACH580-PDR	ABB ACH580-PDR	ABB ACH580-PDR	ABB ACH580-PDR	ABB ACH580-PDR	ABB ACH580-PDR	ABB ACH580-PDR
APPLICABLE NOTES		1-7	1-7	1-7	1-7	1-7	1-7	1-7

NOTES:
1. PROVIDE FACTORY CERTIFIED STARTUP OF NEW DRIVE.
2. PROVIDE BACNET MS/TP CONNECTIVITY.
3. PROVIDE HAND-OFF-AUTO.
4. PROVIDE THREE (3) YEAR PARTS/LABOR WARRANTY.
5. DRIVE TO INCLUDE 5% DC CHOKE.
6. DRIVE TO INCLUDE AN INPUT FOR EARLY-BREAK SIGNAL FROM MOTOR DISCONNECT SWITCH.
7. DRIVE CAPACITY SHALL ACCOMMODATE MOTOR FULL LOAD AMPACITY OR MOTOR HORSEPOWER, WHICHEVER IS HIGHER, AT THE SPECIFIED AMBIENT OPERATING TEMPERATURE.

PUMP SCHEDULE

DESIGNATION		CHWP-1 & CHWP-2	HHWP-1 & HHWP-2
SYSTEM SERVED		CHILLED WATER	HEATING HOT WATER
DUTY		VARIABLE PRIMARY	VARIABLE PRIMARY
MANUFACTURER		TACO	TACO
MODEL		CI-3011D	CI-2511D
CASING / IMPELLER		C.I. / BRONZE	C.I. / BRONZE
CONNECTION SIZES (SUCTION/DISCHARGE)	IN	4 x 3-11, 125# C.I.	3 x 2.5-11, 125# C.I.
PUMP TYPE		CLOSE-COUPLED	CLOSE-COUPLED
FLOW RATE	GPM	324	150
TEMP	°F	44	160
TOTAL DYNAMIC HEAD	FT	87	100
SHUT-OFF HEAD	FT	105	107
PUMP EFFICIENCY	%	75	67
IMPELLER DIA	IN	10	10
PUMP SPEED	RPM	1760	1760
ELECTRICAL CHARACTERISTICS	V/Ø/HZ	460/3/60	460/3/60
MOTOR HORSEPOWER	HP	15	10
MOTOR TYPE		ODP, INVERTER RATED	ODP, INVERTER RATED
SUCTION DIFFUSER, FLG'D	IN	6 x 4	4 X 3
MULTI-PURPOSE VALVE, FLG'D	IN	N/A	N/A
APPLICABLE NOTES		2, 3	2,3

NOTES:
1. FIXED-SPEED PUMP
2. PUMP OPERATED BY VARIABLE FREQUENCY DRIVE, SEE SCHEDULE
3. STANDARD MECHANICAL SEAL WITH NO EXTERNAL FLUSH.

HYDRONIC SYSTEMS DATA / EXPANSION TANK SCHEDULE

DESIGNATION		HHW-ET	CHW-ET
SYSTEM SERVED		HEATING HOT WATER	CHILLED WATER
TANK TYPE		FULL ACCEPT BLADDER	FULL ACCEPT BLADDER
MANUFACTURER		TACO	TACO
MODEL		CA140-125A	CA90-125A
SIZE	IN.	Ø20x46	Ø20x32
SYSTEM CONNECTION	IN.	1" NPT	1" NPT
MAKE-UP FILL PRESSURE	PSI	25	25
MAKE-UP RELIEF PRESSURE	PSI	75	75
MIN OPERATING TEMP	°F	70	40
MAX DESIGN TEMP	°F	170	100
APPROXIMATE SYSTEM VOLUME	GALLONS	750	1000
CALCULATED EXPANSION VOLUME	GALLONS	15.48	5.26
REQUIRED TANK VOLUME	GALLONS	30	10
APPLICABLE NOTES		1-5	1-5

NOTES:
1. RATED FOR 125 PSI & 240 F
2. REMOVABLE BUTYL RUBBER BLADDER
3. FULL ACCEPTANCE BLADDER
4. ASME Section VIII CONSTRUCTION
5. TANK TO BE UNINSULATED

AIR & DIRT SEPARATOR SCHEDULE

DESIGNATION		CHW - ADS	HHW - ADS
SYSTEM SERVED		CHW	HHW
MANUFACTURER		TACO	TACO
MODEL		4906AD-150AR	49064D-150AR
CONNECTION SIZE & TYPE		6" FLANGED	4" FLANGED
FLOW RATE	GPM	324	170
PRESS DROP (MAX)	FT H2O	1.5	2
SUPPORT	TYPE	BASE RING	BASE RING
DIMENSIONS (DIA/HT)	IN	Ø14x46	Ø12x36
DRY WEIGHT	LB	245	100
OPTIONS/FEATURES		SEE BELOW	SEE BELOW

NOTES:
1. RATED FOR 125 PSI & 350° F
2. TANGENTIAL NOZZLES FOR CENTRIFUGAL PARTICULATE REMOVAL
3. PROVIDE BASSE RING, AIR VENT, & BLOWDOWN VALVE
4. ASME Section VIII CONSTRUCTION
5. TANK TO BE INSULATED BY CONTRACTOR
6. SUPPORT PER MANUFACTUER'S INSTRUCTIONS. BASE RING WILL HAVE SUPPORTS TO GRADE.

CHEMICAL POT FEEDER SCHEDULE

DESIGNATION		HHW - CPF	CHW - CPF
SYSTEM SERVED		CHW	CHW
MANUFACTURER		NEPTUNE	NEPTUNE
MODEL		DBF-5HP	DBF-5HP
CONNECTION SIZE & TYPE		3/4" NPT	3/4" NPT
CAPACITY	GAL.	5	5
FILTER BAG KIT	-	YES	YES
DESIGN PRESSURE	PSIG	300	300
DIMENSIONS (DIA/HT)	IN	10 x 30	10 x 30
DRY WEIGHT	LB	38	38
OPTIONS/FEATURES		1	1

NOTES:
1. PROVIDE OPTIONAL FILTER BAG KIT FBK-5.
2. TANK TO BE INSULATED BY CONTRACTOR; MAINTAIN ACCESS TO CAP.

FLOW METER SCHEDULE

DESIGNATION		FM-1	FM-4
SERVICE		CHILLER	BOILER
FLUID		CHILLED WATER	HOT WATER
MANUFACTURER		ONICON	ONICON
MODEL NUMBER		F-3200	F-3200
SENSING METHOD		ELECTROMAGNETIC	ELECTROMAGNETIC
TYPE		INLINE	INLINE
CONNECTION		6" 150# FLG	3" 150# FLG
BODY		CARBON STEEL	CARBON STEEL
LINER		PTFE	PTFE
ACCURACY (FULL SCALE)		+/- 0.2%	+/- 0.2%
INPUT POWER		24 VDC	24 VDC
TRANSMITTER		INTEGRAL	INTEGRAL
OPERATING FLOW	GPM	234	145
DESIGN / OPERATING TEMPERATURE	°F	0 to 212 / 45	0 to 212 / 160
DESIGN / OPERATING PRESSURE	PSIG	580 / 60	580 / 60
OUTPUT		(2) 4-20 mA	(2) 4-20 mA
LOCAL DISPLAY		YES	YES
PROJECT QTY.		1	1
NOTES		1, 2, 3	1, 2, 3

NOTES:
1. FLOW & TEMPERATURE MONITOR. FOR LOCAL DISPLAY ONLY.
2. INSTALL PER MFR INSTRUCTIONS - 3D UPSTREAM, 2D DOWNSTREAM; METER MUST ALWAYS BE FULL OF WATER.
3. AS SPECIFIED, OR EQUIVALENT.

CHILLED/HHW WATER PIPING ACCESSORIES

DESCRIPTION	MODEL	REMARKS	QTY.
EJ-2.5, 2.5"	METRAFLEX MSRDEE	PUMP SUCTION EXPANSION JOINT, EPDM, ANSI 125#/150# FLANGED ENDS, 6" LENGTH, RETAINING RING. CONTROL RODS ARE NOT REQUIRED.	X
EJ-3, 3"	METRAFLEX MSRDEE	PUMP DISCHARGE EXPANSION JOINT, EPDM, ANSI 125#/150# FLANGED ENDS, 6" LENGTH, RETAINING RING. INCLUDE CONTROL RODS.	X
EJ-4, 4"	METRAFLEX MSRDEE	CHILLER EXPANSION JOINT, EPDM, ANSI 125#/150# FLANGED ENDS, 6" LENGTH, RETAINING RING. INCLUDE CONTROL RODS.	X
EJ-6, 6"	METRAFLEX MSRDEE	CHILLER EXPANSION JOINT, EPDM, ANSI 125#/150# FLANGED ENDS, 6" LENGTH, RETAINING RING. INCLUDE CONTROL RODS.	X

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Revisions #	Date	Description

Mechanical - Schedules

M-102

08.28.2023

LOUVER SCHEDULE

DESIGNATION			L-2	L-3	L-4	L-5
SERVICE			INTAKE/EXHAUST	INTAKE/EXHAUST	INTAKE/EXHAUST	INTAKE/EXHAUST
PROJECT QTY.			3	2	2	2
NOMINAL SIZE (WXH)	IN		11'-0" X 3'-4"	5'-8" x 2'-0"	12" x 12"	3'-0" x 2'-0"
FREE AREA (DESIGN MINIMUM)	%		57%	57%	57%	57%
DEPTH	IN		6	6	6	6
TYPE			EXTERIOR	EXTERIOR	EXTERIOR	EXTERIOR
MATERIAL/CONSTRUCTION			ALUMINUM	ALUMINUM	ALUMINUM	ALUMINUM
BASIS OF DESIGN MANUFACTURER			RUSKIN	RUSKIN	RUSKIN	RUSKIN
BASIS OF DESIGN MODEL			ELF6375DXD	ELF6375DXD	ELF6375DXD	ELF6375DXD
NOTES			1 - 5	1 - 4	1 - 4	1 - 4

NOTES:
1. CONSTRUCTED OF 6063T6 EXTRUDED ALUMINUM, DRAINABLE BLASE, POSITIONED HORIZONTALLY.
2. EXPANDED, FLATTENED ALUMINUM BIRD SCREEN, 5/8"X0.040"
3. MIAMI-DADE COUNTY APPROVED, FLORIDA PRODUCT APPROVAL.
4. SANDSTONE FINISH COLOR - VERIFY WITH OWNER.
5. PROVIDE 2" THICK INSULATED BLANK-OFF PANEL.

DIFFUSER & GRILLE SCHEDULE

TYPE	QTY.	DESCRIPTION	MODEL	REMARKS	AIR PATTERN	DAMPER
A	45	AERO BLADE SUPPLY AIR GRILLE	TITUS 271FS	SURFACE MOUNT TYPE-1, ALUMINUM CONSTRUCTION, 3/4" BLADE SPACING, EXTERNALLY-ADJ. INTEGRAL DAMPER, DOUBLE DEFLECTION, WHITE FINISH, SEE PLANS FOR SIZE	NA	YES
B	24	LOUVERED RETURN AIR GRILLE	TITUS 350FS	SURFACE MOUNT TYPE-1, ALUMINUM CONSTRUCTION, 3/4" BLADE SPACING, 35° FIXED BLADE, SINGLE DEFLECTION, WHITE FINISH, SEE PLANS FOR SIZE	NA	YES
C	8	ARCHITECTURAL SQUARE PLAQUE SUPPLY AIR GRILLE	TITUS OMNI-AA	LAY-IN TYPE, SQUARE PLAQUE, ALUMINUM CONSTRUCTION, WHITE FINISH, 24x24 MODULE SIZE, WITH OPTIONAL FACTORY MOLDED INSULATION BLANKET.	4-WAY	NO
D	3	PERFORATED RETURN AIR GRILLE	TITUS PAR	TYPE 1 SURFACE MOUNT, 3/16" Ø HOLES ON 1/4" CENTERS, ALUMINUM CONSTRUCTION, WHITE FINISH, 24x24 MODULE SIZE, 10" ROUND NECK SIZE	NA	YES
E	2	LOUVERED RETURN AIR GRILLE	TITUS 56FL	SURFACE MOUNT TYPE-1, ALUMINUM CONSTRUCTION, 3/4" BLADE SPACING, 0° FIXED BLADE, MILL FINISH, SEE PLANS FOR SIZE	NA	YES
F	20	LOUVERED RETURN AIR GRILLE	TITUS 350FS	SURFACE MOUNT TYPE-1, ALUMINUM CONSTRUCTION, 3/4" BLADE SPACING, 35° FIXED BLADE, SINGLE DEFLECTION, WHITE FINISH, SEE PLANS FOR SIZE	NA	NO

NOTES:
1. COORDINATE FINISHES WITH ARCHITECT.
2. ALL SUPPLY GRILLES WILL BE ADJUSTABLE AT TAKEOFF UOS.

LAY-IN SUPPLY AIR GRILLE NECK SIZES

AIR FLOW RANGE (CFM)	NECK SIZE SIZE (IN)
25-120	6"Ø
125-225	8"Ø
230-350	10"Ø
351-500	12"Ø

NOTES:
1. EQUIVALENT SQUARE/RECT SIZES ARE ACCEPTABLE.

LAY-IN RETURN/EXHAUST/TRANSFER AIR GRILLE CONNECTION SIZES (UOS)

AIR FLOW RANGE (CFM)	NECK/DUCT CONNECTION SIZE (UOS) (IN)
0-100	6"Ø
101-175	8"Ø
176-300	10"Ø
301-450	12"Ø
451-750	14"Ø

FAN SCHEDULE

DESIGNATION		EF-1,2	EF-3,4,5,6	EF-7
AREA/ROOM SERVED & BUILDING		-	-	-
SERVICE		LOCKER ROOM EXHAUST	TOILET EXHAUST	TOILET EXHAUST
MANUFACTURER		GREENHECK	GREENHECK	GREENHECK
MODEL		SQ-120-VG	SP-A70-VG	SQ-100-VG
TYPE		INLINE	CEILING	INLINE
FAN CONSTRUCTION		ALUMINUM	PP & GALV.	ALUMINUM
DRIVE TYPE		DIRECT	DIRECT	DIRECT
AIR FLOWRATE DESIGN	CFM	1060	70	800
DESIGN STATIC PRESSURE	IN	0.5	0.4	0.75
DESIGN FAN SPEED	RPM	1326	808	1535
RADIATED SOUND POWER	SONES	6.0	2.0	8.2
ELECTRICAL CHARACTERISTICS	V/Ø/HZ	120/1/60	120/1/60	120/1/60
MOTOR HORSEPOWER	HP	1/2	FRACTIONAL	1/4
MIN CIRCUIT AMPACITY	AMPS	8.2	0.4	4.8
OPTIONS		1-3	1, 2	1-3
CONTROL NOTES		1	2	1

OPTIONS
1. BACKDRAFT DAMPER
2. VARI-GREEN MOTOR
3. CONTRACTOR TO PROVIDE FILTER RACK FOR 1" DISPOSABLE FILTER. FILTER TO BE ACCESSIBLE.

CONTROL NOTES:
1. FAN WILL OPERATE DURING OCCUPIED HOURS VIA BAS.
2. FAN WILL OPERATE VIA OCCUPANCY SENSOR.

BIPOLAR IONIZATION

DESIGNATION		BI-FCU-1 to 5	BI-BCU-6
SYSTEMS SERVED		FCU-1 to 5	BCU-6
QTY.		5	1
MANUFACTURER		PLASMA AIR	PLASMA AIR
MODEL		602	602
TYPE		FAN COIL	BLOWER COIL
FLOW RATE	CFM	2400	2400
ELECTRICAL CHARACTERISTICS	V/Ø/HZ	24 V AC/DC	24 V AC/DC
POWER CONSUMPTION	WATTS	<1	<1

NOTES:
1. EQUIPMENT SHALL BE LISTED, INCLUDING UL 2998 FOR ZERO OZONE EMISSIONS.
2. MODULES ARE TO BE INSTALLED IN THE FAN COILS, UPSTREAM OF THE FAN INLET
3. BPI WILL ACTIVATE SIMULTANEOUSLY WITH FANS; POWER SUPPLIED FROM FCU TERMINAL STRIP.

FABRIC DUCT DIFFUSER

DESIGNATION		FDD-1	FDD-2
SYSTEMS SERVED		GYM	GYM
QTY.		1	1
MANUFACTURER		PRIHODA	PRIHODA
AIR FLOW	CFM	9,000	9,000
STATIC PRESSURE	IN WG	0.5	0.5
SIZE	INCHES x FT	Ø34" x 99 FT	Ø34" x 99 FT
PERFORATIONS	INCHES	1.5	1.5
POSITIONS		142°, 185°, 230°	130°, 175°, 218°
COLOR		RED, PANTONE 187	RED, PANTONE 187

NOTES:
1. GYM APPROXIMATE FLOOR SIZE IS 110'x97'.
2. FABRIC TO BE 100% FLAME RETARDANT POLYESTER PER UL2518
3. FABRIC TO BE PRIHODA CLASSIC (PERMEABLE) OR EQUAL. MACHINE WASHABLE.
4. DUCT TO HAVE INERNAL RINGS TO MAINTAIN SHAPE WITH NO AIRFLOW.
5. SINGLE TRACK INSTALLATION AND SUPPORTS.

DRYER POWER VENTILATOR SCHEDULE

DESIGNATION		DBF-1&2
AREA/ROOM SERVED & BUILDING		LAUNDRY RMS
SERVICE		DRYER EXHAUST
MANUFACTURER		TJERNLAND
MODEL		LB2
DRIVE TYPE		DIRECT
AIR FLOWRATE DESIGN	CFM	160
FLA	AMPS	0.5
ELECTRICAL CHARACTERISTICS	V/Ø/HZ	120/1/60
MOTOR POWER	WATTS	50
INLET / OUTLET SIZE	IN	4

NOTES
1. UNIT SHALL BE LISTED TO UL 705.
2. INSTALL SECONDARY LINT TRAP MIN. 4' FROM DRYER EXHAUST OUTLET.
3. INSTALL MANUFACTURER-SUPPLIED STATUS ALARM PANEL IN LAUNDRY ROOM PER RECOMMENDATIONS.
4. STANDARD 120V POWER CORD.
5. INSTALL PER MANUFACTURER'S RECOMMENDATIONS

HVAC SYMBOLS/LEGEND

DESIGNATION	DESCRIPTION
	LAY-IN SUPPLY AIR DIFFUSER
	LAY-IN RETURN AIR DIFFUSER WITH OUT DUCT CONNECTION
	SURFACE MOUNT SUPPLY GRILLE
	SURFACE MOUNT RETURN GRILLE
8"Ø	ROUND DUCT WITH SIZE INDICATED
T	THERMOSTAT/TEMPERATURE SENSOR & WIREWAY
T/H	TEMP/RELATIVE HUMIDITY SENSOR AND WIREWAY
12X12	RECTANGULAR DUCTWORK & INTERNAL SIZE (FREE AREA)
8"Ø	INSULATED FLEXIBLE DUCTWORK & SIZE/DIA.
	FLEXIBLE DUCT CONNECTION
	MITERED ELBOW FITTING WITH DOUBLE THICKNESS TURNING VANES
	MITERED TAKEOFF WITH MVD (PROVIDE INSULATION STANDOFF)
	MITERED TAKEOFF WITHOUT MVD (USE AT TAKEOFFS FOR VAV TERMINALS)
	EXTENT OF DEMOLITION
D	DUCT SMOKE DETECTOR
	POINT OF CONNECTION TO EXISTING
M	MANUAL VOLUME DAMPER WITH LOCKING QUADRANT
E	ELECTRIC OPERATED CONTROL DAMPER
P	PNEUMATIC OPERATOR
FD	FIRE DAMPER
FSD	COMBINATION FIRE/SMOKE DAMPER
SD	SMOKE DAMPER
1" UC	AIR FLOW VIA 1" DOOR UNDERCUT
	FLOW DIRECTION
OR	DUCT TURNING DOWN
OR	DUCT TURNING UP
	AIR FLOW DIRECTION
D 375 CFM	GRILLE AND FLOWRATE (CFM) DESIGNATION
OA-	CENTRIFUGAL DIRECT DRIVE CABINET OA SUPPLY FAN
EF-	CEILING MOUNTED EXHAUST FAN
	METHODS OF DENOTING DEMOLITION WORK
R (R)	RELOCATE AND RELOCATED, RESPECTIVELY
	SERVICE AREA - MAINTAIN CLEAR
12" AD	ACCESS DOOR WITH LATCH, DIMENSION INDICATES SIZE
UP OR DN	DUCT ELEVATION CHANGE
	SINGLE LINE DUCT (ROUND) (SIZE PER GRILLE FLOW SCHEDULE)
	FLEXIBLE DUCT (SIZE PER GRILLE FLOW SCHEDULE)
SCR	ELECTRIC HEATER WITH SCR CONTROLLER

ABBREVIATIONS

AD	ACCESS DOOR
AFF	ABOVE FINISHED FLOOR
AHAP	AS HIGH AS POSSIBLE
BAS	BLDG AUTOMATION SYSTEM
BD	BACKDRAFT DAMPER
BHP	BRAKE HORSE POWER
BOD	BOTTOM OF DUCT
BTUH	BRITISH THERMAL UNIT/HOUR
CFM	CUBIC FEET PER MINUTE
CI	CAST IRON
CLG	CEILING
CONC	CONCRETE
CHWS	CHILLED WATER SUPPLY
CHWR	CHILLED WATER RETURN
D	DUCT DETECTOR
DB	DRY BULB
DIA OR Ø	DIAMETER
DG	DOOR GRILLE
DTL	DETAIL
DW	DOMESTIC WATER
EF	EXHAUST FAN
ETR	EXISTING TO REMAIN
EX OR (E)	EXISTING
EXT	EXTERNAL OR EXTERIOR
FD	FLOOR DRAIN
FL	FLOOR
GPM	GALLONS PER MINUTE
H	HIGH
HD	HUB DRAIN
HDG	HOT-DIP GALVANIZED
HP	HORSE POWER
L	LONG
LAT	LEAVING AIR TEMPERATURE
MAX	MAXIMUM
MBH	1000 BTU/HOUR
MIN	MINIMUM
N	NEW
NIC	NOT IN CONTRACT
NPS	NOMINAL PIPE SIZE
OA	OUTSIDE AIR
OC	ON CENTER
PL	PLACES
PNL	PANEL
RA	RETURN AIR
RAG	RETURN AIR GRILLE
RLA	RATED LOAD AMPS
RV	ROOF VENT
SA	SUPPLY AIR
SAG	SUPPLY AIR GRILLE
SP	STATIC PRESSURE
SQ	SQUARE
T	TEMPERATURE
TF	TRANSFER
THK	THICK
TOD	TOP OF DUCT
TYP	TYPICAL
UG	UNDERGROUND
UOS	UNLESS OTHERWISE SPECIFIED
VAV	VARIABLE AIR VOLUME
V	VOLTS
WB	WET BULB
W	WIDE
WG	WATER GAUGE

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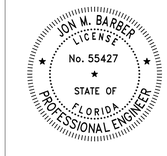

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Hoy+Stark Architects

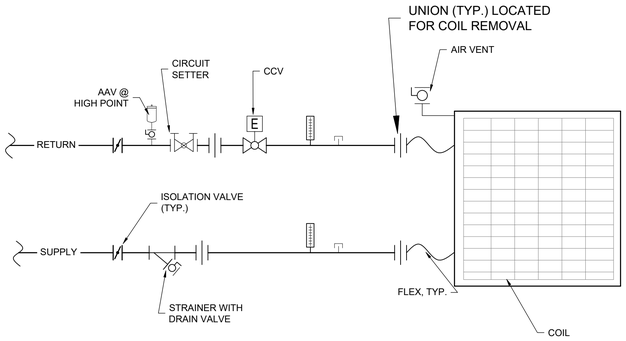
Mechanical - Schedules & Symbol Legend

Revisions #	Date	Description

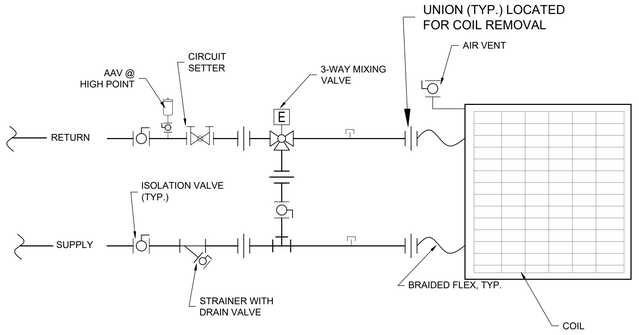
P.I.C. JMS
Design JB
Drawn MH
Reviewed JB
Job Number

M-103

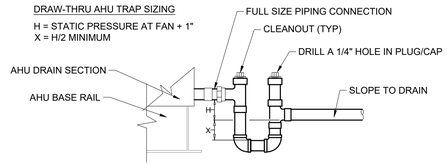
08.28.2023



COOLING COIL DETAIL - 2-WAY VALVE



HEATING COIL DETAIL - 3-WAY VALVE

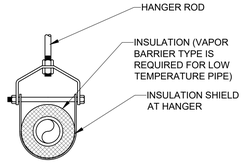


CONDENSATE P-TRAP DETAIL

SCALE: NTS

NOTES:

1. CONDENSATE PIPING SHALL BE FULL SIZE DWV OR TYPE L COPPER WITH CAST DWB OR PRESSURE SOLDER JOINTS.
2. ROUTE CONDENSATE PIPING TO NEW CONDENSATE DRAIN.
3. SLOPE CONDENSATE PIPING 1/4" PER FOOT TOWARD DRAIN.

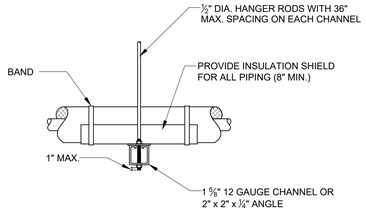


ADJUSTABLE CLEVIS HANGER

N.T.S.

NOTES:

1. INSTALL INCOMPRESSIBLE THERMAL INSERT WITH GALVANIZED SHIELD AT CLEVIS HANGERS WHERE COMPRESSIBLE INSULATION, SUCH AS FIBERGLASS, IS USED. INSERT SHALL BE EQUAL TO VALUE ENGINEERED PRODUCTS PRO-SHIELD FOR SPECIFIC PIPE SIZE.



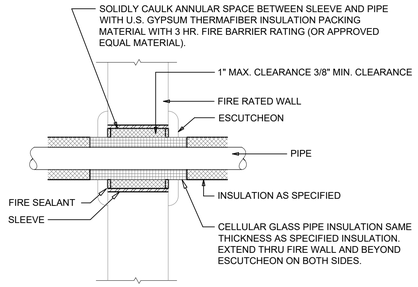
SIDE VIEW

TRAPEZE HANGER FOR UP TO 1000 LB. LOAD

N.T.S.

NOTE:

1. SEE SPECIFICATIONS FOR SPACING OF HANGERS.
2. PROVIDE INCOMPRESSIBLE INSERT AT SUPPORT.
3. MAY USE A 360° INCOMPRESSIBLE INSERT WITH GALVANIZED SHIELD EQUAL TO PRO-SHIELD AS MANUFACTURED BY VALUE ENGINEERED PRODUCTS, INC.

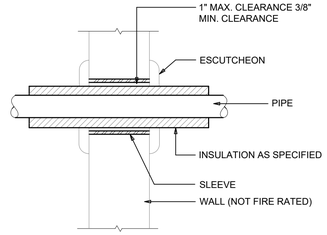


FIRE-RATED WALL PENETRATION

SCALE: NONE

NOTES:

1. SUBMIT MANUFACTURER'S UL LISTED APPROVAL FOR WALL SYSTEM AND RATING TO ARCHITECT/ENGINEER FOR REVIEW/APPROVAL.
2. SEE PLAN FOR WALL RATINGS.
3. INSTALL PRODUCTS IN STRICT ACCORDANCE WITH THE MANUFACTURER'S REQUIREMENTS AND RATING.

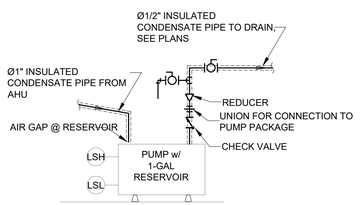


NON-RATED WALL PENETRATION

SCALE: NONE

NOTES:

1. SUBMIT MANUFACTURER'S UL LISTED APPROVAL FOR WALL SYSTEM AND RATING TO ARCHITECT/ENGINEER FOR REVIEW/APPROVAL.
2. SEE PLAN FOR WALL RATINGS.
3. INSTALL PRODUCTS IN STRICT ACCORDANCE WITH THE MANUFACTURER'S REQUIREMENTS AND RATING.

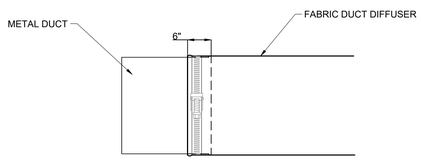


CONDENSATE PUMP DETAIL

SCALE: NTS

NOTES:

1. THERE WILL BE A CONDENSATE PUMP AND PIPING AT THE AIR HANDLER.
2. PUMP TO BE INSTALLED LEVEL ON SUPPORTS.
3. SECURE PUMP TO ITS SUPPORTS TO PREVENT MOVEMENT.
4. PUMP PACKAGE WILL INCLUDE 1-GALLON RESERVOIR FOR COLLECTING CONDENSATE, AND AN OPTIONAL CHECK VALVE.
5. ON FAILURE OF THE PUMP, THE RESERVOIR SHOULD BE ABLE TO OVERFLOW TO GROUND AND ALLOW THE AHU TO CONTINUE OPERATION.
6. THE LEVEL SWITCHES WILL AUTOMATICALLY START AND STOP THE PUMP
7. THE INLET & OUTLET CONDENSATE PIPING SHALL BE INSULATED OUTDOORS AND IN UNCONDITIONED ATTIC SPACES.
8. PIPING SIZES SHALL MATCH THE CONDENSATE CONNECTION ON THE AHU.

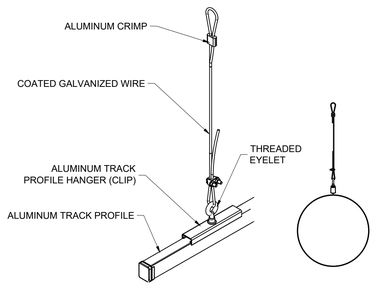


FABRIC DUCT INLET CONNECTION DETAIL

SCALE: NTS

NOTES:

1. FABRIC DUCT DIFFUSER SLIPS OVER METAL DUCT BY 6" AND IS SECURED BY SS CLAMP OR TEXTILE BAND WITH BUCKLE

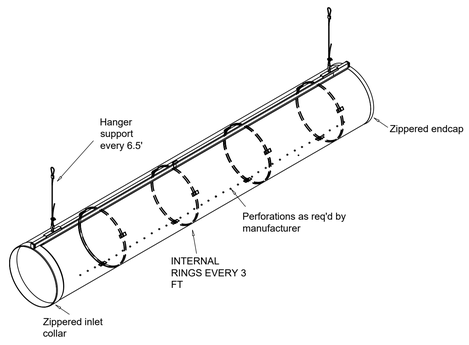


FABRIC DUCT HANGER DETAIL

SCALE: NTS

NOTES:

1. SINGLE TRACK PROFILE
2. SUPPORT FROM STRUCTURE



FABRIC DUCT INSTALLATION DETAIL

SINGLE TRACK PROFILE

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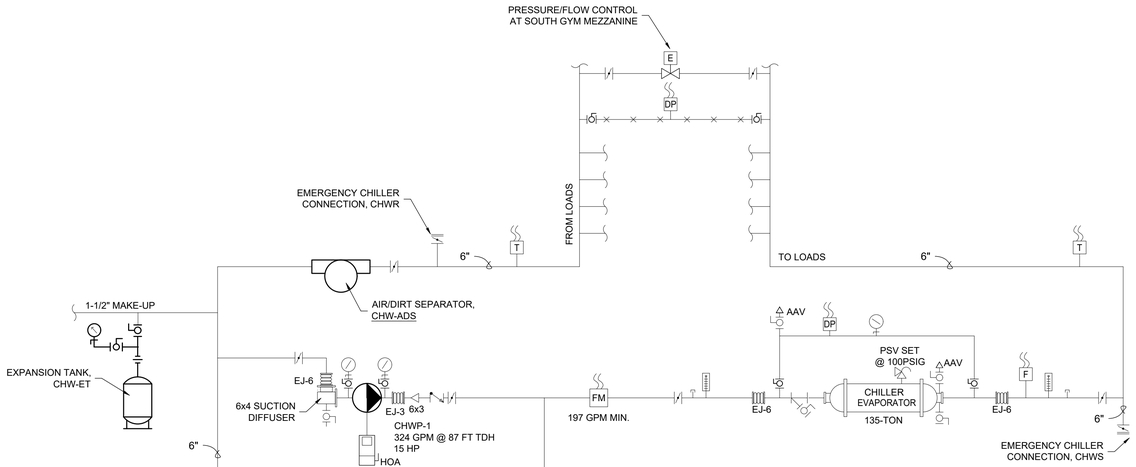
JON M. BARBER LICENSE No. 55427 STATE OF FLORIDA PROFESSIONAL ENGINEER

Revisions #	Date	Description

P.I.C.	JMS
Design	JB
Drawn	MH
Reviewed	JB
Job Number	08.28.2023

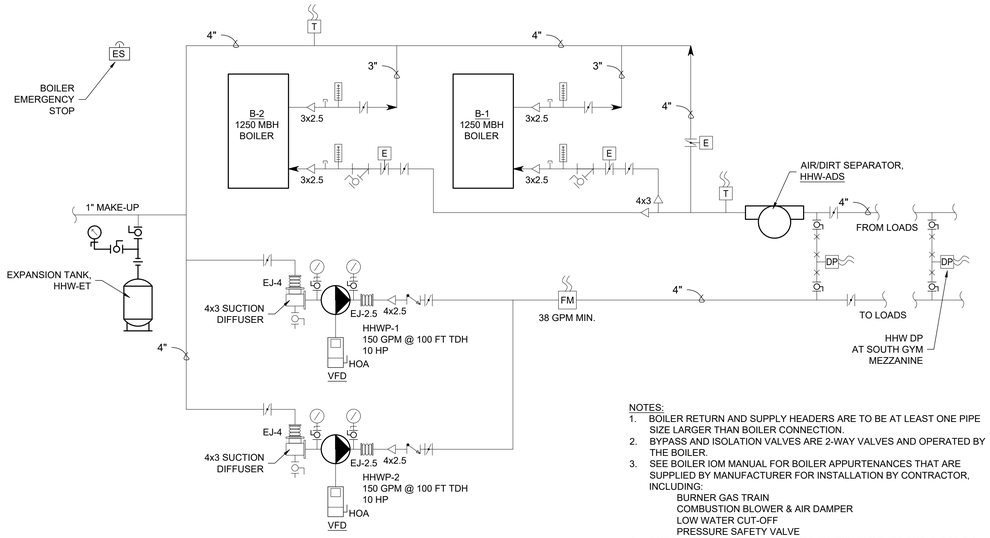
Mechanical - Details

M-104



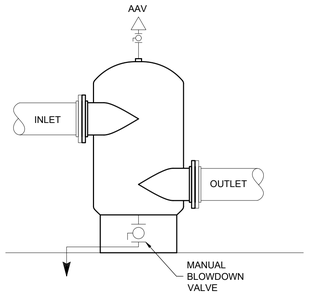
NOTES:
1. CHILLER WILL MOUNT ON MANUFACTURER SUPPLIED ELASTOMERIC ISOLATORS. ISOLATORS TO BE DRILLED & EPOXYED INTO FOUNDATION PER MFR INSTRUCTIONS.
2. INSTALL CHILLER PER MFR INSTRUCTIONS.
3. COORDINATE AND INSTALL DEVICES THAT ARE SHIPPED LOOSE WITH THE CHILLER. SEE CHILLER IOM MANUAL.
4. PROVIDE ADEQUATE PIPE SUPPORT INDEPENDENT OF EVAPORATOR.
5. THE CHILLED WATER PUMPS SHALL BE CONTROLLED BY THE CHILLER
6. INSTALL INSTRUMENTS INTO PIPING. INSTRUMENTS TO BE SUPPLIED BY THE CONTROLS CONTRACTOR; PIPING CONNECTIONS BY MECHANICAL CONTRACTOR
7. FULLY INSULATE PIPING & APPURTENANCES TO MITIGATE CONDENSATION.

VARIABLE PRIMARY CHILLED WATER PIPING SCHEMATIC



NOTES:
1. BOILER RETURN AND SUPPLY HEADERS ARE TO BE AT LEAST ONE PIPE SIZE LARGER THAN BOILER CONNECTION.
2. BYPASS AND ISOLATION VALVES ARE 2-WAY VALVES AND OPERATED BY THE BOILER.
3. SEE BOILER IOM MANUAL FOR BOILER APPURTENANCES THAT ARE SUPPLIED BY MANUFACTURER FOR INSTALLATION BY CONTRACTOR, INCLUDING:
   - BURNER GAS TRAIN
   - COMBUSTION BLOWER & AIR DAMPER
   - LOW WATER CUT-OFF
   - PRESSURE SAFETY VALVE
4. BOILERS SHALL HAVE REMOTE KILL SWITCH SUPPLIED AND WIRED BY CONTROLS CONTRACTOR.
5. BOILER CONDENSATE IS ACIDIC AND SHALL BE TREATED THROUGH A CONDENSATE NEUTRALIZATION KIT.
6. BOILERS AND PUMPS TO BE STAGED ON RETURN AND SUPPLY TEMPERATURE.
7. MINIMUM FLOW FOR BOILER FIRING SHALL BE 38 GPM.
8. MAXIMUM FLOW THROUGH A SINGLE BOILER SHALL BE 140 GPM

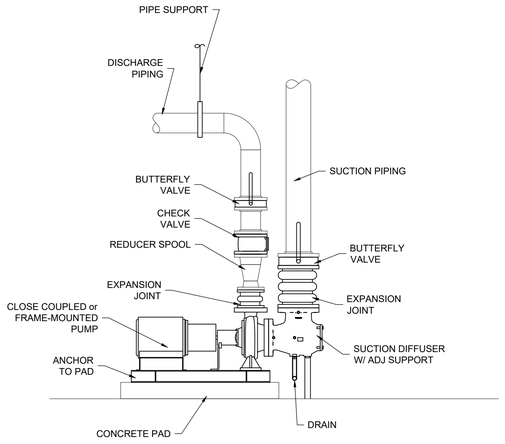
VARIABLE PRIMARY HOT WATER PIPING SCHEMATIC



AIR-DIRT SEPARATOR DETAIL

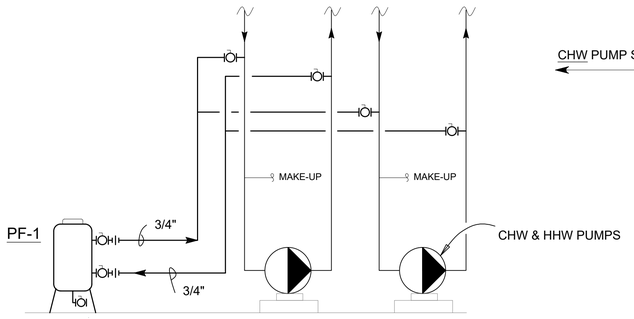
SCALE: NTS

NOTES:
1. SEE EQUIPMENT SCHEDULE.
2. DIRECT AIR VENT & BLOWDOWN TO A SAFE LOCATION.
3. INSULATE AIR SEPARATOR.



PUMP DETAIL

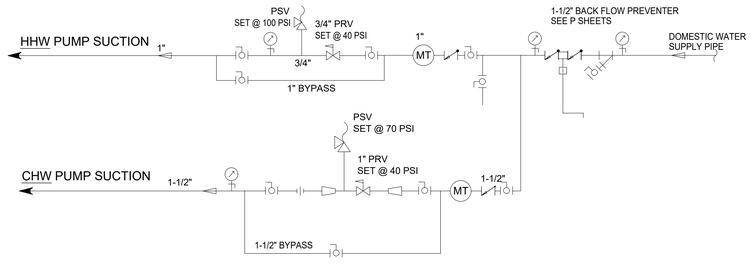
SCALE: NTS



BY-PASS FEEDER DETAIL

NTS

NOTES:
1. INSTALL UNIT PER THE MANUFACTURER'S REQUIREMENTS.
2. PROVIDE ISOLATION VALVES AT CONNECTION TO MAIN PIPING.
3. INSULATE PIPING, VALVES, TANK.



MAKE-UP WATER STATION SCHEMATIC

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Mechanical - Details

M-105

08.28.2023

Revisions #	Date	Description

P.I.C.	JMS
Design	JB
Drawn	MH
Reviewed	JB
Job Number	Hoy+Stark Architects

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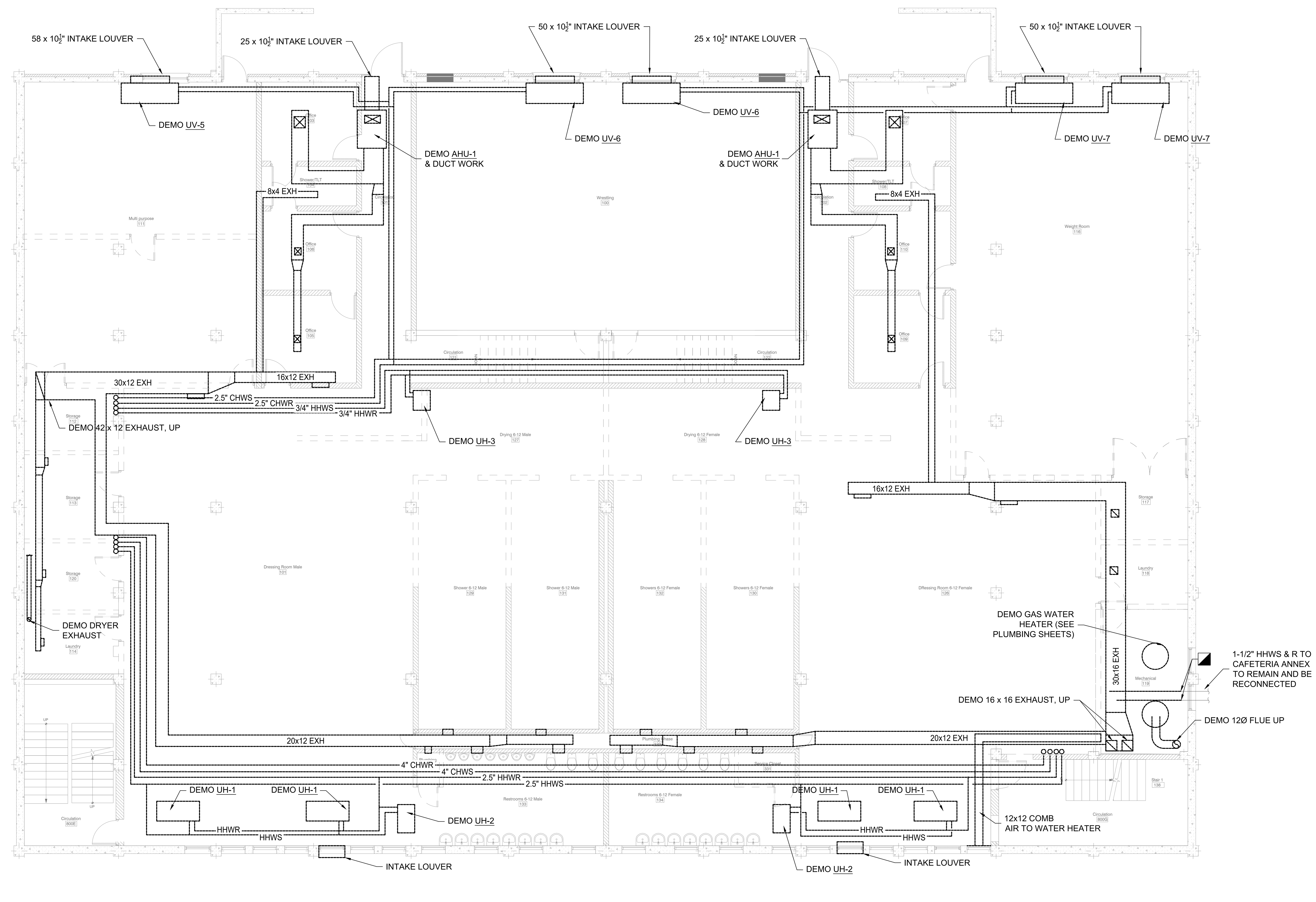
SHEET NOTES:

1. COMPLETE MECHANICAL SYSTEMS WILL BE REMOVED FROM THE GYM, INCLUDING:
   - AIR HANDLERS
   - FAN COIL UNITS
   - UNIT HEATERS
   - UNIT VENTILATORS
   - DUCTS, DIFFUSERS, GRILLES
   - EXHAUST FANS AND DUCTS
2. ALL HVAC CONTROLS - THERMOSTATS, SENSORS, CONTROLLERS, WIRING, ETC. - ARE TO BE REMOVED. THE CONTROLS CONTRACTOR SHALL SALVAGE MODULES, THERMOSTATS AND SUPPLY AIR SENSORS AND RETURN THEM TO LCS.
3. ALL HYDRONIC PIPING FOR CHW, HHW, CONDENSATE, ETC. SHALL BE DEMOLISHED IN THE GYM.



01/Mechanical Demolition Plan - Lower Floor

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

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JON M. BARBER LICENSE No. 55427 STATE OF FLORIDA PROFESSIONAL ENGINEER

Mechanical Demo Plan - Lower Floor

Revisions #	Date	Description

P.I.C.	JMS
Design	JB
Drawn	MH
Reviewed	JB
Job Number	

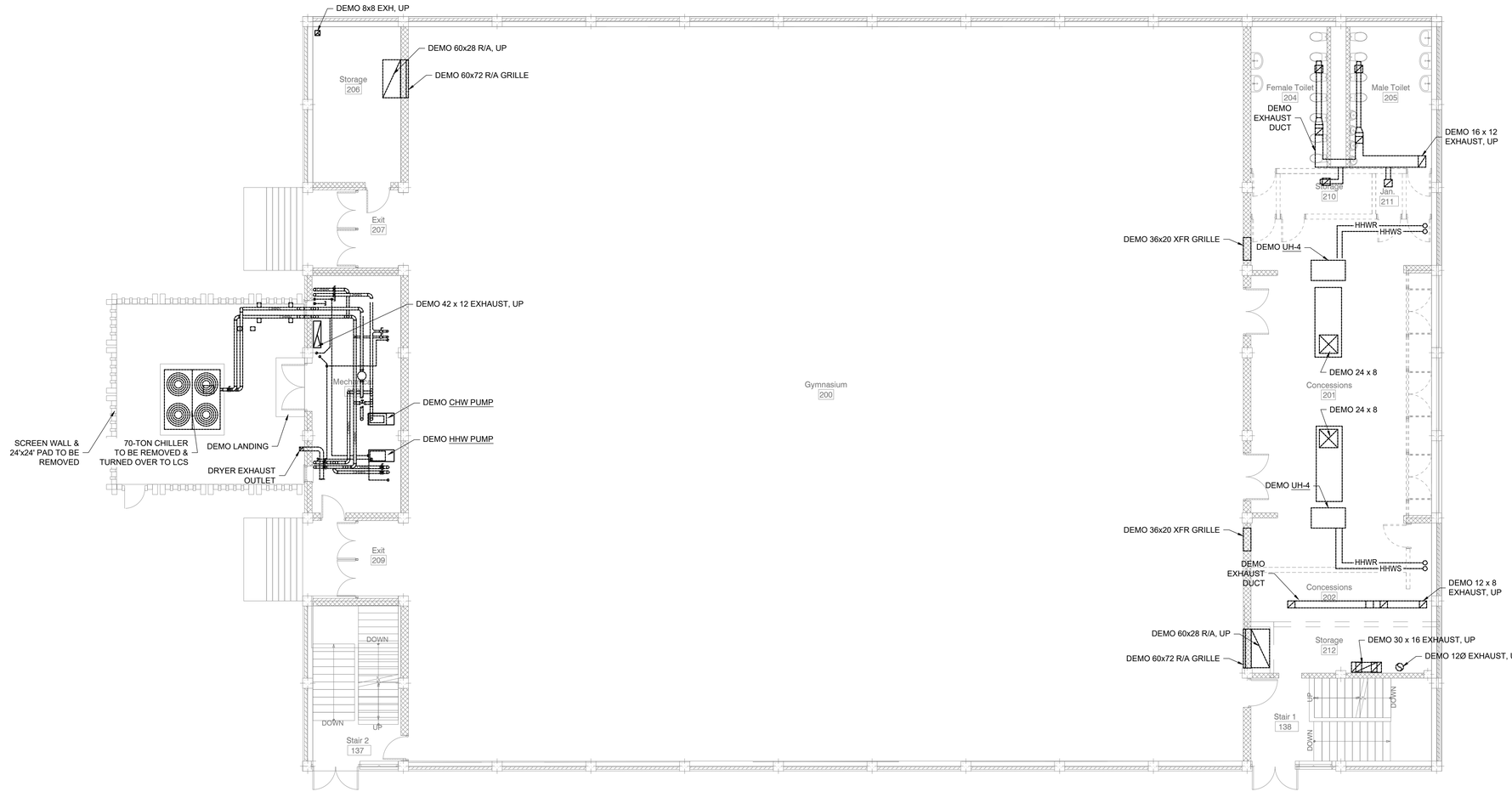
M-200

08.28.2023

Hoy+Stark Architects 1350 Market Street - Suite 209 Tallahassee Florida 32312

SHEET NOTES:

1. EXISTING 70-TON CHILLER IS TO BE CAREFULLY REMOVED & TURNED OVER TO LCS FOR RELOCATION. ALL ASSOCIATED CONTROLS/DEVICES SHALL BE SALVAGED.
2. DEMO ALL HYDRONIC PIPING, PUMPS, AND TANKS ASSOCIATED WITH CHILLER & BOILERS.
3. SCREEN WALL WILL BE DEMOLISHED. CONCRETE PAD WILL BE DEMOLISHED. LANDING OUTSIDE DOUBLE DOORS WILL BE DEMOLISHED.
4. DEMO UNIT HEATERS IN LOBBY, INCLUDING DUCT AND HHW PIPING.
5. DEMO ALL EXHAUST DUCTS FOR RESTROOMS.
6. RETURN AIR GRILLES IN THE WALL TO THE GYM WILL BE DEMOLISHED, HOLES WILL BE FILLED.



01/Mechanical Demolition Plan - Main Floor

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

N

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Mechanical Demo Plan - Main Floor

Revisions #	Date	Description

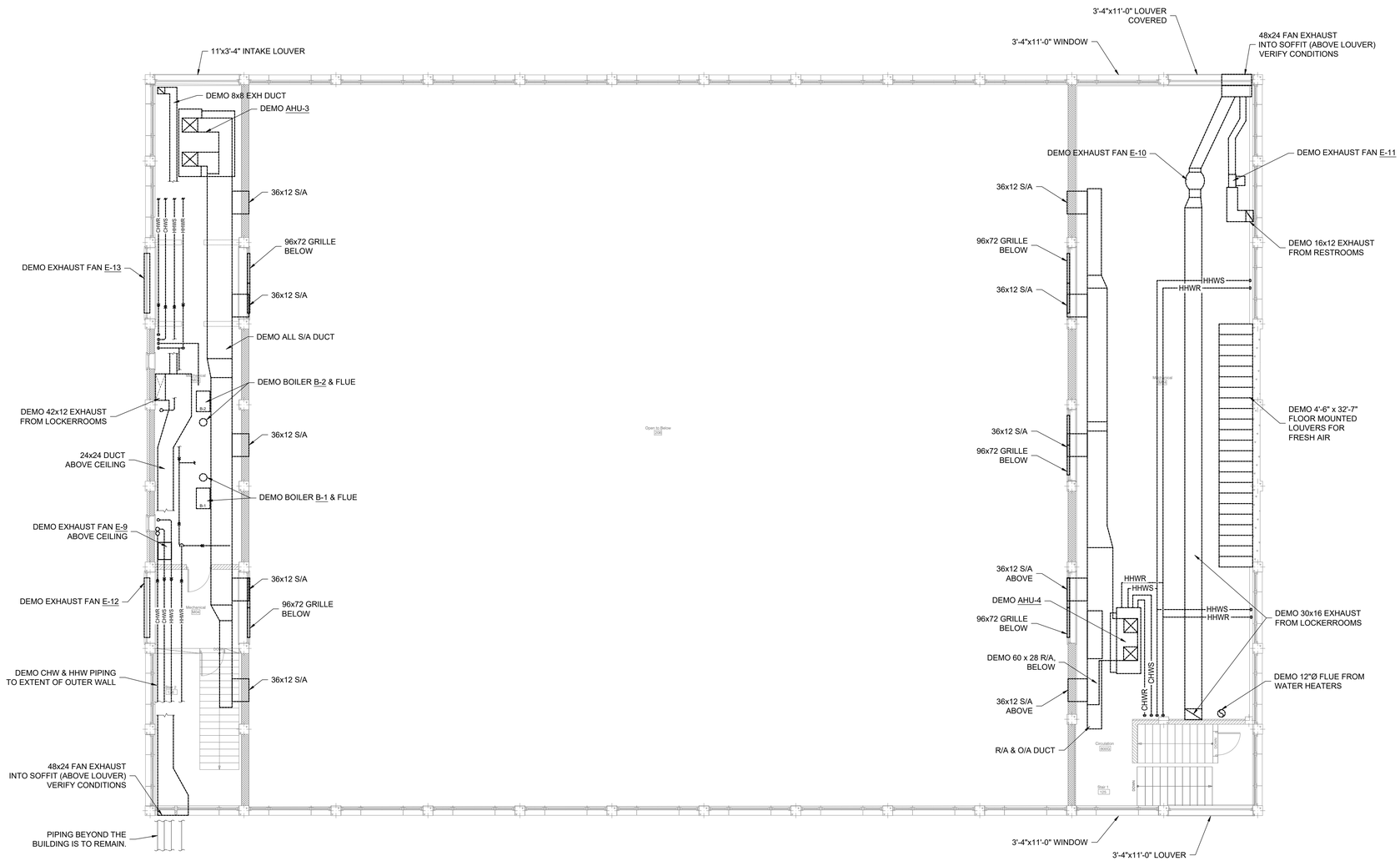
P.I.C.	JMS
Design	JB
Drawn	MH
Reviewed	JB
Job Number	

M-201

08.28.2023

SHEET NOTES:

1. DEMO AIR HANDLERS AHU-3 & AHU-4 ON THE MEZZANINES.
2. DEMO ALL SUPPLY AIR, RETURN AIR, AND OUTSIDE AIR DUCTS CONNECTED TO AIR HANDLERS. DEMO ALL GRILLES & DIFFUSERS.
3. DEMO EXHAUST DUCTS AND FANS.
   (VERIFY CONDITION OF EXHAUST AT SOUTH MEZZANINE.)
4. DEMO FRESH AIR DAMPERS AT FLOOR LEVEL AT SOUTH END.
5. DEMO ALL HYDRONIC PIPING IN THE MEZZANINES.
6. DEMO EXHAUST FANS EF-12 & EF-13 IN THE NORTH WALL
7. DEMO BOILERS, GAS PIPING, & FLUES AT NORTH END.
8. BOILER FLUES AND WATER HEATER FLUES THROUGH THE ROOF WILL BE DEMOLISHED; THERE WILL BE NO REPLACEMENT FLUES - PATCH HOLES IN THE ROOF.



01/Mechanical Demolition Plan - Mezzanine Floor

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

N

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1350 Market Street - Suite 209

Mechanical Demo Plan - Mezzanine

Revisions #	Date	Description

P.I.C.	JMS
Design	JB
Drawn	MH
Reviewed	JB
Job Number	Hoy+Stark Architects

M-202

08.28.2023

SHEET NOTES:

1. INSTALL ALL SCHEDULED EQUIPMENT; FABRICATE AND INSTALL DUCT AND HYDRONIC PIPING.
2. DUCT WORK IN BASEMENT IS TO BE DOUBLE-WALL INSULATED GALVANIZED DUCT TO PROVIDE A LONG-TERM DURABLE INSTALLATION. ROUTE DUCT AS HIGH AS POSSIBLE.
3. COORDINATE LOUVERS WITH ARCHITECTURAL; OUTSIDE AIR AND EXHAUST DUCTS WILL ATTACH TO LOUVERS.
4. INSTALL FAN COIL UNITS GENERALLY WHERE SHOWN AND SUSPEND FROM ABOVE. FAN COIL UNITS WILL HAVE BIPOLAR IONIZATION EQUIPMENT TO HELP MITIGATE ODORS.
5. INSTALL NEW DRYER DUCT BOOSTER FANS WHERE SHOWN. FOLLOW MANUFACTURER'S INSTALLATION GUIDELINES. INSTALL SECONDARY LINT TRAP 4' FROM DRYER EXHAUST OUTLET. ROUTE 4"Ø EXHAUST DUCT TO NEW EXHAUST LOUVERS WHERE SHOWN. INSTALL EXHAUST FAN STATUS ALARM PANEL IN LAUNDRY ROOM PER MANUFACTURER'S INSTRUCTIONS.

01/Mechanical New Work Plan - Lower Floor

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

N

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Hoy+Stark Architects

#	Revisions Date	Description

P.I.C.	JMS
Design	JB
Drawn	MH
Reviewed	JB
Job Number	

Mechanical Plan - Lower Floor

M-300

08.28.2023

SHEET NOTES:

1. INSTALL ALL SCHEDULED EQUIPMENT; FABRICATE AND INSTALL DUCT AND HYDRONIC PIPING.
2. EXPOSED DUCT WORK IN LOBBY IS TO BE DOUBLE-WALL INSULATED GALVANIZED DUCT TO PROVIDE A LONG-TERM DURABLE INSTALLATION. ROUTE DUCT AS HIGH AS POSSIBLE.
3. DUCT ABOVE CEILINGS IS TO BE SINGLE WALL DUCT WITH EXTERNAL INSULATION.

01/Mechanical New Work Plan - Main Floor

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

N

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1350 Market Street - Suite 209

Hoy+Stark Architects

Revisions #	Date	Description

P.I.C.	JMS
Design	JB
Drawn	MH
Reviewed	JB
Job Number	

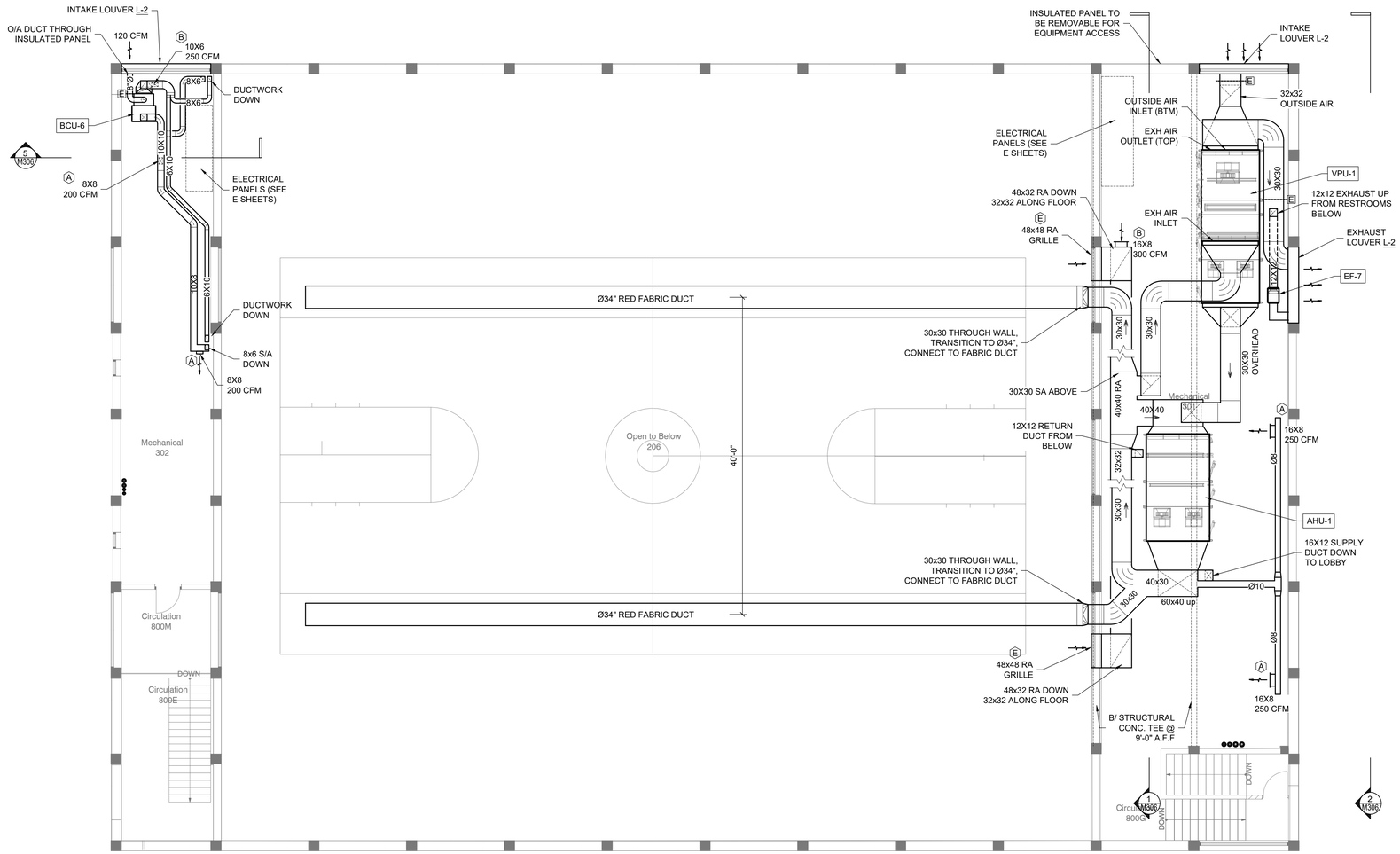
Mechanical Plan - Main Floor

M-301

08.28.2023

SHEET NOTES:

1. INSTALL VENTILATION PROCESSING UNIT AND AIR HANDLER IN MEZZANINE TO SUPPLY GYMNASIUM. THE UNITS SHALL BE FULLY "KNOCKED-DOWN" BEFORE BRINGING PANELS INTO THE BUILDING.
2. INSTALL NEW FABRIC ROUND DUCT (PRIHODA OR SIMILAR) TO SUPPLY GYMNASIUM.
3. COORDINATE LOUVERS WITH ARCHITECTURAL; OUTSIDE AIR AND EXHAUST DUCTS WILL ATTACH TO LOUVERS.



01/Mechanical New Work Plan - Mezzanine Floor

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

N

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Mechanical Plan - Mezzanine

M-302

08.28.2023

#	Revisions Date	Description

P.I.C.	JMS
Design	JB
Drawn	MH
Reviewed	JB
Job Number	

01/Mechanical Piping Plan - Lower Floor

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

N

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Hoy+Stark Architects

#	Date	Description

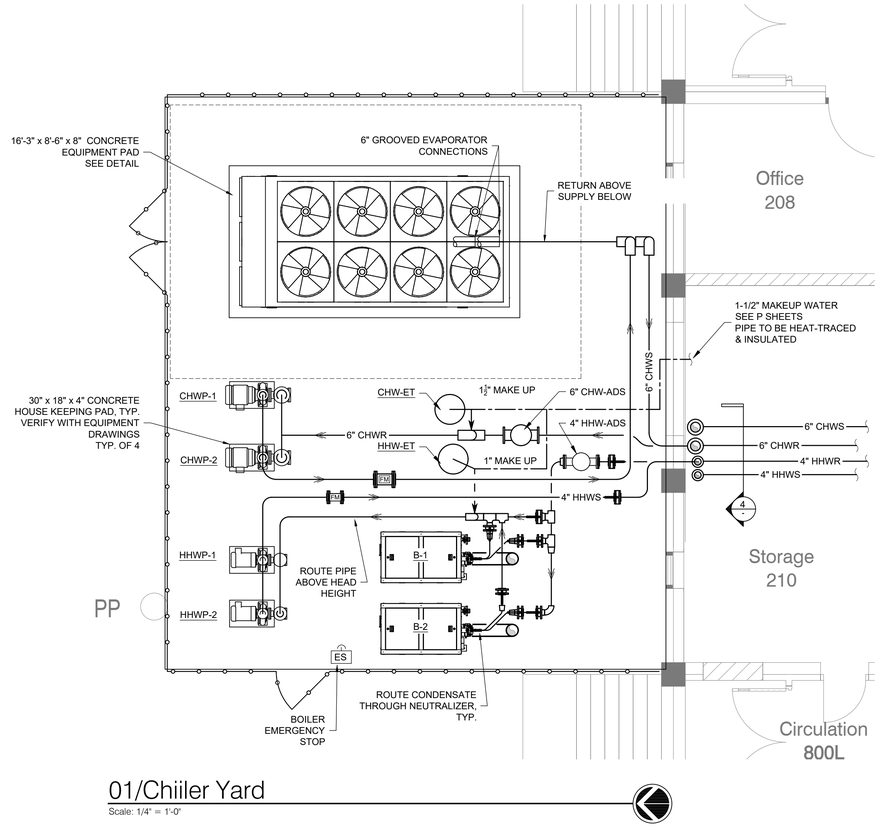
Revisions

P.I.C.	JMS
Design	JB
Drawn	MH
Reviewed	JB
Job Number	

08.28.2023

M-303

Mechanical Plan - Piping Lower Floor



01/Chiiler Yard

Scale: 1/4" = 1'-0"

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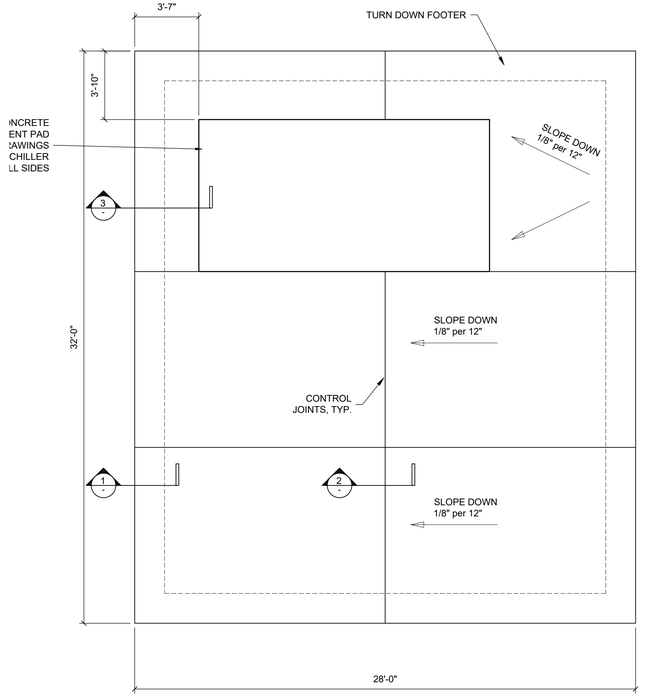
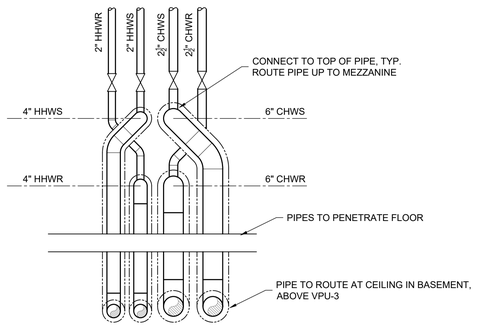


02/New Chiller Slab

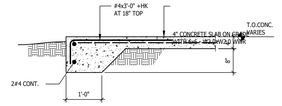
Scale: 1/4" = 1'-0"

N

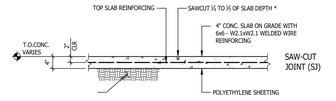


4 PIPE SECTION THROUGH WALL

DRILL & SLEEVE HOLES IN EXTERIOR WALL LEAVE AT LEAST 3 COURSES OF BRICKS BETWEEN LAYERS. SEAL OPENINGS WEATHER TIGHT.

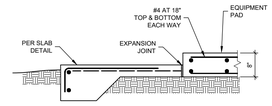


1 SLAB EDGE DETAIL



* SAWCUT AS SOON AS POSSIBLE AFTER CONCRETE HARDENS.

2 SLAB CONTROL JOINTS
SLAB ON GRADE



3 EQUIPMENT PAD DETAIL

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Mechanical Plan - Chiller Yard

Revisions #	Date	Description

P.I.C.	JMS
Design	JB
Drawn	MH
Reviewed	JB
Job Number	

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M-304

08.28.2023

01/Mechanical Piping Plan - Mezzanine

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

N

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Mechanical Plan - Piping Mezzanine

M-305

08.28.2023

Revisions #	Date	Description

P.I.C.	JMS
Design	JB
Drawn	MH
Reviewed	JB
Job Number	

1 MEZZANINE SECTION
1/4" = 1'-0"
M302

2 MEZZANINE SECTION
1/4" = 1'-0"
M302

3 VPU-2 SECTION
1/4" = 1'-0"
M300

4 VPU-3 SECTION
1/4" = 1'-0"
M300

5 BCU-6 SECTION
1/4" = 1'-0"
M302

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Revisions #	Date	Description

P.I.C.	JMS
Design	JB
Drawn	MH
Reviewed	JB
Job Number	

Mechanical Sections

M-306

08.28.2023

HVAC CONTROLS:

- DEMOLITION: DURING THE DEMOLITION PHASE, THE CONTROLS CONTRACTOR SHALL SALVAGE MODULES, THERMOSTATS, AND SUPPLY AIR SENSORS AND RETURN THEM TO LCS.

- CONTROL SYSTEM INCLUDES BUT IS NOT LIMITED TO LABOR AND MATERIALS FOR TERMINATIONS, PATHWAYS, INSTALLATIONS, CERTIFICATIONS, TESTING, SYSTEM VERIFICATION, PROJECT COMMISSIONING, INTEGRATION EQUIPMENT, AND INSTRUMENTATION.

- CONTROL WIRING REQUIRED FOR THIS SYSTEM SHALL BE PROVIDED & INSTALLED PER DIVISION 26. WIRING MUST BE IN CONDUIT OVER ITS ENTIRE LENGTH; COORDINATE SUPPORTS & WALL PENETRATIONS WITH OTHER TRADES.
  1. INSIDE CONTROL WIRING: MINIMUM OF ¾" CONDUIT FOR ALL CONTROL WIRING WITH EXCEPTION OF ½" FOR THE ROOM TEMPERATURE WALL SENSORS BACK TO THE TERMINAL UNIT.
  2. AHU MECHANICAL ROOMS: MINIMUM OF ¾" CONDUIT FOR ALL CONTROL WIRING - WITH ½ INCH STEEL FLEX (6FT. MAX) - WITH ALL STEEL FITTINGS FOR EMT AND FLEX CONNECTORS.
  3. CENTRAL PLANT: EMT ABOVE 6FT ABOVE FINISHED FLOOR. RIGID BELOW 6FT + SEALTITE (6FT MAX) TO ALL DEVICES.
  4. TSTATS: 2 X 4 VERTICAL BOX BY ELECTRICAL DIVISION. LOCATIONS TO BE COORDINATED WITH OTHER TRADES
  5. CONDUITS BETWEEN BUILDINGS: 1" BY ELECTRICAL DIVISION. THESE TYPICALLY RUN BETWEEN COMM ROOMS OR BETWEEN TWO MECHANICAL ROOMS.
  6. EXTERIOR CONDUIT: RIGID CONDUIT+ SEALTITE FOR ANY OUTSIDE CONTROL WIRING.

- UNLESS EXPLICITLY LISTED BELOW, THE CONTROLS DEVICES AND PROGRAMMING SHALL BE SUPPLIED BY THE CONTROLS CONTRACTOR. THE SEQUENCE ON THIS SHEET SHALL GOVERN THE OPERATION OF THE CONTROLS.
  1. THE VFDs ARE SUPPLIED BY THE OWNER

- THE CONTROLS CONTRACTOR SHALL PROVIDE THE FOLLOWING EQUIPMENT AND COORDINATE INSTALLATION WITH THE MECHANICAL AND ELECTRICAL CONTRACTORS:
  1. 2-WAY COOLING COIL VALVES, MODULATING, FAIL CLOSED
  2. 3-WAY HEATING COIL VALVES, DIVERTING, MODULATING, FAIL TO BYPASS POSITION
  3. R/A & O/A CONTROL DAMPERS AND ACTUATORS. MODULATING OPERATION.
  4. ANALOG AND BINARY DEVICES FOR AHU AND DUCT - VERIFY REQUIRED STRAIGHT RUN REQ'S
  5. ANALOG AND BINARY DEVICES FOR HYDRONIC SYSTEMS - VERIFY REQUIRED STRAIGHT RUN REQ'S

- ALL DEVICES SHALL BE INTEGRATED INTO THE BAS; VISIBLE AND CONTROLLABLE (WHERE APPLICABLE) IN THE USER INTERFACE.

- PRIOR TO START-UP, PERFORM SYSTEM OPERATIONAL CHECKOUT.

- PROVIDE OWNER TRAINING, INCLUDING PROCESS TO START-UP AND OPERATE EQUIPMENT

- AT THE END OF THE PROJECT, PROVIDE RECORD DOCUMENTS, MANUFACTURER INFORMATION FOR BAS & INSTRUMENTS, AND OPERATION MANUALS.

CONTROLS LEGEND & ABBREV.

DESIGNATION	DESCRIPTION
T/H	SPACE TEMP/RH SENSOR & WIREWAY
D	DUCT DETECTOR
	THERMOMETER
	PRESS GAUGE & COCK
F	FLOW SWITCH
T	TEMPERATURE SENSOR
FS	FREEZE STAT
HP	HIGH PRESSURE SWITCH
SP	STATIC PRESSURE
LS	LEVEL SWITCH
RH	HUMIDISTAT
FM	FLOW METER
DP	DIFFERENTIAL PRESSURE TRANSDUCER
CT	CURRENT TRANSDUCER
E	ELECTRIC ACTUATOR
M	MANUAL ACTUATOR
ES	EMERGENCY SWITCH
	PUMP
PT	PRESS/TEMP PORT
	TWO-WAY CONTROL VALVE
	THREE-WAY CONTROL VALVE
HOA	COMBINATION MOTOR STARTER DISCONNECT WITH HOA SWITCH
HOA	VARIABLE FREQ. DRIVE W/HOA SWITCH
T	SPACE TEMPERATURE SENSOR & WIREWAY
BAS	BUILDING AUTOMATION SYSTEM

CHILLED WATER SYSTEM

GENERAL

THIS PROJECT WILL INSTALL A 135-TON AIR-COOLED CHILLER AND 2 VARIABLE PRIMARY PUMPS IN AN N+1 CONFIGURATION. THE PUMPS SHALL BE CONTROLLED BY THE CHILLER.

THE CHILLER IS SUPPLIED WITH A MANUFACTURER CONTROLLER WITH BACNET COMPATIBILITY. COMMUNICATION WITH CHILLER & DEVICES SHALL BE VIA BACNET, INCLUDING PUMP CONTROL & FLOW SWITCH STATUS.

THE MECHANICAL CONTRACTOR SHALL COORDINATE WITH THE CONTROLS CONTRACTOR.

PROVIDE CHILLER AND PRIMARY PUMP GRAPHICS. OUTDOOR AIR TEMPERATURE SHALL BE DISPLAYED ON THE CHILLER SCREEN.

PROGRAM TREND DATA FOR KEY OPERATING PARAMETERS OF PLANT SYSTEMS TO INCLUDE CHILLER % RATED AMPS, LEAVING AND ENTERING WATER TEMPERATURES, SETPOINTS, RUN TIME, EQUIPMENT STATUS, PROOF OF FLOW, CHILLER DP, ALARMS, ETC.

START-UP SEQUENCE
THE SYSTEM SHALL NOT BE ALLOWED TO START UNLESS ALL SAFETIES ARE OUT OF ALARM.

THE SYSTEM SHALL BE ACTIVE ANY TIME AN ASSOCIATED AIR HANDLING UNIT IS ACTIVE AND CALLS FOR COOLING.

UPON START-UP COMMAND, VIA BAS:
1. LEAD CHILLER ISOLATION VALVE OPENS.
2. LEAD PUMP STARTS, IS COMMANDED TO MINIMUM SPEED OF 36 Hz (ADJ) AND IS PROVEN
3. LEAD CHILLER STARTS AND IS PROVEN.
4. DIFFERENTIAL PRESSURE RESET SEQUENCE ACTIVATES.
5. TEMPERATURE CONTROL SEQUENCE ACTIVATES.
6. BYPASS CONTROL VALVE SEQUENCE ACTIVATES.

IF A PUMP OR CHILLER IS NOT PROVEN WITHIN 60 SECONDS OF START COMMAND, THE SHUTDOWN SEQUENCE ACTIVATES FOR THAT EQUIPMENT, AN ALARM IS GENERATED, AND THE LAG EQUIPMENT STARTS.

DIFFERENTIAL PRESSURE RESET
EVERY 15 MINUTES (ADJ), THE DIFFERENTIAL PRESSURE SETPOINT RESETS WITHIN MINIMUM AND MAXIMUM LIMITS:
1. IF ANY ASSOCIATED CHILLED WATER VALVE COMMAND IS GREATER THAN 90% (ADJ), INCREASE SETPOINT BY 1.0 PSID (ADJ).
2. IF ALL ASSOCIATED CHILLED WATER VALVE COMMANDS ARE LESS THAN 60% (ADJ), DECREASE SETPOINT BY 1.0 PSID (ADJ).

TEMPERATURE CONTROL
CHILLER CAPACITY MODULATES TO MAINTAIN LOOP SUPPLY TEMPERATURE SETPOINT:

THE SETPOINT FOR LEAVING WATER TEMPERATURE WILL BE 44°F (ADJ).

BYPASS VALVE CONTROL
VALVE SHALL MODULATE TO MAINTAIN MINIMUM FLOW RATE THROUGH CHILLERS.

CHILLER OPERATION MINIMUM FLOW RATE = 197 GPM (ADJ).

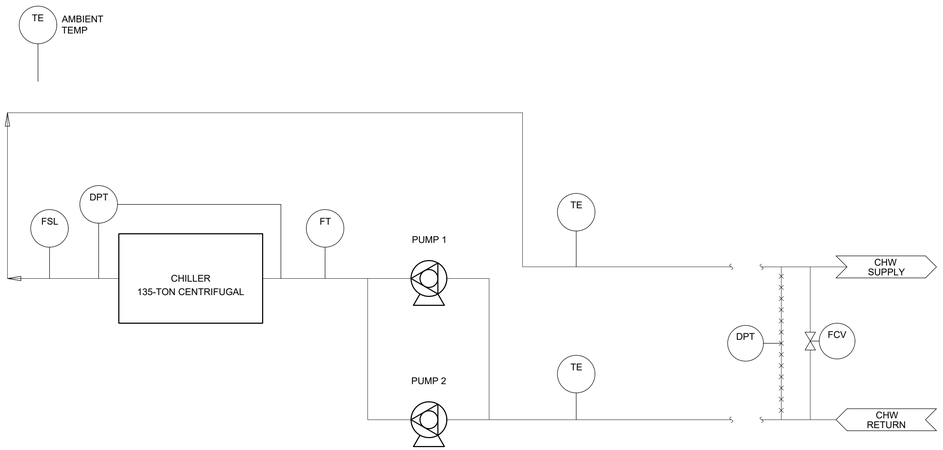
LEAD/LAG PUMP ROTATION
EVERY TWO WEEKS(ADJ) UPON ROTATION COMMAND OR OPERATOR INPUT, THE LEAD/LAG DESIGNATIONS ROTATE, ASSIGNED IN ORDER OF RUN HOURS.

SHUTDOWN SEQUENCE
UPON SHUTDOWN COMMAND:
1. ALL ACTIVE SEQUENCES DEACTIVATE.
2. CHILLER STOPS AND IS PROVEN.
3. PUMP STOPS AND IS PROVEN.

CHILLER PUMP COMMAND:
FREEZE PROTECTION - WHEN CHILLER CALLS FOR PUMP DUE TO LOW AMBIENT TEMPERATURE, START LEAD PUMP. PUMP WILL OPERATE FOR DURATION OF CHILLER CONTROLLER DEMAND.

EQUIPMENT FAILURE
IF THE CHILLER FAILS, THE SHUTDOWN SEQUENCE ACTIVATES, AN ALARM IS GENERATED.

THE DESIGN DP ACROSS THE EVAPORATOR IS 4.6 FT H2O. WHEN THE DP REACHES 6 FT H20 (ADJ) GENERATE AN ALARM



CHILLED WATER SYSTEM

POINT NAME	UNITS	CONTROL POINTS: POINTS: INPUT: ANALOG	DIGITAL	INTEGRATED	OUTPUT: ANALOG	DIGITAL	INTEGRATED	ALARM: GENERAL	UNIT SHUTDOWN	GENERAL: TREND LOG	GRAPHIC	INTERLOCK
PUMP 1 RUN COMMAND	ON/OFF					X				X	X	
PUMP 1 SPEED COMMAND	% SPEED				X					X	X	
PUMP 1 RUN STATUS	ON/OFF		X					X		X	X	
PUMP 2 RUN COMMAND	ON/OFF					X				X	X	
PUMP 2 SPEED COMMAND	% SPEED				X					X	X	
PUMP 2 RUN STATUS	ON/OFF		X					X		X	X	
CHILLED WATER LOOP FLOW	GPM	X						X		X	X	
BYPASS CONTROL VALVE	%				X					X	X	
CHW LOOP DIFFERENTIAL PRESSURE	PSID	X								X	X	
EVAPORATOR DIFFERENTIAL PRESSURE	PSID	X						X		X	X	
CHW LOOP RETURN TEMPERATURE	DEG F	X								X	X	
CHW LOOP SUPPLY TEMPERATURE	DEG F	X								X	X	
OUTSIDE AIR TEMPERATURE	DEG F	X								X	X	
CHILLER ENABLE COMMAND	ON/OFF						X			X	X	
CHW SUPPLY TEMPERATURE SETPOINT	DEG F						X			X	X	
CHW DIFFERENTIAL PRESSURE SETPOINT	PSID						X			X	X	
CHILLED WATER PROOF OF FLOW	YES/NO			X						X	X	
CHW ENTERING TEMPERATURE	DEG F			X						X	X	
CHW LEAVING TEMPERATURE	DEG F			X						X	X	
EVAP HEATER	ON/OFF			X						X	X	
COMPRESSOR CURRENT	% RLA			X						X	X	
COMPRESSOR CURRENT MAX SETPOINT	% RLA			X						X	X	
CHILLER RUN STATUS	ON/OFF			X						X	X	
CHILLER RUN STATUS ALARM	NORMAL/ALARM			X						X	X	
CHILLER CLEAR ALARM							X					
SERVICE REQUEST								X				
PLANT CONSUMPTION TOTALIZED	TON HR			X						X	X	

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Controls - General & Chiller

Revisions #	Date	Description

P.I.C.	JMS
Design	JB
Drawn	MH
Reviewed	JB
Job Number	Hoy+Stark Architects

M-400

08.28.2023

BOILER SHUT DOWN CONTROLS (BY CONTROLS VENDOR)

PROVIDE A SINGLE EMERGENCY STOP SWITCH STATION FOR BOTH BOILERS ON THE INTERIOR OF THE MECHANICAL YARD NEAR THE ENTRANCE GATE, SEE PLAN.

SWITCH SHALL INTERRUPT THE BOILER'S SAFETY CIRCUIT AND INCLUDE SHUTDOWN OF THE BOILER'S GAS TRAIN.

THE SWTICH SHALL BE CERTIFIED TO MEET THE REQUIREMENTS OF ASME CSD-1 AND INCLUDE A NEMA 3R ENCLOUSRE FOR INSTALLATION OUTISDE.

PROVIDE SIGNAGE AT SWITCH STATING "BOILER EMERGENCY STOP SWITCH ".

HEATING HOT WATER SYSTEM

GENERAL

THIS PROJECT WILL INSTALL (2) 1250 MBH CONDENSING BOILERS AND 2 VARIABLE PRIMARY PUMPS, EACH IN AN N+1 CONFIGURATION.

EACH BOILER WILL INCLUDE THE MANUFACTURER'S CONTROLLER AND A PROTOCOL CONVERTER FOR BACNET COMMUNICATION AT THE MASTER CONTROLLER. BAS WILL MONITOR BOILERS; ALL SET POINTS, STAGING, ALARMS, INTERLOCKS, ETC. TO BE MANAGED BY BOILERS.

THE BOILER CONTROLLERS SHALL BE DAISY-CHAINED FOR OPERATIONAL MANAGEMENT.

THE MECHANICAL CONTRACTOR SHALL COORDINATE WITH THE CONTROLS CONTRACTOR.

PROVIDE BOILER AND PRIMARY PUMP GRAPHICS.

PROGRAM TREND DATA FOR KEY OPERATING PARAMETERS OF PLANT SYSTEMS TO INCLUDE LEAVING AND ENTERING WATER TEMPERATURES, SETPOINTS, RUN TIME, EQUIPMENT STATUS, PROOF OF FLOW, ALARMS, ETC.

START-UP SEQUENCE
THE SYSTEM SHALL NOT BE ALLOWED TO START UNLESS ALL SAFETIES ARE OUT OF ALARM.

THE SYSTEM SHALL BE ENABLED ANY TIME AN ASSOCIATED AIR HANDLING UNIT CALLS FOR HEATING.

UPON START-UP COMMAND, VIA BAS:
1. LEAD BOILER ISOLATION VALVE OPENS.
2. LEAD PUMP STARTS, IS COMMANDED TO MINIMUM SPEED OF 20 Hz (ADJ), AND IS PROVEN.
3. LEAD BOILER STARTS AND IS PROVEN.
4. DIFFERENTIAL PRESSURE CONTROL SEQUENCE ACTIVATES.
5. DIFFERENTIAL PRESSURE RESET SEQUENCE ACTIVATES.
6. TEMPERATURE CONTROL SEQUENCE ACTIVATES.

IF A PUMP OR BOILER IS NOT PROVEN WITHIN 60 SECONDS OF START COMMAND, THE SHUTDOWN SEQUENCE ACTIVATES FOR THAT EQUIPMENT, AN ALARM IS GENERATED, AND THE LAG EQUIPMENT STARTS.

PLANT DIFFERENTIAL PRESSURE CONTROL
THE PUMP SPEEDS MODULATE TO MAINTAIN PLANT DIFFERENTIAL PRESSURE SETPOINT.

PLANT DIFFERENTIAL PRESSURE SETPOINT = LOOP DIFFERENTIAL PRESSURE SETPOINT + OFFSET.
PLANT SETPOINT RESETS AS LOOP SETPOINT RESETS BASED ON RESET SEQUENCE BELOW.
1. IF LEAD PUMP SPEED IS 95% (ADJ) OR GREATER FOR A PERIOD OF 10 MINUTES (ADJ), THE LAG BOILER ISOLATION VALVE OPENS AND THE LAG PUMP STAGES ON. THE LAG PUMP SPEED RAMPS UP TO MATCH THE SPEED OF THE LEAD PUMP, 35 Hz (ADJ). BOTH PUMPS MODULATE IN UNISON TO MAINTAIN DIFFERENTIAL PRESSURE SETPOINT.
2. IF LEAD AND LAG PUMP SPEEDS ARE AT 20 Hz (ADJ) FOR A PERIOD OF 5 MINUTES, THE LAG PUMP STAGES OFF AND THE ISOLATION VALVE CLOSES. THE LEAD PUMP MODULATES TO MAINTAIN DIFFERENTIAL PRESSURE SETPOINT.

SECONDARY DIFFERENTIAL PRESSURE RESET
EVERY 15 MINUTES (ADJ), THE DIFFERENTIAL PRESSURE SETPOINT RESETS WITHIN MINIMUM AND MAXIMUM LIMITS:
1. IF ANY ASSOCIATED HOT WATER VALVE COMMAND IS GREATER THAN 90% (ADJ), INCREASE SETPOINT BY 1.0 PSID (ADJ).
2. IF ALL ASSOCIATED HOT WATER VALVE COMMANDS ARE LESS THAN 60% (ADJ), DECREASE SETPOINT BY 1.0 PSID (ADJ).

TEMPERATURE CONTROL
BOILER CAPACITIES MODULATE TO MEET MAINTAIN LOOP SUPPLY WATER TEMPERATURE SETPOINT:
1. IF LEAD BOILER LOAD IS GREATER THAN 80% (ADJ) FOR MORE THAN 10 MINUTES (ADJ):
   A. LAG BOILER ISOLATION VALVE OPENS.
   B. LAG PUMP STARTS.
   C. LAG BOILER STARTS AND IS PROVEN.
2. IF LAG BOILER LOAD IS LESS THAN 30% (ADJ) FOR MORE THAN 10 MINUTES (ADJ):
   A. LAG PUMP STOPS
   B. LAG BOILER STOPS AND IS PROVEN.
   C. LAG BOILER ISOLATION VALVE CLOSES.

SUPPLY WATER TEMPERATURE RESET
THE LOOP SUPPLY WATER TEMPERATURE SEQUENCE ACTIVES ONLY IF PLANT DIFFERENTIAL PRESSURE HAS BEEN RESET TO MINIMUM.

EVERY 5 MINUTES (ADJ), THE TEMPERATURE SETPOINT RESETS WITHIN MINIMUM AND MAXIMUM LIMITS:
1. IF ALL VALVES ARE BELOW 50% (ADJ), DECREASE SETPOINT BY 1°F.
2. IF MORE THAN THREE (ADJ) VALVES ARE MORE THAN 50% OPEN, INCREASE SETPOINT BY 1°F.

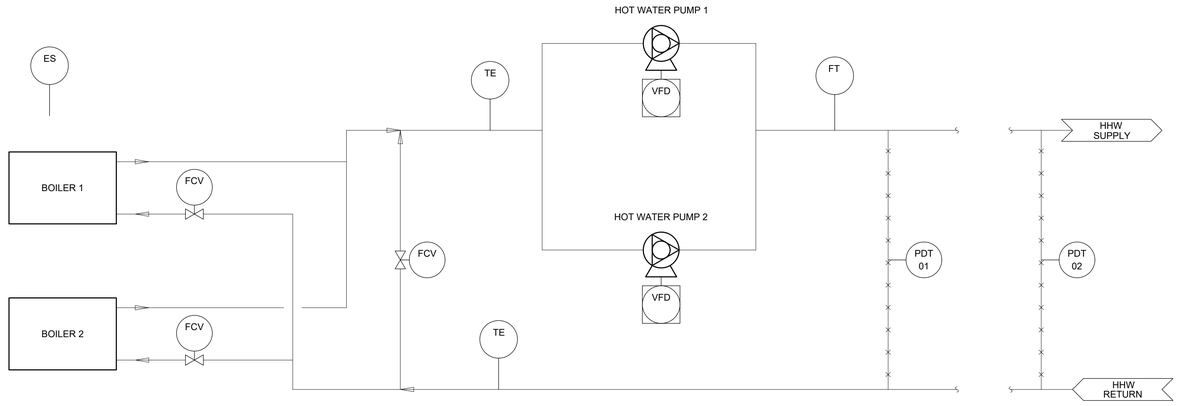
LEAD/LAG BOILER ROTATION
EVERY TWO WEEKS (ADJ) UPON ROTATION COMMAND OR OPERATOR INPUT, THE LEAD/LAG DESIGNATIONS OF BOILERS ROTATE, ASSIGNED IN ORDER OF RUN HOURS. START LAG BOILER PRIOR TO ROTATING LEAD DESIGNATION.

LEAD/LAG SECONDARY PUMP ROTATION
EVERY TWO WEEKS(ADJ) UPON ROTATION COMMAND OR OPERATOR INPUT, THE LEAD/LAG DESIGNATIONS ROTATE, ASSIGNED IN ORDER OF RUN HOURS.

SHUTDOWN SEQUENCE
UPON SHUTDOWN COMMAND
1. ALL ACTIVE SEQUENCES DEACTIVATE
2. PUMPS STOP AND ARE PROVEN.
3. BOILERS STOP AND RE PROVEN.
4. BOILER ISOLATION VALVES CLOSE.

EQUIPMENT FAILURE
IF THE LEAD PUMP OR BOILER FAILS, THE SHUTDOWN SEQUENCE ACTIVATES FOR THAT EQUIPMENT, AN ALARM IS GENERATED, AND THE START-UP SEQUENCE ACTIVATES FOR THE LAG PUMP OR BOILER.

MANUAL RESET IS REQUIRED FOR ALL EQUIPMENT AFTER EQUIPMENT TRIP.



HEATING HOT WATER SYSTEM

POINT NAME	UNITS	CONTROL POINTS: POINTS: INPUT: ANALOG	DIGITAL	INTEGRATED	OUTPUT: ANALOG	DIGITAL	INTEGRATED	ALARM: GENERAL	UNIT SHUTDOWN	GENERAL: TREND LOG	GRAPHIC	INTERLOCK
PUMP 1 RUN COMMAND	ON/OFF					X				X	X	
PUMP 1 SPEED COMMAND	% SPEED				X					X	X	
PUMP 1 RUN STATUS	ON/OFF		X					X		X	X	
PUMP 2 RUN COMMAND	ON/OFF					X				X	X	
PUMP 2 SPEED COMMAND	% SPEED				X					X	X	
PUMP 2 RUN STATUS	ON/OFF		X					X		X	X	
BOILER 1 ISOLATION VALVE COMMAND	ON/OFF					X				X	X	
BOILER 2 ISOLATION VALVE COMMAND	ON/OFF					X				X	X	
BOILER BYPASS VALVE COMMAND	ON/OFF					X				X	X	
HOT WATER LOOP FLOW	GPM	X						X		X	X	
HW PLANT DIFFERENTIAL PRESSURE 01	PSID	X								X	X	
HW LOOP DIFFERENTIAL PRESSURE 02	PSID	X								X	X	
HW LOOP RETURN TEMPERATURE	DEG F	X						X		X	X	
HW LOOP SUPPLY TEMPERATURE	DEG F	X						X		X	X	
BOILER EMERGENCY STOP SWITCH	ON/OFF		X					X	X	X	X	
BOILER 1 ENABLE COMMAND	ON/OFF						X			X	X	
BOILER 1 RUN STATUS	ON/OFF			X						X	X	
BOILER 2 ENABLE COMMAND	ON/OFF						X			X	X	
BOILER 2 RUN STATUS	ON/OFF			X						X	X	
HW SUPPLY TEMPERATURE SETPOINT	DEG F			X						X	X	
HW PLANT DP SETPOINT	PSID			X						X	X	
HW REMOTE DP SETPOINT	PSID									X	X	
BOILER 1 RUN STATUS ALARM	NORMAL/ALARM			X						X	X	
BOILER 2 RUN STATUS ALARM	NORMAL/ALARM			X						X	X	
PLANT CONSUMPTION	MBH			X						X	X	

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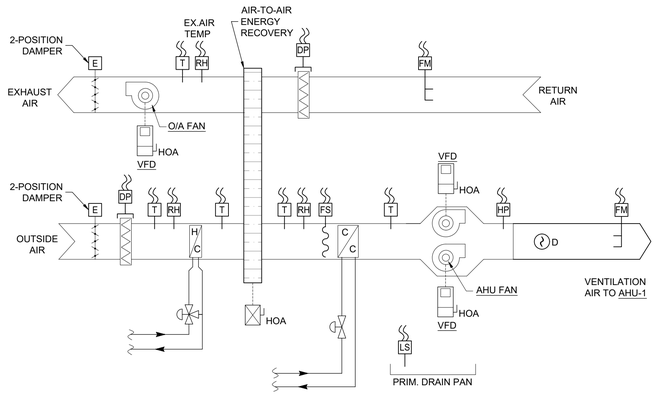
Controls - Heating Hot Water

#	Revisions Date	Description

P.I.C.	JMS
Design	JB
Drawn	MH
Reviewed	JB
Job Number	

M-401

08.28.2023



100% O/A AIR HANDLER WITH ENERGY RECOVERY

TYPICAL OF 1 SYSTEM, VPU-1

NOTE: THE ZONE EXHAUST FAN EF-5 RATE IS 800 CFM, THE VPU OUTSIDE AIR RATE SHALL ALWAYS EXCEED THE VPU EXHAUST FAN RATE BY 1200 CFM.

DOAS WITH ENERGY RECOVERY

GENERAL
THE SYSTEM IS A VARIABLE AIR VOLUME AIR HANDLING SYSTEM WITH AM ENERGY RECOVERY WHEEL, HOT WATER PREHEAT COIL, AND COOLING COIL THAT DISTRIBUTES AIR TO AN AIR HANDLING UNIT FOR DEMAND CONTROL VENTILATION.

START-UP SEQUENCE
THE SYSTEM SHALL NOT BE ALLOWED TO START UNLESS ALL SAFETIES ARE OUT OF ALARM.

UPON START-UP COMMAND:
1. OUTSIDE AIR DAMPER OPENS AND IS PROVEN.
2. OUTSIDE AIR FAN STARTS, IS PROVEN, AND FLOW CONTROL SEQUENCE ACTIVATES.
3. EXHAUST FAN STARTS AND IS PROVEN.
4. ENERGY RECOVERY WHEEL STARTS AND IS PROVEN.
5. DEMAND CONTROL VENTILATION SEQUONCE ACTIVATES
6. COOLING COIL LEAVING AIR TEMPERATURE CONTROL SEQUENCE ACTIVATES.
7. PREHEAT COIL LEAVING AIR TEMPERATURE CONTROL SEQUENCE ACTIVATES.
8. LOW TEMPERATURE SEQUENCE ACTIVATES.

OCCUPIED MODE
UPON OCCUPIED COMMAND, VIA BAS SCHEDULE:
1. OCCUPIED SETPOINTS ACTIVATE.
2. START-UP SEQUENCE ACTIVATES.

OCCUPIED STANDBY MODE
DURING OCCUPIED HOURS AND ROOM OCCUPANCY SENSORS INDICATED UNOCCUPIED:
1. OUTSIDE AIR FAN IS COMMANDED TO MINIMUM SPEED OF 15 Hz (ADJ) AND IS PROVEN
2. MINIMUM FLOWRATE IS 25% OF DESIGN FLOW

UNOCCUPIED MODE
UPON UNOCCUPIED COMMAND, VIA BAS SCHEDULE:
1. SHUTDOWN SEQUENCE ACTIVATES.

DEMAND CONTROL VENTILATION
EVERY 15 MINUTES (ADJ), THE OUTSIDE AIR FAN SPEED RESETS WITHIN THE MINIMUM AND MAXIMUM LIMITS:
1. IF RETURN AIR CO_2 CONCENTRATION IS BELOW THE CO_2 CONCENTRATION LIMIT, THE OUTSIDE AIR FAN SPEED DECREASES BY 5Hz (ADJ).
2. IF RETURN AIR CO_2 CONCENTRATION IS ABOVE THE CO_2 CONCENTRATION LIMIT, THE OUTSIDE AIR FAN SPEED INCREASES BY 5 Hz (ADJ).

EXHAUST FAN SPEED CONTROL
EXHAUST FAN SPEED TRACKS OUTSIDE AIR FAN SPEED TO MAINTAIN CONSTANT OFFSET. TAB TO DETERMINE SPEED SETTINGS.

COOLING COIL LEAVING AIR TEMPERATURE CONTROL
THE COOLING COIL VALVE MODULATES TO MAINTAIN COOLING COIL LEAVING AIR TEMPERATURE, 53.5°F (ADJ)

PREHEAT COIL LEAVING AIR TEMPERATURE CONTROL
THE PREHEAT COIL VALVE MODULATES TO MAINTAIN PREHEAT COIL LEAVING AIR TEMPERATURE SETPOINT, 50°F (ADJ).

SHUTDOWN SEQUENCE
UPON SHUTDOWN COMMAND OR LOSS OF FAN STATUS:
1. OUTSIDE AIR FAN STOPS AND IS PROVEN.
2. OUTSIDE AIR FLOW CONTROL SEQUENCE DEACTIVATES AND DAMPER CLOSES.
3. EXHAUST FAN STOPS AND IS PROVEN.
4. ALL OTHER SEQUENCES DEACTIVATE

LOW TEMPERATURE SEQUENCE
IF PREHEAT COIL AIR TEMPERATURE IS BELOW 40 °F, THE COOLING COIL VALVE OPENS TO 100%

IF PREHEAT COIL AIR TEMPERATURE FALLS BELOW 35 °F, THE SHUTDOWN SEQUENCE ACTIVATES

EQUIPMENT FAILURE
IF OUTSIDE AIR FAN FAILURE IS DETECTED, THE SHUTDOWN SEQUENCE ACTIVATES AND AN ALARM IS GENERATED.

IF EXHAUST AIR FAN FAILURE IS DETECTED, THE SYSTEM CONTINUES TO OPERATE AND AN ALARM IS GENERATED.

SAFETIES
THE FOLLOWING SAFETIES ACTIVATE THE SHUTDOWN SEQUENCE:
1. LOW TEMPERATURE LIMIT SWITCH
2. HIGH STATIC PRESSURE

PREHEAT COIL SETPOINT: 50°F (ADJ.)
COOLING COIL SETPOINT: 53°F (ADJ.)

OUTSIDE AIR FLOW RANGE: 9000 CFM DESIGN, 2250 CFM MINIMUM
EXHAUST AIR FLOW RANGE: 7650 CFM DESIGN, 1000 CFM MINIMUM

		CONTROL POINTS											
		POINTS						ALARM		GENERAL		
		INPUT			OUTPUT							
POINT NAME	UNITS	ANALOG	DIGITAL	INTEGRATED	ANALOG	DIGITAL	INTEGRATED	GENERAL	UNIT SHUTDOWN	TREND LOG	GRAPHIC	INTERLOCK
OUTSIDE AIR DAMPER						X				X	X	
O/A FILTER STATUS	DP, IN W.C.		X					X		X	X	
O/A TEMPERATURE	°F	X								X	X	
O/A RELATIVE HUMIDITY	%	X								X	X	
PREHEAT WATER COIL VALVE	%				X					X	X	
PREHEAT COIL TEMPERATURE	°F	X						X	X	X	X	
ENERGY RECOVERY WHEEL			X			X				X	X	
O/A E/R TEMPERATURE	°F	X								X	X	
O/A E/R RELATIVE HUMIDITY	%	X								X	X	
FREEZE STAT	°F		X					X	X	X	X	X
VPU COOLING COIL VALVE	%				X					X	X	
COOLING COIL TEMPERATURE	°F	X								X	X	
COOLING COIL PAN LEVEL			X					X	X	X	X	
OUTSIDE AIR FAN 1			X		X	X				X	X	
OUTSIDE AIR FAN 2			X		X	X				X	X	
VPU HIGH STATIC PRESSURE			X					X	X	X	X	X
VPU DUCT DETECTOR			X					X	X	X	X	X
OUTSIDE AIR FLOW	CFM	X								X	X	
EXHAUST AIR FLOW	CFM	X								X	X	
E/A FILTER STATUS	DP, IN W.C.		X					X		X	X	
EXHAUST AIR TEMPERATURE	°F	X								X	X	
E/A RELATIVE HUMIDITY	%	X								X	X	
EXHAUST AIR FAN			X		X	X				X	X	
EXHAUST AIR DAMPER						X				X	X	
ENABLE COMMAND	ON/OFF						X			X	X	
PREHEAT COIL TEMP SETPOINT	°F						X			X	X	
COOLING COIL TEMP SETPOINT	°F						X			X	X	
AIR FLOW SETPOINT	CFM						X			X	X	

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Controls - DOAS w/ Energy Recovery, VPU-1

Revisions #	Date	Description

P.I.C.	JMS
Design	JB
Drawn	MH
Reviewed	JB
Job Number	

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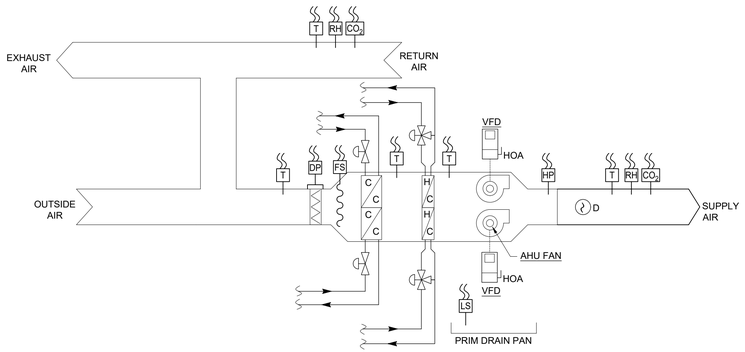
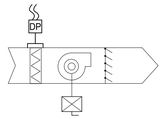


VARIABLE AIR VOLUME AIR HANDLER

TYPICAL OF 1 SYSTEM, AHU-1

NOTE: THE PAIR OF CHW VALVES AND THE PAIR OF HHW VALVES ARE TO OPERATE IN UNISON TO PROVIDE CONSISTENT CONDITIONS ACROSS THE SPLIT COILS. THE SCHEDULED WATER FLOW RATES WILL BE DIVIDED BY 2 FOR EACH VALVE.



RESTROOM EXHAUST FAN

GENERAL
THE EXHAUST FAN SHALL RUN DURING OCCUPIED HOURS.

EXHAUST FAN

AIR HANDLING SYSTEM

GENERAL
THE AIR HANDLING SYSTEM IS A VARIABLE AIR VOLUME SYSTEM WITH CHILLED WATER COOLING AND HOT WATER PREHEAT THAT DISTRIBUTES AIR TO A SINGLE ZONE

OPTIMAL START
ADJUST START TIME OF UNIT TO:
1. WARM-UP FACILITY FOR AN AVERAGE INDOOR AIR TEMPERATURE OF 70°F (ADJ).
2. COOL DOWN FACILITY FOR AN AVERAGE INDOOR TEMPERATURE OF 73°F (ADJ).

WARM-UP / COOL-DOWN MODE
THE SYSTEM SHALL NOT BE ALLOWED TO START UNLESS ALL SAFETIES ARE OUT OF ALARM.

UPON WARM-UP/COOL-DOWN START COMMAND, VIA BAS SCHEDULE OR OPTIMAL START COMMAND:
1. OCCUPIED SETPOINTS ACTIVATE.
2. BEGIN VPU-1 START SEQUENCE AND PUT EQUIPMENT INTO OCCUPIED STAND-BY MODE.
3. SUPPLY FAN STARTS & IS PROVEN.
   - THE SUPPLY FAN IS COMMANDED TO MINIMUM SPEED (20 Hz, ADJ).
   - ON STATUS PROOF, FAN SPEED CONTROL RELEASES.
   - IF THE FAN HAS FAILED (60 SEC DELAY), THE SHUTDOWN SEQUENCE ACTIVATES.
4. ZONE CONTROL SEQUENCES ACTIVATE, EXCEPT FOR ZONE UNOCCUPIED CONTROL

OCCUPIED MODE
UPON OCCUPIED COMMAND, VIA BAS SCHEDULE:
1. WARM-UP / COOL-DOWN SEQUENCES REMAIN ACTIVE.
2. RELEASE VPU-1 TO RUN IN OCCUPIED MODE
3. COOLING COIL / REHEAT COIL LEAVING AIR TEMPERATURE CONTROL SEQUENCE ACTIVATES.
4. LOW TEMPERATURE SEQUENCE ACTIVATES.
5. DEMAND CONTROL VENTILATION SEQUENCE ACTIVATES

OCCUPIED STANDBY MODE
DURING OCCUPIED HOURS AND ROOM OCCUPANCY SENSORS INDICATED UNOCCUPIED:
1. MODULATE VPU-1 TO 25% OF DESIGN FLOW

UNOCCUPIED MODE
UPON UNOCCUPIED COMMAND, VIA BAS SCHEDULE:
1. SHUTDOWN SEQUENCE ACTIVATES
2. UNOCCUPIED HEATING & COOLING SHALL BE AVAILABLE WITH NO OUTSIDE AIR (VPU-1 IS OFF.)
3. UNOCCUPIED SET POINTS ACTIVATE

START COMMAND
1. VPU-1 OPERATION IS PROVEN.
2. SUPPLY FAN STARTS AND IS PROVEN.
   - THE SUPPLY FAN IS COMMANDED TO MINIMUM SPEED (20 Hz, ADJ).
   - ON STATUS PROOF, FAN SPEED CONTROL RELEASES.
3. EXHAUST FAN EF-5 STARTS
4. ZONE CONTROL SEQUENCES ACTIVATE
5. OCCUPIED MODE SEQUENCES ACTIVATE.

SHUTDOWN SEQUENCE
UPON SHUTDOWN COMMAND OR LOSS OF FAN STATUS:
1. COMMAND VPU-1 SHUTDOWN SEQUENCE
2. SHUTDOWN EXHAUST FAN EF-5
3. SUPPLY FAN STOPS AND IS PROVEN.
4. RETURN AIR DAMPER OPENS TO 100%
5. EXHAUST AIR DAMPER CLOSES.
6. ALL OTHER SEQUENCES DEACTIVATE.

ZONE TEMPERATURE CONTROL
1. IF ZONE TEMPERATURE IS ABOVE ZONE COOLING TEMPERATURE SETPOINT:
   A. COOLING COIL CONTROL VALVE MODULATES TO MAINTAIN LEAVING AIR TEMPERATURE SETPOINT AT MINIMUM VALUE.
   B. SUPPLY FAN SPEED MODULATES TO MAINTAIN ZONE TEMPERATURE SETPOINT.
   C. HEATING COIL VALVE REMAINS CLOSED.
2. IF ZONE TEMPERATURE IS BETWEEN COOLING AND HEATING TEMPERATURE SETPOINTS:
   A. COOLING COIL CONTROL VALVE MODULATES TO MAINTAIN LEAVING AIR TEMPERATURE SETPOINT.
   B. SUPPLY FAN SPEED MODULATES TOWARDS MINIMUM.
   C. HEATING COIL VALVE REMAINS CLOSED.
3. IF ZONE TEMPERATURE IS BELOW HEATING TEMPERATURE SETPOINT:
   A. COOLING COIL CONTROL VALVE MODULATES CLOSED.
   B. SUPPLY FAN SPEED REMAINS AT MINIMUM.
   C. HEATING COIL CONTROL VALVE MODULATES TO MAINTAIN LEAVING AIR TEMPERATURE SETPOINT.
4. IF ZONE TEMPERATURE CONTINUES TO FALL BELOW HEATING TEMPERATURE SETPOINT:
   A. COOLING COIL CONTROL VALVE REMAINS CLOSED.
   B. SUPPLY FAN SPEED MODULATES TO MAINTAIN ZONE TEMPERATURE SETPOINT.
   C. HEATING COIL VALVE MODULATES TO MAINTAIN HEATING COIL LEAVING AIR TEMPERATURE SETPOINT.

ZONE DEHUMIDIFICATION CONTROL
1. IF ZONE HUMIDITY EXCEEDS HIGH LIMIT SETPOINT:
   A. COOLING COIL CONTROL VALVE MODULATES TO MINIMUM LEAVING AIR TEMPERATURE SETPOINT.
   B. SUPPLY FAN SPEED MODULATES TOWARDS MAXIMUM.
   C. REHEAT COIL VALVE MODULATES TO MAINTAIN ZONE TEMPERATURE SETPOINT.
2. WHEN ALL ZONE HUMIDITY READINGS ARE BELOW OCCUPIED HIGH LIMIT SETPOINT:
   A. REHEAT COIL VALVE MODULATES TOWARDS CLOSED, AND MAINTAINS ZONE TEMPERATURE SETPOINT.
   B. ZONE TEMPERATURE CONTROL SEQUENCE RESUMES CONTROL

ZONE CO_2 CONCENTRATION CONTROL
1. IF ZONE CO_2 EXCEEDS SETPOINT:
   A. OUTSIDE AIR FLOW FROM VPU-1 MODULATES TOWARDS MAXIMUM
2. WHEN ALL ZONE CO_2 READINGS ARE BELOW SETPOINT:
   A. MODULATE AIR FLOW FROM VPU-1 TO MAINTAIN CO_2 SETPOINT

ZONE UNOCCUPIED CONTROL
1. IF ZONE IS UNOCCUPIED:
   A. UNOCCUPIED SETPOINTS ACTIVATE FOR THAT ZONE
   B. OTHER ZONE CONTROL SEQUENCES ARE PAUSED
2. WHEN ZONE IS OCCUPIED
   A. OCCUPIED SETPOINTS ACTIVATE
   B. ALL ZONE CONTROL SEQUENCES ARE ACTIVE

ECONOMIZING:
1. WHEN THE ZONES CALL FOR COOLING AND THE MIXED AIR DEW POINT IS BELOW 57°F, AND THE MIXED AIR TEMPERATURE IS BELOW THE ZONE TEMPERATURE SET POINT, THE COOLING COIL LEAVING AIR TEMP WILL RESET UP TO MAINTAIN ZONE TEMPERATURE AND HUMIDITY.

EQUIPMENT FAILURE
IF SUPPLY FAN FAILURE IS DETECTED, THE SHUTDOWN SEQUENCE ACTIVATES AND AN ALARM IS GENERATED.

SAFETIES
THE FOLLOWING SAFETIES ACTIVATE THE SHUTDOWN SEQUENCE:
1. LOW TEMPERATURE LIMIT SWITCH
2. DUCT SMOKE ALARM
3. HIGH STATIC PRESSURE ALARM
4. DRAIN PAN FLOAT SWITCH

A MANUAL RESET IS REQUIRED AFTER SAFETY ACTIVATION.

OCCUPIED COOLING SETPOINT: 74°F (ADJ.)
UNOCCUPIED COOLING SETPOINT: 80°F (ADJ.)
OCCUPIED HEATING SETPOINT: 70°F (ADJ.)
UNOCCUPIED HEATING SETPOINT: 63°F (ADJ.)

OCCUPIED RELATIVE HUMIDITY SETPOINT: 55% RH (ADJ.)
UNOCCUPIED RELATIVE HUMIDITY SETPOINT: 60% RH (ADJ.)

OCCUPIED CO_2 CONCENTRATION SETPOINT: 900 PPM
OCCUPIED CO_2 CONCENTRATION MINIMUM: 500 PPM
OCCUPIED CO_2 CONCENTRATION MAXIMUM: 1000 PPM

		CONTROL POINTS											
		POINTS						ALARM		GENERAL			
		INPUT			OUTPUT								
POINT NAME	UNITS	ANALOG	DIGITAL	INTEGRATED	ANALOG	DIGITAL	INTEGRATED	GENERAL	UNIT SHUTDOWN	TREND LOG	GRAPHIC	INTERLOCK
RETURN AIR TEMPERATURE	°F	X								X	X	
R/A RELATIVE HUMIDITY	%	X								X	X	
R/A CO2 CONCENTRATION	PPM	X								X	X	
EXHAUST AIR DAMPER	%				X					X	X	
RETURN AIR DAMPER	%				X					X	X	
MIXED AIR TEMPERATURE	°F	X						X		X	X	
R/A FILTER STATUS	DP, IN W.C.		X					X		X	X	
FREEZE STAT	°F		X					X	X	X	X	X
AHU COOLING COIL VALVE 1	%				X					X	X	
AHU COOLING COIL VALVE 2	%				X					X	X	
COOLING COIL TEMPERATURE	°F	X								X	X	
COOLING COIL PAN LEVEL			X					X	X	X	X	
AHU HEATING COIL VALVE 1	%				X					X	X	
AHU HEATING COIL VALVE 2	%				X					X	X	
REHEAT COIL TEMPERATURE	°F	X								X	X	
AHU AIR FAN 1			X		X	X				X	X	
AHU AIR FAN 2			X		X	X				X	X	
AHU HIGH STATIC PRESSURE	IN W.C.		X					X	X	X	X	X
AHU DUCT DETECTOR			X					X	X	X	X	X
SUPPLY AIR TEMPERATURE	°F	X								X	X	
SUPPLY AIR RELATIVE HUMIDITY	%	X								X	X	
SUPPLY AIR CO2 CONCENTRATION	PPM	X								X	X	
SPACE OCCUPANCY			X							X	X	
EXHAUST FAN	ON/OFF						X			X	X	
EX FAN FILTER STATUS	DP, IN W.C.		X					X		X	X	
ENABLE COMMAND	ON/OFF						X			X	X	
COOLING COIL TEMP SETPOINT	°F						X			X	X	
REHEAT COIL TEMP SETPOINT	°F						X			X	X	
ZONE TEMP SETPOINT	°F						X			X	X	
ZONE HUMIDITY SETPOINT	% RH						X			X	X	
CO_2 CONCENTRATION SETPOINT	PPM						X			X	X	

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Controls - VAV Air Handler AHU-1

Revisions #	Date	Description

P.I.C. JMS
Design JB
Drawn MH
Reviewed JB
Job Number

M-403

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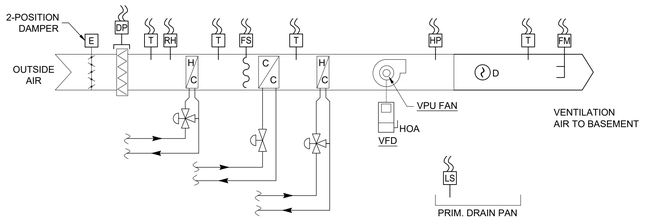
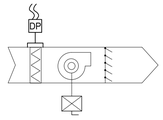


100% O/A AIR HANDLER

TYPICAL OF 2 SYSTEMS, VPU-2 & VPU-3



RESTROOM EXHAUST FAN

GENERAL
THE EXHAUST FAN SHALL RUN DURING OCCUPIED HOURS.

EXHAUST FAN

AIR HANDLING SYSTEM

GENERAL
THE AIR HANDLER IS A 100% OUTSIDE VARIABLE AIR VOLUME SYSTEM WITH HHW PREHEAT, CHW COILING COIL, AND HHW REHEAT THAT DISTRIBUTES NEUTRAL AIR TO MULTIPLE ZONES.

OCCUPIED MODE
UPON OCCUPIED COMMAND, VIA BAS SCHEDULE OR OPTIMAL START COMMAND:
1. OCCUPIED SETPOINTS ACTIVATE.
2. START-UP SEQUENCE ACTIVATES.

START-UP SEQUENCE
THE SYSTEM SHALL NOT BE ALLOWED TO START UNLESS ALL SAFETIES ARE OUT OF ALARM.

UPON START-UP COMMAND:
1. OUTSIDE AIR DAMPER OPENS AND IS PROVEN.
2. SUPPLY FAN STARTS AND IS PROVEN.
   A. THE SUPPLY FAN IS COMMANDED TO MINIMUM SPEED (20 Hz, ADJ).
   B. ON STATUS PROOF, FAN SPEED CONTROL RELEASES.
3. FLOW CONTROL SEQUENCE ACTIVATES.
4. EXHAUST FANS START AND ARE PROVEN.
5. PREHEAT COIL LEAVING AIR TEMPERATURE CONTROL SEQUENCE ACTIVATES.
6. LOW TEMPERATURE SEQUENCE ACTIVATES.
7. COOLING COIL LEAVING AIR TEMPERATURE CONTROL SEQUENCE ACTIVATES.
8. COOLING COIL LEAVING AIR TEMPERATURE RESET CONTROL SEQUENCE ACTIVATES.
9. REHEAT COIL LEAVING AIR TEMPERATURE CONTROL SEQUENCE ACTIVATES.

OCCUPIED STANDBY MODE
DURING OCCUPIED HOURS AND ROOM OCCUPANCY SENSORS INDICATE UNOCCUPIED:
1. STOP EXHAUST FAN
2. MODULATE VPU TO 31% OF DESIGN FLOW

UNOCCUPIED MODE
UPON UNOCCUPIED COMMAND, VIA BAS SCHEDULE:
1. SHUTDOWN SEQUENCE ACTIVATES.

SHUTDOWN SEQUENCE
UPON SHUTDOWN COMMAND OR LOSS OF FAN STATUS:
1. SUPPLY FAN STOPS AND IS PROVEN.
2. OUTSIDE AIR FLOW CONTROL SEQUENCE DEACTIVATES AND DAMPER CLOSES.
3. EXHAUST FANS STOP
4. ALL OTHER SEQUENCES DEACTIVATE.

DISCHARGE AIR FLOW CONTROL
SUPPLY FAN SPEED MODULATES TO MAINTAIN DISCHARGE AIR FLOW SETPOINT.

SUPPLY FAN MINIMUM SPEED IS 20 Hz (ADJ).

PREHEAT COIL LEAVING AIR TEMPERATURE CONTROL
THE PREHEAT COIL VALVE MODULATES TO MAINTAIN PREHEAT COIL LEAVING AIR TEMPERATURE SETPOINT.

COOLING COIL LEAVING AIR TEMPERATURE CONTROL
THE COOLING COIL VALVE MODULATES TO MAINTAIN COOLING COIL LEAVING AIR TEMPERATURE.

REHEAT COIL LEAVING AIR TEMPERATURE CONTROL
THE REHEAT COIL VALVE MODULATES TO MAINTAIN VPU LEAVING AIR TEMPERATURE SETPOINT.

REHEAT COIL LEAVING AIR TEMPERATURE RESET
EVERY 15 MINUTES (ADJ), THE REHEAT COIL LEAVING AIR TEMPERATURE SETPOINT RESETS WITHIN THE MINIMUM AND MAXIMUM LIMITS:
1. IF 80% OR MORE OF ZONES CALL FOR COOLING, LEAVING AIR TEMPERATURE DECREASES BY 1 °F (ADJ).
2. IF LESS THAN 80% OF ZONES CALL FOR COOLING, LEAVING AIR TEMPERATURE RETURNS TO SETPOINT.

LOW TEMPERATURE SEQUENCE
IF PREHEAT COIL LEAVING AIR TEMPERATURE IS BELOW 40 °F, THE COOLING COIL VALVE OPENS TO 100%.

IF PREHEAT COIL LEAVING AIR TEMPERATURE FALLS BELOW 35 °F, THE SHUTDOWN SEQUENCE ACTIVATES.

EQUIPMENT FAILURE
IF SUPPLY FAN FAILURE IS DETECTED, THE SHUTDOWN SEQUENCE ACTIVATES AND AN ALARM IS GENERATED.

ECONOMIZING:
1. WHEN THE OUTSIDE AIR DEW POINT IS BELOW 55°F, THE COOLING COIL LEAVING AIR TEMP WILL RESET UP TO 68°F.

SAFETIES
THE FOLLOWING SAFETIES ACTIVATE THE SHUTDOWN SEQUENCE:
1. LOW TEMPERATURE LIMIT SWITCH
2. DUCT SMOKE ALARM
3. HIGH STATIC PRESSURE ALARM

OCCUPIED PREHEAT COIL SETPOINT: 50°F (ADJ.)
OCCUPIED COOLING COIL SETPOINT: 53°F (ADJ.)
OCCUPIED REHEAT COIL SETPOINT: 70°F (ADJ.)

OCCUPIED AIR FLOW SETPOINT: 1600 CFM (ADJ.)
OCCUPIED STANDBY AIR FLOW SETPOINT: 500 CFM (ADJ.)

		CONTROL POINTS											
		POINTS						ALARM		GENERAL			
		INPUT			OUTPUT								
POINT NAME	UNITS	ANALOG	DIGITAL	INTEGRATED	ANALOG	DIGITAL	INTEGRATED	GENERAL	UNIT SHUTDOWN	TREND LOG	GRAPHIC	INTERLOCK
OUTSIDE AIR DAMPER	OPEN/CLOSE					X				X	X	
O/A FILTER STATUS	DP, IN W.C.		X					X		X	X	
O/A TEMPERATURE	°F	X								X	X	
O/A RELATIVE HUMIDITY	%	X								X	X	
PREHEAT WATER COIL VALVE	%				X					X	X	
PREHEAT COIL TEMPERATURE	°F	X						X	X	X	X	
FREEZE STAT	°F		X					X	X	X	X	X
VPU COOLING COIL VALVE	%				X					X	X	
COOLING COIL TEMPERATURE	°F	X								X	X	
COOLING COIL PAN LEVEL			X					X	X	X	X	
VPU AIR FAN			X		X	X				X	X	
VPU HIGH STATIC PRESSURE			X					X	X	X	X	X
VPU DUCT DETECTOR			X					X	X	X	X	X
SUPPLY AIR TEMPERATURE	°F	X								X	X	
SUPPLY AIR FLOW	CFM	X								X	X	
SPACE OCCUPANCY			X							X	X	
EXHAUST FAN	ON/OFF					X				X	X	
ENABLE COMMAND	ON/OFF						X			X	X	
PREHEAT COIL TEMP SETPOINT	°F						X			X	X	
COOLING COIL TEMP SETPOINT	°F						X			X	X	
REHEAT COIL TEMP SETPOINT	°F						X			X	X	
AIR FLOW SETPOINT	CFM						X			X	X	

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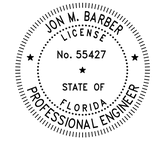


1350 Market Street - Suite 209 Tallahassee Florida 32312

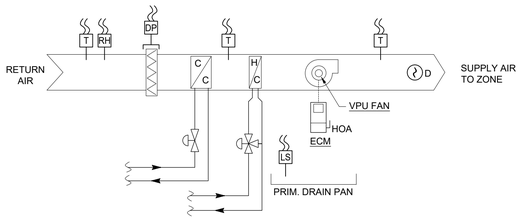
Controls - VAV DOAS, VPU-2 & VPU-3

Revisions #	Date	Description

P.I.C.	JMS
Design	JB
Drawn	MH
Reviewed	JB
Job Number	Hoy+Stark Architects

M-404

08.28.2023



FAN COIL UNIT

TYPICAL OF 5 SYSTEMS, VPU-2 & VPU-3FCU-1, FCU-2, FCU-3, FCU-4, FCU-5
IONIZATION SYSTEMS SHALL BE POWERED FROM FCU CONTROLLER.

FAN COIL UNIT

GENERAL
THE FAN COIL UNIT IS A VARIABLE AIR VOLUME RECIRCULATING SYSTEM WITH HOT WATER REHEAT.

START-UP SEQUENCE
UPON START-UP COMMAND:
1. SUPPLY FAN STARTS AND IS PROVEN
2. ZONE TEMPERATURE CONTROL SEQUENCE ACTIVATES

ZONE TEMPERATURE CONTROL SEQUENCE
AS ZONE TEMPERATURE INCREASES ABOVE COOLING SETPOINT:
1. HEATING COIL VALVE REMAINS CLOSED.
2. COOLING COIL VALVE MODULATES OPEN TO MAINTAIN COOLING COIL SETPOINT.
3. INCREASE SPEED OF ECM MOTOR

AS ROOM TEMPERATURE DECREASES BELOW COOLING SETPOINT BUT ABOVE HEATING SETPOINT:
1. DECREASE SPEED OF ECM MOTOR
2. COOLING COIL VALVE MODULATES CLOSED TO MAINTAIN COOLING COIL SETPOINT.

AS ROOM TEMPERATURE DECREASES BELOW HEATING SETPOINT:
1. HEATING COIL VALVE MODULATES OPEN TO MAINTAIN REHEAT TEMPERATURE SETPOINT.
2. COOLING COIL VALVE REMAINS CLOSE.
3. MODULATE FAN SPEED TO MAINTAIN SPACE TEMPERATURE SETPOINT

ZONE DEHUMIDIFICATION CONTROL
1. IF ZONE HUMIDITY EXCEEDS HIGH LIMIT SETPOINT:
   A. COOLING COIL CONTROL VALVE MODULATES TO MINIMUM LEAVING AIR TEMPERATURE SETPOINT.
   B. SUPPLY FAN SPEED MODULATES TOWARDS MAXIMUM.
   C. REHEAT COIL VALVE MODULATES TO MAINTAIN SPACE TEMPERATURE SETPOINT.
2. WHEN ALL ZONE HUMIDITY READINGS ARE BELOW OCCUPIED HIGH LIMIT SETPOINT:
   A. REHEAT COIL VALVE MODULATES TOWARDS CLOSED, AND MAINTAINS SPACE TEMPERATURE SETPOINT.
   B. ZONE TEMPERATURE CONTROL SEQUENCE RESUMES CONTROL

ECONOMIZING:
1. WHEN THE SPACE DEW POINT IS BELOW 55°F, THE COOLING COIL LEAVING AIR TEMP WILL RESET UP BY 2°F AND CONTINUE AS LONG AS SPACE TEMPERATURE SETPOINT IS MAINTAINED.

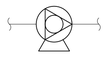
SHUTDOWN SEQUENCE
UPON SHUTDOWN COMMAND OR LOSS OF FAN STATUS:
1. SUPPLY FAN STOPS AND IS PROVEN
2. COOLING AND HEATING COIL CONTROL VALVES CLOSE

SAFETIES
THE FOLLOWING SAFETIES ACTIVATE THE SHUTDOWN SEQUENCE:
1. AUXILIARY DRAIN PAN FLOAT SWITCH

OCCUPIED COOLING SETPOINT: 74°F (ADJ.)
UNOCCUPIED COOLING SETPOINT: 80°F (ADJ.)
OCCUPIED HEATING SETPOINT: 70°F (ADJ.)
UNOCCUPIED HEATING SETPOINT: 63°F (ADJ.)

OCCUPIED RELATIVE HUMIDITY SETPOINT: 55% RH (ADJ.)
UNOCCUPIED RELATIVE HUMIDITY SETPOINT: 60% RH (ADJ.)

POINT NAME	UNITS	CONTROL POINTS: POINTS: INPUT: ANALOG	DIGITAL	INTEGRATED	OUTPUT: ANALOG	DIGITAL	INTEGRATED	ALARM: GENERAL	UNIT SHUTDOWN	GENERAL: TREND LOG	GRAPHIC	INTERLOCK
R/A TEMPERATURE	°F	X								X	X	
R/A RELATIVE HUMIDITY	%	X								X	X	
R/A FILTER STATUS	DP, IN W.C.		X					X		X	X	
COOLING COIL VALVE	%				X					X	X	
COOLING COIL TEMPERATURE	°F	X								X	X	
REHEAT WATER COIL VALVE	%				X					X	X	
FCU AIR FAN					X					X	X	
DRAIN PAN LEVEL			X					X	X	X	X	X
VPU DUCT DETECTOR			X					X	X	X	X	X
SUPPLY AIR TEMPERATURE	°F	X								X	X	
SPACE OCCUPANCY			X							X	X	
ENABLE COMMAND	ON/OFF						X			X	X	
COOLING COIL TEMP SETPOINT	°F						X			X	X	
SUPPLY AIR TEMP SETPOINT	°F						X			X	X	
SPACE TEMP SETPOINT	°F						X			X	X	
SPACE HUMIDITY SETPOINT	% RH						X			X	X	



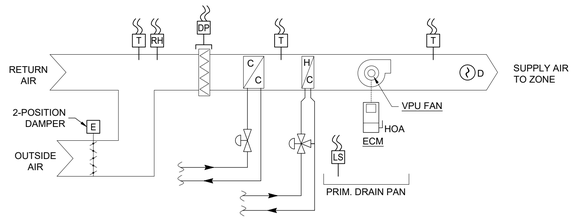
PUMP RP-1

POINT NAME	UNITS	CONTROL POINTS: POINTS: INPUT: ANALOG	DIGITAL	INTEGRATED	OUTPUT: ANALOG	DIGITAL	INTEGRATED	ALARM: GENERAL	UNIT SHUTDOWN	GENERAL: TREND LOG	GRAPHIC	INTERLOCK
PUMP COMMAND	ON/OFF					X				X	X	

GENERAL
HOT WATER CIRCULATING PUMP THAT OPERATES DURING OCCUPIED HOURS.

OCCUPIED MODE
UPON OCCUPIED COMMAND, VIA SCHEDULE:
1. PUMP STARTS

UNOCCUPIED MODE
UPON OCCUPIED COMMAND, VIA SCHEDULE:
1. PUMP STOPS



BLOWER COIL UNIT

TYPICAL OF 1 SYSTEM, BCU-6
IONIZATION SYSTEM SHALL BE POWERED FROM BCU CONTROLLER.

BLOWER COIL UNIT

GENERAL
THE FAN COIL UNIT IS A VARIABLE AIR VOLUME RECIRCULATING SYSTEM WITH HOT WATER REHEAT.

START-UP SEQUENCE
UPON START-UP COMMAND:
1. SUPPLY FAN STARTS AND IS PROVEN
2. ZONE TEMPERATURE CONTROL SEQUENCE ACTIVATES
3. OUTSIDE AIR DAMPER OPENS.

ZONE TEMPERATURE CONTROL SEQUENCE
AS ZONE TEMPERATURE INCREASES ABOVE COOLING SETPOINT:
1. HEATING COIL VALVE REMAINS CLOSED.
2. COOLING COIL VALVE MODULATES OPEN TO MAINTAIN COOLING COIL SETPOINT.
3. INCREASE SPEED OF ECM MOTOR

AS ROOM TEMPERATURE DECREASES BELOW COOLING SETPOINT BUT ABOVE HEATING SETPOINT:
1. DECREASE SPEED OF ECM MOTOR
2. COOLING COIL VALVE MODULATES CLOSED TO MAINTAIN COOLING COIL SETPOINT.

AS ROOM TEMPERATURE DECREASES BELOW HEATING SETPOINT:
1. HEATING COIL VALVE MODULATES OPEN TO MAINTAIN REHEAT TEMPERATURE SETPOINT.
2. COOLING COIL VALVE REMAINS CLOSE.
3. MODULATE FAN SPEED TO MAINTAIN SPACE TEMPERATURE SETPOINT

ZONE DEHUMIDIFICATION CONTROL
1. IF ZONE HUMIDITY EXCEEDS HIGH LIMIT SETPOINT:
   A. COOLING COIL CONTROL VALVE MODULATES TO MINIMUM LEAVING AIR TEMPERATURE SETPOINT.
   B. SUPPLY FAN SPEED MODULATES TOWARDS MAXIMUM.
   C. REHEAT COIL VALVE MODULATES TO MAINTAIN SPACE TEMPERATURE SETPOINT.
2. WHEN ALL ZONE HUMIDITY READINGS ARE BELOW OCCUPIED HIGH LIMIT SETPOINT:
   A. REHEAT COIL VALVE MODULATES TOWARDS CLOSED, AND MAINTAINS SPACE TEMPERATURE SETPOINT.
   B. ZONE TEMPERATURE CONTROL SEQUENCE RESUMES CONTROL

ECONOMIZING:
1. WHEN THE MIXED AIR DEW POINT IS BELOW 55°F, THE COOLING COIL LEAVING AIR TEMP WILL RESET UP BY 2°F AND CONTINUE AS LONG AS SPACE TEMPERATURE SETPOINT IS MAINTAINED.

SHUTDOWN SEQUENCE
UPON SHUTDOWN COMMAND OR LOSS OF FAN STATUS:
1. OUTSIDE AIR DAMPER CLOSES
2. SUPPLY FAN STOPS AND IS PROVEN
3. COOLING AND HEATING COIL CONTROL VALVES CLOSE

SAFETIES
THE FOLLOWING SAFETIES ACTIVATE THE SHUTDOWN SEQUENCE:
1. AUXILIARY DRAIN PAN FLOAT SWITCH

OCCUPIED COOLING SETPOINT: 74°F (ADJ.)
UNOCCUPIED COOLING SETPOINT: 80°F (ADJ.)
OCCUPIED HEATING SETPOINT: 70°F (ADJ.)
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OCCUPIED RELATIVE HUMIDITY SETPOINT: 55% RH (ADJ.)
UNOCCUPIED RELATIVE HUMIDITY SETPOINT: 60% RH (ADJ.)

POINT NAME	UNITS	CONTROL POINTS: POINTS: INPUT: ANALOG	DIGITAL	INTEGRATED	OUTPUT: ANALOG	DIGITAL	INTEGRATED	ALARM: GENERAL	UNIT SHUTDOWN	GENERAL: TREND LOG	GRAPHIC	INTERLOCK
R/A TEMPERATURE	°F	X								X	X	
R/A RELATIVE HUMIDITY	%	X								X	X	
R/A FILTER STATUS	DP, IN W.C.		X					X		X	X	
OUTSIDE AIR DAMPER	OPEN/CLOSE						X			X	X	
COOLING COIL VALVE	%				X					X	X	
COOLING COIL TEMPERATURE	°F	X								X	X	
REHEAT WATER COIL VALVE	%				X					X	X	
BCU AIR FAN					X					X	X	
DRAIN PAN LEVEL			X					X	X	X	X	X
VPU DUCT DETECTOR			X					X	X	X	X	X
SUPPLY AIR TEMPERATURE	°F	X										
SPACE OCCUPANCY			X							X	X	
ENABLE COMMAND	ON/OFF						X			X	X	
COOLING COIL TEMP SETPOINT	°F						X			X	X	
SUPPLY AIR TEMP SETPOINT	°F						X			X	X	
SPACE TEMP SETPOINT	°F						X			X	X	
SPACE HUMIDITY SETPOINT	% RH						X			X	X	

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Controls - Fan Coils, Blower Coil, HW Pump

Revisions #	Date	Description

P.I.C. JMS
Design JB
Drawn MH
Reviewed JB
Job Number Hoy+Stark Architects

M-405

08.28.2023

MECHANICAL SCOPE OF WORK SUMMARY

1. PROVIDE AND INSTALL HVAC AND RELATED PIPING SYSTEMS AS SHOWN ON THESE PLANS AND AS SPECIFIED IN THE PROJECT MANUAL.

2. DEMOLISH & REMOVE ALL EXISTING EQUIPMENT, DUCTWORK, PIPING, CONTROLS, SUPPORTS, ETC FOR A 100% RENOVATION.

   THE AIR-COOLED CHILLER SHALL BE REMOVED AND TURNED OVER TO LCS FOR USE ANOTHER SCHOOL. TAKE CARE TO NOT DAMAGE, AND PROTECT CHILLER FOR RELOCATION.

3. PROVIDE AND INSTALL NEW HVAC EQUIPMENT AND APPURTENANCES AS SCHEDULED OR INDICATED INCLUDING DUCTWORK, VAV TERMINALS, HYDRONIC PIPING, SUPPLY AND RETURN GRILLES, INSULATION, SUPPORTS, SEALING PENETRATIONS, ETC. TO MAKE THE JOB COMPLETE AND FULLY FUNCTIONAL IN ACCORDANCE WITH THE DESIGN INTENT.

   NOTE: THE CHILLER, AIR HANDLER, VENTILATION PROCESSING UNITS, FAN COILS, AND BLOWER COIL WERE PURCHASED BY LEON COUNTY SCHOOLS AND WILL BE PROVIDED TO THE CONTRACTOR FOR INSTALLATION.

4. CONTROLS SHALL BE PERFORMED UNDER A SEPARATE CONTRACT BY LEON COUNTY SCHOOLS. THE MECHANICAL CONTRACTOR SHALL COORDINATE WITH THE CONTROLS CONTRACTOR AND INSTALL VALVES, DAMPERS AND CONTROLS INTO THE MECHANICAL EQUIPMENT.

5. TEST & BALANCE SHALL BE PERFORMED UNDER A SEPARATE CONTRACT BY LEON COUNTY SCHOOLS.

6. WORK INCLUDES OBTAINING PERMITS, PROCUREMENT OF EQUIPMENT, MATERIALS, ETC. ; COORDINATING BETWEEN TRADES; DEMOLITION, INSTALLATION, STARTUP, REPORTING, SYSTEMS CHECKOUT; ASSISTING THE TEST, ADJUST AND BALANCE CONTRACTOR, AND RESOLVING DISCREPANCIES; PERFORMING SUBSTANTIAL AND FINAL COMPLETION ACTIVITIES, TRAINING, DEVELOPING AND SUBMITTING THE OPERATION AND MAINTENANCE MANUALS, AND PERFORMING PROJECT CLOSEOUT.

7. A COMMISSIONING AUTHORITY, HIRED UNDER SEPARATE CONTRACT, WILL COMMISSION THE EQUIPMENT PER THE SPEC AND PLAN. CM, MECHANICAL CONTRACTOR, AND T&B CONTRACTOR WILL SUPPORT THESE EFFORTS.

GENERAL NOTES:

- FURNISH ALL LABOR, MATERIALS, EQUIPMENT AND INCIDENTALS REQUIRED TO COMPLETE ALL WORK SHOWN ON THE CONTRACT DRAWINGS.

- ALL CONSTRUCTION SHALL CONFORM TO APPLICABLE CODE STANDARDS INCLUDING:

  NFPA 51B, FIRE PREVENTION DURING WELDING, CUTTING, AND OTHER HOT WORK
  NFPA 70, NATIONAL ELECTRIC CODE
  NFPA 90 A, AIR CONDITIONING & VENTILATION SYSTEMS
  NFPA 101, LIFE SAFETY CODE
  FLORIDA BUILDING CODE BUILDING (2020)
  FLORIDA BUILDING CODE MECHANICAL (2020)
  FLORIDA BUILDING CODE PLUMBING (2020)
  FLORIDA BUILDING CODE FUEL GAS (2020)
  FLORIDA FIRE PREVENTION CODE (2020 EDITION)
  STATE REQUIREMENTS FOR EDUCATIONAL FACILITIES - 2014 EDITION
  STATE AND LOCAL CODES AND ORDINANCES

- SHOULD CONFLICT OCCUR BETWEEN PROJECT SPECIFICATIONS & DRAWING NOTES, THE DRAWING NOTES WILL TAKE PRECEDENCE.

- THE CONTRACTOR IS EXPECTED TO PROVIDE PROFESSIONAL WORK PERFORMED IN ACCORDANCE WITH INDUSTRY STANDARDS AND BEST PRACTICES.

- THE WORK SHALL BE COMPLETE, FULLY OPERATIONAL, AND SUITABLE IN EVERY WAY FOR THE SERVICE REQUIRED.

- DRAWINGS INDICATE SCOPE AND DO NOT SHOW ALL DETAILS, DEVICES AND INCIDENTAL MATERIALS NECESSARY TO ACCOMPLISH THE WORK. THEREFORE, IT SHALL BE UNDERSTOOD THAT SUCH DEVICES AND INCIDENTAL MATERIALS REQUIRED SHALL BE FURNISHED AT NO COST TO THE OWNER.

- CONTRACTOR SHALL TAKE INTO ACCOUNT FIELD CONDITIONS AND COORDINATE IN ORDER TO AVOID CONFLICTS WITH EXISTING CONDITIONS AND INTERFERENCE BETWEEN TRADES.

- EQUIPMENT SHALL BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURER'S REQUIREMENTS FOR PROPER OPERATION, MAINTENANCE, AND SERVICE. IF CHANGES TO THE CONTRACT DOCUMENTS ARE NECESSARY TO AVOID CONFLICTS, THE CONTRACTOR IS RESPONSIBLE FOR REQUESTING CLARIFICATION IN A TIMELY FASHION.

- CONTRACTOR SHALL VERIFY SIZE, FLOW DIRECTION, AND LOCATION OF EXISTING DUCTS/PIPING TO REMAIN, RELATED BUILDING INFRASTRUCTURE/SERVICES, PRIOR TO COMMENCING WORK. ADVISE THE ENGINEER IN WRITING IF MATERIALLY DIFFERENT THAN SHOWN.

- ALL PIPING AND DUCT SHALL BE INSTALLED PARALLEL OR PERPENDICULAR TO WALLS, AND SHALL PASS THROUGH WALLS AT 90 DEGREES. UNLESS SHOWN OR APPROVED, PIPING AND DUCT INSTALLED DIAGONALLY IS NOT ALLOWED.

- THE CONTRACTOR SHALL TAKE DUE CARE DURING ALL PHASES OF WORK TO PROTECT BUILDING FINISHES, FURNISHINGS, EQUIPMENT, ETC. THE CONTRACTOR SHALL BEAR ALL COSTS TO REPAIR ANY DAMAGED ITEMS, FINISHES, ETC. RESULTING FROM HIS OR HIS SUBCONTRACTORS' WORK.

- THE CONTRACTOR SHALL PROVIDE DAILY CLEANUP OF HIS WORK AREAS. UPON COMPLETION OF THE WORK THE CONTRACTOR SHALL THOROUGHLY CLEAN SPACES THAT WERE OCCUPIED BY TEMPORARY WORK AND TEMPORARY FACILITIES. REMOVE ALL DEBRIS, RUBBISH, AND EXCESS MATERIAL FROM THE SITES.

- REPAIR DAMAGE CAUSED BY INSTALLATION OR USE OF TEMPORARY FACILITIES. THIS INCLUDES HARDSCAPING, LANDSCAPING, FINISHES, ETC.

- THE CONTRACTOR SHALL DELIVER TO THE OWNER, UPON SUBSTANTIAL COMPLETION OF THE WORK, TWO COPIES OF DESCRIPTIVE LITERATURE RELATED TO THE EQUIPMENT INSTALLED UNDER THIS CONTRACT, INCLUDING PARTS LISTS, WIRING DIAGRAMS, MAINTENANCE AND OPERATION MANUALS AND WARRANTIES CUSTOMARILY SUPPLIED BY MANUFACTURERS FOR EQUIPMENT INCORPORATED IN THIS WORK.

- THE CONTRACTOR SHALL LABEL NEW EQUIPMENT AND ANCILLARY SYSTEMS INCLUDED IN THE SCOPE OF THIS PROJECT

- THE CONTRACTOR SHALL GIVE PHYSICAL DEMONSTRATION AND VERBAL INSTRUCTIONS FOR PROPER OPERATION AND MAINTENANCE OF EQUIPMENT TO THE OWNER OR HIS DESIGNATED REPRESENTATIVE. SCHEDULE THESE DEMONSTRATIONS AND INSTRUCTIONS AT THE OWNER'S CONVENIENCE.

TEST, ADJUST AND BALANCE (TAB) SCOPE OF WORK AND COORDINATION

1. LEON COUNTY SCHOOLS WILL CONTRACT WITH A PROFESSIONAL/AABB CERTIFIED TAB COMPANY TO TEST, ADJUST AND BALANCE THE NEW HVAC SYSTEMS. CONSTRUCTION MANAGER & MECHANICAL CONTRACTOR WILL ASSIST IN COORDINATING THIS WORK.

2. THE MECHANICAL CONTRACTOR SHALL FULLY TEST THE OPERATION OF THE HVAC SYSTEM AND RESOLVE ALL KNOWN DISCREPANCIES PRIOR TO REQUESTING TAB SERVICES VIA THE CONSTRUCTION MANAGER.

3. THE MECHANICAL CONTRACTOR SHALL PARTICIPATE AND ASSIST THE TAB WORK , INCLUDING RESOLUTION OF TAB DISCREPANCIES.

4. TEST AND BALANCE CONTRACTOR SHALL PERFORM THE FOLLOWING TASKS:

   A. MARK EQUIPMENT/DAMPER POSITIONS TO SHOW FINAL SETTINGS. MARK WITH PAINT OR OTHER SUITABLE/PERMANENT IDENTIFICATION MATERIALS.

   B. COMPLETE TESTING, ADJUSTING, AND BALANCING OF NEW HVAC SYSTEMS, INCLUDING HYDRONIC PIPING AND RELATED SYSTEMS INCLUDED IN THE SCOPE OF WORK.

   C. MEASURE PRESSURE DROP ACROSS EACH AHU SECTION. REPORT SHALL INCLUDE AN AHU DIAGRAM AND PRESSURE MEASUREMENTS FOR EACH AHU.

   D. MEASURE RETURN AIR, OUTSIDE AIR, MIXED AIR, COIL LEAVING AND UNIT LEAVING AIR CONDITIONS OF EACH AHU.

   E. BALANCE OUTSIDE AIR FANS WITH 0.15" ADDITIONAL PRESSURE DROP (I.E. ABOVE CLEAN PRESSURE DROP) TO ACCOUNT FOR AVERAGE/DIRTY FILTER PRESSURE DROP. SET POTENTIOMETER TO PROVIDE THE DESIGN FLOWRATE AT THE HIGHER PRESSURE DROP.

   F. MEASURE AND BALANCE CHILLED WATER & CONDENSER WATER TO CENTRIFUGAL CHILLERS. MEASURE & BALANCE HOT WATER TO BOILERS.

5. TEST AND BALANCE CONTRACTOR SHALL PROVIDE ONE (1) PAPER AND ELECTRONIC COPY OF THE PRELIMINARY REPORT TO THE ENGINEER FOR REVIEW/COMMENTS. DISCREPANCIES SHALL BE RESOLVED, THE TAB CONTRACTOR SHALL RETEST SYSTEMS AS NEEDED AND ISSUE THREE (3) FINAL SIGNED AND SEALED REPORTS PLUS ONE ELECTRONIC COPY AFTER ALL ISSUES ARE RESOLVED TO THE SATISFACTION OF THE ENGINEER. ITERATIVE PRELIMINARY COPIES MAY BE REQUIRED.

PIPING:

- ALL NEW MECHANICAL SYSTEMS PIPING SERVING AIR HANDLERS SHALL BE SCHEDULE 40, ASTM A53B CARBON STEEL PIPE. PIPING 2-1/2" & LARGER WILL BE WELDED CONSTRUCTION; PIPING 2" & SMALLER WILL BE THREADED CONSTRUCTION.

- ALL WELDED PIPE SHALL HAVE BEVELED ENDS. SMALL-BORE PIPE WILL HAVE THREADED ENDS.

- BUTT-WELD FITTINGS SHALL CONFORM TO ASTM A234 WPB AND THREADED FITTINGS TO BE MALLEABLE IRON, A197, ANSI B16.3, CLASS 150.

- STEEL FLANGES SHALL CONFORM TO ANSI B16.5 150# RAISED FACE. ALL FLANGES LARGER THAN 2" SHALL BE A105 SLIP-ON, UNLESS ATTACHING DIRECTLY TO A FITTING. FLANGES THAT ARE 2" AND SMALLER SHALL BE THREADED.

- PROVIDE DIELECTRIC COUPLINGS/NIPPLES TO ISOLATE DISSIMILAR MATERIALS.

- CHILLED/HOT WATER FLEXIBLE PIPING CONNECTIONS SHALL BE CORRUGATED RUBBER.

- HEATING HOT WATER FLEXIBLE PIPING CONNECTIONS SHALL BE RUBBER WITH STAINLESS STEEL BRAID.

- AIR VENT WASTE PIPING SHALL BE 1/4" SOFT COPPER.

GENERAL PIPING INSTALLATION:

- SUPPORT PIPING: 1" & SMALLER - 8' MAX SPACING; 11/2" & 2" - 12' MAX SPACING; 3" & LARGER - 20' SPACING

- INSTALL VALVES, INSTRUMENTATION AND DEVICES AS INDICATED ON THE SCHEMATIC DIAGRAMS.

- PIPE DISCHARGE FROM AUTOMATIC AIR VENTS TO THE NEAREST FLOOR OR HUB DRAIN.

- PROVIDE VALVE AND WELL EXTENSIONS TO ACCOMMODATE INSULATION THICKNESS.

- INSTALL DEVICES SHIPPED LOOSE WITH EQUIPMENT. LOCATE AND ORIENT VALVES FOR EASY ACCESS AND MAINTENANCE. INSTALL ALL GAUGES AND THERMOMETERS AS NEAR TO EYE LEVEL AS PRACTICAL. INSTALL MISCELLANEOUS DEVICES IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS AND THE SCHEMATIC DIAGRAMS.

- PROTECT OPEN PIPING WITH TEMPORARY COVERS/CAPS. CLEAN NEW PIPING OF LOOSE SCALE, RUST AND WELD SPATTER.

- PROTECT SYSTEM CONTROL VALVES AND CIRCULATE SYSTEM FLUID AT THE GREATEST FLOW POSSIBLE. CLEAN SYSTEM STRAINERS.

- CAPS SHALL BE PERMANENT AND OF THE SAME MATERIAL AS THE BASE PIPE. USE WELD CAPS FOR WELDED PIPING.

  NOTE: NOT ALL NEEDED PIPE SUPPORTS ARE SHOWN ON THE PLANS. CONTRACTOR SHALL SELECT AND INSTALL REQUIRED PIPE SUPPORTS.

WELDING STEEL PIPE/FITTINGS:

- WELDING SHALL BE PERFORMED IN ACCORDANCE WITH ANSI B31.1. BEVEL PIPE THAT IS FIELD CUT IN ACCORDANCE WITH RECOGNIZED STANDARDS.

- WELDERS SHALL BE CERTIFIED WITHIN THE LAST 12 MONTHS FOR THE PIPE SIZE REQUIRED BY THIS PROJECT. AT LEAST TWO WEEKS PRIOR TO COMMENCING WELDING, THE CONSTRUCTION MANAGER SHALL OBTAIN CERTIFICATIONS AND PHOTO ID COPIES FOR EACH WELDER PROPOSED FOR THE PROJECT. THE CONSTRUCTION MANAGER SHALL VERIFY THE INFORMATION TO ENSURE WELDER IS AS NAMED ON THE CERTIFICATION AND THAT THE CERTIFICATION IS ACCEPTABLE.

- BEFORE PERFORMING WELDING OPERATIONS, REMOVE DIRT, SCALE AND OTHER FOREIGN MATTER FROM PIPING. SET JOINTS TRUE AND SQUARE WITH PROPER ROOT PASS GAP FOR SIZE PIPE. ROOT BEAD WILL PROVIDE FOR COMPLETE PENETRATION INTO THE ROOT OF THE JOINT, PROVIDE ROOT BEAD AND MULTIPLE FILLER LAYERS AND A FINAL COVER PASS. WELDERS SHALL PROVIDE IDENTIFYING MARK AT EACH WELD.

- CONTRACTOR SHALL REMOVE SUSPECT WELDS AND SUBMIT FOR DESTRUCTIVE TESTS AS REQUESTED BY THE ENGINEER. CONTRACTOR SHALL PAY FOR DESTRUCTIVE TESTS THAT FAIL.

- ALL WELDING SHALL BE PERFORMED BY WELDERS ADEQUATELY FAMILIAR WITH WELDING SAFETY PRACTICES INCLUDING NFPA 51B.

- INSTALL PIPING PARALLEL TO WALLS. SLOPE PIPING AT 1 INCH PER 40 FEET BACK TOWARDS PUMPS OR TO DRAINAGE POINTS. INSTALL DRAINS AT ANY LOW POINT THAT WILL TRAP OVER 5 GALLONS OF WATER. INSTALL BLOWDOWN PIPING WITH VALVE FOR ALL STRAINERS.

- LEAK TEST ALL PIPING IN ACCORDANCE WITH NORMAL PRACTICE BUT NO LESS THAN 1.5 TIMES OPERATING PRESSURE AND NOT LESS THAN 100 PSI.

- PROTECT BUILDING FINISHES FROM WELD SPATTER WITH FIRE RETARDANT SHIELDS. MAINTAIN A FIRE EXTINGUISHER AT HAND AT ALL TIMES WHEN WELDING. PROVIDE ADEQUATE VENTILATION FOR WELDING OPERATIONS.

CONDENSATE PIPING

- CONDENSATE DRAIN SHALL INCLUDE A P-TRAP, SEE DETAIL. DISCHARGE SHALL BE INTO A CONDENSATE PUMPING UNIT (CPU-1, SEE SCHEDULE). MECHANICAL CONTRACTOR SHALL PROVIDE THE CPU AND PIPE CONDENSATE INTO THE CPU. THE PLUMBING CONTRACTOR SHALL PIPE THE CPU DISCHARGE TO THE POINT OF TERMINATION INTO THE STORM SYSTEM (EXISTING STORM DRAIN IN CHILLER YARD).

- PIPING SHALL BE SAME SIZE AS DISCHARGE CONNECTION, D-W-V COPPER AND FITTINGS. MINIMUM SIZE IS 3/4". SUPPORT PIPING AT P-TRAP AND ON 4' CENTERS AND SLOPE 1/8" PER FOOT TOWARD DRAIN.

- PROVIDE CLEANOUTS WITH SCREW CAPS/PLUGS AT TRAPS, ON VERTICAL DROPS, AND IN HORIZONTAL DIRECTION CHANGES.

MISCELLANEOUS METALS:

- INTERIOR EQUIPMENT/PIPING SUPPORTS, HARDWARE, BRACKETS, FRAMING CHANNEL, ETC. SHALL BE GALVANIZED STEEL AND EQUAL TO B-LINE.

- METAL/ELECTRICAL FRAMING/CHANNEL, SUPPORTS, ETC. IN CONTACT WITH CONCRETE OR INSTALLED OUTDOORS SHALL BE HOT-DIPPED GALVANIZED.

- MISCELLANEOUS INTERIOR SUPPORTS SHALL BE 12 GA, 1-5/8" SQ. ELECTRO-GALVANIZED FRAMING CHANNEL. (MINIMUM).

PIPE/EQUIPMENT INSULATION:

INTERIOR COLD PIPING - INSULATE CHILLED WATER PIPING WITH 2" THICKNESS OF CELLULAR GLASS PIPE INSULATION AND FINISH WITH ALL-SERVICE JACKETING. USE 1-1/2" THICKNESS FOR PIPES 4" AND SMALLER; AND 1" THICKNESS FOR PIPES 1-1/2" AND SMALLER. USE BEDDING MASTIC ON PIPING AND JOINTS AND FINISH ELBOWS WITH GLASS FABRIC AND MASTIC.

INTERIOR HOT PIPING - INSULATE HEATING HOT WATER PIPING WITH 1" PREFORMED FIBERGLASS INSULATION WITH ALL-SERVICE JACKET. PROVIDE PVC COVERS AT ELBOWS.

EXTERIOR COLD PIPING - INSULATE CHILLED WATER PIPING WITH 2" THICKNESS OF CELLULAR GLASS PIPE INSULATION AND FINISH WITH ALL-SERVICE JACKETING. USE 1-1/2" THICKNESS FOR PIPES 4" AND SMALLER; AND 1" THICKNESS FOR PIPES 1-1/2" AND SMALLER. COVER WITH ALUMINUM CLADDING. INSULATION SHALL EXTEND A MINIMUM OF 2 FEET INTO BUILDING.

EXTERIOR WATER PIPING - INSULATE EXTERIOR DOMESTIC WATER, FIRE WATER, ETC. WITH 1" PREFORMED FIBERGLASS WITH ASJ. COVER WITH ALUMINUM CLADDING. INSULATION SHALL EXTEND A MINIMUM OF 2 FEET INTO BUILDING.

INTERIOR WATER PIPING - INSULATE INTERIOR DOMESTIC WATER PIPING WITH 1" CLOSED CELL FOAM INSULATION. SEAL ALL JOINTS & SEAMS AIR TIGHT.

EXTERIOR HOT PIPING - INSULATE HEATING HOT WATER PIPING WITH FOAM GLASS PER SPECIFICATION. ABOVE GROUND PIPE TO HAVE ALUMINUM JACKETING; BELOW GROUND PIPE TO HAVE POLYGUARD JACKETING.

VALVES/EQUIPMENT/HYDRONIC DEVICES - INSULATE VALVES, FLEXIBLE CONNECTORS, PORTS, ITEMS REQUIRING MAINTENANCE ACCESS, ETC. WITH 1" THICKNESS OF FLEXIBLE CLOSED CELL ELASTOMERIC INSULATION AND INSTALL TO FACILITATE REMOVAL/ACCESS. PROVIDE ACCESS TO ALL PORTS, VALVE SHAFTS, PETE'S PLUGS, ETC.

CONDENSATE PIPING - INSULATE CONDENSATE PIPING WITH 3/4" CLOSED CELL FOAM INSULATION WITHIN BUILDING. SEAL ALL JOINTS, SEAMS, ETC. AIR TIGHT. PROVIDE ACCESS PLUGS/CAPS TO FITTINGS THAT REQUIRE MAINTENANCE.

CONDENSATE PIPING, EXTERIOR - INSULATE CONDENSATE PIPING WITH 3/4" CLOSED CELL FOAM INSULATION. COVER INSULATION WITH ALUMINUM CLADDING

INSULATION

ALL INSULATION SHALL BE INSTALLED BY PROFESSIONAL INSULATORS WITH ADEQUATE EXPERIENCE AND ABILITY TO INSURE A SUCCESSFUL JOB. INSTALL INSULATION PRODUCTS IN ACCORDANCE WITH MANUFACTURER'S WRITTEN INSTRUCTIONS, AND IN ACCORDANCE WITH RECOGNIZED INDUSTRY PRACTICES TO ENSURE THAT INSULATION SERVES ITS INTENDED PURPOSE.

PROVIDE COMPOSITE MECHANICAL INSULATION (INSULATION, JACKETS, COVERINGS, SEALERS, MASTICS AND ADHESIVES) HAVING FLAME SPREAD INDEX OF 25 OR LESS, AND SMOKE DEVELOPED INDEX OF 50 OR LESS, AS TESTED BY ASTM E 84 (NFPA 255) METHODS.

VAPOR BARRIER SHALL BE MAINTAINED COMPLETE AND CONTINUOUS. GAPS AND OPENINGS IN COLD PIPE OR DUCT INSULATION VAPOR BARRIER WILL NOT BE TOLERATED.

INSULATION IS NOT TO BE INSTALLED UNTIL THE PIPING SYSTEMS HAVE BEEN CHECKED AND FOUND FREE OF ALL LEAKS. SURFACES SHALL BE CLEAN AND DRY BEFORE ATTEMPTING TO APPLY INSULATION. HYDRONIC DEVICES:

INSTALL MISCELLANEOUS DEVICES IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS AND THE SCHEMATIC DIAGRAMS.

COORDINATE WITH THE CONTROL PROVIDER AND MAKE PIPING PREPARATIONS FOR BAS CONTROL DEVICES.

INSTALL VALVES, INSTRUMENTATION AND DEVICES AS INDICATED ON THE SCHEMATIC DIAGRAMS. INSTALL DEVICES SHIPPED LOOSE WITH THE CHILLERS. LOCATE AND ORIENT VALVES FOR EASY ACCESS AND MAINTENANCE. INSTALL ALL GAUGES AND THERMOMETERS AS NEAR TO EYE LEVEL AS PRACTICAL.

INSTALL METERS TO CONFORM TO MANUFACTURER'S RECOMMENDATIONS FOR UP AND DOWN STREAM STRAIGHT LENGTHS OF PIPE. INSTALL BACKFLOW PREVENTERS WITH PRESSURE TEST PORTS VERTICAL TO AVOID ACCUMULATION OF TRASH. INSTALL COMPRESSION TANKS, SHOT FEEDERS, AND MISCELLANEOUS DEVICES IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS AND THE SCHEMATIC DIAGRAMS.

TAKE CARE TO PROTECT EXISTING PIPING FROM INTRODUCTION OF FOREIGN DEBRIS. CLEAN NEW PIPING OF LOOSE SCALE, RUST AND WELD SPATTER. REMOVE TIGHTLY ADHERING DEBRIS WITH WIRE BRUSH OR BY GRINDING AS NECESSARY. PROTECT SYSTEM CONTROL VALVES AND CIRCULATE SYSTEM FLUID AT THE GREATEST FLOW POSSIBLE. CLEAN SYSTEM STRAINERS. PROVIDE INITIAL CHEMICAL TREATMENT.

PAINTING
CARBON STEEL PIPING AND SUPPORTS THAT WILL NOT BE INSULATED ARE TO BE CLEANED, PRIMED, AND PAINTED TO PROTECT THE CARBON STEEL FROM OXIDATION AND CORROSION. THE PAINT SYSTEM SHALL BE SUITABLE FOR THE ENVIRONMENT.

NATURAL GAS PIPING TOPCOAT SHALL BE SAFETY YELLOW.

TOPCOAT COLOR FOR SUPPORT STEEL, DRAIN PIPING, ETC., SHALL BE WHITE.

DUCTWORK:

- ALL WORK SHALL COMPLY WITH SMACNA HVAC DUCT CONSTRUCTION STANDARDS - METAL AND FLEXIBLE. CONSTRUCT SUPPLY DUCTWORK FOR VAV SYSTEMS TO WITHSTAND 3" (MIN) AND RETURN DUCT -2" STATIC PRESSURES.

- USE EITHER ROUND OR RECTANGULAR DUCT WITH EQUAL OR GREATER EQUIVALENT FREE AREA TO ACCOMMODATE EXISTING STRUCTURE.

- CROSS BREAK DUCTS AND OTHER SHEET METAL OVER 24" WIDE.

- INTERIOR - USE GALVANIZED SHEET METAL FOR RECTANGULAR WITH EXTERIOR INSULATION, UOS. USE GALVANIZED SPIRAL SEAM ROUND DUCT WITH EXTERIOR INSULATION.

- FOR HIGH PRESSURE TAKE-OFF, USE A BELLMOUTH OR MITERED FITTING TO CONNECT ROUND DUCT TO RECTANGULAR. USE A MITERED FITTING WHEN CONNECTING RECTANGULAR TO RECTANGULAR DUCT.

- FLEXIBLE DUCT ON RUNOUTS SHALL NOT EXCEED 15'. USE ROUND SPIRAL DUCT FOR LONGER RUNS.

- PROVIDE SHEET METAL CLOSURE ANGLES, ESCUTCHEONS, OR FLASHING ON BOTH SIDES OF WALL PENETRATIONS (NON RATED) AND SEAL AIR TIGHT. MINIMUM WIDTH IS 1" OR AS REQUIRED TO COVER OPENING.

- PROVIDE SMOKE TIGHT SEAL WHEN PENETRATING SMOKE COMPARTMENT WALLS.

- PROVIDE DOUBLE-THICKNESS TURNING VANES IN ALL RECTANGULAR ELBOWS AND OFFSETS.

- DUCT SIZES MAY BE CHANGED TO ACCOMMODATE CONDITION AS LONG AS THE INTERNAL FREE AREA IS NOT DIMINISHED.

- RUN-OUT DUCTS TO DIFFUSERS SHALL BE EQUAL TO DIFFUSER NECK SIZE, SEE GRILLE/FLOW SCHEDULES.

- ALL FABRICATED DUCTWORK LONGITUDINAL AND TRANSVERSE JOINTS, TAPS, AND CONNECTIONS SHALL BE SEALED WITH DUCT MASTIC REGARDLESS OF PRESSURE CLASS.

- PAINT ALL REFLECTIVE SURFACES SEEN THRU GRILLE FLAT BLACK.

- TAG ALL DAMPER LOCATIONS WITH ORANGE FLAG TAPE.

- PERMANENTLY MARK ALL DAMPER SHAFTS TO INDICATE DAMPER POSITION.

DUCT ACCESSORIES:

- ACCESSORIES, GRILLES, ETC. SHALL BE INSTALLED PER THE MANUFACTURER'S RECOMMENDATIONS.

- MANUAL VOLUME DAMPERS IN RECTANGULAR DUCTS SHALL BE OPPOSED-BLADE TYPE, HANDLES SHALL HAVE LOCKING QUADRANTS, AND EXTENSIONS TO ACCOMMODATE EXTERNAL INSULATION. ROUND DUCTS SHALL HAVE BUTTERFLY TYPE DAMPERS.

- RECTANGULAR TAKEOFFS SHALL BE MITERED TYPE WITH MANUAL VOLUME DAMPERS AND INSULATION STANDOFFS TO ACCOMMODATE THE INSULATION THICKNESS, UOS. DAMPERS SHALL INCLUDE A LOCKING QUADRANT AND HARDWARE TO FIX/LOCK FINAL DAMPER POSITION. USE A PERMANENT MARKER ON THE DAMPER SHAFT TO INDICATE DAMPER POSITION.

- ROUND TAKEOFFS SHALL HAVE A MANUAL VOLUME DAMPER, INSULATION STANDOFF, AND LOCKING QUADRANT, UOS. USE A PERMANENT MARKER ON THE DAMPER SHAFT TO INDICATE DAMPER POSITION.

VAV AIR TERMINALS:

- INSTALL AND ORIENT TERMINALS TO OPTIMIZE AVAILABLE SPACE FOR ACCESS AND NOT HIGHER THAN 12" ABOVE CEILING. SUPPORT UNITS FROM EXISTING STRUCTURE USING ELECTRICAL FRAMING CHANNEL. RELOCATED ANY CONDUITS BELOW EACH UNIT.

DAMPERS:

- ELECTRIC/MOTOR OPERATED CONTROL DAMPERS SHALL BE OPPOSED-BLADE TYPE WITH NEOPRENE BLADE EDGE SEALS EQUAL TO RUSKIN.

- ELECTRIC MOTOR OPERATED DAMPERS SHALL HAVE 120VAC, 18 IN-LB TORQUE (MINIMUM) ACTUATORS EQUAL TO BELIMO "TF" SERIES WITH SPRING RETURN. OPERATORS SHALL BE SIZED ACCORDING TO DAMPER SIZE AND TORQUE REQUIREMENTS PER THE DAMPER/OPERATOR REQUIREMENTS (WHICHEVER IS HIGHER).

- DURING DAMPER INSTALLATION, PERMANENTLY MARK OR ENGRAVE EACH DAMPER SHAFT TO INDICATE DAMPER POSITION.

DUCTWORK INSULATION:

- INSULATION IN CONCEALED/ACCESSIBLE INTERIOR SPACES SHALL BE BLANKET TYPE. SECURE INSULATION WITH IMPALE PINS WHEN DUCT IS OVER 24" WIDE.

- BLANKET INSULATION SHALL BE 2.2" THICK (OUT OF PACKAGE) FOIL BACKED R-6 (INSTALLED) INSULATION. SEAL ALL JOINTS, SEAMS, ETC. PER THE MANUFACTURER'S RECOMMENDATIONS. SEALING TAPE SHALL BE UL 181 LISTED PRESSURE-SENSITIVE TYPE.

- INSULATION IN MECHANICAL ROOMS AND ON DUCTS PENETRATING WALLS (WITHOUT FIRE DAMPERS) SHALL BE RIGID FIBERGLASS. EXTEND INSULATION 6" BEYOND WALL THEN TRANSITION TO DUCT WRAP (WHEN CONCEALED). USE CLIP ANGLES AT WALL TO SEAL OPENING (BOTH SIDES) UOS. SEAL PENETRATION TO COMPLY WITH THE WALL RATING, SEE ARCHITECTURAL SHEETS.

- RIGID INSULATION ON SUPPLY DUCTWORK SHALL BE 1.5" THICK TO PROVIDE AN R-VALUE EQUAL TO 6 (MINIMUM).

- RIGID INSULATION ON RETURN AND OUTSIDE AIR DUCTWORK SHALL BE 1" THICK.

- INSULATE OUTSIDE AIR PLENUMS, LOUVER COVERS, OA DUCTS, ETC. WITH 1" RIGID INSULATION. SECURE INSULATION WITH MECHANICAL FASTENERS (IMPALE PINS) ON DUCTS OVER 24" WIDE. SEAL ALL RIGID EDGES WITH ALUMINUM TAPE AND MASTIC AT TAPE EDGES.

- MECHANICAL FASTENERS (IMPALE PINS) SHALL BE ADHERED WITH MASTIC SPACED ON 18" CENTERS.
  NOTE: SELF-ADHESIVE TYPE IMPALE PINS ARE PROHIBITED.

- INSULATE THE BACKS OF NEW SUPPLY AIR GRILLES - SEE DETAIL.

- ALL DUCTWORK CONVEYING CONDITIONED OR OUTSIDE AIR AIR SHALL BE EXTERNALLY INSULATED UNLESS SPECIFIED OTHERWISE.

- PROVIDE INCOMPRESSIBLE INSULATION/INSERTS AT ALL TRAPEZE-TYPE SUPPORTS TO PREVENT INSULATION COMPRESSION.

- INSTALL INSULATION PRODUCTS IN ACCORDANCE WITH MANUFACTURER'S WRITTEN INSTRUCTIONS AND IN ACCORDANCE WITH RECOGNIZED INDUSTRY BEST PRACTICES FOR THE INTENDED PURPOSE.

- PROVIDE COMPOSITE MECHANICAL INSULATION (INSULATION, JACKETS, COVERINGS, SEALERS, MASTICS AND ADHESIVES) HAVING FLAME SPREAD INDEX OF 25 OR LESS, AND SMOKE DEVELOPED INDEX OF 50 OR LESS, AS TESTED BY ASTM E 84 (NFPA 255) METHODS.

- VAPOR BARRIERS SHALL BE MAINTAINED COMPLETE AND CONTINUOUS. SEAL ALL GAPS, JOINTS, SEAMS, ETC.

- INSTALL INSULATION AFTER THE DUCT SYSTEMS HAVE BEEN SEALED WITH MASTIC, PRESSURE TESTED AND FOUND FREE OF ALL LEAKS.

- SURFACES SHALL BE CLEAN AND DRY BEFORE APPLYING INSULATION MASTICS OR INSULATION.

- RATED PARTITIONS & WALLS SHALL BE PENETRATED ONLY WITH INSULATION MATERIALS AND TECHNIQUES THAT ARE UL LISTED TO MAINTAIN FIRE RATING. ANY QUESTIONS SHALL BE REFERRED TO THE ARCHITECT/ENGINEER.

AIR HANDLER UNIT INSTALLATION:

- COORDINATE WITH THE SUPPLIER TO UNDERSTAND WHICH FEATURES AND OPTIONS MUST BE FIELD INSTALLED.

- COORDINATE CONTROLS AND POWER WIRING INSTALLATION. PROVIDE ALL PENETRATIONS INTO UNIT CABINET FOR ELECTRICAL AND POWER WIRING INSTALLATION.

- LOCATE UNIT TO PROVIDE PROPER CLEARANCE TO ACCESS PANELS, PIPING, CONTROLS, ETC. OPTIMIZE AVAILABLE SPACE.

- SET UNIT ON 1/2" THICK NEOPRENE VIBRATION-ISOLATION PADS ON 2' CENTERS UNDER MAIN SUPPORTS.

- PROVIDE EXTERNAL CONDENSATE PUMP WITH AUTOMATIC SHUTOFF CAPABILITIES AND AN ALARM IN CASE OF SHUTDOWN. ROUTE PUMPED CONDENSATE TO EXISTING CONDENSATE DRAIN LINE ABOVE CEILING.

- PROVIDE HEATING COIL DRAIN PIPING WITH NORMALLY CLOSED BALL VALVE (FOR FUTURE COIL CLEANING) AND ELBOW AND SHORT PIPE FOR HOSE CONNECTION.

- INSTALL DUCTWORK.

- INSTALL HEATING AND CHILLED WATER PIPING, SEE COIL PIPING DETAILS. PROVIDE PIPING SUPPORTS AT COIL CONNECTIONS WITHIN 12" OF LAST ELBOW WHERE VERTICAL PIPING SERVES COIL.

- REMOVE ALL DEBRIS, DUST, METAL SHAVINGS, ETC. FROM INTERIOR OF UNIT PRIOR TO STARTUP.

- PERFORM START-UP IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS AND COMPLETE A STARTUP REPORT.

- PROGRAM AND TEST CONTROLS, DAMPERS, AND SAFETIES.

- CLEAN FACTORY-FINISHED SURFACES. REPAIR ANY MARRED OR SCRATCHED SURFACES WITH MANUFACTURER'S TOUCH-UP PAINT.

- PROVIDE NEW FILTERS AT SUBSTANTIAL COMPLETION.

FANS:

- INSTALL FANS WITH REQUISITE LENGTH OF STRAIGHT FULL SIZE DUCTS ON INLET AND DISCHARGE TO MINIMIZE SYSTEM EFFECT. MINIMUM LENGTH IS 3 TIMES THE WHEEL DIAMETER UOS. LOCATE TAPS/BRANCHES BEYOND MINIMUM LENGTHS.

- PROVIDE FLEXIBLE DUCT CONNECTIONS AT FAN.

- SUPPORT FAN FROM STRUCTURE OR WALL.

DUCT SMOKE DETECTORS:

- DUCT SMOKE DETECTORS ARE PROVIDED AND WIRED TO THE FIRE ALARM BY DIVISION 16.

- THE MECHANICAL SUBCONTRACTOR WILL BE RESPONSIBLE FOR MOUNTING DUCT SMOKE DETECTORS AND WIRING TO THE AHU FOR SYSTEM SHUTDOWN ON ANY GENERAL FIRE ALARM.

CONTROLS SCOPE OF WORK & COORDINATION:

- CONTROLS SHALL BE PERFORMED UNDER A SEPARATE CONTRACT BY LEON COUNTY SCHOOLS. ALL WORK SHALL BE COORDINATED WITH THE CONTROLS VENDOR JUST AS IF THEY WERE UNDER THE PRIME OR MECHANICAL SUBCONTRACTOR.

- CONTROL WIRING OF THIS CONTRACT IS LIMITED TO THAT SPECIFICALLY REQUIRED BY THESE DRAWINGS AND SPECIFICATIONS.

- MECHANICAL CONTRACTOR SHALL INSTALL MISCELLANEOUS, SENSORS, ACTUATORS, AND OTHER DEVICES PROVIDED BY THE CONTROLS' SUBCONTRACTOR FOR INSTALLATION IN THE MECHANICAL SYSTEM.

- LOW-VOLTAGE WIRE MUST BE IN CONDUIT THROUGHOUT ITS ENTIRE LENGTH. COORDINATE CONTROL WIRING IN GENERAL AND FOR SENSORS IN WALLS DURING ELECTRICAL ROUGH IN.

- PROVIDE WIRING AND DEVICES AS NECESSARY TO PROVIDE FOR CONTROL OF FANS AS INDICATED ON THE FAN SCHEDULE.

DUCT SMOKE/FIRE DAMPERS, COMMON DAMPERS, AND DETECTORS:

- SMOKE AND FIRE DAMPERS, WHERE INDICATED, SHALL BE INSTALLED IN STRICT CONFORMANCE WITH THE MANUFACTURER'S INSTRUCTIONS. PROVIDE SLEEVES AND ANGLES WHERE REQUIRED. PROVIDE DUCT ACCESS PANELS FOR INSPECTION AND RESETTING OF FIRE DAMPERS.

- DUCT SMOKE DETECTORS ARE PROVIDED AND WIRED TO THE FIRE ALARM BY DIVISION 16.

- THE MECHANICAL SUBCONTRACTOR WILL BE RESPONSIBLE FOR MOUNTING DUCT FIRE/SMOKE DAMPERS/ DETECTORS AND WIRING TO THE AHU FOR SYSTEM SHUTDOWN ON ANY GENERAL FIRE ALARM.

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This item has been digitally signed and sealed by **Jon Barber, PE** on 08/25/23 Printed copies of this document are not considered signed and sealed and the signature must be verified on any electronic copies.

JON M. BARBER LICENSE No. 55427 STATE OF FLORIDA PROFESSIONAL ENGINEER

Mechanical - General Notes

Revisions #	Date	Description

P.I.C.	JMS
Design	JB
Drawn	MH
Reviewed	JB
Job Number	

M-100

08.28.2023

DOAS W/ENERGY RECOVERY WHEEL SCHEDULE

DESIGNATION		VPU-1
AREA SERVED		UPPER LEVELS
MANUFACTURER		DAIKIN
UNIT MODEL		CAH020GDGM
CONFIGURATION (SEE BELOW)		STACKED W/ HEAT WHEEL
VENTILATION AIR	CFM	9000 (2250 MIN)
EXHAUST AIR	CFM	7650
MAX COIL FACE VELOCITY	FPM	500
CC ENTERING AIR CONDITIONS	°FDB/°FWB	80 / 69.8
CC LEAVING AIR CONDITIONS	°FDB/°FWB	53.6 / 53.2
UNIT TOTAL COOLING CAPACITY	MBH	476.1
UNIT LATENT COOLING CAPACITY	MBH	215
UNIT SENSIBLE COOLING CAPACITY	MBH	261.3
CHILLED WATER FLOW RATE	GPM	95
CHILLED WATER HEAD LOSS	FT H2O	8.8
CHILLED WATER TEMP ENT/LEAV	°F / °F	44 / 54
CHILLED WATER COIL ROWS & FINS/INCH		6 / 10
CHILLED WATER COIL FACE VELOCITY	FPM	480
PRE-HEAT COIL HEATING CAPACITY	MBH	244
PRE-HEAT COIL ENTERING AIR CONDITIONS	°F DB	25
PRE-HEAT COIL LEAVING AIR CONDITIONS	°F DB	50
PRE-HEAT COIL WATER FLOW RATE	GPM	25
PRE-HEAT COIL WATER HEAD LOSS	FT H2O	3.8
PRE-HEAT COIL WATER TEMP ENT/LEAV	°F / °F	160 / 140
PRE-HEAT COIL ROWS & FINS PER INCH		1 / 11
WHEEL DIAMETER	IN	72"
OUTSIDE AIR CONDITIONS	°FDB/°FWB	95 / 80
SUMMER: WHEEL EAT	°F DB	72 / 63
SUMMER: WHEEL LAT	°F DB	80 / 69.8
WHEEL EFFICIENCY (SUMMER)	%	74.2%
TOTAL ENERGY RECOVERED - SUMMER	MBH	375,211
OUTSIDE AIR CONDITIONS	°FDB/°FWB	50 / 49.9
WINTER WHEEL EAT	°F DB	68 / 59
WINTER WHEEL LAT	°F DB	61.8 / 56
WHEEL EFFICIENCY -WINTER	%	77.5%
TOTAL ENERGY RECOVERED - WINTER	MBH	114,289
EXTERNAL STATIC - OUTSIDE AIR	IN WG	1
EXTERNAL STATIC - EXHAUST AIR	IN WG	1
TOTAL STATIC PRESS. DROP (CLEAN/DIRTY)	IN WG	3.67
AHU FAN BRAKE HORSEPOWER (DIRTY)	BHP	2 @ 4.25
OUTSIDE AIR FAN MOTOR HORSEPOWER	HP	2 FANS @ 7.5 HP
MOTOR FLA / MOP	AMPS	2 @ 8.7 / 2 @ 20
EXHAUST FAN MOTOR HORSEPOWER	HP	1 FAN @ 7.5 HP
MOTOR FLA / MOP	AMPS	8.7 / 20
MOTOR ELECTRICAL CHARACTERISTICS	V/Ø/HZ	480 / 3 / 60
ENERGY WHEEL MOTOR HORSEPOWER	HP	1
MOTOR FLA / MOP	AMPS	6.8 / 15
MOTOR ELECTRICAL CHARACTERISTICS	V/Ø/HZ	208 / 1 / 60
CABINET NOMINAL DIMENSIONS (LXWXH)	IN	232 x 88 x 92

NOTES:

1. AIR HANDLER WILL BE FOR 100% OUTSIDE AIR SERVICE WITH ENERGY RECOVERY FROM EXHAUST AIR.
2. COOLING COIL SECTION SHALL HAVE STAINLESS STEEL IAQ DRAIN PAN.
3. RIGHT HAND CONFIGURATION FOR ALL CONNECTIONS AND ACCESS - FIELD VERIFY
4. FILTER SECTION TO ACCOMMODATE 4" THICK FILTERS (MERV 11).
5. GALVANIZED DOUBLE-WALL UNIT WITH 2" THICK FOAM FILLED INSULATION, MINIMUM R = 13.
6. MOTOR SHALL BE PREMIUM EFFICIENCY, OPEN DRIP PROOF, 1.15 SERVICE FACTOR, AND RATED FOR INVERTER DUTY.
7. PROVIDE BASE RAIL INTEGRAL TO UNIT. CONDENSATE CONNECTION SHALL BE HIGH ENOUGH TO ALLOW FOR P-TRAP AND NO STANDING WATER IN PAN.
8. ACCESS DOORS SHALL BE HINGED WITH ROTATING DOOR LOCK AND GASKETS, AND MANUFACTURED OF THE SAME CONSTRUCTION OF THE CABINET.
9. VFD IS BY OTHERS, SEE SCHEDULE
10. MEAN FILTER PRESSURE DROP USED IN TSP AND BHP CALCULATIONS.
11. FC FAN, FACTORY BALANCED ACROSS OPERATING RPM, MOUNTED ON SPRING ISOLATORS.
12. HEAT WHEEL REQUIRES SEPERATE 115V SINGLE PHASE CIRCUIT
13. EQUIPMENT SECTIONS SHALL FIT THROUGH 11'-0" x 3'-4" OPENING INTO THE BUILDING. UNIT CAN BE 'KNOCKED DOWN' BY CONTRACTOR ON SITE.

DOAS SCHEDULE

DESIGNATION		VPU-2	VPU-3
AREA SERVED		LOWER LEVEL	LOWER LEVEL
MANUFACTURER		DAIKIN	DAIKIN
UNIT MODEL		CAH004GDGM	-
CONFIGURATION (SEE BELOW)		STACKED DRAW THROUGH	HORIZ. DRAW THROUGH
ORIENTATION / HANDING		RIGHT (TBD)	RIGHT (TBD)
SUPPLY AIR - CONSTANT VOLUME	CFM	1600	1600
VENTILATION AIR	CFM	1600	1600
MAX COIL FACE VELOCITY	FPM	500	500
PRE-HEAT COIL HEATING CAPACITY	MBH	44.7	44.7
PRE-HEAT COIL ENTERING AIR CONDITIONS	°F DB	25	25
PRE-HEAT COIL LEAVING AIR CONDITIONS	°F DB	50	50
PRE-HEAT COIL WATER FLOW RATE	GPM	4.4	4.4
PRE-HEAT COIL PRESSURE DROP	FT WG	0.4	0.4
PRE-HEAT COIL WATER TEMP ENT/LEAV	°F / °F	160 / 140	160 / 140
PRE-HEAT COIL ROWS & FINS PER INCH		1 / 7	1 / 7
CC ENTERING AIR CONDITIONS	°FDB/°FWB	95 / 80	95 / 80
CC LEAVING AIR CONDITIONS	°FDB/°FWB	53.2 / 53.0	53.2 / 53.0
UNIT TOTAL COOLING CAPACITY	MBH	155	155
UNIT LATENT COOLING CAPACITY	MBH	81.8	81.8
UNIT SENSIBLE COOLING CAPACITY	MBH	73.2	73.2
CHILLED WATER FLOW RATE	GPM	31	31
CHILLED WATER PRESSURE DROP	FT WG	7.6	7.6
CHILLED WATER TEMP ENT/LEAV	°F / °F	44 / 54	44 / 54
CHILLED WATER COIL ROWS & FINS/INCH		6 / 12	6 / 12
CHILLED WATER COIL FACE VELOCITY	FPM	406	406
RE-HEAT COIL CAPACITY	MBH	43.4	43.4
RE-HEAT ENTERING AIR CONDITIONS	°F DB	50	50
RE-HEAT LEAVING AIR CONDITIONS	°F DB	75	75
RE-HEAT WATER FLOW RATE	GPM	4.4	4.4
RE-HEAT COIL PRESSURE DROP	FT WG	0.4	0.4
RE-HEAT WATER TEMP ENT/LEAV (MAX/MIN)	°F / °F	160 / 140	160 / 140
RE-HEAT COIL ROWS & FINS PER INCH		1 / 7	1 / 7
FILTER STATIC (CLEAN/DIRTY)	IN WG	0.3 / 1	0.3 / 1
PRE- & RE-HEAT COIL STATIC	IN WG	0.07	0.07
COOLING COIL STATIC	IN WG	0.6	0.6
EXTERNAL STATIC	IN WG	1.5	1.5
TOTAL STATIC PRESS. DROP (CLEAN/DIRTY)	IN WG	3.4	3.4
AHU FAN BRAKE HORSEPOWER (DIRTY)	BHP	1.6	1.6
AHU FAN MOTOR HORSEPOWER	HP	3	3
AHU ELECTRICAL CHARACTERISTICS	V/Ø/HZ	480 / 3 / 60	480 / 3 / 60
MOTOR FLA	AMPS	3.8	3.8
BREAKER SIZE (MOCP)	AMPS	15	15
CABINET NOMINAL DIMENSIONS (LXWXH)	IN	84 x 40 x 60	84 x 40 x 60
NOTES		SEE BELOW	SEE BELOW

NOTES:

1. AIR HANDLER WILL BE FOR 100% OUTSIDE AIR SERVICE; CONSTANT VOLUME DURING OCCUPIED HOURS.
2. COOLING COIL SECTION SHALL HAVE STAINLESS STEEL IAQ DRAIN PAN.
3. RIGHT HAND CONFIGURATION FOR ALL CONNECTIONS AND ACCESS.
4. FILTER SECTION TO ACCOMMODATE 4" THICK FILTERS (MERV 11).
5. GALVANIZED DOUBLE-WALL UNIT WITH 2" THICK FOAM FILLED INSULATION, MINIMUM R = 13.
6. MOTOR SHALL BE PREMIUM EFFICIENCY, OPEN DRIP PROOF, 1.15 SERVICE FACTOR, AND RATED FOR INVERTER DUTY.
7. 6" HIGH BASE RAIL INTEGRAL TO UNIT. CONDENSATE CONNECTION SHALL BE HIGH ENOUGH TO ALLOW FOR P-TRAP AND NO STANDING WATER IN PAN.
8. ACCESS DOORS SHALL BE HINGED WITH ROTATING DOOR LOCK AND GASKETS, AND MANUFACTURED OF THE SAME CONSTRUCTION OF THE CABINET.
9. VFD IS BY OTHERS.
10. MEAN FILTER PRESSURE DROP USED IN TSP AND BHP CALCULATIONS.
11. FC FAN, FACTORY BALANCED ACROSS OPERATING RPM, MOUNTED ON ISOLATION PLATFORM.
12. EQUIPMENT SECTIONS SHALL FIT THROUGH 3'-0"x7'-0" DOOR.

CONDENSATE PUMP SCHEDULE

DESIGNATION		CPU-2, CPU-3
SYSTEMS SERVED		VPU-2 & VPU-3
MANUFACTURER		LITTLE GIANT
MODEL		VCL-45ULS
PUMP TYPE		CENTRIFUGAL
FLOW RATE	GPH	320
DYNAMIC HEAD	FT	20
DISCHARGE SIZE	NPS	3/8" COPPER
SHUT OFF HEAD	FT	45
MOTOR ELECTRICAL CHARACTERISTICS	V/Ø/HZ	115/1/60
MOTOR HORSEPOWER & CURRENT	HP (AMPS)	1/5 (3.5)
OVERALL DIMENSIONS (LxWxH)	IN	12x6x10

NOTES:

1. MOTOR SHALL INCLUDE THERMAL OVERLOAD, AND PERMANENTLY LUBRICATED BEARINGS.
2. VOLUTE AND IMPELLER SHALL BE NYLON.
3. SHAFT SEAL SHALL BE NITRILE.
4. INLET SCREEN SHALL BE POLYETHYLENE.
5. RESERVOIR SHALL BE 1 GAL CAPACITY AND CONSTRUCTED OF ABS PLASTIC, AND INCLUDE FLOAT SWITCHES FOR PUMP ACTIVATION.
6. INCLUDE COPPER CHECK VALVE ON DISCHARGE AND 6' POWER CORD.

AHU SCHEDULE - VARIABLE AIR VOLUME (VAV)

DESIGNATION		AHU-1	
AREA SERVED		GYM & LOBBY	
MANUFACTURER		DAIKIN	
UNIT MODEL		CAH040GDGM	
CONFIGURATION (SEE BELOW)		HORIZONTAL VAV	
ORIENTATION/HANDING		RIGHT (T.B.D)	
MAX SUPPLY AIR (COOLING/HEATING)	CFM	18000	
VENTILATION AIR	CFM	9000 (FROM VPU-1)	
MAX COIL FACE VELOCITY	FPM	500	
CC ENTERING AIR CONDITIONS	°FDB/°FWB	65.9 / 61.4	
CC LEAVING AIR CONDITIONS	°FDB/°FWB	53 / 52.7	
UNIT TOTAL COOLING CAPACITY	MBH	457.7	
UNIT LATENT COOLING CAPACITY	MBH	201.5	
UNIT SENSIBLE COOLING CAPACITY	MBH	256.2	
CHILLED WATER FLOW RATE	GPM	90	
CHILLED WATER PRESSURE DROP	FT WG	10.0	
CHILLED WATER COIL FACE VELOCITY	FPM	473	
CHILLED WATER TEMP ENT/LEAV	°F / °F	44 / 54	
CHILLED WATER COIL ROWS & FINS/INCH		4 / 12	
HEATING COIL CAPACITY (MINIMUM)	MBH	500	
HC ENTERING AIR CONDITIONS	°F DB	55	
HC LEAVING AIR CONDITIONS	°F DB	80	
HOT WATER FLOW RATE	GPM	50	
HOT WATER COIL PRESSURE DROP	FT WG	3.9	
HOT WATER TEMP ENT/LEAV (MAX/MIN)	°F / °F	160 / 140	
HOT WATER COIL ROWS & FINS PER INCH		1 / 12	
PRE & FINAL FILTER STATIC (CLEAN/DIRTY)	IN WG	0.6 / 1.0	
HEATING COIL STATIC	IN WG	0.1	
COOLING COIL STATIC	IN WG	0.7	
EXTERNAL STATIC	IN WG	2.3	
TOTAL STATIC PRESS. DROP (CLEAN/DIRTY)	IN WG	3.7 / 4.1	
AHU FAN BRAKE HORSEPOWER (DIRTY)	BHP	2 @ 10.6	
AHU FAN MOTOR HORSEPOWER	HP	2 FANS @ 15 HP	
AHU ELECTRICAL CHARACTERISTICS	V/Ø/HZ	480/3/60	
MOTOR F.L.A.	AMPS	2 @ 17.5	
BREAKER SIZE (MOCP)	AMPS	2 @ 30	
MAXIMUM CABINET DIMENSIONS (LxWxH)	IN	162 x 96 x 78	
NOTES		1 THRU 14	

NOTES:

1. VENTILATION AIR FLOW RATE SHALL VARY BASED ON INDOOR CO2 CONCENTRATION (DCV) WITH A PAIR OF BALANCING DAMPERS (BY CONTROLS).
2. COOLING COIL SECTION SHALL HAVE STAINLESS STEEL IAQ DRAIN PAN AND FLOAT SWITCH.
3. FILTER SECTION TO ACCOMMODATE 2" THICK PRE-FILTERS (FUTURE) WITH 4" THICK FINAL FILTERS (MERV 11).
4. THE COOLING COIL SHALL NOT HAVE MORE THAN 8 ROWS.
5. G-60 GALVANIZED DOUBLE-WALL UNIT WITH 2" THICK FOAM FILLED INSULATION, MINIMUM R = 13
6. MOTOR SHALL BE PREMIUM EFFICIENCY, OPEN DRIP PROOF, 1.15 SERVICE FACTOR, AND RATED FOR INVERTER DUTY.
7. ACCESS DOORS SHALL BE HINGED WITH ROTATING DOOR LOCK AND GASKETS, AND MANUFACTURED OF THE SAME CONSTRUCTION OF THE BASE.
8. VFD IS BY OTHERS, SEE SCHEDULE.
9. MEAN FILTER PRESSURE DROP USED IN TSP AND BHP CALCULATIONS.
10. FC FAN, FACTORY BALANCED ACROSS OPERATING RPM, MOUNTED ON SPRING ISOLATORS..
11. PROVIDE A 1-YEAR MANUFACTURER'S WARRANTY ON PARTS AND LABOR
12. PROVIDE BASE RAIL INTEGRAL TO UNIT. CONDENSATE CONNECTION SHALL BE HIGH ENOUGH TO ALLOW FOR P-TRAP AND NO STANDING WATER IN PAN.
13. ENTERING AIR TEMPERATURES ARE CALCULATED WITH ERV SYSTEM
14. EQUIPMENT SECTIONS SHALL FIT THROUGH 11'-0" x 3'-4" OPENING INTO THE BUILDING. UNIT CAN BE 'KNOCKED DOWN' BY CONTRACTOR ON SITE.

DRAW -THRU CONFIGURATION:

1. INLET SECTION, END INLET, WITH FILTERS
2. HOT WATER COIL
3. COOLING COIL
4. FAN SECTION, END OUTLET
5. PROVIDE ACCESS DOORS ON ONE SIDE.

FAN COIL / BLOWER COIL

DESIGNATION		FCU-1, 2, 3, 4, 5	BCU-6
AREA SERVED		LOWER LEVEL	OFFICE 207 & GYM STORAGE
MANUFACTURER		ENVIRO-TEC	ENVIRO-TEC
UNIT MODEL		HPP-12	VDD-12
CONFIGURATION (SEE BELOW)		HORIZONTAL FAN COIL	VERTICAL BLOWER COIL
ORIENTATION/HANDING		LEFT	RIGHT
MAX SUPPLY AIR (COOLING/HEATING)	CFM	1200	700
VENTILATION AIR	CFM	N/A	110
MAX COOLING COIL FACE VELOCITY	FPM	500	500
CC ENTERING AIR CONDITIONS	°FDB/°FWB	74 / 63	77.1 / 64.4
CC LEAVING AIR CONDITIONS	°FDB/°FWB	54 / 54	53.6 / 52.5
UNIT TOTAL COOLING CAPACITY	MBH	33	24
UNIT LATENT COOLING CAPACITY	MBH	8	6.6
UNIT SENSIBLE COOLING CAPACITY	MBH	25	17.4
CHILLED WATER FLOW RATE	GPM	6.7	5
CHILLED WATER CONNECTION	INCHES	1-1/8	7/8
CHILLED WATER TEMP ENT/LEAV	°F / °F	44 / 54	44 / 54
CHILLED WATER COIL ROWS & FINS/INCH		4 / 10	4 / 10
CHILLED WATER COIL FACE VELOCITY	FPM	-	-
CHILLED WATER PRESSURE DROP	FT WG	5.22	6.67
HEATING COIL CAPACITY (MINIMUM)	MBH	26	15
HC ENTERING AIR CONDITIONS	°F DB	65	60
HC LEAVING AIR CONDITIONS	°F DB	85	80
HOT WATER FLOW RATE	GPM	4	2
HOT WATER CONNECTION	INCHES	7/8	7/8
HOT WATER TEMP ENT/LEAV (MAX/MIN)	°F / °F	160 / 140	160 / 140
HOT WATER COIL ROWS & FINS PER INCH		1 / 10	1 / 8
HOT WATER PRESSURE DROP	FT WG	4.13	0.11
FILTER STATIC (CLEAN/DIRTY)	IN WG	0.3 / 1.0	0.3 / 1.0
HEATING COIL STATIC	IN WG	0.1	0.1
COOLING COIL STATIC	IN WG	0.1	0.1
EXTERNAL STATIC	IN WG	1	1.0
TOTAL STATIC PRESS. DROP (CLEAN/DIRTY)	IN WG	1.26	1.26
AHU FAN BRAKE HORSEPOWER (DIRTY)	BHP	-	-
AHU FAN MOTOR HORSEPOWER	HP	2 FANS @ 1/3	1/2
AHU ELECTRICAL CHARACTERISTICS	V/Ø/HZ	277/1/60	277/1/60
MOTOR F.L.A.	AMPS	5.9	5.1
BREAKER SIZE (MOCP)	AMPS	15	15
MAXIMUM CABINET DIMENSIONS (LxWxH)	IN	-	-
NOTES		1 - 13	1 - 10, 14, 15

NOTES:

1. COOLING COIL SECTION SHALL HAVE STAINLESS STEEL IAQ DRAIN PAN AND FLOAT SWITCH.
2. FILTER SECTION TO ACCOMMODATE 2" THICK FILTERS (MERV 11).
3. FANS SHALL HAVE ECM MOTORS FOR BAS FOR SPEED CONTROL.
4. PROVIDE LINE VOLTAGE TO 24VAC, 50VA TRANSFORMER.
4. UNIT SHALL INCLUDE REMOVABLE ACCESS PANEL. PANEL SHALL BE INSULATED.
5. VFD IS BY OTHERS, SEE SCHEDULE.
6. MEAN FILTER PRESSURE DROP USED IN TSP AND BHP CALCULATIONS.
7. FC FAN, FACTORY BALANCED ACROSS OPERATING RPM, DIRECT DRIVE.
8. PROVIDE A 1-YEAR MANUFACTURER'S WARRANTY ON PARTS AND LABOR
9. PIPING AND INLINE DEVICES ARE TO BE PROVIDED BY CONTRACTOR
10. CONTRACTOR WILL SUPPLY AND INSTALL IONIZATION SYSTEM FOR COMBATING ODORS.
11. GALVANIZED SINGLE-WALL UNIT WITH 1" THICK CLOSED CELL FOAM INSULATION.
12. UNIT TO INCLUDE BRACKETS FOR SUPPORTING FROM ABOVE.
13. GALVANIZED DOUBLE-WALL UNIT WITH 1" THICK CLOSED CELL FOAM INSULATION.
14. PROVIDE 3" BASE RAIL FOR VERTICAL UNITS.

FAN COIL CONFIGURATION:

1. END INLET, WITH FILTER
2. COOLING COIL
3. REHEAT COIL
4. FAN SECTION, END OUTLET
5. PROVIDE ACCESS DOORS ON ONE SIDE OR BOTTOM.

BLOWER COIL CONFIGURATION:

1. SIDE INLET, WITH FILTER
2. COOLING COIL
3. REHEAT COIL
4. FAN SECTION, TOP OUTLET
5. PROVIDE ACCESS DOORS ON ONE SIDE OR BOTTOM.

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This item has been digitally signed and sealed by **Jon Barber, PE** on 08/25/23
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Revisions #	Date	Description

P.I.C.	JMS
Design	JB
Drawn	MH
Reviewed	JB
Job Number	

Mechanical - Schedules

M-101

08.28.2023

AIR COOLED ROTARY SCREW CHILLER

DESIGNATION		CH-1	
MANUFACTURER		DAIKIN	
MODEL		AWV008B	
REFRIGERANT / OPERATING CHARGE		R134a / 209 LBS	
COOLING CAPACITY (NOMINAL)	TONS	135	
UNIT POWER CONSUMPTION	KW	170.9	
FULL LOAD EFFICIENCY / EER (MIN)	BTUH / W	9.482	
INTEGRATED PART LOAD VALUE (MIN)	kW / TON	17.17	
AMBIENT CONDITIONS	°F	95°	
EVAPORATOR FLOW RATE (NOMINAL)	GPM	323 (197 MIN)	
SYSTEM PRESSURE DROP (MAX)	FT	4.6	
ENTERING WATER TEMPERATURE	°F	54°	
LEAVING WATER TEMPERATURE	°F	44°	
AVAILABLE HEAD PRESSURE for CHWS	TDH	N/A	
EXPANSION TANK	GAL	N/A	
BUFFER TANK	GAL	N/A	
FOULING FACTOR	HR-SF-°F/ BTU	0.00010	
INDEPENDENT REFRIGERANT CIRCUITS	MIN	2	
COMPRESSORS	MAX	2	
CAPACITY CONTROL DOWN TO	MIN. %	20%	
CHILLER ELECTRICAL CHARACTERISTICS	V/Ø/HZ	460 / 3 / 60	
UNIT POWER REQUIREMENT (MAX)	MCA/MOP	303 / 350	
SHORT CIRCUIT CURRENT RATING (MIN)	kA	65	
EVAP HEAT POWER ELECTRICAL	V/Ø/HZ	N/A	
EVAP HEAT POWER REQUIREMENT	MCA	N/A	
A-WEIGHTED SOUND PRESSURE 100/75/50/25	dBA	69 / 66 / 64 / 60	(at 30 FEET)
SHIPPING WEIGHT	LBS	11431	
UNIT DIMENSIONS L x W x H	IN	179 x 88 x 100	

NOTES:
1. HIGH-EFFICIENCY AIR-COOLED SCREW CHILLER; INCLUDES VARIABLE SPEED COMPRESSORS & VARIABLE SPEED PERMANENT MAGNET MOTORS FOR CONDENSER FANS. VFDs ARE FACTORY SUPPLIED, MOUNTED AND WIRED.
2. SYSTEM TO BE VARIABLE PRIMARY, WITH REDUNDANT PUMP. PUMPS BY OTHERS.
2. SINGLE-POINT POWER CONNECTION.
3. FACTORY CONTROL PANEL WITH LCD DISPLAY & BACNET CARD. BACNET OVER MS/TP OR IP.
4. LOW AMBIENT TEMPERATURE OPERATION: 0°-105°F
5. FREEZE PROTECTION TO -20°F.
6. INCLUDE EVAPORATOR INSULATION FOR HIGH HUMIDITY CLIMATE, MIN. 1.5" THICK; AND EVAP HEATER FOR FREEZE PROTECTION.
7. PROVIDE EVAPORATOR INLET STRAINER FOR FIELD INSTALLATION.
8. PROVIDE FACTORY MOUNTED AND WIRED FLOW SWITCH AT EVAP OUTLET.
9. PROVIDE NECESSARY SOUND ATTENUTAION TO MEET SCHEDULED SOUND PRESSURES.
10. PROVIDE ELASTOMERIC ISOLATORS FOR MOUNTING TO CONCRETE PAD.
11. PROVIDE FACTORY MOUNTED CIRCUIT BREAKER.
12. PROVIDE COMPLETE MANUFACTURER 5-YEAR PARTS, LABOR & REFRIGERANT WARRANTY.

BOILER SCHEDULE

DESIGNATION		B-1 & B-2
SERVICE		HYDRONIC HEAT
BOILER TYPE		CONDENSING
VENT TYPE		MFR STD
MANUFACTURER		PATTERSON KELLY
MODEL		ST1250
MAX PRESSURE	PSIG	160
MAX TEMPERATURE	°F	210
LEAVING WATER TEMP (DESIGN)	°F	160
ENTERING WATER TEMP	°F	140
FUEL TYPE		NATURAL GAS
OUTPUT CAPACITY (LOW/HIGH)	MBH	121 / 1212
HEATING EFFICIENCY	%	97
INPUT (LOW/HIGH)	MBH	125 / 1250
WATER FLOW RATE (DESIGN / MIN)	GPM	121 / 38
TEMPERATURE DIFF (DESIGN)	°F	20
WATER PRESSURE DROP (MAX)	FT WG	18
INLET GAS PRESSURE RANGE	IN WG	4" - 14"
ELECTRICAL CHARACTERISTICS	V/Ø/Hz	208 / 1 / 60
POWER REQUIREMENTS (MAX)	AMPS	20
DIMENSIONS (LxWxH)	IN	58x34x55
OPERATING WEIGHT	#	1112

FEATURES:
1. BOILERS WILL BE INSTALLED OUTDOORS IN A VARIABLE PRIMARY CONFIGURATION.
2. PROVIDE FACTORY STACK & NEUTRALIZATION KIT FOR INSTALLATION BY CONTRACTOR.
3. FULL MODULATION, 10:1 TURNDOWN
4. ASME CSD-1 RATED
5. FACTORY INTEGRATED CONTROLS
6. PROVIDE A BACNET PROTOCOL CONVERTER ON THE MASTER CONTROLLER (B-1) INCLUDING ENCLOSURE AND 24VDC POWER.
7. HIGH LIMIT AND OPERATING THERMOSTATS,
8. LOW WATER CUT-OFF, 100 PSIG PRESSURE RELIEF VALVE W/ TEMP INDICATOR.
9. PROVIDE GAS TRAIN WITH VALVES
10. HIGH EXHAUST BACK PRESSURE SWITCH
11. DP COMBUSTION AIR SWITCH
12. COMBUSTION BLOWER, VARIABLE SPEED. PROVIDE FILTER AND SPARE FILTER FOR START-UP.

GYM EQUIPMENT	COOLING LOADS		HEATING LOADS	
	MBH	GPM @ 10° DT	MBH	GPM @ 20° DT
INDUSTRIAL ARTS	284	56	369	37
CAFETERIA ANNEX	-	-	548	55
VPU-1	480	96	244	25
AHU-1	458	91	500	50
VPU-2	155	30	87	9
VPU-3	155	30	87	9
FCU-1	33	6.7	26	3
FCU-2	33	6.7	26	3
FCU-3	33	6.7	26	3
FCU-4	33	6.7	26	3
FCU-5	33	6.7	26	3
BCU-6	24	5	15	2
TOTALS	1721	342	1980	202
TONS	143.4			

VARIABLE FREQUENCY DRIVE SCHEDULE

DESIGNATION		VFD-AHU-1A & B	VFD-VPU-1A & B	VFD-VPU-1C	VFD-VPU-2	VFD-VPU-3	VFD-CHWP-1	VFD-HHWP-1
SERVICE		AHU SUPPLY FANS	VPU-1 SUPPLY FANS	VPU-1 EXHAUST FAN	AHU SUPPLY FAN	AHU SUPPLY FAN	CHILLED WATER PUMP	HOT WATER PUMP
QTY.		2	2	1	1	1	1	1
DRIVE RATED HORSEPOWER CAPACITY (MIN)	HP	15	7.5	7.5	3	3	15	10
DRIVE MOTOR FULL LOAD AMPACITY (MIN)	AMP	23	12	12	4.8	4.8	23	14
DRIVE AMBIENT OPERATING TEMP (MAX)	°F	104	104	104	104	104	104	104
MOTOR ELECTRICAL SERVICE	V/PH/HZ	480/3/60	480/3/60	480/3/60	480/3/60	480/3/60	480/3/60	480/3/60
SPEED CONTROL SIGNAL		0-10vDC	0-10vDC	0-10vDC	0-10vDC	0-10vDC	0-10vDC	0-10vDC
DRIVE EFFICIENCY (MINIMUM AT FULL LOAD)		95%	95%	95%	95%	95%	95%	95%
POWER FACTOR (MINIMUM)		0.95	0.95	0.95	0.95	0.95	0.95	0.95
DISCONNECT		YES	YES	YES	YES	YES	YES	YES
BYPASS		NO	NO	NO	NO	NO	NO	NO
ENCLOSURE TYPE		TYPE 1	TYPE 1	TYPE 1	TYPE 1	TYPE 1	TYPE 1	TYPE 1
BASIS OF DESIGN MANUFACTURER/MODEL		ABB ACH580-PDR	ABB ACH580-PDR	ABB ACH580-PDR	ABB ACH580-PDR	ABB ACH580-PDR	ABB ACH580-PDR	ABB ACH580-PDR
APPLICABLE NOTES		1-7	1-7	1-7	1-7	1-7	1-7	1-7

NOTES:
1. PROVIDE FACTORY CERTIFIED STARTUP OF NEW DRIVE.
2. PROVIDE BACNET MS/TP CONNECTIVITY.
3. PROVIDE HAND-OFF-AUTO.
4. PROVIDE THREE (3) YEAR PARTS/LABOR WARRANTY.
5. DRIVE TO INCLUDE 5% DC CHOKE.
6. DRIVE TO INCLUDE AN INPUT FOR EARLY-BREAK SIGNAL FROM MOTOR DISCONNECT SWITCH.
7. DRIVE CAPACITY SHALL ACCOMMODATE MOTOR FULL LOAD AMPACITY OR MOTOR HORSEPOWER, WHICHEVER IS HIGHER, AT THE SPECIFIED AMBIENT OPERATING TEMPERATURE.

PUMP SCHEDULE

DESIGNATION		CHWP-1 & CHWP-2	HHWP-1 & HHWP-2
SYSTEM SERVED		CHILLED WATER	HEATING HOT WATER
DUTY		VARIABLE PRIMARY	VARIABLE PRIMARY
MANUFACTURER		TACO	TACO
MODEL		CI-3011D	CI-2511D
CASING / IMPELLER		C.I. / BRONZE	C.I. / BRONZE
CONNECTION SIZES (SUCTION/DISCHARGE)	IN	4 x 3-11, 125# C.I.	3 x 2.5-11, 125# C.I.
PUMP TYPE		CLOSE-COUPLED	CLOSE-COUPLED
FLOW RATE	GPM	324	150
TEMP	°F	44	160
TOTAL DYNAMIC HEAD	FT	87	100
SHUT-OFF HEAD	FT	105	107
PUMP EFFICIENCY	%	75	67
IMPELLER DIA	IN	10	10
PUMP SPEED	RPM	1760	1760
ELECTRICAL CHARACTERISTICS	V/Ø/HZ	460/3/60	460/3/60
MOTOR HORSEPOWER	HP	15	10
MOTOR TYPE		ODP, INVERTER RATED	ODP, INVERTER RATED
SUCTION DIFFUSER, FLG'D	IN	6 x 4	4 X 3
MULTI-PURPOSE VALVE, FLG'D	IN	N/A	N/A
APPLICABLE NOTES		2, 3	2,3

NOTES:
1. FIXED-SPEED PUMP
2. PUMP OPERATED BY VARIABLE FREQUENCY DRIVE, SEE SCHEDULE
3. STANDARD MECHANICAL SEAL WITH NO EXTERNAL FLUSH.

HYDRONIC SYSTEMS DATA / EXPANSION TANK SCHEDULE

DESIGNATION		HHW-ET	CHW-ET
SYSTEM SERVED		HEATING HOT WATER	CHILLED WATER
TANK TYPE		FULL ACCEPT BLADDER	FULL ACCEPT BLADDER
MANUFACTURER		TACO	TACO
MODEL		CA140-125A	CA90-125A
SIZE	IN.	Ø20x46	Ø20x32
SYSTEM CONNECTION	IN.	1" NPT	1" NPT
MAKE-UP FILL PRESSURE	PSI	25	25
MAKE-UP RELIEF PRESSURE	PSI	75	75
MIN OPERATING TEMP	°F	70	40
MAX DESIGN TEMP	°F	170	100
APPROXIMATE SYSTEM VOLUME	GALLONS	750	1000
CALCULATED EXPANSION VOLUME	GALLONS	15.48	5.26
REQUIRED TANK VOLUME	GALLONS	30	10
APPLICABLE NOTES		1-5	1-5

NOTES:
1. RATED FOR 125 PSI & 240 F
2. REMOVABLE BUTYL RUBBER BLADDER
3. FULL ACCEPTANCE BLADDER
4. ASME Section VIII CONSTRUCTION
5. TANK TO BE UNINSULATED

AIR & DIRT SEPARATOR SCHEDULE

DESIGNATION		CHW - ADS	HHW - ADS
SYSTEM SERVED		CHW	HHW
MANUFACTURER		TACO	TACO
MODEL		4906AD-150AR	49064D-150AR
CONNECTION SIZE & TYPE		6" FLANGED	4" FLANGED
FLOW RATE	GPM	324	170
PRESS DROP (MAX)	FT H2O	1.5	2
SUPPORT	TYPE	BASE RING	BASE RING
DIMENSIONS (DIA/HT)	IN	Ø14x46	Ø12x36
DRY WEIGHT	LB	245	100
OPTIONS/FEATURES		SEE BELOW	SEE BELOW

NOTES:
1. RATED FOR 125 PSI & 350° F
2. TANGENTIAL NOZZLES FOR CENTRIFUGAL PARTICULATE REMOVAL
3. PROVIDE BASSE RING, AIR VENT, & BLOWDOWN VALVE
4. ASME Section VIII CONSTRUCTION
5. TANK TO BE INSULATED BY CONTRACTOR
6. SUPPORT PER MANUFACTUER'S INSTRUCTIONS. BASE RING WILL HAVE SUPPORTS TO GRADE.

CHEMICAL POT FEEDER SCHEDULE

DESIGNATION		HHW - CPF	CHW - CPF
SYSTEM SERVED		CHW	CHW
MANUFACTURER		NEPTUNE	NEPTUNE
MODEL		DBF-5HP	DBF-5HP
CONNECTION SIZE & TYPE		3/4" NPT	3/4" NPT
CAPACITY	GAL.	5	5
FILTER BAG KIT	-	YES	YES
DESIGN PRESSURE	PSIG	300	300
DIMENSIONS (DIA/HT)	IN	10 x 30	10 x 30
DRY WEIGHT	LB	38	38
OPTIONS/FEATURES		1	1

NOTES:
1. PROVIDE OPTIONAL FILTER BAG KIT FBK-5.
2. TANK TO BE INSULATED BY CONTRACTOR; MAINTAIN ACCESS TO CAP.

FLOW METER SCHEDULE

DESIGNATION		FM-1	FM-4
SERVICE		CHILLER	BOILER
FLUID		CHILLED WATER	HOT WATER
MANUFACTURER		ONICON	ONICON
MODEL NUMBER		F-3200	F-3200
SENSING METHOD		ELECTROMAGNETIC	ELECTROMAGNETIC
TYPE		INLINE	INLINE
CONNECTION		6" 150# FLG	3" 150# FLG
BODY		CARBON STEEL	CARBON STEEL
LINER		PTFE	PTFE
ACCURACY (FULL SCALE)		+/- 0.2%	+/- 0.2%
INPUT POWER		24 VDC	24 VDC
TRANSMITTER		INTEGRAL	INTEGRAL
OPERATING FLOW	GPM	234	145
DESIGN / OPERATING TEMPERATURE	°F	0 to 212 / 45	0 to 212 / 160
DESIGN / OPERATING PRESSURE	PSIG	580 / 60	580 / 60
OUTPUT		(2) 4-20 mA	(2) 4-20 mA
LOCAL DISPLAY		YES	YES
PROJECT QTY.		1	1
NOTES		1, 2, 3	1, 2, 3

NOTES:
1. FLOW & TEMPERATURE MONITOR. FOR LOCAL DISPLAY ONLY.
2. INSTALL PER MFR INSTRUCTIONS - 3D UPSTREAM, 2D DOWNSTREAM; METER MUST ALWAYS BE FULL OF WATER.
3. AS SPECIFIED, OR EQUIVALENT.

CHILLED/HHW WATER PIPING ACCESSORIES

DESCRIPTION	MODEL	REMARKS	QTY.
EJ-2.5, 2.5"	METRAFLEX MSRDEE	PUMP SUCTION EXPANSION JOINT, EPDM, ANSI 125#/150# FLANGED ENDS, 6" LENGTH, RETAINING RING. CONTROL RODS ARE NOT REQUIRED.	X
EJ-3, 3"	METRAFLEX MSRDEE	PUMP DISCHARGE EXPANSION JOINT, EPDM, ANSI 125#/150# FLANGED ENDS, 6" LENGTH, RETAINING RING. INCLUDE CONTROL RODS.	X
EJ-4, 4"	METRAFLEX MSRDEE	CHILLER EXPANSION JOINT, EPDM, ANSI 125#/150# FLANGED ENDS, 6" LENGTH, RETAINING RING. INCLUDE CONTROL RODS.	X
EJ-6, 6"	METRAFLEX MSRDEE	CHILLER EXPANSION JOINT, EPDM, ANSI 125#/150# FLANGED ENDS, 6" LENGTH, RETAINING RING. INCLUDE CONTROL RODS.	X

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JON M. BARBER LICENSE No. 55427 STATE OF FLORIDA PROFESSIONAL ENGINEER

Revisions #	Date	Description

P.I.C.	JMS
Design	JB
Drawn	MH
Reviewed	JB
Job Number	

Mechanical - Schedules

M-102

08.28.2023

LOUVER SCHEDULE

DESIGNATION			L-2	L-3	L-4	L-5
SERVICE			INTAKE/EXHAUST	INTAKE/EXHAUST	INTAKE/EXHAUST	INTAKE/EXHAUST
PROJECT QTY.			3	2	2	2
NOMINAL SIZE (WXH)	IN		11'-0" X 3'-4"	5'-8" x 2'-0"	12" x 12"	3'-0" x 2'-0"
FREE AREA (DESIGN MINIMUM)	%		57%	57%	57%	57%
DEPTH	IN		6	6	6	6
TYPE			EXTERIOR	EXTERIOR	EXTERIOR	EXTERIOR
MATERIAL/CONSTRUCTION			ALUMINUM	ALUMINUM	ALUMINUM	ALUMINUM
BASIS OF DESIGN MANUFACTURER			RUSKIN	RUSKIN	RUSKIN	RUSKIN
BASIS OF DESIGN MODEL			ELF6375DXD	ELF6375DXD	ELF6375DXD	ELF6375DXD
NOTES			1 - 5	1 - 4	1 - 4	1 - 4

NOTES:
1. CONSTRUCTED OF 6063T6 EXTRUDED ALUMINUM, DRAINABLE BLASE, POSITIONED HORIZONTALLY.
2. EXPANDED, FLATTENED ALUMINUM BIRD SCREEN, 5/8"X0.040"
3. MIAMI-DADE COUNTY APPROVED, FLORIDA PRODUCT APPROVAL.
4. SANDSTONE FINISH COLOR - VERIFY WITH OWNER.
5. PROVIDE 2" THICK INSULATED BLANK-OFF PANEL.

DIFFUSER & GRILLE SCHEDULE

TYPE	QTY.	DESCRIPTION	MODEL	REMARKS	AIR PATTERN	DAMPER
A	45	AERO BLADE SUPPLY AIR GRILLE	TITUS 271FS	SURFACE MOUNT TYPE-1, ALUMINUM CONSTRUCTION, 3/4" BLADE SPACING, EXTERNALLY-ADJ. INTEGRAL DAMPER, DOUBLE DEFLECTION, WHITE FINISH, SEE PLANS FOR SIZE	NA	YES
B	24	LOUVERED RETURN AIR GRILLE	TITUS 350FS	SURFACE MOUNT TYPE-1, ALUMINUM CONSTRUCTION, 3/4" BLADE SPACING, 35° FIXED BLADE, SINGLE DEFLECTION, WHITE FINISH, SEE PLANS FOR SIZE	NA	YES
C	8	ARCHITECTURAL SQUARE PLAQUE SUPPLY AIR GRILLE	TITUS OMNI-AA	LAY-IN TYPE, SQUARE PLAQUE, ALUMINUM CONSTRUCTION, WHITE FINISH, 24x24 MODULE SIZE, WITH OPTIONAL FACTORY MOLDED INSULATION BLANKET.	4-WAY	NO
D	3	PERFORATED RETURN AIR GRILLE	TITUS PAR	TYPE 1 SURFACE MOUNT, 3/16" Ø HOLES ON 1/4" CENTERS, ALUMINUM CONSTRUCTION, WHITE FINISH, 24x24 MODULE SIZE, 10" ROUND NECK SIZE	NA	YES
E	2	LOUVERED RETURN AIR GRILLE	TITUS 56FL	SURFACE MOUNT TYPE-1, ALUMINUM CONSTRUCTION, 3/4" BLADE SPACING, 0° FIXED BLADE, MILL FINISH, SEE PLANS FOR SIZE	NA	YES
F	20	LOUVERED RETURN AIR GRILLE	TITUS 350FS	SURFACE MOUNT TYPE-1, ALUMINUM CONSTRUCTION, 3/4" BLADE SPACING, 35° FIXED BLADE, SINGLE DEFLECTION, WHITE FINISH, SEE PLANS FOR SIZE	NA	NO

NOTES:
1. COORDINATE FINISHES WITH ARCHITECT.
2. ALL SUPPLY GRILLES WILL BE ADJUSTABLE AT TAKEOFF UOS.

LAY-IN SUPPLY AIR GRILLE NECK SIZES

AIR FLOW RANGE (CFM)	NECK SIZE SIZE (IN)
25-120	6"Ø
125-225	8"Ø
230-350	10"Ø
351-500	12"Ø

NOTES:
1. EQUIVALENT SQUARE/RECT SIZES ARE ACCEPTABLE.

LAY-IN RETURN/EXHAUST/TRANSFER AIR GRILLE CONNECTION SIZES (UOS)

AIR FLOW RANGE (CFM)	NECK/DUCT CONNECTION SIZE (UOS) (IN)
0-100	6"Ø
101-175	8"Ø
176-300	10"Ø
301-450	12"Ø
451-750	14"Ø

FAN SCHEDULE

DESIGNATION		EF-1,2	EF-3,4,5,6	EF-7
AREA/ROOM SERVED & BUILDING		-	-	-
SERVICE		LOCKER ROOM EXHAUST	TOILET EXHAUST	TOILET EXHAUST
MANUFACTURER		GREENHECK	GREENHECK	GREENHECK
MODEL		SQ-120-VG	SP-A70-VG	SQ-100-VG
TYPE		INLINE	CEILING	INLINE
FAN CONSTRUCTION		ALUMINUM	PP & GALV.	ALUMINUM
DRIVE TYPE		DIRECT	DIRECT	DIRECT
AIR FLOWRATE DESIGN	CFM	1060	70	800
DESIGN STATIC PRESSURE	IN	0.5	0.4	0.75
DESIGN FAN SPEED	RPM	1326	808	1535
RADIATED SOUND POWER	SONES	6.0	2.0	8.2
ELECTRICAL CHARACTERISTICS	V/Ø/HZ	120/1/60	120/1/60	120/1/60
MOTOR HORSEPOWER	HP	1/2	FRACTIONAL	1/4
MIN CIRCUIT AMPACITY	AMPS	8.2	0.4	4.8
OPTIONS		1-3	1, 2	1-3
CONTROL NOTES		1	2	1

OPTIONS
1. BACKDRAFT DAMPER
2. VARI-GREEN MOTOR
3. CONTRACTOR TO PROVIDE FILTER RACK FOR 1" DISPOSABLE FILTER. FILTER TO BE ACCESSIBLE.

CONTROL NOTES:
1. FAN WILL OPERATE DURING OCCUPIED HOURS VIA BAS.
2. FAN WILL OPERATE VIA OCCUPANCY SENSOR.

BIPOLAR IONIZATION

DESIGNATION		BI-FCU-1 to 5	BI-BCU-6
SYSTEMS SERVED		FCU-1 to 5	BCU-6
QTY.		5	1
MANUFACTURER		PLASMA AIR	PLASMA AIR
MODEL		602	602
TYPE		FAN COIL	BLOWER COIL
FLOW RATE	CFM	2400	2400
ELECTRICAL CHARACTERISTICS	V/Ø/HZ	24 V AC/DC	24 V AC/DC
POWER CONSUMPTION	WATTS	<1	<1

NOTES:
1. EQUIPMENT SHALL BE LISTED, INCLUDING UL 2998 FOR ZERO OZONE EMISSIONS.
2. MODULES ARE TO BE INSTALLED IN THE FAN COILS, UPSTREAM OF THE FAN INLET
3. BPI WILL ACTIVATE SIMULTANEOUSLY WITH FANS; POWER SUPPLIED FROM FCU TERMINAL STRIP.

FABRIC DUCT DIFFUSER

DESIGNATION		FDD-1	FDD-2
SYSTEMS SERVED		GYM	GYM
QTY.		1	1
MANUFACTURER		PRIHODA	PRIHODA
AIR FLOW	CFM	9,000	9,000
STATIC PRESSURE	IN WG	0.5	0.5
SIZE	INCHES x FT	Ø34" x 99 FT	Ø34" x 99 FT
PERFORATIONS	INCHES	1.5	1.5
POSITIONS		142°, 185°, 230°	130°, 175°, 218°
COLOR		RED, PANTONE 187	RED, PANTONE 187

NOTES:
1. GYM APPROXIMATE FLOOR SIZE IS 110'x97'.
2. FABRIC TO BE 100% FLAME RETARDANT POLYESTER PER UL2518
3. FABRIC TO BE PRIHODA CLASSIC (PERMEABLE) OR EQUAL. MACHINE WASHABLE.
4. DUCT TO HAVE INERNAL RINGS TO MAINTAIN SHAPE WITH NO AIRFLOW.
5. SINGLE TRACK INSTALLATION AND SUPPORTS.

DRYER POWER VENTILATOR SCHEDULE

DESIGNATION		DBF-1&2
AREA/ROOM SERVED & BUILDING		LAUNDRY RMS
SERVICE		DRYER EXHAUST
MANUFACTURER		TJERNLAND
MODEL		LB2
DRIVE TYPE		DIRECT
AIR FLOWRATE DESIGN	CFM	160
FLA	AMPS	0.5
ELECTRICAL CHARACTERISTICS	V/Ø/HZ	120/1/60
MOTOR POWER	WATTS	50
INLET / OUTLET SIZE	IN	4

NOTES
1. UNIT SHALL BE LISTED TO UL 705.
2. INSTALL SECONDARY LINT TRAP MIN. 4' FROM DRYER EXHAUST OUTLET.
3. INSTALL MANUFACTURER-SUPPLIED STATUS ALARM PANEL IN LAUNDRY ROOM PER RECOMMENDATIONS.
4. STANDARD 120V POWER CORD.
5. INSTALL PER MANUFACTURER'S RECOMMENDATIONS

HVAC SYMBOLS/LEGEND

DESIGNATION	DESCRIPTION
	LAY-IN SUPPLY AIR DIFFUSER
	LAY-IN RETURN AIR DIFFUSER WITH OUT DUCT CONNECTION
	SURFACE MOUNT SUPPLY GRILLE
	SURFACE MOUNT RETURN GRILLE
8"Ø	ROUND DUCT WITH SIZE INDICATED
T	THERMOSTAT/TEMPERATURE SENSOR & WIREWAY
T/H	TEMP/RELATIVE HUMIDITY SENSOR AND WIREWAY
12X12	RECTANGULAR DUCTWORK & INTERNAL SIZE (FREE AREA)
8"Ø	INSULATED FLEXIBLE DUCTWORK & SIZE/DIA.
	FLEXIBLE DUCT CONNECTION
	MITERED ELBOW FITTING WITH DOUBLE THICKNESS TURNING VANES
	MITERED TAKEOFF WITH MVD (PROVIDE INSULATION STANDOFF)
	MITERED TAKEOFF WITHOUT MVD (USE AT TAKEOFFS FOR VAV TERMINALS)
	EXTENT OF DEMOLITION
D	DUCT SMOKE DETECTOR
	POINT OF CONNECTION TO EXISTING
M	MANUAL VOLUME DAMPER WITH LOCKING QUADRANT
E	ELECTRIC OPERATED CONTROL DAMPER
P	PNEUMATIC OPERATOR
FD	FIRE DAMPER
FSD	COMBINATION FIRE/SMOKE DAMPER
SD	SMOKE DAMPER
1" UC	AIR FLOW VIA 1" DOOR UNDERCUT
	FLOW DIRECTION
OR	DUCT TURNING DOWN
OR	DUCT TURNING UP
	AIR FLOW DIRECTION
D 375 CFM	GRILLE AND FLOWRATE (CFM) DESIGNATION
OA-	CENTRIFUGAL DIRECT DRIVE CABINET OA SUPPLY FAN
EF-	CEILING MOUNTED EXHAUST FAN
	METHODS OF DENOTING DEMOLITION WORK
R (R)	RELOCATE AND RELOCATED, RESPECTIVELY
	SERVICE AREA - MAINTAIN CLEAR
12" AD	ACCESS DOOR WITH LATCH, DIMENSION INDICATES SIZE
UP OR DN	DUCT ELEVATION CHANGE
	SINGLE LINE DUCT (ROUND) (SIZE PER GRILLE FLOW SCHEDULE)
	FLEXIBLE DUCT (SIZE PER GRILLE FLOW SCHEDULE)
SCR	ELECTRIC HEATER WITH SCR CONTROLLER

ABBREVIATIONS

AD	ACCESS DOOR
AFF	ABOVE FINISHED FLOOR
AHAP	AS HIGH AS POSSIBLE
BAS	BLDG AUTOMATION SYSTEM
BD	BACKDRAFT DAMPER
BHP	BRAKE HORSE POWER
BOD	BOTTOM OF DUCT
BTUH	BRITISH THERMAL UNIT/HOUR
CFM	CUBIC FEET PER MINUTE
CI	CAST IRON
CLG	CEILING
CONC	CONCRETE
CHWS	CHILLED WATER SUPPLY
CHWR	CHILLED WATER RETURN
D	DUCT DETECTOR
DB	DRY BULB
DIA OR Ø	DIAMETER
DG	DOOR GRILLE
DTL	DETAIL
DW	DOMESTIC WATER
EF	EXHAUST FAN
ETR	EXISTING TO REMAIN
EX OR (E)	EXISTING
EXT	EXTERNAL OR EXTERIOR
FD	FLOOR DRAIN
FL	FLOOR
GPM	GALLONS PER MINUTE
H	HIGH
HD	HUB DRAIN
HDG	HOT-DIP GALVANIZED
HP	HORSE POWER
L	LONG
LAT	LEAVING AIR TEMPERATURE
MAX	MAXIMUM
MBH	1000 BTU/HOUR
MIN	MINIMUM
N	NEW
NIC	NOT IN CONTRACT
NPS	NOMINAL PIPE SIZE
OA	OUTSIDE AIR
OC	ON CENTER
PL	PLACES
PNL	PANEL
RA	RETURN AIR
RAG	RETURN AIR GRILLE
RLA	RATED LOAD AMPS
RV	ROOF VENT
SA	SUPPLY AIR
SAG	SUPPLY AIR GRILLE
SP	STATIC PRESSURE
SQ	SQUARE
T	TEMPERATURE
TF	TRANSFER
THK	THICK
TOD	TOP OF DUCT
TYP	TYPICAL
UG	UNDERGROUND
UOS	UNLESS OTHERWISE SPECIFIED
VAV	VARIABLE AIR VOLUME
V	VOLTS
WB	WET BULB
W	WIDE
WG	WATER GAUGE

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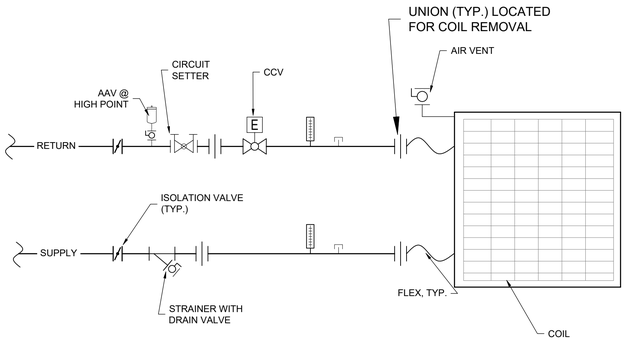
Mechanical - Schedules & Symbol Legend

Revisions #	Date	Description

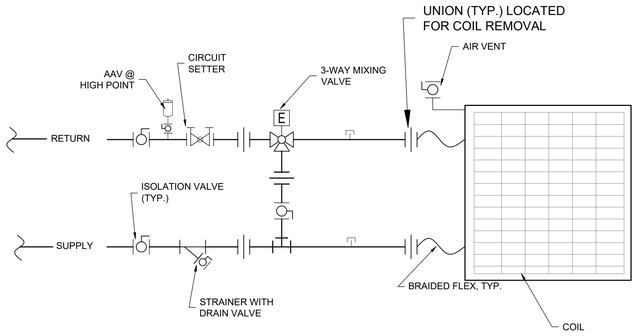
P.I.C. JMS
Design JB
Drawn MH
Reviewed JB
Job Number

M-103

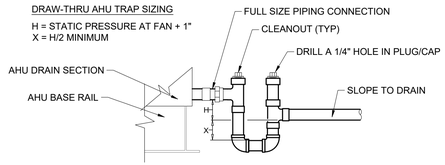
08.28.2023



COOLING COIL DETAIL - 2-WAY VALVE



HEATING COIL DETAIL - 3-WAY VALVE

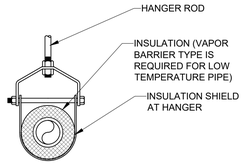


CONDENSATE P-TRAP DETAIL

SCALE: NTS

NOTES:

1. CONDENSATE PIPING SHALL BE FULL SIZE DWV OR TYPE L COPPER WITH CAST DWB OR PRESSURE SOLDER JOINTS.
2. ROUTE CONDENSATE PIPING TO NEW CONDENSATE DRAIN.
3. SLOPE CONDENSATE PIPING 1/4" PER FOOT TOWARD DRAIN.

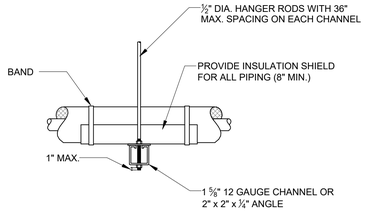


ADJUSTABLE CLEVIS HANGER

N.T.S.

NOTES:

1. INSTALL INCOMPRESSIBLE THERMAL INSERT WITH GALVANIZED SHIELD AT CLEVIS HANGERS WHERE COMPRESSIBLE INSULATION, SUCH AS FIBERGLASS, IS USED. INSERT SHALL BE EQUAL TO VALUE ENGINEERED PRODUCTS PRO-SHIELD FOR SPECIFIC PIPE SIZE.



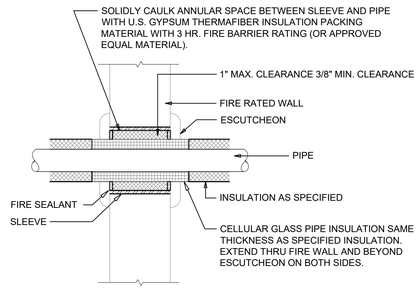
SIDE VIEW

TRAPEZE HANGER FOR UP TO 1000 LB. LOAD

N.T.S.

NOTE:

1. SEE SPECIFICATIONS FOR SPACING OF HANGERS.
2. PROVIDE INCOMPRESSIBLE INSERT AT SUPPORT.
3. MAY USE A 360° INCOMPRESSIBLE INSERT WITH GALVANIZED SHIELD EQUAL TO PRO-SHIELD AS MANUFACTURED BY VALUE ENGINEERED PRODUCTS, INC.

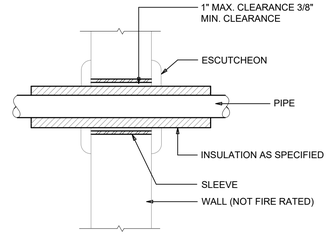


FIRE-RATED WALL PENETRATION

SCALE: NONE

NOTES:

1. SUBMIT MANUFACTURER'S UL LISTED APPROVAL FOR WALL SYSTEM AND RATING TO ARCHITECT/ENGINEER FOR REVIEW/APPROVAL.
2. SEE PLAN FOR WALL RATINGS.
3. INSTALL PRODUCTS IN STRICT ACCORDANCE WITH THE MANUFACTURER'S REQUIREMENTS AND RATING.

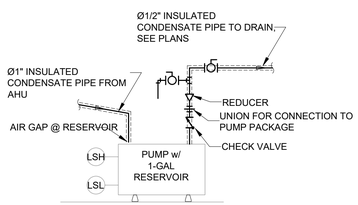


NON-RATED WALL PENETRATION

SCALE: NONE

NOTES:

1. SUBMIT MANUFACTURER'S UL LISTED APPROVAL FOR WALL SYSTEM AND RATING TO ARCHITECT/ENGINEER FOR REVIEW/APPROVAL.
2. SEE PLAN FOR WALL RATINGS.
3. INSTALL PRODUCTS IN STRICT ACCORDANCE WITH THE MANUFACTURER'S REQUIREMENTS AND RATING.

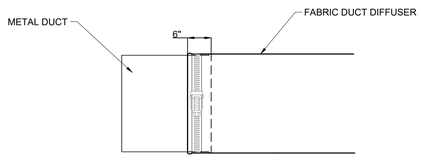


CONDENSATE PUMP DETAIL

SCALE: NTS

NOTES:

1. THERE WILL BE A CONDENSATE PUMP AND PIPING AT THE AIR HANDLER.
2. PUMP TO BE INSTALLED LEVEL ON SUPPORTS.
3. SECURE PUMP TO ITS SUPPORTS TO PREVENT MOVEMENT.
4. PUMP PACKAGE WILL INCLUDE 1-GALLON RESERVOIR FOR COLLECTING CONDENSATE, AND AN OPTIONAL CHECK VALVE.
5. ON FAILURE OF THE PUMP, THE RESERVOIR SHOULD BE ABLE TO OVERFLOW TO GROUND AND ALLOW THE AHU TO CONTINUE OPERATION.
6. THE LEVEL SWITCHES WILL AUTOMATICALLY START AND STOP THE PUMP
7. THE INLET & OUTLET CONDENSATE PIPING SHALL BE INSULATED OUTDOORS AND IN UNCONDITIONED ATTIC SPACES.
8. PIPING SIZES SHALL MATCH THE CONDENSATE CONNECTION ON THE AHU.

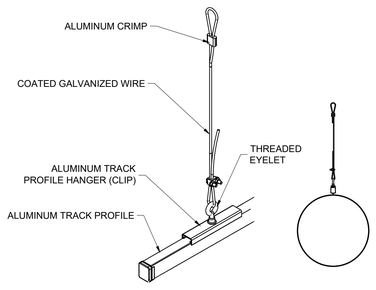


FABRIC DUCT INLET CONNECTION DETAIL

SCALE: NTS

NOTES:

1. FABRIC DUCT DIFFUSER SLIPS OVER METAL DUCT BY 6" AND IS SECURED BY SS CLAMP OR TEXTILE BAND WITH BUCKLE

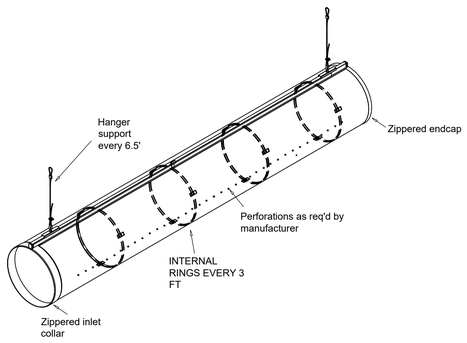


FABRIC DUCT HANGER DETAIL

SCALE: NTS

NOTES:

1. SINGLE TRACK PROFILE
2. SUPPORT FROM STRUCTURE



FABRIC DUCT INSTALLATION DETAIL

SINGLE TRACK PROFILE

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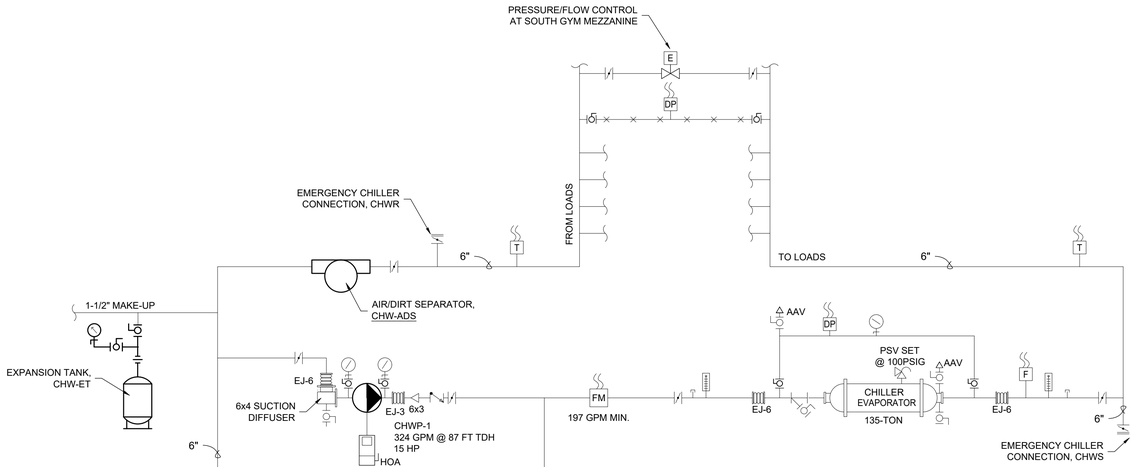
P.I.C.	JMS
Design	JB
Drawn	MH
Reviewed	JB
Job Number	08.28.2023

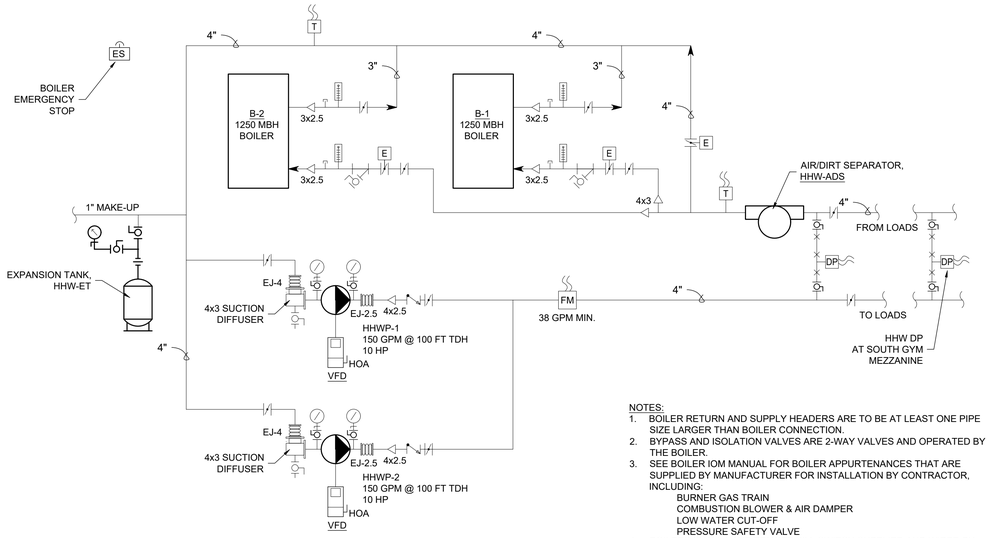
Mechanical - Details

M-104



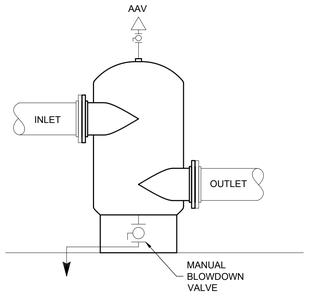
NOTES:
1. CHILLER WILL MOUNT ON MANUFACTURER SUPPLIED ELASTOMERIC ISOLATORS. ISOLATORS TO BE DRILLED & EPOXYED INTO FOUNDATION PER MFR INSTRUCTIONS.
2. INSTALL CHILLER PER MFR INSTRUCTIONS.
3. COORDINATE AND INSTALL DEVICES THAT ARE SHIPPED LOOSE WITH THE CHILLER. SEE CHILLER IOM MANUAL.
4. PROVIDE ADEQUATE PIPE SUPPORT INDEPENDENT OF EVAPORATOR.
5. THE CHILLED WATER PUMPS SHALL BE CONTROLLED BY THE CHILLER
6. INSTALL INSTRUMENTS INTO PIPING. INSTRUMENTS TO BE SUPPLIED BY THE CONTROLS CONTRACTOR; PIPING CONNECTIONS BY MECHANICAL CONTRACTOR
7. FULLY INSULATE PIPING & APPURTENANCES TO MITIGATE CONDENSATION.

VARIABLE PRIMARY CHILLED WATER PIPING SCHEMATIC



NOTES:
1. BOILER RETURN AND SUPPLY HEADERS ARE TO BE AT LEAST ONE PIPE SIZE LARGER THAN BOILER CONNECTION.
2. BYPASS AND ISOLATION VALVES ARE 2-WAY VALVES AND OPERATED BY THE BOILER.
3. SEE BOILER IOM MANUAL FOR BOILER APPURTENANCES THAT ARE SUPPLIED BY MANUFACTURER FOR INSTALLATION BY CONTRACTOR, INCLUDING:
   - BURNER GAS TRAIN
   - COMBUSTION BLOWER & AIR DAMPER
   - LOW WATER CUT-OFF
   - PRESSURE SAFETY VALVE
4. BOILERS SHALL HAVE REMOTE KILL SWITCH SUPPLIED AND WIRED BY CONTROLS CONTRACTOR.
5. BOILER CONDENSATE IS ACIDIC AND SHALL BE TREATED THROUGH A CONDENSATE NEUTRALIZATION KIT.
6. BOILERS AND PUMPS TO BE STAGED ON RETURN AND SUPPLY TEMPERATURE.
7. MINIMUM FLOW FOR BOILER FIRING SHALL BE 38 GPM.
8. MAXIMUM FLOW THROUGH A SINGLE BOILER SHALL BE 140 GPM

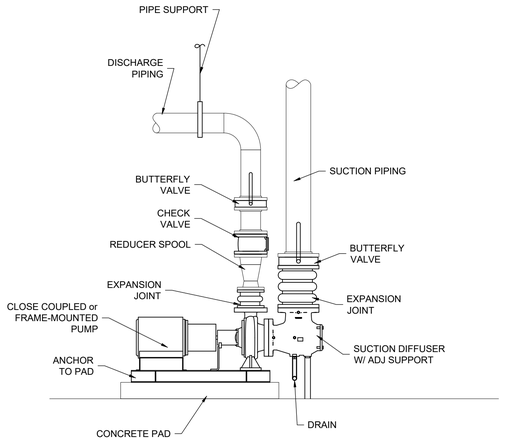
VARIABLE PRIMARY HOT WATER PIPING SCHEMATIC



AIR-DIRT SEPARATOR DETAIL

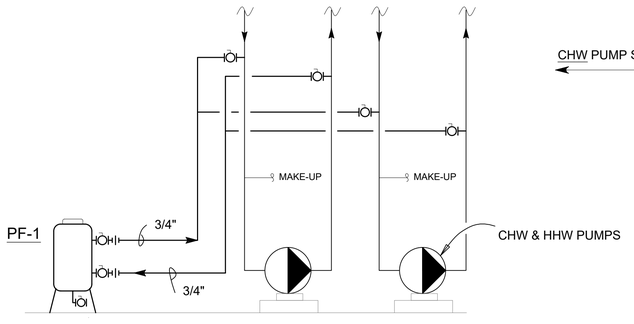
SCALE: NTS

NOTES:
1. SEE EQUIPMENT SCHEDULE.
2. DIRECT AIR VENT & BLOWDOWN TO A SAFE LOCATION.
3. INSULATE AIR SEPARATOR.



PUMP DETAIL

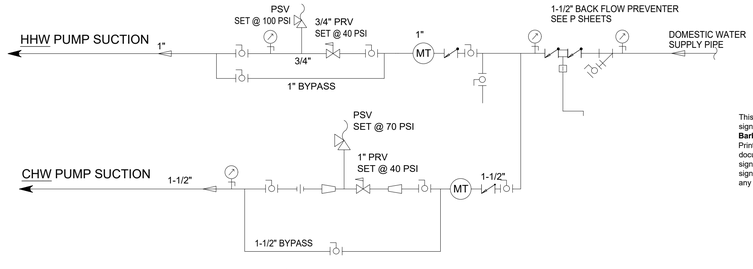
SCALE: NTS



BY-PASS FEEDER DETAIL

NTS

NOTES:
1. INSTALL UNIT PER THE MANUFACTURER'S REQUIREMENTS.
2. PROVIDE ISOLATION VALVES AT CONNECTION TO MAIN PIPING.
3. INSULATE PIPING, VALVES, TANK.



MAKE-UP WATER STATION SCHEMATIC

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1350 Market Street - Suite 209
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JON M. BARBER LICENSE No. 55427 STATE OF FLORIDA PROFESSIONAL ENGINEER

#	Revisions Date	Description

P.I.C.	JMS
Design	JB
Drawn	MH
Reviewed	JB
Job Number	

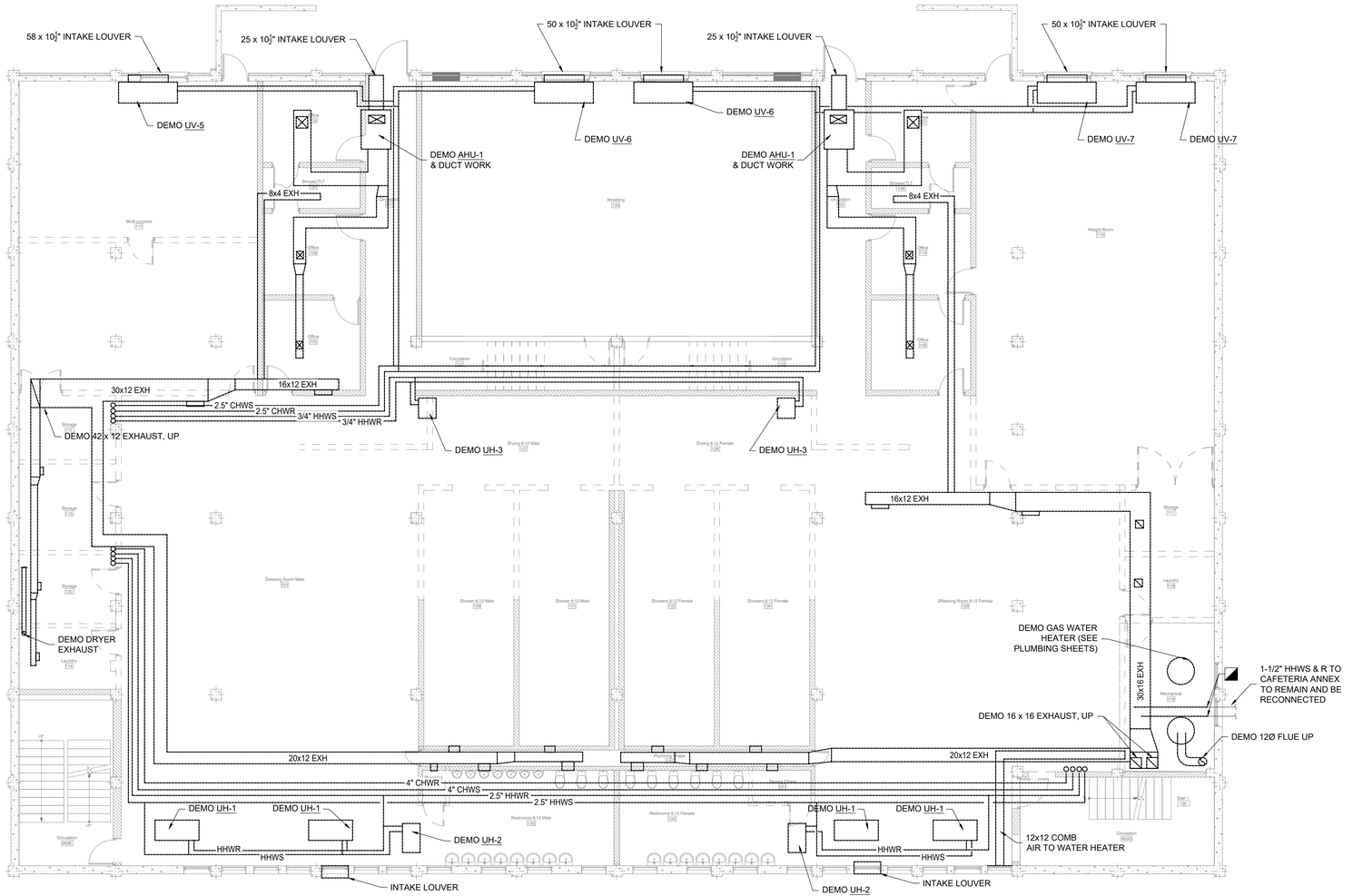
Mechanical - Details

M-105

08.28.2023

SHEET NOTES:

1. COMPLETE MECHANICAL SYSTEMS WILL BE REMOVED FROM THE GYM, INCLUDING:
   AIR HANDLERS
   FAN COIL UNITS
   UNIT HEATERS
   UNIT VENTILATORS
   DUCTS, DIFFUSERS, GRILLES
   EXHAUST FANS AND DUCTS
2. ALL HVAC CONTROLS - THERMOSTATS, SENSORS, CONTROLLERS, WIRING, ETC. - ARE TO BE REMOVED. THE CONTROLS CONTRACTOR SHALL SALVAGE MODULES, THERMOSTATS AND SUPPLY AIR SENSORS AND RETURN THEM TO LCS.
3. ALL HYDRONIC PIPING FOR CHW, HHW, CONDENSATE, ETC. SHALL BE DEMOLISHED IN THE GYM.



01/Mechanical Demolition Plan - Lower Floor

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

N

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Mechanical Demo Plan - Lower Floor

Revisions #	Date	Description

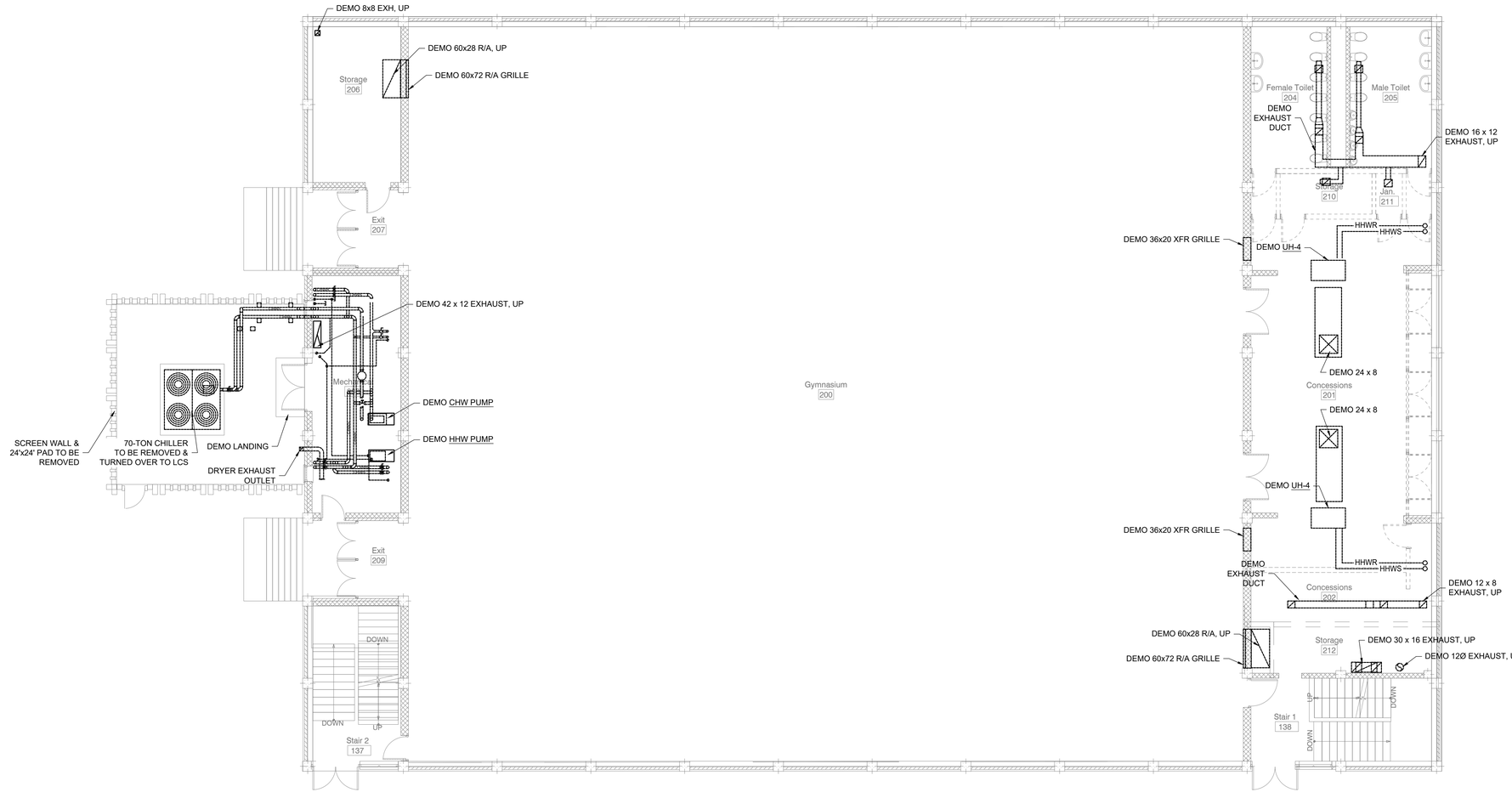
P.I.C. JMS
Design JB
Drawn MH
Reviewed JB
Job Number Hoy+Stark Architects

M-200

08.28.2023

SHEET NOTES:

1. EXISTING 70-TON CHILLER IS TO BE CAREFULLY REMOVED & TURNED OVER TO LCS FOR RELOCATION. ALL ASSOCIATED CONTROLS/DEVICES SHALL BE SALVAGED.
2. DEMO ALL HYDRONIC PIPING, PUMPS, AND TANKS ASSOCIATED WITH CHILLER & BOILERS.
3. SCREEN WALL WILL BE DEMOLISHED. CONCRETE PAD WILL BE DEMOLISHED. LANDING OUTSIDE DOUBLE DOORS WILL BE DEMOLISHED.
4. DEMO UNIT HEATERS IN LOBBY, INCLUDING DUCT AND HHW PIPING.
5. DEMO ALL EXHAUST DUCTS FOR RESTROOMS.
6. RETURN AIR GRILLES IN THE WALL TO THE GYM WILL BE DEMOLISHED, HOLES WILL BE FILLED.



01/Mechanical Demolition Plan - Main Floor

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

N

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Mechanical Demo Plan - Main Floor

Revisions #	Date	Description

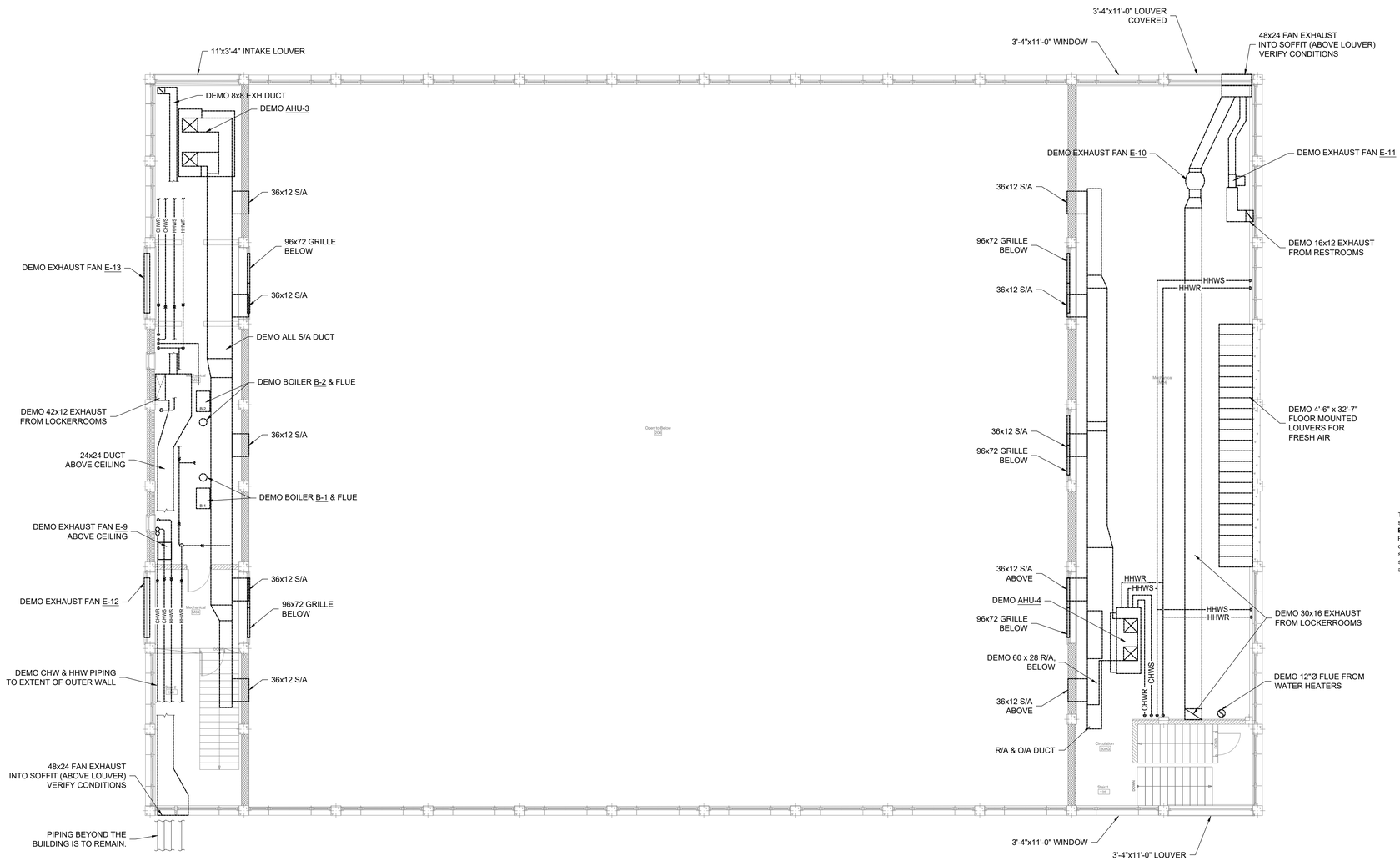
P.I.C.	JMS
Design	JB
Drawn	MH
Reviewed	JB
Job Number	

M-201

08.28.2023

SHEET NOTES:

1. DEMO AIR HANDLERS AHU-3 & AHU-4 ON THE MEZZANINES.
2. DEMO ALL SUPPLY AIR, RETURN AIR, AND OUTSIDE AIR DUCTS CONNECTED TO AIR HANDLERS. DEMO ALL GRILLES & DIFFUSERS.
3. DEMO EXHAUST DUCTS AND FANS.
   (VERIFY CONDITION OF EXHAUST AT SOUTH MEZZANINE.)
4. DEMO FRESH AIR DAMPERS AT FLOOR LEVEL AT SOUTH END.
5. DEMO ALL HYDRONIC PIPING IN THE MEZZANINES.
6. DEMO EXHAUST FANS EF-12 & EF-13 IN THE NORTH WALL
7. DEMO BOILERS, GAS PIPING, & FLUES AT NORTH END.
8. BOILER FLUES AND WATER HEATER FLUES THROUGH THE ROOF WILL BE DEMOLISHED; THERE WILL BE NO REPLACEMENT FLUES - PATCH HOLES IN THE ROOF.



01/Mechanical Demolition Plan - Mezzanine Floor

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

N

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Revisions #	Date	Description

P.I.C.	JMS
Design	JB
Drawn	MH
Reviewed	JB
Job Number	

Mechanical Demo Plan - Mezzanine

M-202

08.28.2023

SHEET NOTES:

1. INSTALL ALL SCHEDULED EQUIPMENT; FABRICATE AND INSTALL DUCT AND HYDRONIC PIPING.
2. DUCT WORK IN BASEMENT IS TO BE DOUBLE-WALL INSULATED GALVANIZED DUCT TO PROVIDE A LONG-TERM DURABLE INSTALLATION. ROUTE DUCT AS HIGH AS POSSIBLE.
3. COORDINATE LOUVERS WITH ARCHITECTURAL; OUTSIDE AIR AND EXHAUST DUCTS WILL ATTACH TO LOUVERS.
4. INSTALL FAN COIL UNITS GENERALLY WHERE SHOWN AND SUSPEND FROM ABOVE. FAN COIL UNITS WILL HAVE BIPOLAR IONIZATION EQUIPMENT TO HELP MITIGATE ODORS.
5. INSTALL NEW DRYER DUCT BOOSTER FANS WHERE SHOWN. FOLLOW MANUFACTURER'S INSTALLATION GUIDELINES. INSTALL SECONDARY LINT TRAP 4' FROM DRYER EXHAUST OUTLET. ROUTE 4"Ø EXHAUST DUCT TO NEW EXHAUST LOUVERS WHERE SHOWN. INSTALL EXHAUST FAN STATUS ALARM PANEL IN LAUNDRY ROOM PER MANUFACTURER'S INSTRUCTIONS.

01/Mechanical New Work Plan - Lower Floor

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

N

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#	Revisions Date	Description

P.I.C.	JMS
Design	JB
Drawn	MH
Reviewed	JB
Job Number	

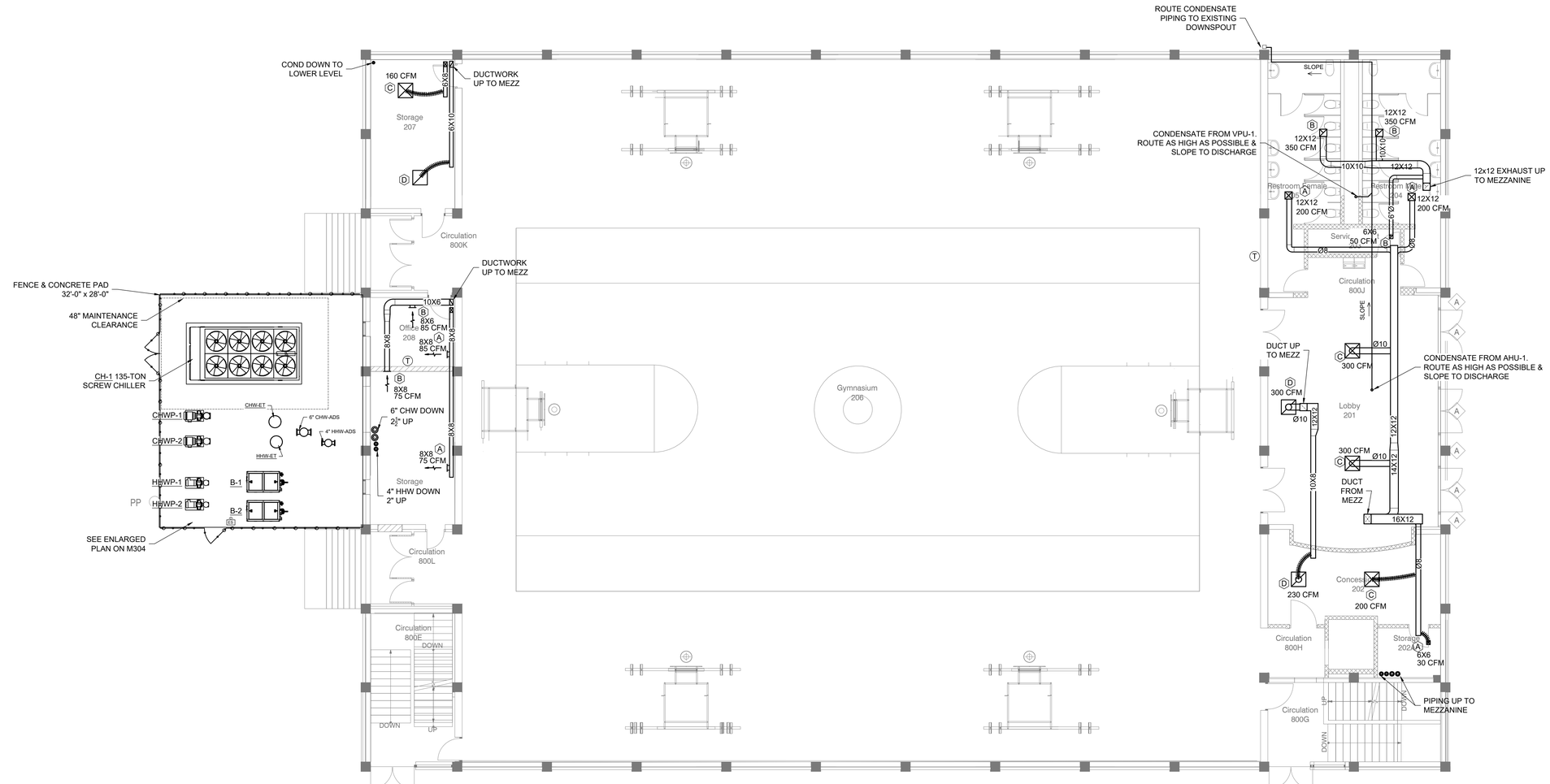
Mechanical Plan - Lower Floor

M-300

08.28.2023

SHEET NOTES:

1. INSTALL ALL SCHEDULED EQUIPMENT; FABRICATE AND INSTALL DUCT AND HYDRONIC PIPING.
2. EXPOSED DUCT WORK IN LOBBY IS TO BE DOUBLE-WALL INSULATED GALVANIZED DUCT TO PROVIDE A LONG-TERM DURABLE INSTALLATION. ROUTE DUCT AS HIGH AS POSSIBLE.
3. DUCT ABOVE CEILINGS IS TO BE SINGLE WALL DUCT WITH EXTERNAL INSULATION.



01/Mechanical New Work Plan - Main Floor

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

N

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Revisions #	Date	Description

P.I.C.	JMS
Design	JB
Drawn	MH
Reviewed	JB
Job Number	

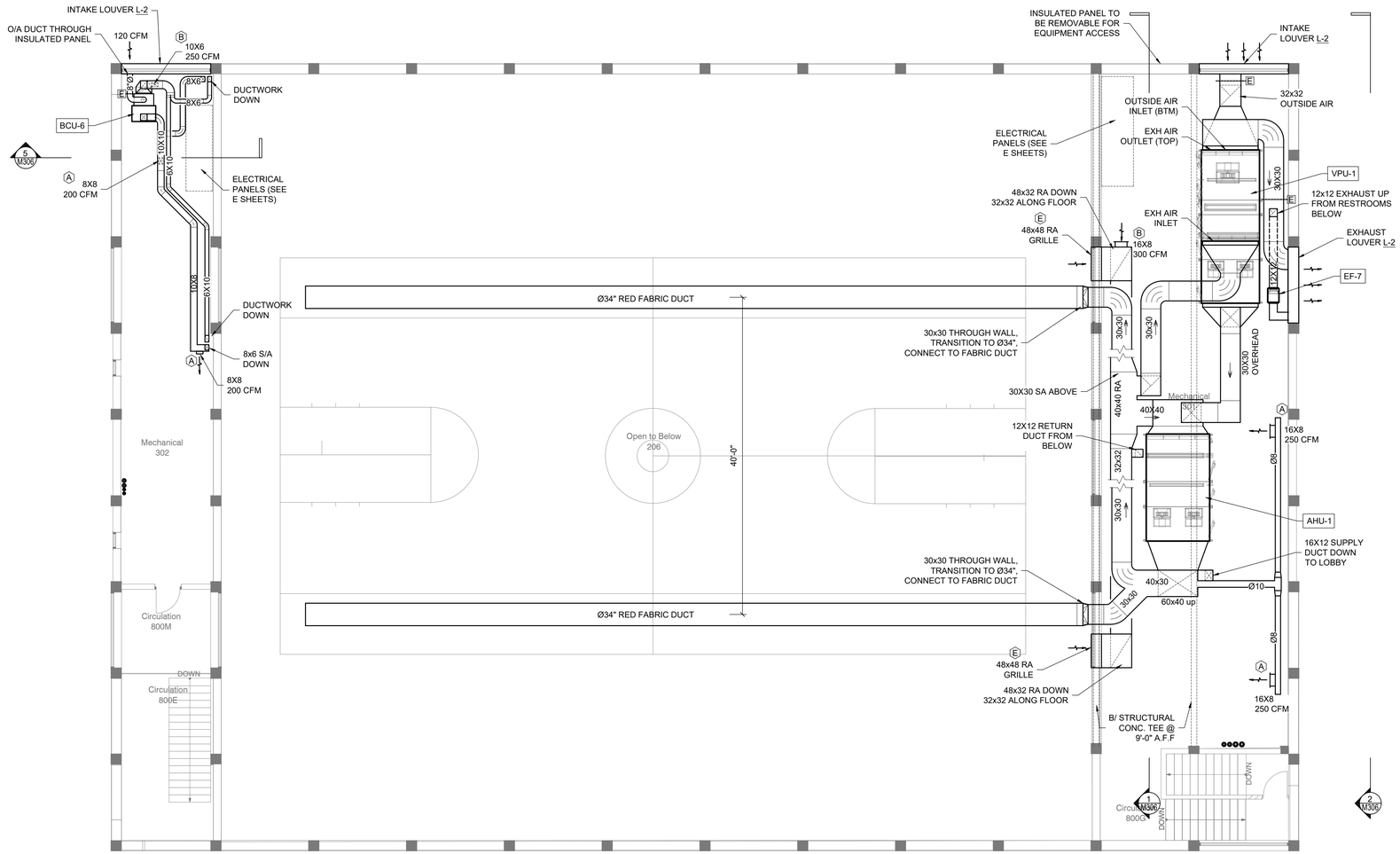
Mechanical Plan - Main Floor

M-301

08.28.2023

SHEET NOTES:

1. INSTALL VENTILATION PROCESSING UNIT AND AIR HANDLER IN MEZZANINE TO SUPPLY GYMNASIUM. THE UNITS SHALL BE FULLY "KNOCKED-DOWN" BEFORE BRINGING PANELS INTO THE BUILDING.
2. INSTALL NEW FABRIC ROUND DUCT (PRIHODA OR SIMILAR) TO SUPPLY GYMNASIUM.
3. COORDINATE LOUVERS WITH ARCHITECTURAL; OUTSIDE AIR AND EXHAUST DUCTS WILL ATTACH TO LOUVERS.



01/Mechanical New Work Plan - Mezzanine Floor

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

N

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Mechanical Plan - Mezzanine

M-302

08.28.2023

Revisions #	Date	Description

P.I.C.	JMS
Design	JB
Drawn	MH
Reviewed	JB
Job Number	

01/Mechanical Piping Plan - Lower Floor

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

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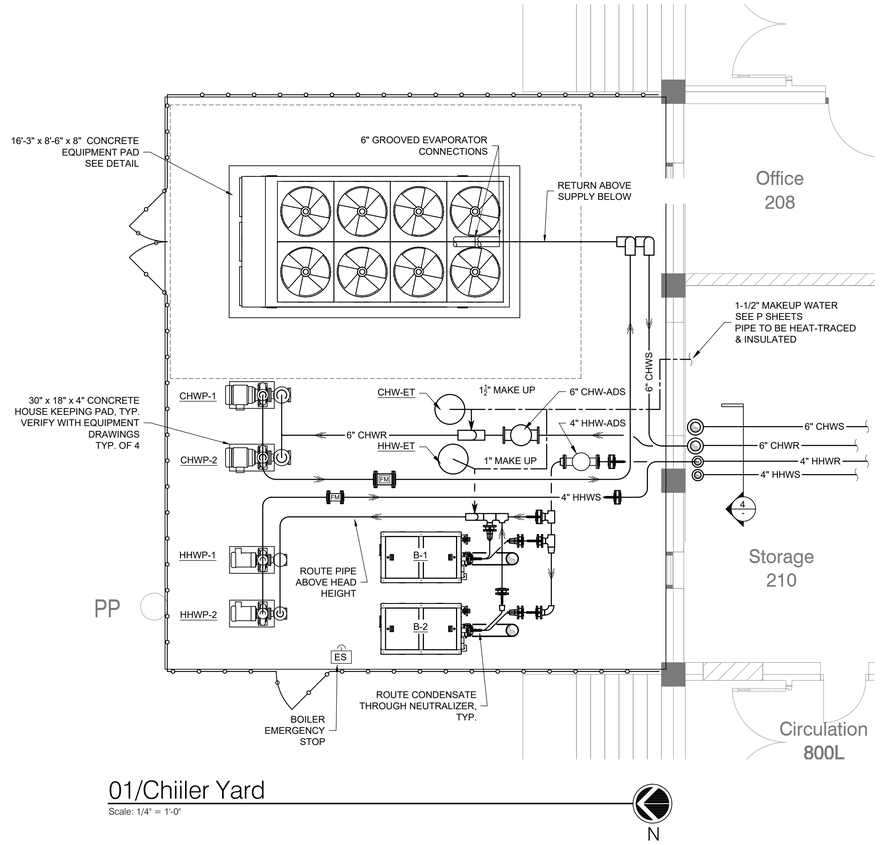
Mechanical Plan - Piping Lower Floor

M-303

08.28.2023

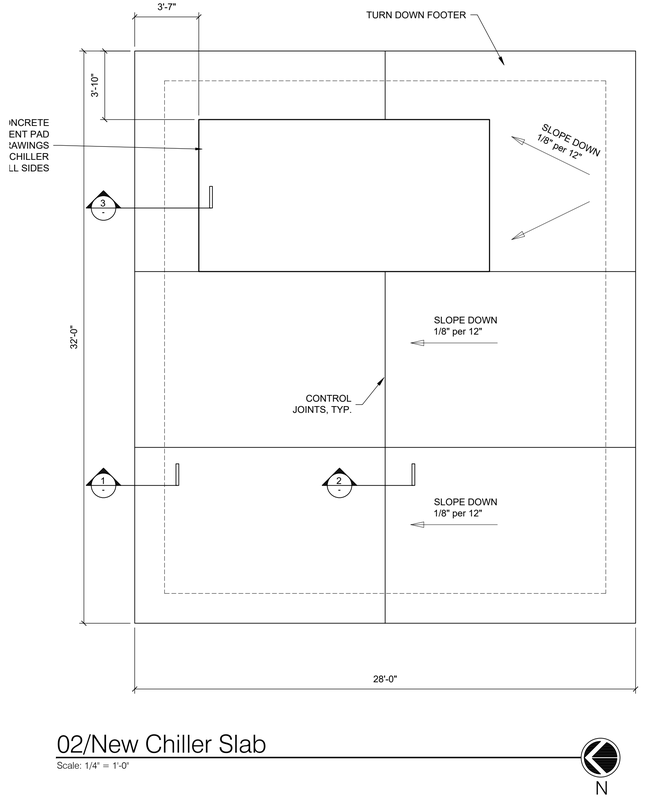
#	Revisions Date	Description

P.I.C.	JMS
Design	JB
Drawn	MH
Reviewed	JB
Job Number	Hoy+Stark Architects 1350 Market Street - Suite 209 Tallahassee Florida 32312



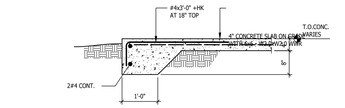
01/Chiiler Yard

Scale: 1/4" = 1'-0"



02/New Chiller Slab

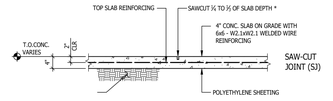
Scale: 1/4" = 1'-0"



4 PIPE SECTION THROUGH WALL

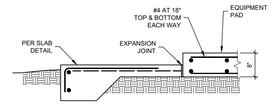
DRILL & SLEEVE HOLES IN EXTERIOR WALL LEAVE AT LEAST 3 COURSES OF BRICKS BETWEEN LAYERS. SEAL OPENINGS WEATHER TIGHT.

1 SLAB EDGE DETAIL



* SAWCUT AS SOON AS POSSIBLE AFTER CONCRETE HARDENS.

2 SLAB CONTROL JOINTS
SLAB ON GRADE



3 EQUIPMENT PAD DETAIL

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#	Revisions Date	Description

P.I.C. JMS
Design JB
Drawn MH
Reviewed JB
Job Number

Mechanical Plan - Chiller Yard

M-304

08.28.2023

01/Mechanical Piping Plan - Mezzanine

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

N

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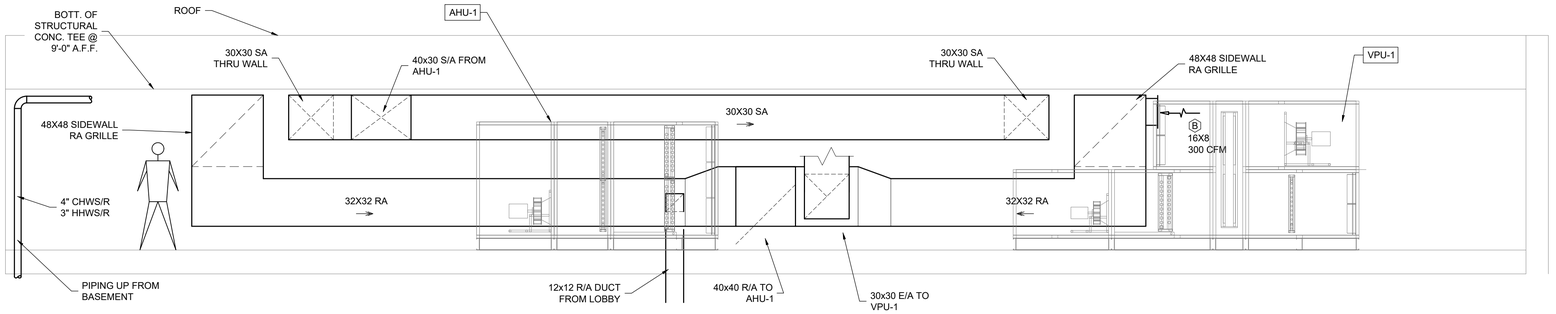
Mechanical Plan - Piping Mezzanine

Revisions #	Date	Description

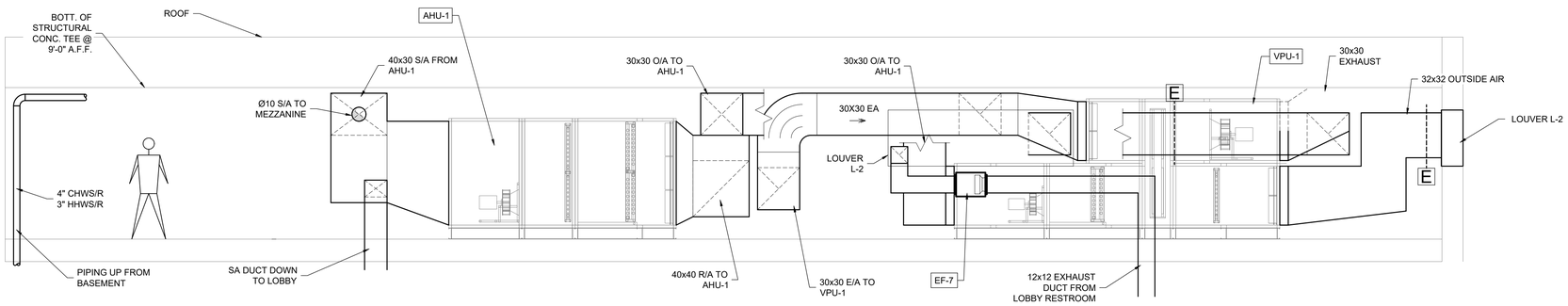
P.I.C.	JMS
Design	JB
Drawn	MH
Reviewed	JB
Job Number	

M-305

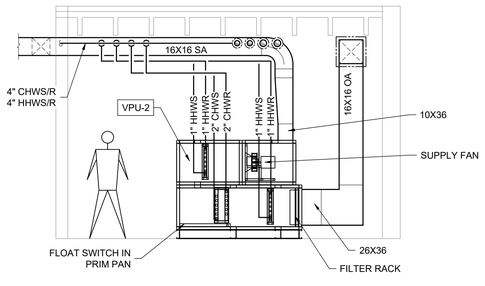
08.28.2023



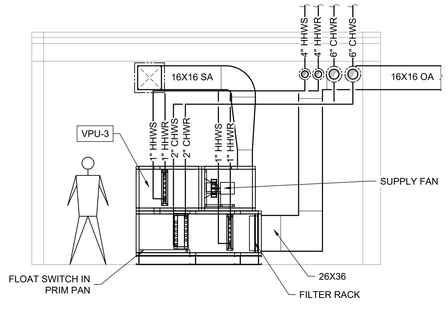
1 MEZZANINE SECTION
1/4" = 1'-0"
M302



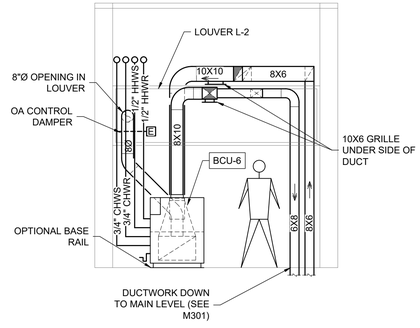
2 MEZZANINE SECTION
1/4" = 1'-0"
M302



3 VPU-2 SECTION
1/4" = 1'-0"
M300



4 VPU-3 SECTION
1/4" = 1'-0"
M300



5 BCU-6 SECTION
1/4" = 1'-0"
M302

Hoy+Stark Architects

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JON M. BARBER LICENSE No. 55427 STATE OF FLORIDA PROFESSIONAL ENGINEER

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Mechanical Sections

M-306

08.28.2023

Revisions #	Date	Description

P.I.C.	JMS
Design	JB
Drawn	MH
Reviewed	JB
Job Number	Hoy+Stark Architects

HVAC CONTROLS:

- DEMOLITION: DURING THE DEMOLITION PHASE, THE CONTROLS CONTRACTOR SHALL SALVAGE MODULES, THERMOSTATS, AND SUPPLY AIR SENSORS AND RETURN THEM TO LCS.

- CONTROL SYSTEM INCLUDES BUT IS NOT LIMITED TO LABOR AND MATERIALS FOR TERMINATIONS, PATHWAYS, INSTALLATIONS, CERTIFICATIONS, TESTING, SYSTEM VERIFICATION, PROJECT COMMISSIONING, INTEGRATION EQUIPMENT, AND INSTRUMENTATION.

- CONTROL WIRING REQUIRED FOR THIS SYSTEM SHALL BE PROVIDED & INSTALLED PER DIVISION 26. WIRING MUST BE IN CONDUIT OVER ITS ENTIRE LENGTH; COORDINATE SUPPORTS & WALL PENETRATIONS WITH OTHER TRADES.
  1. INSIDE CONTROL WIRING: MINIMUM OF ¾" CONDUIT FOR ALL CONTROL WIRING WITH EXCEPTION OF ½" FOR THE ROOM TEMPERATURE WALL SENSORS BACK TO THE TERMINAL UNIT.
  2. AHU MECHANICAL ROOMS: MINIMUM OF ¾" CONDUIT FOR ALL CONTROL WIRING - WITH ½ INCH STEEL FLEX (6FT. MAX) - WITH ALL STEEL FITTINGS FOR EMT AND FLEX CONNECTORS.
  3. CENTRAL PLANT: EMT ABOVE 6FT ABOVE FINISHED FLOOR. RIGID BELOW 6FT + SEALTITE (6FT MAX) TO ALL DEVICES.
  4. TSTATS: 2 X 4 VERTICAL BOX BY ELECTRICAL DIVISION. LOCATIONS TO BE COORDINATED WITH OTHER TRADES
  5. CONDUITS BETWEEN BUILDINGS: 1" BY ELECTRICAL DIVISION. THESE TYPICALLY RUN BETWEEN COMM ROOMS OR BETWEEN TWO MECHANICAL ROOMS.
  6. EXTERIOR CONDUIT: RIGID CONDUIT+ SEALTITE FOR ANY OUTSIDE CONTROL WIRING.

- UNLESS EXPLICITLY LISTED BELOW, THE CONTROLS DEVICES AND PROGRAMMING SHALL BE SUPPLIED BY THE CONTROLS CONTRACTOR. THE SEQUENCE ON THIS SHEET SHALL GOVERN THE OPERATION OF THE CONTROLS.
  1. THE VFDs ARE SUPPLIED BY THE OWNER

- THE CONTROLS CONTRACTOR SHALL PROVIDE THE FOLLOWING EQUIPMENT AND COORDINATE INSTALLATION WITH THE MECHANICAL AND ELECTRICAL CONTRACTORS:
  1. 2-WAY COOLING COIL VALVES, MODULATING, FAIL CLOSED
  2. 3-WAY HEATING COIL VALVES, DIVERTING, MODULATING, FAIL TO BYPASS POSITION
  3. R/A & O/A CONTROL DAMPERS AND ACTUATORS. MODULATING OPERATION.
  4. ANALOG AND BINARY DEVICES FOR AHU AND DUCT - VERIFY REQUIRED STRAIGHT RUN REQ'S
  5. ANALOG AND BINARY DEVICES FOR HYDRONIC SYSTEMS - VERIFY REQUIRED STRAIGHT RUN REQ'S

- ALL DEVICES SHALL BE INTEGRATED INTO THE BAS; VISIBLE AND CONTROLLABLE (WHERE APPLICABLE) IN THE USER INTERFACE.

- PRIOR TO START-UP, PERFORM SYSTEM OPERATIONAL CHECKOUT.

- PROVIDE OWNER TRAINING, INCLUDING PROCESS TO START-UP AND OPERATE EQUIPMENT

- AT THE END OF THE PROJECT, PROVIDE RECORD DOCUMENTS, MANUFACTURER INFORMATION FOR BAS & INSTRUMENTS, AND OPERATION MANUALS.

CONTROLS LEGEND & ABBREV.

DESIGNATION	DESCRIPTION
T/H	SPACE TEMP/RH SENSOR & WIREWAY
D	DUCT DETECTOR
	THERMOMETER
	PRESS GAUGE & COCK
F	FLOW SWITCH
T	TEMPERATURE SENSOR
FS	FREEZE STAT
HP	HIGH PRESSURE SWITCH
SP	STATIC PRESSURE
LS	LEVEL SWITCH
RH	HUMIDISTAT
FM	FLOW METER
DP	DIFFERENTIAL PRESSURE TRANSDUCER
CT	CURRENT TRANSDUCER
E	ELECTRIC ACTUATOR
M	MANUAL ACTUATOR
ES	EMERGENCY SWITCH
	PUMP
PT	PRESS/TEMP PORT
	TWO-WAY CONTROL VALVE
	THREE-WAY CONTROL VALVE
HOA	COMBINATION MOTOR STARTER DISCONNECT WITH HOA SWITCH
HOA	VARIABLE FREQ. DRIVE W/HOA SWITCH
T	SPACE TEMPERATURE SENSOR & WIREWAY
BAS	BUILDING AUTOMATION SYSTEM

CHILLED WATER SYSTEM

GENERAL

THIS PROJECT WILL INSTALL A 135-TON AIR-COOLED CHILLER AND 2 VARIABLE PRIMARY PUMPS IN AN N+1 CONFIGURATION. THE PUMPS SHALL BE CONTROLLED BY THE CHILLER.

THE CHILLER IS SUPPLIED WITH A MANUFACTURER CONTROLLER WITH BACNET COMPATIBILITY. COMMUNICATION WITH CHILLER & DEVICES SHALL BE VIA BACNET, INCLUDING PUMP CONTROL & FLOW SWITCH STATUS.

THE MECHANICAL CONTRACTOR SHALL COORDINATE WITH THE CONTROLS CONTRACTOR.

PROVIDE CHILLER AND PRIMARY PUMP GRAPHICS. OUTDOOR AIR TEMPERATURE SHALL BE DISPLAYED ON THE CHILLER SCREEN.

PROGRAM TREND DATA FOR KEY OPERATING PARAMETERS OF PLANT SYSTEMS TO INCLUDE CHILLER % RATED AMPS, LEAVING AND ENTERING WATER TEMPERATURES, SETPOINTS, RUN TIME, EQUIPMENT STATUS, PROOF OF FLOW, CHILLER DP, ALARMS, ETC.

START-UP SEQUENCE
THE SYSTEM SHALL NOT BE ALLOWED TO START UNLESS ALL SAFETIES ARE OUT OF ALARM.

THE SYSTEM SHALL BE ACTIVE ANY TIME AN ASSOCIATED AIR HANDLING UNIT IS ACTIVE AND CALLS FOR COOLING.

UPON START-UP COMMAND, VIA BAS:
1. LEAD CHILLER ISOLATION VALVE OPENS.
2. LEAD PUMP STARTS, IS COMMANDED TO MINIMUM SPEED OF 36 Hz (ADJ) AND IS PROVEN
3. LEAD CHILLER STARTS AND IS PROVEN.
4. DIFFERENTIAL PRESSURE RESET SEQUENCE ACTIVATES.
5. TEMPERATURE CONTROL SEQUENCE ACTIVATES.
6. BYPASS CONTROL VALVE SEQUENCE ACTIVATES.

IF A PUMP OR CHILLER IS NOT PROVEN WITHIN 60 SECONDS OF START COMMAND, THE SHUTDOWN SEQUENCE ACTIVATES FOR THAT EQUIPMENT, AN ALARM IS GENERATED, AND THE LAG EQUIPMENT STARTS.

DIFFERENTIAL PRESSURE RESET
EVERY 15 MINUTES (ADJ), THE DIFFERENTIAL PRESSURE SETPOINT RESETS WITHIN MINIMUM AND MAXIMUM LIMITS:
1. IF ANY ASSOCIATED CHILLED WATER VALVE COMMAND IS GREATER THAN 90% (ADJ), INCREASE SETPOINT BY 1.0 PSID (ADJ).
2. IF ALL ASSOCIATED CHILLED WATER VALVE COMMANDS ARE LESS THAN 60% (ADJ), DECREASE SETPOINT BY 1.0 PSID (ADJ).

TEMPERATURE CONTROL
CHILLER CAPACITY MODULATES TO MAINTAIN LOOP SUPPLY TEMPERATURE SETPOINT:

THE SETPOINT FOR LEAVING WATER TEMPERATURE WILL BE 44°F (ADJ).

BYPASS VALVE CONTROL
VALVE SHALL MODULATE TO MAINTAIN MINIMUM FLOW RATE THROUGH CHILLERS.

CHILLER OPERATION MINIMUM FLOW RATE = 197 GPM (ADJ).

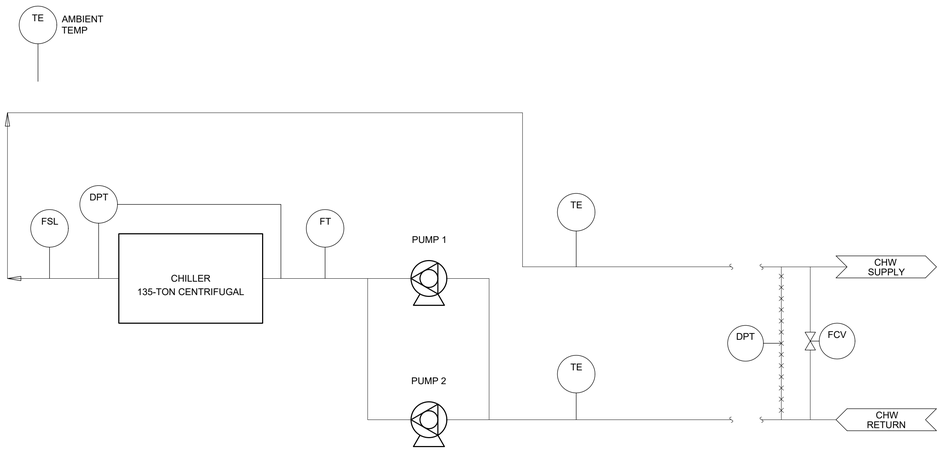
LEAD/LAG PUMP ROTATION
EVERY TWO WEEKS(ADJ) UPON ROTATION COMMAND OR OPERATOR INPUT, THE LEAD/LAG DESIGNATIONS ROTATE, ASSIGNED IN ORDER OF RUN HOURS.

SHUTDOWN SEQUENCE
UPON SHUTDOWN COMMAND:
1. ALL ACTIVE SEQUENCES DEACTIVATE.
2. CHILLER STOPS AND IS PROVEN.
3. PUMP STOPS AND IS PROVEN.

CHILLER PUMP COMMAND:
FREEZE PROTECTION - WHEN CHILLER CALLS FOR PUMP DUE TO LOW AMBIENT TEMPERATURE, START LEAD PUMP. PUMP WILL OPERATE FOR DURATION OF CHILLER CONTROLLER DEMAND.

EQUIPMENT FAILURE
IF THE CHILLER FAILS, THE SHUTDOWN SEQUENCE ACTIVATES, AN ALARM IS GENERATED.

THE DESIGN DP ACROSS THE EVAPORATOR IS 4.6 FT H2O. WHEN THE DP REACHES 6 FT H20 (ADJ) GENERATE AN ALARM



CHILLED WATER SYSTEM

POINT NAME	UNITS	CONTROL POINTS: POINTS: INPUT: ANALOG	DIGITAL	INTEGRATED	OUTPUT: ANALOG	DIGITAL	INTEGRATED	ALARM: GENERAL	UNIT SHUTDOWN	GENERAL: TREND LOG	GRAPHIC	INTERLOCK
PUMP 1 RUN COMMAND	ON/OFF					X				X	X	
PUMP 1 SPEED COMMAND	% SPEED				X					X	X	
PUMP 1 RUN STATUS	ON/OFF		X					X		X	X	
PUMP 2 RUN COMMAND	ON/OFF					X				X	X	
PUMP 2 SPEED COMMAND	% SPEED				X					X	X	
PUMP 2 RUN STATUS	ON/OFF		X					X		X	X	
CHILLED WATER LOOP FLOW	GPM	X						X		X	X	
BYPASS CONTROL VALVE	%				X					X	X	
CHW LOOP DIFFERENTIAL PRESSURE	PSID	X								X	X	
EVAPORATOR DIFFERENTIAL PRESSURE	PSID	X						X		X	X	
CHW LOOP RETURN TEMPERATURE	DEG F	X								X	X	
CHW LOOP SUPPLY TEMPERATURE	DEG F	X								X	X	
OUTSIDE AIR TEMPERATURE	DEG F	X								X	X	
CHILLER ENABLE COMMAND	ON/OFF						X			X	X	
CHW SUPPLY TEMPERATURE SETPOINT	DEG F						X			X	X	
CHW DIFFERENTIAL PRESSURE SETPOINT	PSID						X			X	X	
CHILLED WATER PROOF OF FLOW	YES/NO			X						X	X	
CHW ENTERING TEMPERATURE	DEG F			X						X	X	
CHW LEAVING TEMPERATURE	DEG F			X						X	X	
EVAP HEATER	ON/OFF			X						X	X	
COMPRESSOR CURRENT	% RLA			X						X	X	
COMPRESSOR CURRENT MAX SETPOINT	% RLA			X						X	X	
CHILLER RUN STATUS	ON/OFF			X						X	X	
CHILLER RUN STATUS ALARM	NORMAL/ALARM			X						X	X	
CHILLER CLEAR ALARM							X					
SERVICE REQUEST								X				
PLANT CONSUMPTION TOTALIZED	TON HR			X						X	X	

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Controls - General & Chiller

Revisions #	Date	Description

P.I.C.	JMS
Design	JB
Drawn	MH
Reviewed	JB
Job Number	19

M-400

08.28.2023

BOILER SHUT DOWN CONTROLS (BY CONTROLS VENDOR)

PROVIDE A SINGLE EMERGENCY STOP SWITCH STATION FOR BOTH BOILERS ON THE INTERIOR OF THE MECHANICAL YARD NEAR THE ENTRANCE GATE, SEE PLAN.

SWITCH SHALL INTERRUPT THE BOILER'S SAFETY CIRCUIT AND INCLUDE SHUTDOWN OF THE BOILER'S GAS TRAIN.

THE SWTICH SHALL BE CERTIFIED TO MEET THE REQUIREMENTS OF ASME CSD-1 AND INCLUDE A NEMA 3R ENCLOUSRE FOR INSTALLATION OUTISDE.

PROVIDE SIGNAGE AT SWITCH STATING "BOILER EMERGENCY STOP SWITCH ".

HEATING HOT WATER SYSTEM

GENERAL

THIS PROJECT WILL INSTALL (2) 1250 MBH CONDENSING BOILERS AND 2 VARIABLE PRIMARY PUMPS, EACH IN AN N+1 CONFIGURATION.

EACH BOILER WILL INCLUDE THE MANUFACTURER'S CONTROLLER AND A PROTOCOL CONVERTER FOR BACNET COMMUNICATION AT THE MASTER CONTROLLER. BAS WILL MONITOR BOILERS; ALL SET POINTS, STAGING, ALARMS, INTERLOCKS, ETC. TO BE MANAGED BY BOILERS.

THE BOILER CONTROLLERS SHALL BE DAISY-CHAINED FOR OPERATIONAL MANAGEMENT.

THE MECHANICAL CONTRACTOR SHALL COORDINATE WITH THE CONTROLS CONTRACTOR.

PROVIDE BOILER AND PRIMARY PUMP GRAPHICS.

PROGRAM TREND DATA FOR KEY OPERATING PARAMETERS OF PLANT SYSTEMS TO INCLUDE LEAVING AND ENTERING WATER TEMPERATURES, SETPOINTS, RUN TIME, EQUIPMENT STATUS, PROOF OF FLOW, ALARMS, ETC.

START-UP SEQUENCE
THE SYSTEM SHALL NOT BE ALLOWED TO START UNLESS ALL SAFETIES ARE OUT OF ALARM.

THE SYSTEM SHALL BE ENABLED ANY TIME AN ASSOCIATED AIR HANDLING UNIT CALLS FOR HEATING.

UPON START-UP COMMAND, VIA BAS:
1. LEAD BOILER ISOLATION VALVE OPENS.
2. LEAD PUMP STARTS, IS COMMANDED TO MINIMUM SPEED OF 20 Hz (ADJ), AND IS PROVEN.
3. LEAD BOILER STARTS AND IS PROVEN.
4. DIFFERENTIAL PRESSURE CONTROL SEQUENCE ACTIVATES.
5. DIFFERENTIAL PRESSURE RESET SEQUENCE ACTIVATES.
6. TEMPERATURE CONTROL SEQUENCE ACTIVATES.

IF A PUMP OR BOILER IS NOT PROVEN WITHIN 60 SECONDS OF START COMMAND, THE SHUTDOWN SEQUENCE ACTIVATES FOR THAT EQUIPMENT, AN ALARM IS GENERATED, AND THE LAG EQUIPMENT STARTS.

PLANT DIFFERENTIAL PRESSURE CONTROL
THE PUMP SPEEDS MODULATE TO MAINTAIN PLANT DIFFERENTIAL PRESSURE SETPOINT.

PLANT DIFFERENTIAL PRESSURE SETPOINT = LOOP DIFFERENTIAL PRESSURE SETPOINT + OFFSET.
PLANT SETPOINT RESETS AS LOOP SETPOINT RESETS BASED ON RESET SEQUENCE BELOW.
1. IF LEAD PUMP SPEED IS 95% (ADJ) OR GREATER FOR A PERIOD OF 10 MINUTES (ADJ), THE LAG BOILER ISOLATION VALVE OPENS AND THE LAG PUMP STAGES ON. THE LAG PUMP SPEED RAMPS UP TO MATCH THE SPEED OF THE LEAD PUMP, 35 Hz (ADJ). BOTH PUMPS MODULATE IN UNISON TO MAINTAIN DIFFERENTIAL PRESSURE SETPOINT.
2. IF LEAD AND LAG PUMP SPEEDS ARE AT 20 Hz (ADJ) FOR A PERIOD OF 5 MINUTES, THE LAG PUMP STAGES OFF AND THE ISOLATION VALVE CLOSES. THE LEAD PUMP MODULATES TO MAINTAIN DIFFERENTIAL PRESSURE SETPOINT.

SECONDARY DIFFERENTIAL PRESSURE RESET
EVERY 15 MINUTES (ADJ), THE DIFFERENTIAL PRESSURE SETPOINT RESETS WITHIN MINIMUM AND MAXIMUM LIMITS:
1. IF ANY ASSOCIATED HOT WATER VALVE COMMAND IS GREATER THAN 90% (ADJ), INCREASE SETPOINT BY 1.0 PSID (ADJ).
2. IF ALL ASSOCIATED HOT WATER VALVE COMMANDS ARE LESS THAN 60% (ADJ), DECREASE SETPOINT BY 1.0 PSID (ADJ).

TEMPERATURE CONTROL
BOILER CAPACITIES MODULATE TO MEET MAINTAIN LOOP SUPPLY WATER TEMPERATURE SETPOINT:
1. IF LEAD BOILER LOAD IS GREATER THAN 80% (ADJ) FOR MORE THAN 10 MINUTES (ADJ):
   A. LAG BOILER ISOLATION VALVE OPENS.
   B. LAG PUMP STARTS.
   C. LAG BOILER STARTS AND IS PROVEN.
2. IF LAG BOILER LOAD IS LESS THAN 30% (ADJ) FOR MORE THAN 10 MINUTES (ADJ):
   A. LAG PUMP STOPS
   B. LAG BOILER STOPS AND IS PROVEN.
   C. LAG BOILER ISOLATION VALVE CLOSES.

SUPPLY WATER TEMPERATURE RESET
THE LOOP SUPPLY WATER TEMPERATURE SEQUENCE ACTIVES ONLY IF PLANT DIFFERENTIAL PRESSURE HAS BEEN RESET TO MINIMUM.

EVERY 5 MINUTES (ADJ), THE TEMPERATURE SETPOINT RESETS WITHIN MINIMUM AND MAXIMUM LIMITS:
1. IF ALL VALVES ARE BELOW 50% (ADJ), DECREASE SETPOINT BY 1°F.
2. IF MORE THAN THREE (ADJ) VALVES ARE MORE THAN 50% OPEN, INCREASE SETPOINT BY 1°F.

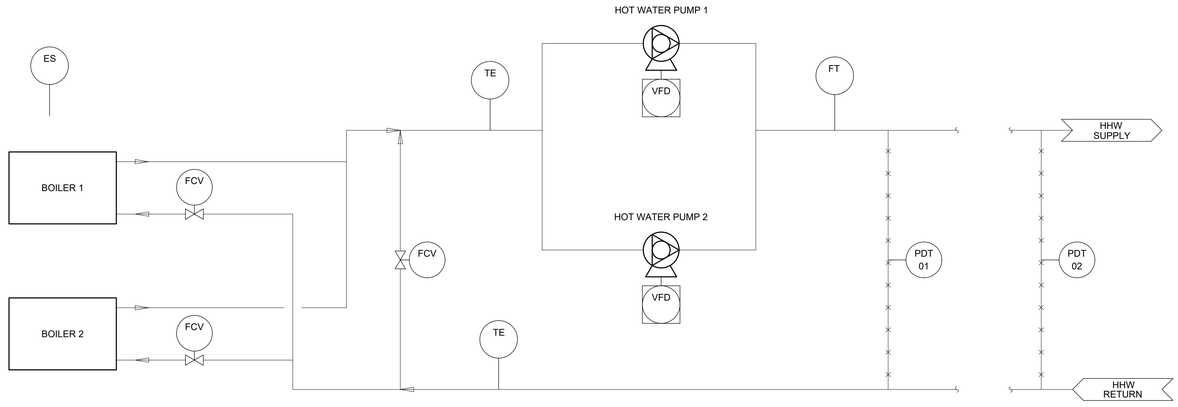
LEAD/LAG BOILER ROTATION
EVERY TWO WEEKS (ADJ) UPON ROTATION COMMAND OR OPERATOR INPUT, THE LEAD/LAG DESIGNATIONS OF BOILERS ROTATE, ASSIGNED IN ORDER OF RUN HOURS. START LAG BOILER PRIOR TO ROTATING LEAD DESIGNATION.

LEAD/LAG SECONDARY PUMP ROTATION
EVERY TWO WEEKS(ADJ) UPON ROTATION COMMAND OR OPERATOR INPUT, THE LEAD/LAG DESIGNATIONS ROTATE, ASSIGNED IN ORDER OF RUN HOURS.

SHUTDOWN SEQUENCE
UPON SHUTDOWN COMMAND
1. ALL ACTIVE SEQUENCES DEACTIVATE
2. PUMPS STOP AND ARE PROVEN.
3. BOILERS STOP AND RE PROVEN.
4. BOILER ISOLATION VALVES CLOSE.

EQUIPMENT FAILURE
IF THE LEAD PUMP OR BOILER FAILS, THE SHUTDOWN SEQUENCE ACTIVATES FOR THAT EQUIPMENT, AN ALARM IS GENERATED, AND THE START-UP SEQUENCE ACTIVATES FOR THE LAG PUMP OR BOILER.

MANUAL RESET IS REQUIRED FOR ALL EQUIPMENT AFTER EQUIPMENT TRIP.



HEATING HOT WATER SYSTEM

POINT NAME	UNITS	CONTROL POINTS: POINTS: INPUT: ANALOG	DIGITAL	INTEGRATED	OUTPUT: ANALOG	DIGITAL	INTEGRATED	ALARM: GENERAL	UNIT SHUTDOWN	GENERAL: TREND LOG	GRAPHIC	INTERLOCK
PUMP 1 RUN COMMAND	ON/OFF					X				X	X	
PUMP 1 SPEED COMMAND	% SPEED				X					X	X	
PUMP 1 RUN STATUS	ON/OFF		X					X		X	X	
PUMP 2 RUN COMMAND	ON/OFF					X				X	X	
PUMP 2 SPEED COMMAND	% SPEED				X					X	X	
PUMP 2 RUN STATUS	ON/OFF		X					X		X	X	
BOILER 1 ISOLATION VALVE COMMAND	ON/OFF					X				X	X	
BOILER 2 ISOLATION VALVE COMMAND	ON/OFF					X				X	X	
BOILER BYPASS VALVE COMMAND	ON/OFF					X				X	X	
HOT WATER LOOP FLOW	GPM	X						X		X	X	
HW PLANT DIFFERENTIAL PRESSURE 01	PSID	X								X	X	
HW LOOP DIFFERENTIAL PRESSURE 02	PSID	X								X	X	
HW LOOP RETURN TEMPERATURE	DEG F	X						X		X	X	
HW LOOP SUPPLY TEMPERATURE	DEG F	X						X		X	X	
BOILER EMERGENCY STOP SWITCH	ON/OFF		X					X	X	X	X	
BOILER 1 ENABLE COMMAND	ON/OFF						X			X	X	
BOILER 1 RUN STATUS	ON/OFF			X						X	X	
BOILER 2 ENABLE COMMAND	ON/OFF						X			X	X	
BOILER 2 RUN STATUS	ON/OFF			X						X	X	
HW SUPPLY TEMPERATURE SETPOINT	DEG F			X						X	X	
HW PLANT DP SETPOINT	PSID			X						X	X	
HW REMOTE DP SETPOINT	PSID									X	X	
BOILER 1 RUN STATUS ALARM	NORMAL/ALARM			X						X	X	
BOILER 2 RUN STATUS ALARM	NORMAL/ALARM			X						X	X	
PLANT CONSUMPTION	MBH			X						X	X	

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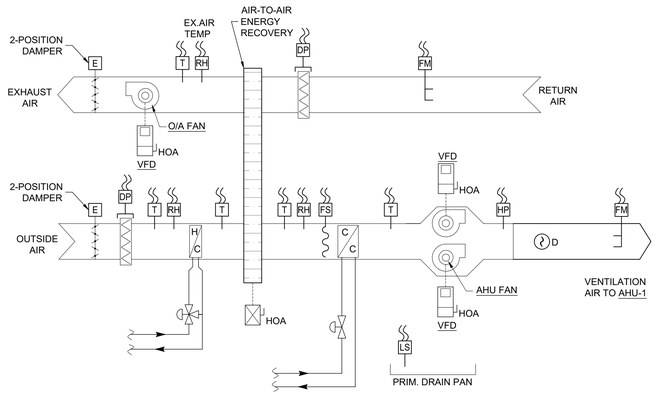
Controls - Heating Hot Water

#	Revisions Date	Description

P.I.C.	JMS
Design	JB
Drawn	MH
Reviewed	JB
Job Number	

M-401

08.28.2023



100% O/A AIR HANDLER WITH ENERGY RECOVERY

TYPICAL OF 1 SYSTEM, VPU-1

NOTE: THE ZONE EXHAUST FAN EF-5 RATE IS 800 CFM, THE VPU OUTSIDE AIR RATE SHALL ALWAYS EXCEED THE VPU EXHAUST FAN RATE BY 1200 CFM.

DOAS WITH ENERGY RECOVERY

GENERAL
THE SYSTEM IS A VARIABLE AIR VOLUME AIR HANDLING SYSTEM WITH AM ENERGY RECOVERY WHEEL, HOT WATER PREHEAT COIL, AND COOLING COIL THAT DISTRIBUTES AIR TO AN AIR HANDLING UNIT FOR DEMAND CONTROL VENTILATION.

START-UP SEQUENCE
THE SYSTEM SHALL NOT BE ALLOWED TO START UNLESS ALL SAFETIES ARE OUT OF ALARM.

UPON START-UP COMMAND:
1. OUTSIDE AIR DAMPER OPENS AND IS PROVEN.
2. OUTSIDE AIR FAN STARTS, IS PROVEN, AND FLOW CONTROL SEQUENCE ACTIVATES.
3. EXHAUST FAN STARTS AND IS PROVEN.
4. ENERGY RECOVERY WHEEL STARTS AND IS PROVEN.
5. DEMAND CONTROL VENTILATION SEQUONCE ACTIVATES
6. COOLING COIL LEAVING AIR TEMPERATURE CONTROL SEQUENCE ACTIVATES.
7. PREHEAT COIL LEAVING AIR TEMPERATURE CONTROL SEQUENCE ACTIVATES.
8. LOW TEMPERATURE SEQUENCE ACTIVATES.

OCCUPIED MODE
UPON OCCUPIED COMMAND, VIA BAS SCHEDULE:
1. OCCUPIED SETPOINTS ACTIVATE.
2. START-UP SEQUENCE ACTIVATES.

OCCUPIED STANDBY MODE
DURING OCCUPIED HOURS AND ROOM OCCUPANCY SENSORS INDICATED UNOCCUPIED:
1. OUTSIDE AIR FAN IS COMMANDED TO MINIMUM SPEED OF 15 Hz (ADJ) AND IS PROVEN
2. MINIMUM FLOWRATE IS 25% OF DESIGN FLOW

UNOCCUPIED MODE
UPON UNOCCUPIED COMMAND, VIA BAS SCHEDULE:
1. SHUTDOWN SEQUENCE ACTIVATES.

DEMAND CONTROL VENTILATION
EVERY 15 MINUTES (ADJ), THE OUTSIDE AIR FAN SPEED RESETS WITHIN THE MINIMUM AND MAXIMUM LIMITS:
1. IF RETURN AIR CO_2 CONCENTRATION IS BELOW THE CO_2 CONCENTRATION LIMIT, THE OUTSIDE AIR FAN SPEED DECREASES BY 5Hz (ADJ).
2. IF RETURN AIR CO_2 CONCENTRATION IS ABOVE THE CO_2 CONCENTRATION LIMIT, THE OUTSIDE AIR FAN SPEED INCREASES BY 5 Hz (ADJ).

EXHAUST FAN SPEED CONTROL
EXHAUST FAN SPEED TRACKS OUTSIDE AIR FAN SPEED TO MAINTAIN CONSTANT OFFSET. TAB TO DETERMINE SPEED SETTINGS.

COOLING COIL LEAVING AIR TEMPERATURE CONTROL
THE COOLING COIL VALVE MODULATES TO MAINTAIN COOLING COIL LEAVING AIR TEMPERATURE, 53.5°F (ADJ)

PREHEAT COIL LEAVING AIR TEMPERATURE CONTROL
THE PREHEAT COIL VALVE MODULATES TO MAINTAIN PREHEAT COIL LEAVING AIR TEMPERATURE SETPOINT, 50°F (ADJ).

SHUTDOWN SEQUENCE
UPON SHUTDOWN COMMAND OR LOSS OF FAN STATUS:
1. OUTSIDE AIR FAN STOPS AND IS PROVEN.
2. OUTSIDE AIR FLOW CONTROL SEQUENCE DEACTIVATES AND DAMPER CLOSES.
3. EXHAUST FAN STOPS AND IS PROVEN.
4. ALL OTHER SEQUENCES DEACTIVATE

LOW TEMPERATURE SEQUENCE
IF PREHEAT COIL AIR TEMPERATURE IS BELOW 40 °F, THE COOLING COIL VALVE OPENS TO 100%

IF PREHEAT COIL AIR TEMPERATURE FALLS BELOW 35 °F, THE SHUTDOWN SEQUENCE ACTIVATES

EQUIPMENT FAILURE
IF OUTSIDE AIR FAN FAILURE IS DETECTED, THE SHUTDOWN SEQUENCE ACTIVATES AND AN ALARM IS GENERATED.

IF EXHAUST AIR FAN FAILURE IS DETECTED, THE SYSTEM CONTINUES TO OPERATE AND AN ALARM IS GENERATED.

SAFETIES
THE FOLLOWING SAFETIES ACTIVATE THE SHUTDOWN SEQUENCE:
1. LOW TEMPERATURE LIMIT SWITCH
2. HIGH STATIC PRESSURE

PREHEAT COIL SETPOINT: 50°F (ADJ.)
COOLING COIL SETPOINT: 53°F (ADJ.)

OUTSIDE AIR FLOW RANGE: 9000 CFM DESIGN, 2250 CFM MINIMUM
EXHAUST AIR FLOW RANGE: 7650 CFM DESIGN, 1000 CFM MINIMUM

		CONTROL POINTS											
		POINTS						ALARM		GENERAL			
		INPUT			OUTPUT								
POINT NAME	UNITS	ANALOG	DIGITAL	INTEGRATED	ANALOG	DIGITAL	INTEGRATED	GENERAL	UNIT SHUTDOWN	TREND LOG	GRAPHIC	INTERLOCK
OUTSIDE AIR DAMPER						X				X	X	
O/A FILTER STATUS	DP, IN W.C.		X					X		X	X	
O/A TEMPERATURE	°F	X								X	X	
O/A RELATIVE HUMIDITY	%	X								X	X	
PREHEAT WATER COIL VALVE	%				X					X	X	
PREHEAT COIL TEMPERATURE	°F	X						X	X	X	X	
ENERGY RECOVERY WHEEL			X			X				X	X	
O/A E/R TEMPERATURE	°F	X								X	X	
O/A E/R RELATIVE HUMIDITY	%	X								X	X	
FREEZE STAT	°F		X					X	X	X	X	X
VPU COOLING COIL VALVE	%				X					X	X	
COOLING COIL TEMPERATURE	°F	X								X	X	
COOLING COIL PAN LEVEL			X					X	X	X	X	
OUTSIDE AIR FAN 1			X		X	X				X	X	
OUTSIDE AIR FAN 2			X		X	X				X	X	
VPU HIGH STATIC PRESSURE			X					X	X	X	X	X
VPU DUCT DETECTOR			X					X	X	X	X	X
OUTSIDE AIR FLOW	CFM	X								X	X	
EXHAUST AIR FLOW	CFM	X								X	X	
E/A FILTER STATUS	DP, IN W.C.		X					X		X	X	
EXHAUST AIR TEMPERATURE	°F	X								X	X	
E/A RELATIVE HUMIDITY	%	X								X	X	
EXHAUST AIR FAN			X		X	X				X	X	
EXHAUST AIR DAMPER						X				X	X	
ENABLE COMMAND	ON/OFF						X			X	X	
PREHEAT COIL TEMP SETPOINT	°F						X			X	X	
COOLING COIL TEMP SETPOINT	°F						X			X	X	
AIR FLOW SETPOINT	CFM						X			X	X	

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Controls - DOAS w/ Energy Recovery, VPU-1

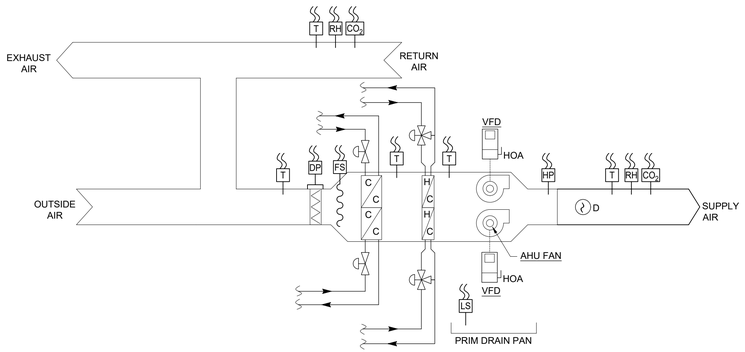
#	Revisions Date	Description

P.I.C. JMS
Design JB
Drawn MH
Reviewed JB
Job Number

Hoy+Stark Architects

M-402

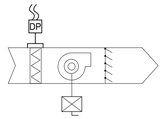
08.28.2023



VARIABLE AIR VOLUME AIR HANDLER

TYPICAL OF 1 SYSTEM, AHU-1

NOTE: THE PAIR OF CHW VALVES AND THE PAIR OF HHW VALVES ARE TO OPERATE IN UNISON TO PROVIDE CONSISTENT CONDITIONS ACROSS THE SPLIT COILS. THE SCHEDULED WATER FLOW RATES WILL BE DIVIDED BY 2 FOR EACH VALVE.



RESTROOM EXHAUST FAN

GENERAL
THE EXHAUST FAN SHALL RUN DURING OCCUPIED HOURS.

EXHAUST FAN

AIR HANDLING SYSTEM

GENERAL
THE AIR HANDLING SYSTEM IS A VARIABLE AIR VOLUME SYSTEM WITH CHILLED WATER COOLING AND HOT WATER PREHEAT THAT DISTRIBUTES AIR TO A SINGLE ZONE

OPTIMAL START
ADJUST START TIME OF UNIT TO:
1. WARM-UP FACILITY FOR AN AVERAGE INDOOR AIR TEMPERATURE OF 70°F (ADJ).
2. COOL DOWN FACILITY FOR AN AVERAGE INDOOR TEMPERATURE OF 73°F (ADJ).

WARM-UP / COOL-DOWN MODE
THE SYSTEM SHALL NOT BE ALLOWED TO START UNLESS ALL SAFETIES ARE OUT OF ALARM.

UPON WARM-UP/COOL-DOWN START COMMAND, VIA BAS SCHEDULE OR OPTIMAL START COMMAND:
1. OCCUPIED SETPOINTS ACTIVATE.
2. BEGIN VPU-1 START SEQUENCE AND PUT EQUIPMENT INTO OCCUPIED STAND-BY MODE.
3. SUPPLY FAN STARTS & IS PROVEN.
   - THE SUPPLY FAN IS COMMANDED TO MINIMUM SPEED (20 Hz, ADJ).
   - ON STATUS PROOF, FAN SPEED CONTROL RELEASES.
   - IF THE FAN HAS FAILED (60 SEC DELAY), THE SHUTDOWN SEQUENCE ACTIVATES.
4. ZONE CONTROL SEQUENCES ACTIVATE, EXCEPT FOR ZONE UNOCCUPIED CONTROL

OCCUPIED MODE
UPON OCCUPIED COMMAND, VIA BAS SCHEDULE:
1. WARM-UP / COOL-DOWN SEQUENCES REMAIN ACTIVE.
2. RELEASE VPU-1 TO RUN IN OCCUPIED MODE
3. COOLING COIL / REHEAT COIL LEAVING AIR TEMPERATURE CONTROL SEQUENCE ACTIVATES.
4. LOW TEMPERATURE SEQUENCE ACTIVATES.
5. DEMAND CONTROL VENTILATION SEQUENCE ACTIVATES

OCCUPIED STANDBY MODE
DURING OCCUPIED HOURS AND ROOM OCCUPANCY SENSORS INDICATED UNOCCUPIED:
1. MODULATE VPU-1 TO 25% OF DESIGN FLOW

UNOCCUPIED MODE
UPON UNOCCUPIED COMMAND, VIA BAS SCHEDULE:
1. SHUTDOWN SEQUENCE ACTIVATES
2. UNOCCUPIED HEATING & COOLING SHALL BE AVAILABLE WITH NO OUTSIDE AIR (VPU-1 IS OFF.)
3. UNOCCUPIED SET POINTS ACTIVATE

START COMMAND
1. VPU-1 OPERATION IS PROVEN.
2. SUPPLY FAN STARTS AND IS PROVEN.
   - THE SUPPLY FAN IS COMMANDED TO MINIMUM SPEED (20 Hz, ADJ).
   - ON STATUS PROOF, FAN SPEED CONTROL RELEASES.
3. EXHAUST FAN EF-5 STARTS
4. ZONE CONTROL SEQUENCES ACTIVATE
5. OCCUPIED MODE SEQUENCES ACTIVATE.

SHUTDOWN SEQUENCE
UPON SHUTDOWN COMMAND OR LOSS OF FAN STATUS:
1. COMMAND VPU-1 SHUTDOWN SEQUENCE
2. SHUTDOWN EXHAUST FAN EF-5
3. SUPPLY FAN STOPS AND IS PROVEN.
4. RETURN AIR DAMPER OPENS TO 100%
5. EXHAUST AIR DAMPER CLOSES.
6. ALL OTHER SEQUENCES DEACTIVATE.

ZONE TEMPERATURE CONTROL
1. IF ZONE TEMPERATURE IS ABOVE ZONE COOLING TEMPERATURE SETPOINT:
   A. COOLING COIL CONTROL VALVE MODULATES TO MAINTAIN LEAVING AIR TEMPERATURE SETPOINT AT MINIMUM VALUE.
   B. SUPPLY FAN SPEED MODULATES TO MAINTAIN ZONE TEMPERATURE SETPOINT.
   C. HEATING COIL VALVE REMAINS CLOSED.
2. IF ZONE TEMPERATURE IS BETWEEN COOLING AND HEATING TEMPERATURE SETPOINTS:
   A. COOLING COIL CONTROL VALVE MODULATES TO MAINTAIN LEAVING AIR TEMPERATURE SETPOINT.
   B. SUPPLY FAN SPEED MODULATES TOWARDS MINIMUM.
   C. HEATING COIL VALVE REMAINS CLOSED.
3. IF ZONE TEMPERATURE IS BELOW HEATING TEMPERATURE SETPOINT:
   A. COOLING COIL CONTROL VALVE MODULATES CLOSED.
   B. SUPPLY FAN SPEED REMAINS AT MINIMUM.
   C. HEATING COIL CONTROL VALVE MODULATES TO MAINTAIN LEAVING AIR TEMPERATURE SETPOINT.
4. IF ZONE TEMPERATURE CONTINUES TO FALL BELOW HEATING TEMPERATURE SETPOINT:
   A. COOLING COIL CONTROL VALVE REMAINS CLOSED.
   B. SUPPLY FAN SPEED MODULATES TO MAINTAIN ZONE TEMPERATURE SETPOINT.
   C. HEATING COIL VALVE MODULATES TO MAINTAIN HEATING COIL LEAVING AIR TEMPERATURE SETPOINT.

ZONE DEHUMIDIFICATION CONTROL
1. IF ZONE HUMIDITY EXCEEDS HIGH LIMIT SETPOINT:
   A. COOLING COIL CONTROL VALVE MODULATES TO MINIMUM LEAVING AIR TEMPERATURE SETPOINT.
   B. SUPPLY FAN SPEED MODULATES TOWARDS MAXIMUM.
   C. REHEAT COIL VALVE MODULATES TO MAINTAIN ZONE TEMPERATURE SETPOINT.
2. WHEN ALL ZONE HUMIDITY READINGS ARE BELOW OCCUPIED HIGH LIMIT SETPOINT:
   A. REHEAT COIL VALVE MODULATES TOWARDS CLOSED, AND MAINTAINS ZONE TEMPERATURE SETPOINT.
   B. ZONE TEMPERATURE CONTROL SEQUENCE RESUMES CONTROL

ZONE CO_2 CONCENTRATION CONTROL
1. IF ZONE CO_2 EXCEEDS SETPOINT:
   A. OUTSIDE AIR FLOW FROM VPU-1 MODULATES TOWARDS MAXIMUM
2. WHEN ALL ZONE CO_2 READINGS ARE BELOW SETPOINT:
   A. MODULATE AIR FLOW FROM VPU-1 TO MAINTAIN CO_2 SETPOINT

ZONE UNOCCUPIED CONTROL
1. IF ZONE IS UNOCCUPIED:
   A. UNOCCUPIED SETPOINTS ACTIVATE FOR THAT ZONE
   B. OTHER ZONE CONTROL SEQUENCES ARE PAUSED
2. WHEN ZONE IS OCCUPIED
   A. OCCUPIED SETPOINTS ACTIVATE
   B. ALL ZONE CONTROL SEQUENCES ARE ACTIVE

ECONOMIZING:
1. WHEN THE ZONES CALL FOR COOLING AND THE MIXED AIR DEW POINT IS BELOW 57°F, AND THE MIXED AIR TEMPERATURE IS BELOW THE ZONE TEMPERATURE SET POINT, THE COOLING COIL LEAVING AIR TEMP WILL RESET UP TO MAINTAIN ZONE TEMPERATURE AND HUMIDITY.

EQUIPMENT FAILURE
IF SUPPLY FAN FAILURE IS DETECTED, THE SHUTDOWN SEQUENCE ACTIVATES AND AN ALARM IS GENERATED.

SAFETIES
THE FOLLOWING SAFETIES ACTIVATE THE SHUTDOWN SEQUENCE:
1. LOW TEMPERATURE LIMIT SWITCH
2. DUCT SMOKE ALARM
3. HIGH STATIC PRESSURE ALARM
4. DRAIN PAN FLOAT SWITCH

A MANUAL RESET IS REQUIRED AFTER SAFETY ACTIVATION.

OCCUPIED COOLING SETPOINT: 74°F (ADJ.)
UNOCCUPIED COOLING SETPOINT: 80°F (ADJ.)
OCCUPIED HEATING SETPOINT: 70°F (ADJ.)
UNOCCUPIED HEATING SETPOINT: 63°F (ADJ.)

OCCUPIED RELATIVE HUMIDITY SETPOINT: 55% RH (ADJ.)
UNOCCUPIED RELATIVE HUMIDITY SETPOINT: 60% RH (ADJ.)

OCCUPIED CO_2 CONCENTRATION SETPOINT: 900 PPM
OCCUPIED CO_2 CONCENTRATION MINIMUM: 500 PPM
OCCUPIED CO_2 CONCENTRATION MAXIMUM: 1000 PPM

		CONTROL POINTS											
		POINTS					ALARM		GENERAL				
		INPUT			OUTPUT								
POINT NAME	UNITS	ANALOG	DIGITAL	INTEGRATED	ANALOG	DIGITAL	INTEGRATED	GENERAL	UNIT SHUTDOWN	TREND LOG	GRAPHIC	INTERLOCK
RETURN AIR TEMPERATURE	°F	X								X	X	
R/A RELATIVE HUMIDITY	%	X								X	X	
R/A CO2 CONCENTRATION	PPM	X								X	X	
EXHAUST AIR DAMPER	%				X					X	X	
RETURN AIR DAMPER	%				X					X	X	
MIXED AIR TEMPERATURE	°F	X						X		X	X	
R/A FILTER STATUS	DP, IN W.C.		X					X		X	X	
FREEZE STAT	°F		X					X	X	X	X	X
AHU COOLING COIL VALVE 1	%				X					X	X	
AHU COOLING COIL VALVE 2	%				X					X	X	
COOLING COIL TEMPERATURE	°F	X								X	X	
COOLING COIL PAN LEVEL			X					X	X	X	X	
AHU HEATING COIL VALVE 1	%				X					X	X	
AHU HEATING COIL VALVE 2	%				X					X	X	
REHEAT COIL TEMPERATURE	°F	X								X	X	
AHU AIR FAN 1			X		X	X				X	X	
AHU AIR FAN 2			X		X	X				X	X	
AHU HIGH STATIC PRESSURE	IN W.C.		X					X	X	X	X	X
AHU DUCT DETECTOR			X					X	X	X	X	X
SUPPLY AIR TEMPERATURE	°F	X								X	X	
SUPPLY AIR RELATIVE HUMIDITY	%	X								X	X	
SUPPLY AIR CO2 CONCENTRATION	PPM	X								X	X	
SPACE OCCUPANCY			X							X	X	
EXHAUST FAN	ON/OFF					X				X	X	
EX FAN FILTER STATUS	DP, IN W.C.		X					X		X	X	
ENABLE COMMAND	ON/OFF						X			X	X	
COOLING COIL TEMP SETPOINT	°F						X			X	X	
REHEAT COIL TEMP SETPOINT	°F						X			X	X	
ZONE TEMP SETPOINT	°F						X			X	X	
ZONE HUMIDITY SETPOINT	% RH						X			X	X	
CO_2 CONCENTRATION SETPOINT	PPM						X			X	X	

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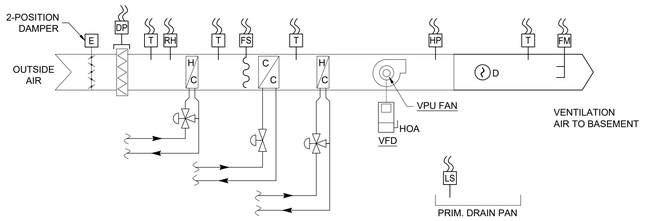
Controls - VAV Air Handler AHU-1

Revisions #	Date	Description

P.I.C. JMS
Design JB
Drawn MH
Reviewed JB
Job Number

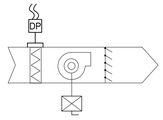
M-403

08.28.2023



100% O/A AIR HANDLER

TYPICAL OF 2 SYSTEMS, VPU-2 & VPU-3



RESTROOM EXHAUST FAN

GENERAL
THE EXHAUST FAN SHALL RUN DURING OCCUPIED HOURS.

EXHAUST FAN

AIR HANDLING SYSTEM

GENERAL
THE AIR HANDLER IS A 100% OUTSIDE VARIABLE AIR VOLUME SYSTEM WITH HHW PREHEAT, CHW COILING COIL, AND HHW REHEAT THAT DISTRIBUTES NEUTRAL AIR TO MULTIPLE ZONES.

OCCUPIED MODE
UPON OCCUPIED COMMAND, VIA BAS SCHEDULE OR OPTIMAL START COMMAND:
1. OCCUPIED SETPOINTS ACTIVATE.
2. START-UP SEQUENCE ACTIVATES.

START-UP SEQUENCE
THE SYSTEM SHALL NOT BE ALLOWED TO START UNLESS ALL SAFETIES ARE OUT OF ALARM.

UPON START-UP COMMAND:
1. OUTSIDE AIR DAMPER OPENS AND IS PROVEN.
2. SUPPLY FAN STARTS AND IS PROVEN.
   A. THE SUPPLY FAN IS COMMANDED TO MINIMUM SPEED (20 Hz, ADJ).
   B. ON STATUS PROOF, FAN SPEED CONTROL RELEASES.
3. FLOW CONTROL SEQUENCE ACTIVATES.
4. EXHAUST FANS START AND ARE PROVEN.
5. PREHEAT COIL LEAVING AIR TEMPERATURE CONTROL SEQUENCE ACTIVATES.
6. LOW TEMPERATURE SEQUENCE ACTIVATES.
7. COOLING COIL LEAVING AIR TEMPERATURE CONTROL SEQUENCE ACTIVATES.
8. COOLING COIL LEAVING AIR TEMPERATURE RESET CONTROL SEQUENCE ACTIVATES.
9. REHEAT COIL LEAVING AIR TEMPERATURE CONTROL SEQUENCE ACTIVATES.

OCCUPIED STANDBY MODE
DURING OCCUPIED HOURS AND ROOM OCCUPANCY SENSORS INDICATE UNOCCUPIED:
1. STOP EXHAUST FAN
2. MODULATE VPU TO 31% OF DESIGN FLOW

UNOCCUPIED MODE
UPON UNOCCUPIED COMMAND, VIA BAS SCHEDULE:
1. SHUTDOWN SEQUENCE ACTIVATES.

SHUTDOWN SEQUENCE
UPON SHUTDOWN COMMAND OR LOSS OF FAN STATUS:
1. SUPPLY FAN STOPS AND IS PROVEN.
2. OUTSIDE AIR FLOW CONTROL SEQUENCE DEACTIVATES AND DAMPER CLOSES.
3. EXHAUST FANS STOP
4. ALL OTHER SEQUENCES DEACTIVATE.

DISCHARGE AIR FLOW CONTROL
SUPPLY FAN SPEED MODULATES TO MAINTAIN DISCHARGE AIR FLOW SETPOINT.

SUPPLY FAN MINIMUM SPEED IS 20 Hz (ADJ).

PREHEAT COIL LEAVING AIR TEMPERATURE CONTROL
THE PREHEAT COIL VALVE MODULATES TO MAINTAIN PREHEAT COIL LEAVING AIR TEMPERATURE SETPOINT.

COOLING COIL LEAVING AIR TEMPERATURE CONTROL
THE COOLING COIL VALVE MODULATES TO MAINTAIN COOLING COIL LEAVING AIR TEMPERATURE.

REHEAT COIL LEAVING AIR TEMPERATURE CONTROL
THE REHEAT COIL VALVE MODULATES TO MAINTAIN VPU LEAVING AIR TEMPERATURE SETPOINT.

REHEAT COIL LEAVING AIR TEMPERATURE RESET
EVERY 15 MINUTES (ADJ), THE REHEAT COIL LEAVING AIR TEMPERATURE SETPOINT RESETS WITHIN THE MINIMUM AND MAXIMUM LIMITS:
1. IF 80% OR MORE OF ZONES CALL FOR COOLING, LEAVING AIR TEMPERATURE DECREASES BY 1 °F (ADJ).
2. IF LESS THAN 80% OF ZONES CALL FOR COOLING, LEAVING AIR TEMPERATURE RETURNS TO SETPOINT.

LOW TEMPERATURE SEQUENCE
IF PREHEAT COIL LEAVING AIR TEMPERATURE IS BELOW 40 °F, THE COOLING COIL VALVE OPENS TO 100%.

IF PREHEAT COIL LEAVING AIR TEMPERATURE FALLS BELOW 35 °F, THE SHUTDOWN SEQUENCE ACTIVATES.

EQUIPMENT FAILURE
IF SUPPLY FAN FAILURE IS DETECTED, THE SHUTDOWN SEQUENCE ACTIVATES AND AN ALARM IS GENERATED.

ECONOMIZING:
1. WHEN THE OUTSIDE AIR DEW POINT IS BELOW 55°F, THE COOLING COIL LEAVING AIR TEMP WILL RESET UP TO 68°F.

SAFETIES
THE FOLLOWING SAFETIES ACTIVATE THE SHUTDOWN SEQUENCE:
1. LOW TEMPERATURE LIMIT SWITCH
2. DUCT SMOKE ALARM
3. HIGH STATIC PRESSURE ALARM

OCCUPIED PREHEAT COIL SETPOINT: 50°F (ADJ.)
OCCUPIED COOLING COIL SETPOINT: 53°F (ADJ.)
OCCUPIED REHEAT COIL SETPOINT: 70°F (ADJ.)

OCCUPIED AIR FLOW SETPOINT: 1600 CFM (ADJ.)
OCCUPIED STANDBY AIR FLOW SETPOINT: 500 CFM (ADJ.)

		CONTROL POINTS											
		POINTS						ALARM		GENERAL			
		INPUT			OUTPUT								
POINT NAME	UNITS	ANALOG	DIGITAL	INTEGRATED	ANALOG	DIGITAL	INTEGRATED	GENERAL	UNIT SHUTDOWN	TREND LOG	GRAPHIC	INTERLOCK
OUTSIDE AIR DAMPER	OPEN/CLOSE					X				X	X	
O/A FILTER STATUS	DP, IN W.C.		X					X		X	X	
O/A TEMPERATURE	°F	X								X	X	
O/A RELATIVE HUMIDITY	%	X								X	X	
PREHEAT WATER COIL VALVE	%				X					X	X	
PREHEAT COIL TEMPERATURE	°F	X						X	X	X	X	
FREEZE STAT	°F		X					X	X	X	X	X
VPU COOLING COIL VALVE	%				X					X	X	
COOLING COIL TEMPERATURE	°F	X								X	X	
COOLING COIL PAN LEVEL			X					X	X	X	X	
VPU AIR FAN			X		X	X				X	X	
VPU HIGH STATIC PRESSURE			X					X	X	X	X	X
VPU DUCT DETECTOR			X					X	X	X	X	X
SUPPLY AIR TEMPERATURE	°F	X								X	X	
SUPPLY AIR FLOW	CFM	X								X	X	
SPACE OCCUPANCY			X							X	X	
EXHAUST FAN	ON/OFF					X				X	X	
ENABLE COMMAND	ON/OFF						X			X	X	
PREHEAT COIL TEMP SETPOINT	°F						X			X	X	
COOLING COIL TEMP SETPOINT	°F						X			X	X	
REHEAT COIL TEMP SETPOINT	°F						X			X	X	
AIR FLOW SETPOINT	CFM						X			X	X	

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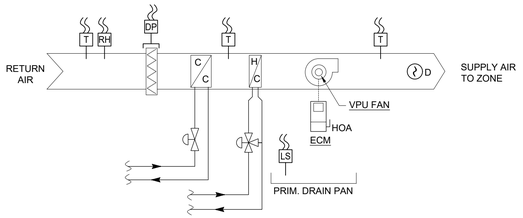
Controls - VAV DOAS, VPU-2 & VPU-3

Revisions #	Date	Description

P.I.C.	JMS
Design	JB
Drawn	MH
Reviewed	JB
Job Number	Hoy+Stark Architects

M-404

08.28.2023



FAN COIL UNIT

TYPICAL OF 5 SYSTEMS, VPU-2 & VPU-3FCU-1, FCU-2, FCU-3, FCU-4, FCU-5
IONIZATION SYSTEMS SHALL BE POWERED FROM FCU CONTROLLER.

FAN COIL UNIT

GENERAL
THE FAN COIL UNIT IS A VARIABLE AIR VOLUME RECIRCULATING SYSTEM WITH HOT WATER REHEAT.

START-UP SEQUENCE
UPON START-UP COMMAND:
1. SUPPLY FAN STARTS AND IS PROVEN
2. ZONE TEMPERATURE CONTROL SEQUENCE ACTIVATES

ZONE TEMPERATURE CONTROL SEQUENCE
AS ZONE TEMPERATURE INCREASES ABOVE COOLING SETPOINT:
1. HEATING COIL VALVE REMAINS CLOSED.
2. COOLING COIL VALVE MODULATES OPEN TO MAINTAIN COOLING COIL SETPOINT.
3. INCREASE SPEED OF ECM MOTOR

AS ROOM TEMPERATURE DECREASES BELOW COOLING SETPOINT BUT ABOVE HEATING SETPOINT:
1. DECREASE SPEED OF ECM MOTOR
2. COOLING COIL VALVE MODULATES CLOSED TO MAINTAIN COOLING COIL SETPOINT.

AS ROOM TEMPERATURE DECREASES BELOW HEATING SETPOINT:
1. HEATING COIL VALVE MODULATES OPEN TO MAINTAIN REHEAT TEMPERATURE SETPOINT.
2. COOLING COIL VALVE REMAINS CLOSE.
3. MODULATE FAN SPEED TO MAINTAIN SPACE TEMPERATURE SETPOINT

ZONE DEHUMIDIFICATION CONTROL
1. IF ZONE HUMIDITY EXCEEDS HIGH LIMIT SETPOINT:
   A. COOLING COIL CONTROL VALVE MODULATES TO MINIMUM LEAVING AIR TEMPERATURE SETPOINT.
   B. SUPPLY FAN SPEED MODULATES TOWARDS MAXIMUM.
   C. REHEAT COIL VALVE MODULATES TO MAINTAIN SPACE TEMPERATURE SETPOINT.
2. WHEN ALL ZONE HUMIDITY READINGS ARE BELOW OCCUPIED HIGH LIMIT SETPOINT:
   A. REHEAT COIL VALVE MODULATES TOWARDS CLOSED, AND MAINTAINS SPACE TEMPERATURE SETPOINT.
   B. ZONE TEMPERATURE CONTROL SEQUENCE RESUMES CONTROL

ECONOMIZING:
1. WHEN THE SPACE DEW POINT IS BELOW 55°F, THE COOLING COIL LEAVING AIR TEMP WILL RESET UP BY 2°F AND CONTINUE AS LONG AS SPACE TEMPERATURE SETPOINT IS MAINTAINED.

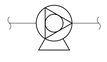
SHUTDOWN SEQUENCE
UPON SHUTDOWN COMMAND OR LOSS OF FAN STATUS:
1. SUPPLY FAN STOPS AND IS PROVEN
2. COOLING AND HEATING COIL CONTROL VALVES CLOSE

SAFETIES
THE FOLLOWING SAFETIES ACTIVATE THE SHUTDOWN SEQUENCE:
1. AUXILIARY DRAIN PAN FLOAT SWITCH

OCCUPIED COOLING SETPOINT: 74°F (ADJ.)
UNOCCUPIED COOLING SETPOINT: 80°F (ADJ.)
OCCUPIED HEATING SETPOINT: 70°F (ADJ.)
UNOCCUPIED HEATING SETPOINT: 63°F (ADJ.)

OCCUPIED RELATIVE HUMIDITY SETPOINT: 55% RH (ADJ.)
UNOCCUPIED RELATIVE HUMIDITY SETPOINT: 60% RH (ADJ.)

		CONTROL POINTS											
		POINTS						ALARM		GENERAL			
		INPUT			OUTPUT								
POINT NAME	UNITS	ANALOG	DIGITAL	INTEGRATED	ANALOG	DIGITAL	INTEGRATED	GENERAL	UNIT SHUTDOWN	TREND LOG	GRAPHIC	INTERLOCK
R/A TEMPERATURE	°F	X								X	X	
R/A RELATIVE HUMIDITY	%	X								X	X	
R/A FILTER STATUS	DP, IN W.C.		X					X		X	X	
COOLING COIL VALVE	%				X					X	X	
COOLING COIL TEMPERATURE	°F	X								X	X	
REHEAT WATER COIL VALVE	%				X					X	X	
FCU AIR FAN					X					X	X	
DRAIN PAN LEVEL			X					X	X	X	X	X
VPU DUCT DETECTOR			X					X	X	X	X	X
SUPPLY AIR TEMPERATURE	°F	X								X	X	
SPACE OCCUPANCY			X							X	X	
ENABLE COMMAND	ON/OFF						X			X	X	
COOLING COIL TEMP SETPOINT	°F						X			X	X	
SUPPLY AIR TEMP SETPOINT	°F						X			X	X	
SPACE TEMP SETPOINT	°F						X			X	X	
SPACE HUMIDITY SETPOINT	% RH						X			X	X	



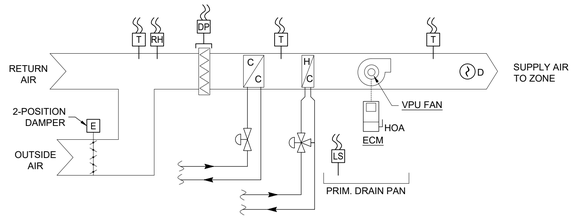
PUMP RP-1

		CONTROL POINTS											
		POINTS						ALARM		GENERAL			
		INPUT			OUTPUT								
POINT NAME	UNITS	ANALOG	DIGITAL	INTEGRATED	ANALOG	DIGITAL	INTEGRATED	GENERAL	UNIT SHUTDOWN	TREND LOG	GRAPHIC	INTERLOCK
PUMP COMMAND	ON/OFF					X				X	X	

GENERAL
HOT WATER CIRCULATING PUMP THAT OPERATES DURING OCCUPIED HOURS.

OCCUPIED MODE
UPON OCCUPIED COMMAND, VIA SCHEDULE:
1. PUMP STARTS

UNOCCUPIED MODE
UPON OCCUPIED COMMAND, VIA SCHEDULE:
1. PUMP STOPS



BLOWER COIL UNIT

TYPICAL OF 1 SYSTEM, BCU-6
IONIZATION SYSTEM SHALL BE POWERED FROM BCU CONTROLLER.

BLOWER COIL UNIT

GENERAL
THE FAN COIL UNIT IS A VARIABLE AIR VOLUME RECIRCULATING SYSTEM WITH HOT WATER REHEAT.

START-UP SEQUENCE
UPON START-UP COMMAND:
1. SUPPLY FAN STARTS AND IS PROVEN
2. ZONE TEMPERATURE CONTROL SEQUENCE ACTIVATES
3. OUTSIDE AIR DAMPER OPENS.

ZONE TEMPERATURE CONTROL SEQUENCE
AS ZONE TEMPERATURE INCREASES ABOVE COOLING SETPOINT:
1. HEATING COIL VALVE REMAINS CLOSED.
2. COOLING COIL VALVE MODULATES OPEN TO MAINTAIN COOLING COIL SETPOINT.
3. INCREASE SPEED OF ECM MOTOR

AS ROOM TEMPERATURE DECREASES BELOW COOLING SETPOINT BUT ABOVE HEATING SETPOINT:
1. DECREASE SPEED OF ECM MOTOR
2. COOLING COIL VALVE MODULATES CLOSED TO MAINTAIN COOLING COIL SETPOINT.

AS ROOM TEMPERATURE DECREASES BELOW HEATING SETPOINT:
1. HEATING COIL VALVE MODULATES OPEN TO MAINTAIN REHEAT TEMPERATURE SETPOINT.
2. COOLING COIL VALVE REMAINS CLOSE.
3. MODULATE FAN SPEED TO MAINTAIN SPACE TEMPERATURE SETPOINT

ZONE DEHUMIDIFICATION CONTROL
1. IF ZONE HUMIDITY EXCEEDS HIGH LIMIT SETPOINT:
   A. COOLING COIL CONTROL VALVE MODULATES TO MINIMUM LEAVING AIR TEMPERATURE SETPOINT.
   B. SUPPLY FAN SPEED MODULATES TOWARDS MAXIMUM.
   C. REHEAT COIL VALVE MODULATES TO MAINTAIN SPACE TEMPERATURE SETPOINT.
2. WHEN ALL ZONE HUMIDITY READINGS ARE BELOW OCCUPIED HIGH LIMIT SETPOINT:
   A. REHEAT COIL VALVE MODULATES TOWARDS CLOSED, AND MAINTAINS SPACE TEMPERATURE SETPOINT.
   B. ZONE TEMPERATURE CONTROL SEQUENCE RESUMES CONTROL

ECONOMIZING:
1. WHEN THE MIXED AIR DEW POINT IS BELOW 55°F, THE COOLING COIL LEAVING AIR TEMP WILL RESET UP BY 2°F AND CONTINUE AS LONG AS SPACE TEMPERATURE SETPOINT IS MAINTAINED.

SHUTDOWN SEQUENCE
UPON SHUTDOWN COMMAND OR LOSS OF FAN STATUS:
1. OUTSIDE AIR DAMPER CLOSES
2. SUPPLY FAN STOPS AND IS PROVEN
3. COOLING AND HEATING COIL CONTROL VALVES CLOSE

SAFETIES
THE FOLLOWING SAFETIES ACTIVATE THE SHUTDOWN SEQUENCE:
1. AUXILIARY DRAIN PAN FLOAT SWITCH

OCCUPIED COOLING SETPOINT: 74°F (ADJ.)
UNOCCUPIED COOLING SETPOINT: 80°F (ADJ.)
OCCUPIED HEATING SETPOINT: 70°F (ADJ.)
UNOCCUPIED HEATING SETPOINT: 63°F (ADJ.)

OCCUPIED RELATIVE HUMIDITY SETPOINT: 55% RH (ADJ.)
UNOCCUPIED RELATIVE HUMIDITY SETPOINT: 60% RH (ADJ.)

		CONTROL POINTS											
		POINTS						ALARM		GENERAL			
		INPUT			OUTPUT								
POINT NAME	UNITS	ANALOG	DIGITAL	INTEGRATED	ANALOG	DIGITAL	INTEGRATED	GENERAL	UNIT SHUTDOWN	TREND LOG	GRAPHIC	INTERLOCK
R/A TEMPERATURE	°F	X								X	X	
R/A RELATIVE HUMIDITY	%	X								X	X	
R/A FILTER STATUS	DP, IN W.C.		X					X		X	X	
OUTSIDE AIR DAMPER	OPEN/CLOSE						X			X	X	
COOLING COIL VALVE	%				X					X	X	
COOLING COIL TEMPERATURE	°F	X								X	X	
REHEAT WATER COIL VALVE	%				X					X	X	
BCU AIR FAN					X					X	X	
DRAIN PAN LEVEL			X					X	X	X	X	X
VPU DUCT DETECTOR			X					X	X	X	X	X
SUPPLY AIR TEMPERATURE	°F	X										
SPACE OCCUPANCY			X							X	X	
ENABLE COMMAND	ON/OFF						X			X	X	
COOLING COIL TEMP SETPOINT	°F						X			X	X	
SUPPLY AIR TEMP SETPOINT	°F						X			X	X	
SPACE TEMP SETPOINT	°F						X			X	X	
SPACE HUMIDITY SETPOINT	% RH						X			X	X	

Hoy+Stark Architects

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This item has been digitally signed and sealed by **Jon Barber, PE** on 08/25/23
Printed copies of this document are not considered signed and sealed and the signature must be verified on any electronic copies.

JON M. BARBER LICENSE No. 55427 STATE OF FLORIDA PROFESSIONAL ENGINEER

Controls - Fan Coils, Blower Coil, HW Pump

Revisions #	Date	Description

P.I.C. JMS
Design JB
Drawn MH
Reviewed JB
Job Number

Hoy+Stark Architects 1350 Market Street - Suite 209 Tallahassee Florida 32312

M-405

08.28.2023

Leon County Schools
Leon High School
Building 7 Gymnasium Remodeling & Renovation Project
550 East Tennessee Street
Tallahassee, Florida 32308
LCSB RFQ #504-2023
H+SA#22.133
August 25, 2023

SECTION 21 11 00 - FIRE PROTECTION PIPING AND ACCESSORIES

PART 1 - GENERAL

GENERAL CONDITIONS

The work described hereunder shall be installed in accordance with the "Mechanical General Provisions," Section 23 01 00.

DESCRIPTION OF THE WORK

The extent of the work is indicated on the Drawings. In general, the work consists of, but is not limited to, the following:

Installation of a Fire Pump, including piping inside of the building.

Installation of a Fire Department Connection including piping both inside of the building and underground exterior.

Replacement of an existing two-way FDC with a four-way FDC.

Installation of tamper switches on new and existing valves, at locations shown on the drawings.

All equipment, devices and anchors, cutting & patching as necessary for a complete and operable fire standpipe system including restoration of site to original conditions.

RELATED WORK

Fire alarm wiring, demolition, and connections are by others.

QUALITY ASSURANCE:

Installer Qualifications: Installation and alterations of fire protection piping, equipment, specialties, and accessories, and repair and servicing of equipment shall be performed only by a State of Florida certified fire protection installer having a minimum of 5 previous projects similar in size and scope to this project, familiar with all precautions required, and having complied with all the requirements of the authority having jurisdiction.

Codes and Standards:

Comply with current editions of all codes as listed on the Drawings including but not limited to:

NFPA 13 - Standard for Installation of Sprinkler Systems.

NFPA 24 - Standard for Installation of Private Fire Service Mains and Appurtenances.

UL and FM Compliance: Fire protection system materials and components shall be Underwriter's Laboratories listed and labeled, and Factory Mutual approved for the application anticipated.

PERMITS AND APPROVALS:

Contractor shall obtain all permits and approvals required for execution of his work.

WORKING PLANS:

Work Plans: Have been prepared for the Contractor's submittal to the local authority having jurisdiction. Signed and sealed sets will be provided to the Contractor as needed.

SHOP DRAWINGS:

Shop Drawings: The Contractor shall produce a set of installation plans including, pipe cut based upon field measurements, proposed pipe support and miscellaneous Contractor information required by NFPA standards 13, 14 & 24.

SUBMITTALS:

Submit to the Architect/Engineer for approval electronic copies of brochures, technical data and/or shop drawings, and as many additional copies as required for Contractor use:

Shop Drawings: Submit drawings which indicate pipe cut, support detail and other installation data.

Product Data: Submit manufacturer's technical product data for all fire protection valves, devices, piping, and fittings.

Proposed fire proofing systems at penetrations of rated walls

Proposed water proofing systems at penetrations of exterior walls

PRODUCT DELIVERY, STORAGE, AND HANDLING:

Handle components carefully to prevent damage. Do not install damaged components; replace with new.

Store components in clean dry place. Protect from weather, dirt, fumes, water, construction debris, and physical damage.

GUARANTEE AND WARRANTY:

Installer shall guarantee in writing, his responsibility for defective materials and workmanship for a period of one (1) year from date of Final Acceptance issued by the Engineer and correct any deficiencies, labor and material, without additional cost to Owner.

CONTRACTOR'S CERTIFICATES:

Installer shall complete all system acceptance tests and provide copies of material and test certificates as required by referenced NFPA codes, and/or manufacturer's installation instructions.

PART 2 - PRODUCTS

GENERAL REQUIREMENTS:

All products and materials shall comply with referenced Codes and Standards.

PIPING:

Interior Piping: Black steel pipe: ASTM A53, A795 or A135. All threaded piping shall be schedule 40. All roll-grooved piping shall be schedule 10.

> Grooved fitting specifically listed for fire main service approved by NFPA 13, 14 & 24 for the pipe specified will be acceptable.

Below Grade Piping: Pressure-rated PVC pipe, ASTM D1784, AWWA C900-16, working pressure 235 psig (DR 18). Bell and spigot gasketed connections

VALVES:

All valves shall be specifically listed or approved for fire protection service by UL or Factory Mutual. Provide for supervision of valves as indicated on drawings.

Gate: OS&Y, 250 psig WWP.

Butterfly: Gear operated, indicating type, 250 psig WWP.

Underground Check: Ductile Iron swing type, 250 psig WWP.

Test and Drain Valves: Threaded bronze angle or globe with composition disc, 250 psig WWP.

Provide identification sign (enamel on metal) to all valves.

AUTOMATIC BALL DRIPS:

UL or Factory Mutual approved, ¾-inch cast brass in-line automatic ball drip. Pipe drain to spill through building wall, over floor drain, over mop sink or as approved.

FIRE DEPARTMENT INLET CONNECTION

Free Standing Inlet Connection: Chrome plated brass clappered FDC: 6” x 4 @ 2.5” F NST snoots & plugs. Provide chrome plated brass identification plate, with words " Standpipe & Auto Spkr” in raised letters.

MATERIALS WHICH PENETRATE FIRE WALLS

Where bare-metal piping systems penetrate fire walls, provide a permanent sleeve which is grouted or rocked into wall. Provide a UL listed fire caulk for the annular space.

PART 3 - EXECUTION

PIPING INSTALLATIONS:

Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate the general location and arrangement of piping systems. So far as practical, install piping as indicated.

Deviations from approved "Working Plans" for piping, requires written approval of the authority having jurisdiction. Written approval shall be on file with the Architect/Engineer prior to deviating from the approved "Working Plans."

Install flanges on valves, apparatus, and equipment having 2-1/2 inch and larger connections.

Hangers and Supports: Comply with the applicable requirements of NFPA 14 or 24. Hanger and support spacing and locations for piping joined with grooved mechanical couplings shall be

in accordance with the grooved mechanical coupling manufacturer's written instructions, for rigid systems.

Make connections between underground and above-ground piping using an approved transition piece fastened to prevent separation.

Install mechanical sleeve seal at pipe penetrations in basement and foundation walls.

PIPE JOINTS:

Welded Joints: AWS D10.9, Level AR-3. Welding shall not be performed on site unless the building and contents are noncombustible.

Threaded Joints: Conform to ANSI B1.20.1, tapered pipe threads for field cut threads. Join pipe, fittings, and valves as follows:

> Note the internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint. Align threads at point of assembly. Apply appropriate tape or thread compound to the external pipe threads. Assemble joint to appropriate thread depth. When using a wrench on valves place the wrench on the valve end into which the pipe is being threaded.
>
> Damaged Threads: Do not use pipe with threads which are stripped, chipped, corroded, or otherwise damaged. If a weld opens during cutting or threading operations, that portion of pipe shall not be used.

Flanged Joints: Align flanges surfaces parallel. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly to appropriate torque specified by the bolt manufacturer.

Mechanical Grooved Joints: Cut or roll grooves on pipe ends dimensionally compatible with the couplings.

End Treatment: After cutting pipe lengths, remove burrs and fins from pipe ends.

VALVE INSTALLATIONS:

General: Install fire protection valves, fittings, and specialties in accordance with the manufacturer's written instructions, NFPA 14 and 24, and the authority having jurisdiction.

FIRE DEPARTMENT CONNECTION INSTALLATIONS:

General: Install FDC valves, fittings, and specialties in accordance with the manufacturer's written instructions, NFPA 14 and 24, and the authority having jurisdiction.

Install automatic drip valves and check valve on the fire department connection to the mains. Install mechanical sleeve seal at pipe penetration in outside walls.

DRAINS, TEST PIPES AND ACCESSORIES:

Provide drains on valved sections and at other locations as necessary for complete drainage of system. Drains shall be valved and plugged or drained to the pump room drain.

FIELD QUALITY CONTROL:

Test and inspect piping systems in accordance with NFPA 13, 14 & 24

Provide all testing as recommended by the Manufacturer

Replace piping system components which do not pass the test procedures specified, and retest repaired portion of the system.

Hydrostatically test entire system to 50 psi over normal operating pressure or 150 psi which ever is more.

Required tests to be witnessed by Fire Marshal.

END OF SECTION

Leon County Schools
Leon High School
Building 7 Gymnasium Remodeling & Renovation Project
550 East Tennessee Street
Tallahassee, Florida 32308
LCSB RFQ #504-2023
H+SA#22.133
August 25, 2023

SECTION 21 13 00 - FIRE PROTECTION SPRINKLERS

PART 1 - GENERAL

GENERAL CONDITIONS

The work described hereunder shall be installed in accordance with the "Mechanical General Provisions," Section 23 01 00.

DESCRIPTION OF THE WORK

The extent of the work is indicated on the Drawings.

In general, the work consists of, but is not limited to, the following:

Installation of wet pipe sprinkler system including all piping, equipment, devices and hangers as necessary for a complete and operable fire protection sprinkler system.

QUALITY ASSURANCE:

Installer Qualifications: Installation and alterations of fire protection piping, equipment, specialties, and accessories, and repair and servicing of equipment shall be performed only by a State of Florida certified fire protection installer having a minimum of 5 previous projects similar in size and scope to this project, familiar with all precautions required, and having complied with all the requirements of the authority having jurisdiction.

Codes and Standards:

NFPA 13 - Comply with 2016 Edition of NFPA 13, Standard for Installation of Sprinkler Systems.

UL and FM Compliance: Fire protection system materials and components shall be Underwriter's Laboratories listed and labeled, and Factory Mutual approved for the application anticipated.

PERMITS AND APPROVALS:

Contractor shall obtain all permits and approvals required for execution of his work.

DESIGN CRITERIA PLANS & SHOP DRAWINGS:

Design Criteria Plans: Design Criteria plans have been prepared for the Contractor's bid and submittal to the local authority having jurisdiction.

Shop Drawings: The Contractor shall produce a set of installation plans including hydraulic calculations, pipe cut based upon field measurements, proposed pipe support and miscellaneous Contractor information required by NFPA 13.

SUBMITTALS:

Submit to the Architect/Engineer for approval electronic copies of brochures, technical data and/or shop drawings, and as many additional copies as required for Contractor use:

Shop Drawings: Submit drawings which indicate pipe cut, support detail and other installation data.

Product Data: Submit manufacturer's technical product data, include each type sprinkler head, valve, piping specialty, fire protection specialty, and fire department connection.

INSTRUCTION AND MAINTENANCE MANUALS:

Installer shall instruct Owner's designated employee in the proper operation and maintenance all fire protection systems and equipment. Installer will also furnish Owner with typed operating instructions, for inclusion in operating and maintenance manual specified in Division 1 and Division 15.

Maintenance Data: For each type sprinkler head, valve, piping specialty, fire protection specialty, and fire department connection, for inclusion in operating and maintenance manual specified in Division 1 and Division 15.

PRODUCT DELIVERY, STORAGE, AND HANDLING:

Handle components carefully to prevent damage. Do not install damaged components; replace with new.

Store components in clean dry place. Protect from weather, dirt, fumes, water, construction debris, and physical damage.

GUARANTEE AND WARRANTY:

Installer shall guarantee in writing, his responsibility for defective materials and workmanship for a period of one (1) year from date of Final Acceptance issued by the Architect and correct any deficiencies, labor and material, without additional cost to Owner.

CONTRACTOR'S CERTIFICATES:

Installer shall complete all system acceptance test and provide copies of material and test certificates as required by referenced NFPA codes.

AUTHORITY APPROVAL:

Provide final approval letter from local authority.

PART 2 - PRODUCTS

GENERAL REQUIREMENTS:

All products and materials shall comply with referenced Codes and Standards.

PIPING:

Interior Piping: Black steel pipe: ASTM A53, A795 or A135. Where a specific joining method is not indicated on the Drawings, any fittings approved by NFPA 13 for the pipe specified will be acceptable.

All threaded piping shall be schedule 40. All roll-grooved piping shall be schedule 10. Individual sprinkler run-puts shall be 1” schedule 40 or flexible sprinkler drops.

Exterior Corrosion Protection: All exposed piping shall be cleaned, primed, and painted.

VALVES:

All valves shall be specifically listed or approved for fire protection service by UL or Factory Mutual.

Test and Drain Valves: Threaded bronze angle or globe with composition disc, 175 psig WWP.

Provide identification sign (enamel on metal) to all valves in accordance with NFPA No. 13.

SPRINKLERS:

UL approved, automatic, quick-response with 1/2-inch orifice discharge, having temperature ratings suitable for installation. See Drawing Notes for additional information. Provide the following type of sprinkler heads:

LOCATION	TYPE
Unfinished ceiling areas	Standard, upright, brass
Finished ceilings	Flush with two-piece escutcheon

Finished ceiling pendant sprinklers shall be a flush type, chrome plated with push-on escutcheon.

SPRINKLER CABINET:

Complete with sprinklers and special wrenches in accordance with NFPA No. 13.

PART 3 - EXECUTION

PIPING INSTALLATIONS:

Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate the general location and arrangement of piping systems. So far as practical, install piping as indicated.

> Deviations from approved "Design Criteria Plans" for sprinkler piping, requires written approval of the authority having jurisdiction. Written approval shall be on file with the Architect/Engineer prior to deviating from the approved “Design Criteria Plans."

Install sprinkler piping to provide for system drainage in accordance with NFPA 13.

Use approved fittings to make all changes in direction, branch takeoff from mains, and reductions in pipe sizes.

Install unions in pipes 2 inch and smaller, adjacent to each valve. Unions are not required on flanged devices or in piping installations using grooved mechanical couplings.

Install flanges on valves, apparatus, and equipment having 2-1/2 inch and larger connections.

Hangers and Supports: Comply with the applicable requirements of NFPA 13. Hanger and support spacing and locations for piping joined with grooved mechanical couplings shall be in

accordance with the grooved mechanical coupling manufacturer's written instructions, for rigid systems.

PIPE JOINTS:

Welded Joints: AWS D10.9, Level AR-3. Welding shall not be performed on site unless the building and contents are noncombustible.

Threaded Joints: Conform to ANSI B1.20.1, tapered pipe threads for field cut threads. Join pipe, fittings, and valves as follows:

Note the internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint. Align threads at point of assembly. Apply appropriate tape or thread compound to the external pipe threads. Assemble joint to appropriate thread depth. When using a wrench on valves place the wrench on the valve end into which the pipe is being threaded.

Damaged Threads: Do not use pipe with threads which are stripped, chipped, corroded, or otherwise damaged. If a weld opens during cutting or threading operations, that portion of pipe shall not be used.

End Treatment: After cutting pipe lengths, remove burrs and fins from pipe ends.

Flanged Joints: Align flanges surfaces parallel. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly to appropriate torque specified by the bolt manufacturer.

Mechanical Grooved Joints: Cut or roll grooves on pipe ends dimensionally compatible with the couplings.

VALVE INSTALLATIONS:

General: Install fire protection valves, fittings, and specialties in accordance with the manufacturer's written instructions, NFPA 13, and the authority having jurisdiction.

SPRINKLER HEAD INSTALLATIONS:

Use proper tools to prevent damage during installations.

DRAINS, TEST PIPES AND ACCESSORIES:

Provide drains at base of risers, on valved sections and at other locations as necessary for complete drainage of system. Drains shall be valved and plugged or connected to the central drain riser system to discharge outside over splash block or as indicated.

Provide test pipes in accordance with NFPA No. 13. Test pipes shall be valved and piped to discharge through proper orifice. Provide approved required accessories such as sight glasses, etc. Test connections may also serve as drain pipes.

FIELD QUALITY CONTROL:

Flush, test and inspect sprinkler piping systems in accordance with NFPA 13.

Replace piping system components which do no`t pass the test procedures specified, and retest repaired portion of the system.

END OF SECTION

Leon County Schools
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SECTION 22 05 00 - PLUMBING

PART 1 - GENERAL

GENERAL CONDITIONS

The work described hereunder shall be installed in accordance with the "Mechanical General Conditions," Section 23 01 00.

DESCRIPTION OF THE WORK

The extent of the work is indicated on the Drawings. In general, the work consists of, but is not limited to, the following:

Plumbing demolition and new plumbing fixture and piping installation.

RELATED WORK

Insulation is specified in Section 23 07 10.

Pipe hangers and supports are specified in Section 23 05 29.

QUALITY ASSURANCE

All materials and installations are to comply with the following. If conflicts occur between plumbing codes and the specifications, the most restrictive requirements shall govern.

National Electric Code
Florida Building Code
Florida Plumbing Code
Florida Energy Efficiency Code for Building Construction
Florida Administrative Code, 10D-10, Sanitary Facilities for Buildings Serving the Public and Places of Employment.
Accessibility Requirements Manual, Florida Board of Building Codes & Standards

Furnish and install equipment having the characteristics and accessories indicated on the drawings or in these specifications. The manufacturer's specifications for the models shown on the drawings or given as basis for design, plus all features, options, and accessories indicated on the drawings or in these specifications, whether or not standard for the model scheduled or offered as a substitute, shall constitute the minimum requirements for equipment furnished under this section.

SUBMITTALS

Submit to the Architect/Engineer for approval electronic copies of brochures, technical data and/or shop drawings of the following, and as many additional copies as required for Contractor use:

Piping and Fittings

Plumbing fixtures

Valves, cleanouts, and floor drains

Proposed fire proofing systems at penetrations of rated walls.

Pipe hangers and supports.

CHANGES

The Drawings indicate generally the locations of plumbing fixtures, apparatus, piping, etc., and while these are to be followed as closely as possible, if before installation, it is found necessary to change the location of same to accommodate the conditions at the building, such changes shall be made without additional cost to the Owner and as directed by the Architect/Engineer.

PART 2 - PRODUCTS

MATERIALS WHICH PENETRATE FIRE WALLS

Where insulated piping or plastic materials penetrate fire walls, provide a UL listed systems for maintaining the rating.

Where bare-metal piping systems penetrate fire walls, provide a permanent sleeve which is grouted or rocked into wall. Provide a UL listed fire caulk for the annular space.

PLUMBING FIXTURES, TRIM AND FITTINGS

Furnish and install all plumbing fixtures and trim, floor drains and cleanouts as shown on the Drawings. Fixtures shall be as specified or equivalent quality fixtures by American Standard, Kohler, Universal Rundle or Eljer.

Provide all items of brass and chrome plated finish except where otherwise noted.

Brackets, Anchors, and Cleats: Furnish and install where required for support, conceal behind finished wall.

PIPING

Where more than one material is specified for a particular application, comply with Drawing Notes. Where interfacing with an existing system supply materials to match the existing. Where not connecting to existing and where not specified on the Drawings, then the Contractor may select from the options listed.

All materials shall comply with latest ASTM specifications in each instance that ASTM has specifications and standards relating to such materials.

Sanitary Waste and Vent

Cast Iron Soil Pipe, service weight bell and spigot; ASTM A 74, with neoprene single service compression gaskets.

PVC Sewer Pipe, schedule 40, ASTM D2665

Cast Iron Soil Pipe, service weight no-hub, ASTM A 74, with neoprene gasket and stainless-steel band and screw assemblies conforming to CISPI Standard 301. May be used for vent piping. May be used for drain piping only where space prohibits use of bell's spigot piping. For below slab underground connections of new piping to existing piping, provide underground adjustable repair coupling with T-bolt Surgical Grade 316 stainless steel nut and bolt sealing clamps.

Copper tubing, Type L, conforming to ASTM B88, with brazed or solder-joint copper, brass or bronze fittings conforming to ANSI B16.18 or B16.22.

Copper tubing, DWV grade, hard temper conforming to ASTM B306, with solder joint, cast bronze fittings conforming to ANSI B16.23. Tubing larger than 2 inches shall use wrought copper fittings conforming to ANSI B16.29.

Domestic Water Pipe:

Above grade domestic water pipe shall be type L hard copper, conforming to ASTM B88. ProPress cast or wrought fittings per ASME B16.18 or B16.22. Where required solder fittings are acceptable

Piping below grade shall be annealed soft copper per ASTM B88. Limit fittings where possible.

Below Grade & Below Slab Piping & Fittings: Ductile iron pipe: AWWA C151, working pressure 150 psig, exterior and interior bituminous coating. Provide flanged and anchored connection to interior piping.

Below Grade Piping Alternative: PVC pipe: ASTM D2241, Class 150, working pressure 150 psig, fittings to be AWWA C151. J-M Ring-Tite or approved equal.

Below Piping Alternative 4" and Above: PVC pipe: AWWA C900, Class 150, working pressure 150 psig, fittings to be AWWA C151. J-M Ring Tite or approved equal.

Exposed Pipe in Toilet Areas:

Exposed pipe shall be chrome plated brass, American Brass Co., or equivalent. Furnish and install chrome plated brass wall plates.

Lavatory and Similar Waste Arms:

Type M or L copper water tube, Mueller or equivalent.

Urinal Waste Arms:

PVC.

Roof Drain Piping:

Cast Iron Soil Pipe, service weight bell and spigot; ASTM A 74, with neoprene single service compression gaskets.

Cast Iron Soil Pipe, service weight no-hub, ASTM A 74, with neoprene gasket and stainless-steel band and screw assemblies conforming to CISPI Standard 301.

Below grade and below slab piping may be PVC pipe and fittings: schedule 40, conforming to ASTM D2665 or D2661 respectively.

PIPE ACCESSORIES:

Pipe sleeves: metal sized to allow minimum clearance between pipe and sleeves or insulation and sleeves.

Provide chrome-plated brass escutcheon plates where exposed pipe passes through walls, floors, or ceiling in finished areas.

Furnish and install dielectric or isolation fittings at all points where copper pipe connects to steel pipe.

Adjustable wrought clevis type hanger and rods: Anvil or equivalent. Provide copper hangers for copper piping.

Install water hammer arrestors as shown on the Drawings and where required by codes.

VALVES

Ball Valves: 125 lb., bronze ball valve.

TRAPS

For Lavatories and Sinks: Fully Cast Brass, 17ga., chrome plated.

TRAP PRIMERS

1/2 automatic trap primers: all bronze body with integral vacuum breaker and gasketed service cover.

PART 3- EXECUTION

INSTALLATION OF PIPING

Condensate piping shall be sloped same as sanitary waste and vent.

On vertical sanitary drain lines, connect all soil and waste inlets through sanitary tees, wyes, or wyes and eighth bends. Short radius fittings may be used for vent piping. On horizontal lines connect all waste and soil connections through wyes or wyes and eighth bends. Double branch

fittings may be used on vertical lines and horizontal runs, providing proper grades can be maintained.

Make joints in PVC plastic pipe with solvent cement in accordance with pipe manufacturer's instructions.

Lay horizontal drain pipes to uniform grade; riser pipes, vertical. Make changes in directions of drain pipes with long bends. No screwed joints permitted in drain pipes, except as described herein.

Lay all sewers and branches, where practicable, on undisturbed earth cut at proper grade. Where laid on fill, provide adequate supports to maintain pitch of the line.

Sizes of risers and mains of water system piping shall be as designated on the Drawings. Verify any omitted sizes before installation.

Cover pipe openings at all times that the work is not in progress at that point.

Cut brass and copper pipe by means of hacksaw. Remove all burrs and metal chips, dirt, etc., before joining pipe. Chrome plated pipe shall show no wrench marks after installation; no threads shall show.

Adequately support all piping above floors inside the building from or on the building structure. Support piping suspended from the building structure by means of the specified pipe hangers and rods. Make maximum spacing between pipe supports as follows:

Nominal Pipe Size	Maximum Span
3/4" and under	5'
1"	7'
1-1/4"	7'
1-1/2"	9'
2"	10'
2-1/2"	11'
3"	12'
4"	14'

Sanitary and storm drain piping shall be supported by at least one hanger on each full length of pipe close to hub where possible and at least one within 24 inches of each fitting, and wherever else required to prevent tendency toward deflection due to load. Provide a hanger at upper angle at each drop. Locate hangers adjacent to hubs on multiple fittings not more than four feet on centers.

For support spacing of all other horizontal piping refer to MSS-SP-69 and provide additional supports at valves, strainers, in line pumps and other heavy components. Provide a support within one foot of each elbow.

Vertical Pipe Supports: Up to 6 inch 60 feet long or not over 12-inch pipe up to 30 feet long, Riser clamps bolted to pipe below couplings, or welded to pipe and resting securely on the building structure. Vertical pipe larger than the foregoing, support on base elbows or tees, or substantial pipe legs extending to the building structure. Vertical runs less than 15 feet long may be supported by the hangers on the connecting horizontal runs.

Bases of drain stacks: If not buried in earth support on concrete, brick in cement mortar, or metal brackets permanently attached to building structure.

Make joints in PVC plastic pipe with solvent cement in accordance with pipe manufacturer's instructions.

Yard supply main piping: Piping shall be installed in strict accordance with the manufacturer’s recommendations. Provide 6” clean sand fill for pipe bedding. Insure minimum 18” of cover. Provide concrete thrust blocks at all changes of direction. Hand dig thrust block area just behind fittings. Bevel ends of PVC piping. Test piping in accordance with manufactures instruction.

INSTALLATION OF VALVES

Isolate all major piping assemblies as shown on the Drawings and as required for proper operation and maintenance. All valves shall be accessible. Provide valve boxes and access panels where required for accessibility.

Install service valve for hot and cold water at each plumbing fixture.

INSTALLATION OF TRAPS

Trap each fixture by water sealing trap placed as near the fixture as possible.

Vent all traps and place within 5 feet of the fixture which it serves unless otherwise noted.

INSTALLATION OF PIPE SLEEVES

Install pipe sleeves at all locations where pipe passes through walls, floors, or ceilings above or below grade. Sleeves shall extend above floor a minimum of 1”. Seal floor sleeves in concrete floors with mortar. Coordinate sleeve size with piping and firestopping requirements in advance.

Where subject to moisture or weather, seal sleeves with watertight sealant.

INSTALLATION OF FIXTURES, TRIM, AND FITTINGS

Install the fixtures, trim and fittings specified, taking care to properly anchor each fixture.

Installation of carriers shall comply with manufacturers' maximum recommendations. Carriers shall be bolted to floor slab using all bolt holes or slots provided on carrier. Bolt size shall match hole or slot. Provide lock washer on each bolt. Use "Red Head" self-drilling anchors as manufactured by Phillips Drill Co. or approved equal product to set bolts.

When the use of a wrench is necessary on chrome plated piping, protect the pipe from marring by use of felt or cloth wrapping beneath wrench jaws.

INSULATION

Insulate all domestic hot water lines.

Insulate all interior condensate piping with ¾" thick elastomeric closed cell foam insulation. Insulation shall have a flame spread of less than 25 and a smoke developed rating of 50 or less as tested by ASTM C534, E84, UL-723 and NFPA 255.

Hot water pipe insulation shall be rigid glass fiber insulation with a nominal density of 3 pounds per cubic foot with a thermal conductivity of not more than 0.23 at 75 deg F mean temperature. Insulation cover shall be an all-service jacket with double self-sealing laps, with self-sealing butt strips. Insulation thickness shall be as follows:

One half-inch (1/2") thick for pipe sizes ½" to 1".
One inch (1") thick for pipe sizes 1-1/4" to 4".

Insulate all domestic cold-water lines subject to ambient conditions. Use minimum 1/2" thick closed-cell elastomeric thermal insulation, minimum density of 5.5 pounds per cubic foot with a thermal conductivity of not more than 0.27 at 75 deg F mean temperature. The material shall have a flame spread of 25 or less and a smoke-developed rating of 50 or less as tested by ASTM C534, E84 (25/50) UL-723 (25-50) and NFPA 255 (25-50). Seal all joints, seams, etc. air tight.

Pipe insulation is not required in crawl spaces where located more than 10' from a ventilation opening.

Install insulation in accordance with manufacturer's recommendations.

TESTS AND INSPECTIONS

Make all water and air tests of the piping systems in the presence of and to the satisfaction of the Architect/Engineer or his designated representative. Conduct these tests at such places and with timing to permit work to proceed with as little interruption as possible. Make tests before work is concealed.

Test water piping to hydrostatic pressure at 125 psi and hold for 4 hours.

After the installation of sanitary piping and before the pipe is concealed or the fixtures are installed, cap or plug the ends of the system and fill all lines with water to top of vents above roof and allow to stand until a thorough inspection has been made. Should leaks appear, repeat the tests until the system is tight.

Do not use resin, candle wax or any other such substance for stopping leaks in cast iron soil, waste or vent lines or in storm drain lines. Caulking of screw joints to stop leaks will not be permitted.

STERILIZATION

The sterilization process shall comply with all governing regulations and with the sterilization procedures recommended by the American Water Works Association. The chlorination process may be simplified by first flushing the system thoroughly clean, then charging with water containing a minimum of 50 parts per million of chlorine, allowing this to stand for 24 hours, then thoroughly flushing. After sterilization and final flushing, the local health authority is to be notified and their approval obtained in writing. Provide copies to the Construction Manager, engineer and Owner. Include a copy in the close out manual.

END OF SECTION

Leon County Schools
Leon High School
Building 7 Gymnasium Remodeling & Renovation Project
550 East Tennessee Street
Tallahassee, Florida 32308
LCSB RFQ #504-2023
H+SA#22.133
August 25, 2023

SECTION 23 01 00 - MECHANICAL GENERAL PROVISIONS

PART 1 - GENERAL

GENERAL CONDITIONS

The work described hereunder shall be installed subject to the Contractual Conditions for the entire Specifications.

CORRELATION

This Section of the Specifications and its accompanying Drawings are made separate for the convenience of the General Contractor in preparing his bid and in no way relieves the General Contractor of his responsibility to correlate the work under this Section with that of all other trades as regards the items to be furnished by various Subcontractors, the exact location of all equipment and materials and the necessity of planning the work of all trades to avoid interference.

PLANS AND SPECIFICATIONS

Drawings and Specifications are intended to clearly set forth all work, and the detailed description is added to assist in establishing the scope and the location of the several parts of the work. Collectively, they shall govern and control the scope, character, and design of the Work, and any item called for in any one of the documents shall be as though mentioned in all.

Failure to make reference in the Specifications to any items of the work shown on the Drawings, but necessary to the completion of the Work shall not relieve the Contractor of the full responsibility to furnish the materials and perform the work of such items, in a manner comparable to other items of similar nature for which detailed Specifications are included.

PROJECT FAMILIARIZATION

The bidder is expected to visit the site and familiarize himself with conditions at the site before submitting his bid. He shall familiarize himself with the work required throughout the entire project and shall make allowances for contingencies which may occur in the interconnection of the various systems.

ALTERNATES AND ADDENDA

The Contractor shall investigate all Alternates, Addenda and Allowances as they relate to the Work of this Section.

TESTING

The Work shall include complete testing of all equipment and piping at the completion of the Work and making any connection changes or adjustments necessary for the proper functioning of the system and equipment.

WORK INCLUDED

Work covered under this Section consists of furnishing all labor, materials, tools, equipment, transportation, scaffolding, services, supervision, and performing of all operations required to properly complete all mechanical work in accordance with this Division of the Specifications and as indicated on the applicable Drawings, subject to terms and conditions of the Contract.

SUPERVISION OF WORK

The Mechanical Contractor shall have a qualified and experienced superintendent on the job when any related work is in progress.

RELATED WORK SPECIFIED ELSEWHERE

The Contractor is cautioned to note carefully other Sections of the project Specifications with their cross references to other specific standard specifications, standard detail, etc., describing work to be furnished under these Specifications as well as any mechanical work that may be shown on electrical, structural, architectural, or other drawings, in order that he may fully understand the requirements and work to be provided under this Section of the Specifications.

ORDINANCES AND REGULATIONS

All work shall conform with all local and State ordinances or regulations governing the installation of such equipment. If work as laid out, indicated or specified is recognized to be contrary to or conflicting with local ordinances or regulations, the Subcontractor shall report same to the Architect/Engineer before submitting a bid. The Architect/Engineer will then issue instructions as to procedure.

CODES AND STANDARDS

The currently adopted standards of the following organizations, and individual standards named, shall be followed the same as if they were fully written herein and constitute a part of the Specification requirements except where otherwise specified:

National Fire Protection Associations - Standards
- NFPA 70, National Electric Code
- NFPA 101, Life Safety Code
- NFPA 90-A, Installation of Air Conditioning and Ventilating Systems.

FL Building Code
FL Mechanical Code
FL Gas Code
FL Plumbing Code
Florida Fire Prevention Code
National Board of Fire Underwriters
SMACNA HVAC Duct Construction Standard
ANSI/ASME B31.1, Power Piping
ANSI/ASME B31.9, Building Services Piping

The foregoing rules, standards, regulations, specifications, recommendations and requirements shall be followed by the Contractor as minimum requirements. They shall not relieve the Contract from furnishing and installing higher grades of materials and workmanship which are specified herein or indicated on the Drawings.

Any material, equipment or workmanship specified by reference to the number, symbol or title of Specification or detail, or other standard rules, codes, regulations, etc., shall comply with the latest edition amendments and revisions thereto in effect on the date of these Specifications.

The Contractor shall submit proof, if requested by the Engineer or his representative, that the materials, appliances, equipment or devices that he furnishes and installs under this Contract meet the requirements of the Underwriters' Laboratories, Inc., or Factory Mutual, as regards fire and casualty hazards.

PERMITS, INSPECTIONS AND UTILITY FEES

Coordinate costs of taps with the Owners Representative & the CM.

The Contractor shall obtain necessary permits and inspections required for work and pay all charges incidental thereto. Contractor shall coordinate all utility taps and shall pay all associated fees, impact charges, etc. Upon completion of the work the Contractor shall deliver to the Engineer a certificate of inspection and approval from the local inspection department, if required.

MINOR DEVIATIONS

The Contractor shall note that the Mechanical Drawings are intended to indicate only the extent diagrammatically, general character and location of the work included. Work intended, but

having minor details obviously omitted or not shown, shall be furnished and installed complete to perform the functions intended.

Arrangements of piping, ductwork, and equipment that differ materially from the obvious intent of the Drawings will not be permitted except where necessary to avoid interferences, and only where specifically approved by the Architect/Engineer. Drawings shall be furnished showing all changes. Any change resulting in a saving in labor and materials shall be made in accordance with a Contract change order.

BASIC MATERIALS AND METHODS

The materials and methods specified in this article are to be used for work specified throughout this Section of the Specifications.

All materials and workmanship shall be of the highest quality.

Any materials on the job rejected by the Architect/Engineer shall be removed from the premises.

The installation shall be made in a workmanlike manner in accordance with acceptable industry standards except where specific procedures are called for in these Specifications, in which case they shall be followed.

All materials shall be new, free of defects and of the manufacturers latest standard design.

Reference to a particular material or specific equipment by name, make or catalog number is to describe equipment which will meet the requirements of the project and is not intended to restrict bidding.

It is the intent that all of the equipment of a similar type shall be the products of the same (one) manufacturer when practicable, providing unit responsibility for each group.

REVIEW OF MATERIALS

Submittals shall be made in compliance with the General Conditions of the Contract for Construction and the following:

Submittals shall be identified by items numbers as listed in the pertinent section of the specifications and shall be accompanied by a letter of transmittal.

Certificates shall be in triplicate and where required in conjunction with other submittals shall accompany such submittals.

Materials and other items subject to approval shall not be purchased or incorporated in the work before receipt of written approval.

Submittals shall be rendered all at one time for the entire project. Partial submittals will not be accepted or acknowledged. Exception: If a few items have long shop drawing preparation time, then these items will be accepted later to avoid delaying the shop drawing procedure.

SHOP DRAWINGS

Shop Drawings are drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are prepared by the Contractor or any subcontractor, manufacturer, supplier or distributor and which illustrates some portion of the Work.

All shop drawings submitted shall bear the stamps of approval of the Contractor as evidence that the drawings have been checked by the Contractor. Any drawings submitted without this stamp of approval will not be considered and will be returned to contractor for proper resubmission. If the shop drawings show variances from the other requirements of the contract because of standard shop practice or other reason, the Contractor shall make specific mention of such variation in his letter of transmittal in order that, if acceptable, suitable action may be taken for proper adjustment. Otherwise, the Contractor will not be relieved of the responsibility for executing the work even though such shop drawings have been approved.

Submit electronic copies of the shop drawings to be retained and additional copies as required by the Contractor, all items required under appropriate sections of the Specifications.

All materials are to be submitted in a hard cover, three ring binder. All materials are to be labeled with the pertinent Specification Section and are to be separated with dividers for each section of the Mechanical Specifications.

All materials submitted late or re-submitted shall be 3-ring punched and marked with the appropriate Specification Section Numbers.

PROJECT CLOSEOUT

The Contractor shall remove all temporary work and temporary facilities prior to final pay request.

The Contractor shall clean spaces that were occupied by temporary work and temporary facilities. Remove debris, rubbish and excess materials from the sites. Burning or burying is not permitted on the sites.

Repair damages caused by installation or use of temporary facilities. Restore to original condition.

Restore grass, landscaping, hardscaping to original condition.

GUARANTEES, BONDS AND AFFIDAVITS

Warranties:

The Contractor shall submit to the Owner all manufacturer's warranties on equipment furnished and installed under this Contract.

In addition, to the guarantee of equipment by the manufacturer of each piece specified herein, the Contractor shall also guarantee such equipment and shall be held for a period of one year from final acceptance test to make good any defects of the materials or workmanship occurring during this period, without expense to the Owner.

Affidavits:

The Contractor shall provide affidavits as required in the non-technical portion of these Specifications.

Provide Warranty Labels:

All warrantied mechanical equipment: see Mechanical Identification requirements.

OPERATION AND MAINTENANCE DATA

Manuals and Instructions:

The Contractor shall deliver to the Engineer, upon substantial completion of the Work, two copies of descriptive literature related to the equipment installed under this Contract, including parts lists, wiring diagrams, maintenance and operation manuals and warranties customarily supplied by manufacturers for equipment incorporated in this work. The literature shall be neatly bound in a 3-ring binder and delivered to the Engineer prior to final acceptances. Each manual shall include a copy of the Control Diagrams and a complete description of the operation of the control systems.

The Contractor shall give physical demonstration and verbal instructions for proper operation and maintenance of equipment to the Owner or his designated representative. Schedule these demonstrations and instructions at the Owner's convenience.

Provide four (4) hours of tour and demonstration of all equipment installed under this project.

AS-BUILT DRAWINGS

As-Built Drawings are required. Maintain a current and legible record set (full size set) on the job. Final record prints will be drafted by the Engineer and signed off by the contractor. The Contractor is solely responsible for providing accurate as-builts.

QUALITY ASSURANCE

Products Criteria:

Standard Products: Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products. Items of equipment shall essentially duplicate equipment that has been in satisfactory use at least two (2) years prior to bid opening. Provide list of users upon request.

Equipment having less than a two-year use record, which in the opinion of the Engineer, provided significant benefits to the Owner such as improved energy efficiency, will be acceptable if it is a product of a manufacturer who has been regularly engaged in the manufacture of that specific type of product which has been used in similar applications

for a period of two years. The Engineer reserves the right to require the Contractor to submit evidence to this effect for his approval.

Equipment Service: Products shall be supported by a service organization which maintains an adequate inventory of repair parts and is located, in the opinion of the Engineer, reasonably close to the site.

Manufacturer's Nameplates: Nameplate bearing manufacturer's name or identifiable trademark shall be securely affixed in a conspicuous place on equipment, or name or trademark cast integrally with equipment, stamped or otherwise permanently marked on each item of equipment.

Welding: Before any welding is performed submit a copy of the Welding Procedure Specification (WPS) together with the Procedure Qualification Record as required by Section IX of the ASME Boiler and Pressure Vessel Code.

Before any welder performs any welding, submit a copy of the Manufacturer's Record of Welder or Welding Operator Qualification Tests as required by Section IX of the ASME Boiler and Pressure Code. The letter or symbol (as shown on the qualification test form) shall be used to identify the work of that welder and shall be affixed, in accordance with appropriate construction code, to each completed weld.

The types and extent of non-destructive examinations required for pipe welds are shown in Table 136.4 of the Code for Pressure Piping, ANSI/ASME B 31.1.

Manufacturer's Recommendations: Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations shall be furnished to the Engineer prior to installation. Installation of the item will not be allowed to proceed until the recommendations are received. Failure to furnish these recommendations can be cause for rejection of the material.

FIRESTOPPING

Provide for firestopping of all mechanical systems. UL listed methods conforming to the situations present shall be utilized. Submit shop drawings of intended methods, including installation instructions and proof of UL Listing.

WALL, FLOOR AND CEILING PLATES

Material and Type: Chrome plated brass or chrome plated steel. Use plates that fit tight around pipes, cover openings around pipes, and cover the entire pipe sleeve projection.

Thickness: Not less than 3/32 inch for floor plates. For wall and ceiling plates, not less than 0.025 for up to 3-inch pipe, 0.035 for larger pipe.

Locations: Use where pipe penetrates floors, walls and ceilings in exposed locations, except mechanical rooms or chases. Use also where insulation ends on exposed water supply pipe drop from overhead. Provide a watertight joint in spaces where brass or steel pipe sleeves are specified.

INSTALLATION

Coordinate location of piping, sleeves, inserts, hangers, ductwork and equipment. Locate piping, sleeves, inserts, hangers, ductwork and equipment clear of windows, doors, openings, light outlets, and other services and utilities. Follow manufacturer's published recommendations for installation methods not otherwise specified.

Protection and Cleaning:

> Equipment and materials shall be carefully handled, properly stored, and adequately protected to prevent damage before and during installation, in accordance with the manufacturer's recommendations and as approved by the Engineer. Damaged or defective items, in the opinion of the Engineer, shall be replaced.
>
> Protect all finished parts of equipment, such as shafts and bearings, where accessible, from rust prior to operation by means of protective grease coating and wrapping. Close pipe openings with caps or plugs during installation. Tightly cover and protect fixtures and equipment against dirt, water, chemical or mechanical injury. At completion of all work thoroughly clean fixtures, exposed materials and equipment.

Concrete and Grout: Use concrete and shrink-compensating grout, 3000 psi minimum.

Install gauges, thermometers, valves and other devices with due regard for ease in reading or operating and maintaining said devices. Locate and position thermometers and gauges to be easily read by operator or staff standing on floor or walkway provided. Servicing shall not require dismantling adjacent equipment or pipe work.

PAINTING

Paint all bare steel pipe, supports, hangers, fabricated parts, etc. with two coats of enamel paint. Prepare surfaces in accordance with the manufacturer’s recommendations. Coordinate colors with existing like components or per the Owner.

Paint all cut or heat affected galvanized steel components with two coats of cold galvanizing spray-paint, ZRC Cold Galvanizing compound or equal. Prepare surfaces per the manufacturer's recommendations.

PIPE AND EQUIPMENT SUPPORTS

Generally, support in accordance with industry standards and as described in Section 23 15 00.

Use of chain, wire or strap hangers, wood for blocking, stays and bracing, nor hangers suspended from piping above will not be permitted.

Use hanger rods that are straight and vertical. Turnbuckles for vertical adjustments may be omitted where limited space prevents use. Provide a minimum of 1" clearance between pipe or pipe covering and adjacent work.

LUBRICATION

Field check and lubricate equipment requiring lubrication prior to initial operation.

END OF SECTION

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SECTION 23 05 29 – SUPPORTS AND ANCHORS

PART 1 - GENERAL

DESCRIPTION OF WORK

Drawings and general provisions of Contract, including General Supplementary Conditions and Division 1 Specification section, apply to work of this section.

This section is a Division 23 Basic Materials and Methods section, and is part of each Division 22 & 23 section making reference to or requiring supports, anchors, and seals specified herein.

Extent of supports, anchors and seals required by this section is indicated on drawings and/or specified in other Division 23 sections.

Code Compliance: Comply with applicable codes pertaining to product materials and installation of supports, anchors and seals.

MSS Standard Compliance:

Provide pipe hangers and supports of which materials, design and manufacture comply with ANSI/MSS SP-58.

Select and apply pipe hangers and support, complying with MSS SP-69.

Fabricate and install pipe hangers and supports, complying with MSS SP-89.

Terminology used in this section is defined in MSS SP-90.

UL Compliance: Provide products which are Underwriters Laboratories listed.

PART 2 - PRODUCTS

ACCEPTABLE MANUFACTURERS

Subject to compliance with requirements, provide supports and hangers by Grinnell, Michigan Hanger Company, B-Line Systems, or approved equal.

HORIZONTAL PIPING HANGERS AND SUPPORTS

Except as otherwise indicated, provide factory fabricated horizontal piping hangers and supports complying with ANSI/MSS SP-58, of one of the following MSS types listed, selected by Installer to suit horizontal piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hangers and support to exactly fit pipe size for bare piping, and to exactly fit around piping insulation with saddle or shield for insulating piping. Provide copper plated hangers and support for copper piping systems.

Adjustable Steel Clevises: MSS Type 1.

Steel Double Bolt Pipe Clamps: MSS Type 3.

Adjustable Steel Band Hangers: MSS Type 7.

Steel Pipe Clamps: MSS Type 4.

Pipe Stanchion Saddles: MSS Type 37, including steel pipe base support and cast-iron floor flange.

Vertical Piping Clamps: Except as otherwise indicated, provide factory fabricated vertical piping clamps complying with ANSI/MSS SP-58, of one of the following MSS types listed, selected by Installer to suit vertical piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Select size of vertical piping clamps to exactly fit pipe size of bare pipe. Provide copper plated clamps for copper ping systems.

Two-Bolt Riser Clamps: MSS Type 8.

Four-Bolt Riser Clamps: MSS Type 42.

HANGER-ROD ATTACHMENTS

Except as otherwise indicated, provide factory fabricated hanger-rod attachments complying with ANDI/MSS SP-58, of one of the following MSS types listed, selected by Installer to suit horizontal piping hangers and building attachments, in accordance with MSS-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hanger-rod attachments to suit hanger rods. Provider copper plated hanger-rod attachments for copper piping systems.

Steel Turnbuckles: MSS Type 13.

Malleable Iron Sockets: MSS Type 16.

BUILDING ATTACHMENTS

Except as otherwise indicated, provide factory fabricated building attachments complying with ANSI/MSS SP-58, of one of the following MSS types listed, selected by Installer to suit building substrate conditions, in accordance with MSS SP-69 and manufacturer's published product information. Select size of building attachments to suit hanger rods.

Center Beam Clamps: MSS Type 21.

C-Clamps: MSS Type 23.

Malleable Beam Clamps: MSS Type 30.

Side Beam Brackets: MSS Type 34.

Concrete Inserts: MSS Type 18.

SADDLES AND SHIELDS

Except as otherwise indicated, provide saddles or shields under piping hangers and supports, factory fabricated, for all insulated piping. Size saddles and shields for exact fit to mate with pipe insulation.

Protection Shields: MSS Type 40; of length recommended by manufacturer to prevent crushing of insulation.

Protection Saddles: MSS Type 39; use with rollers, fill interior voids with segments of insulation adjoining insulation.

MISCELLANEOUS MATERIALS

Metal Framing: Provide products complying with NEMA STD ML 1.

Steel Plates, Shapes and Bars: Provide products complying with ANSI/ASTM A 36.

Cement Grout: Portland cement (ANSI/ASTM C 150, Type I or Type III) and clean uniformly graded, natural sand (ANSI/ATM C 404, Size No. 2). Mix at a ratio of 1.0 part cement to 3.0 parts sand, by volume, with minimum amount of water required for placement and hydration.

Heavy Duty Steel Trapezes: Fabricate from steel shapes or continuous channel struts selected for loads required; weld steel in accordance with AWS standards.

PART 3 - EXECUTION

PREPARATION

Proceed with installation of hangers, supports and anchors only after required building structural work has been completed in areas where the work is to be installed. Correct inadequacies including (but not limited to) proper placement of inserts, anchors and other building structural attachments.

Prior to installation of hangers, supports, anchors and associated work, Installer shall meet at project site with Contractor, installer of each component of associated work, and installers of other work requiring coordination with work of this section for purpose of reviewing material selection and procedures to followed in performing the work in compliance with requirements specified.

INSTALLATION OF BUILDING ATTACHMENTS

Install building attachments as required locations within concrete or structural steel for proper piping support. Space attachments within maximum piping span length indicated

in MSS SP-69. Install additional building attachments where support is required for additional concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is places; fasten insert securely to forms. Where concrete with compressive strength less than 2500 psi is indicated, install reinforcing bars through openings at top of inserts.

In areas of work requiring attachments to existing concrete, use self-drilling rod inserts, Phillips Drill Co., "Red-Head" or equal.

INSTALLATION OF HANGERS AND SUPPORTS

General: Install hangers, supports, clamps and attachments to support piping properly from building structure; comply with MSS SP-69. Arrange for grouping of parallel runs of horizontal piping to be supported together on trapeze type hangers where possible. Install supports with maximum spacings complying with MSS SP-69 or as listed herein, whichever is most limiting. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe. Do no use wire of perforated metal to support piping, and do not support piping from other piping.

Horizontal steel pipe and copper tube 1-½" diameter and smaller: support on 6-foot centers.

Horizontal steel pipe and copper tube over 1-½" diameter: support on 10-foot centers.

Locate pipe hangers/supports within 1' of elbow when pipe turns up or down, e.g., for supply/return piping to AHU coils/headers.

Support piping to not bear on coil headers or on flexible piping connections.

Vertical steel pipe and copper: support at each floor.

Plastic pipe: support in accordance with manufacturer's recommendations.

Fire protection piping: support in accordance with NFPA 13.

Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers and other accessories.

Paint all black steel hangers with black enamel. Galvanized steel and copper clad hanger do not require paint.

Prevent electrolysis in support of copper tubing by use of hangers and supports which are copper plated, or by other recognized industry methods.

Provision for Movement:

Install hangers and supports to allow controlled movement of piping systems and to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends and similar units.

Load Distribution: Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.

Pipe Slopes: Install hangers and supports to provide indicated pipe slopes, and so that maximum pipe deflections allowed by ANSI B31 are not exceeded.

Insulated Piping: Comply with the following installation requirements.

Shields: Where low compressive strength insulation or vapor barriers are indicated, install noncompressible insert and use a coated protective insulation shield.

Clamps: Attach clamps, including spacers (if any) to piping projecting through insulation; do not exceed pipe stresses allowed by ANSI B31.

Support fire protection piping independently of other piping.

INSTALLATION OF ANCHORS:

Install anchors at proper locations to prevent stresses from exceeding those permitted by ANSI B31, and to prevent transfer of loading and stresses to connected equipment.

Fabricate and install anchors by welding steel shapes, plates and bars to piping and to structure. Comply with ANSI B31 and with AWS standards.

Anchor Spacing: Where not otherwise indicated, install anchors at ends of principal pipe runs, at intermediate points in pipe runs between expansion loops and elbows. Make provisions for present of anchors as required to accommodate both expansion and contraction of piping.

Where expansion compensators are indicated, install anchors in accordance with expansion unit manufacturer's written instructions to limit movement of piping and forces to maximums recommended by manufacturer for each unit.

EQUIPMENT BASES

Where specified, provide concrete housekeeping bases for all floor-mounted equipment furnished as part of the work of Division 23. Size bases to extend minimum of 4" beyond equipment base in any direction; and 4" above finished floor elevation unless otherwise specified. Construct of reinforced concrete, roughen floor slab beneath base for bond, and provide steel rod anchors between floor and base. Locate anchor bolts using equipment manufacturer's templates. Chamfer top edge or corners ¾" on all sides.

Provide structural steel stands to support equipment not floor mounted or hung from structure. Construct of structural steel members or steel pipe fittings. Provide factory

fabricated tank saddles for tanks mounted on steel stands. Prime and paint with black enamel.

END OF SECTION

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SECTION 23 05 53 - MECHANICAL IDENTIFICATION

PART 1 - GENERAL

RELATED DOCUMENTS:

Drawings and general provisions of contract, including General and Supplementary Conditions and Division-23 Specification sections, apply to work of this section.

DESCRIPTION OF WORK:

Provide identification of the following:

Mechanical Equipment (air handlers, condensing units, terminals, VFDs, etc.)
Mechanical Controls (panels, equipment, devices, sensors, etc.)
Mechanical Piping (chilled water, hot water, etc.)

Extent of mechanical identification work required by this section is indicated on drawings and/or specified in other Division 23 sections.

Types of identification devices specified in this section include the following:

Laminated Self-adhesive Identification Materials.
Self-Adhering Pipe Identification Materials

QUALITY ASSURANCE:

Manufacturer's Qualifications: Firms regularly engaged in manufacturer of identification devices of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

Codes and Standards:

ANSI Standards: Comply with ANSI A13.1 for lettering size, colors, and viewing angles of identification devices.

SUBMITTALS

Product Data: Submit electronic copies of manufacturer's technical product data and installation instructions for each identification material and device required.

PART 2 - PRODUCTS

ACCEPTABLE MANUFACTURES:

Manufacturer: Subject to compliance with requirements, provide mechanical identification materials of one of the following:

Allen Systems, Inc.
Brady (W. H.) Co.; Signmark Div.
Industrial Safety Supply Co., Inc.
Seton Name Plate Corp.

MECHANICAL IDENTIFICATION MATERIALS:

General: Provide manufacturer's standard products of categories and types required for each application. Where more than one type is specified for application, selection is Installer's option, but provide single selection for each product category. Labels and lettering shall be neat and machine made.

EQUIPMENT IDENTIFICATION MATERIALS:

Plastic or phenolic self-adhesive labels with 3/8” high stenciled letters. Label shall be black color with white stenciling.

PAINTED IDENTIFICATION MATERIALS:

Stencils: Standard fiberboard stencils, prepared for required applications with letter sizes generally complying with recommendation of ANSI A13.1

Stencil Paint: Standard exterior type stenciling enamel; black, except as otherwise indicated; either brushing grade or pressurized spray-can form and grade.

Identification Paint: Standard identification enamel to match existing systems elsewhere in the building.

PLASTIC PIPE MARKERS:

Snap-On Type: Provide manufacturer's standard pre-printed, semi-rigid snap-on, color-coded pipe markers, complying with ANSI A13.1 and matching existing.

Pressure-Sensitive Type: Provide manufacturer’s standard pre-printed, permanent adhesive, color-coded, pressure-sensitive vinyl pipe markers, complying with ANSI A13.1 and matching existing.

Small Pipes: For external diameters less than 6" (including insulation if any), provide full-band pipe markers, extending 360 degrees around pipe at each location.

Large Pipes: For external diameters 6" and larger (including insulation if any), provide either full-band or strip-type pipe markers, but not narrower than 3 times letter height.

Lettering: Comply with piping system nomenclature to match existing systems elsewhere in the building.

Arrows: Apply printed pipe markers with arrows indicating direction of flow.

PART 3 - EXECUTION

EQUIPMENT IDENTIFICATION:

General: Coordinate names, abbreviations with the schedules on the plans.

Install equipment labels on all new and affected panels, and equipment. Place labels in conspicuous location. Ensure label does not interfere with access.

PIPING SYSTEM IDENTIFICATION:

General: Coordinate names, abbreviations, pipe colors and other designations used in mechanical identification work, with existing corresponding designations with plans and existing equipment. Consult with the engineer regarding conflicts with existing equipment names.

Install pipe markers of one of the following types on each system indicated to receive identification, and include arrows to show normal direction of flow:

Plastic pipe markers, with application system as indicated under "Materials" in this section.

Stenciled marker, black or white for best contrast.

Locate pipe markers as follows wherever piping is exposed to view in occupied spaces, machine room, accessible maintenance spaces and exterior non-concealed locations.

Near each valve and control device.

Near each branch, excluding short take-offs for fixtures and terminal units; mark each pipe at branch, where there could be question of flow pattern.

Near locations where pipes pass through walls or floors/ceiling, or enter non-accessible enclosures.

At access doors, manholes and similar access points which permit view of concealed piping.

Near major equipment items and other points of origination and termination.

Spaced intermediately at maximum spacing of 25' along each piping run, except reduce spacing to 15' in congested areas of piping and equipment.

On piping above removable acoustical ceilings, except omit intermediately spaced markers.

END OF SECTION

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SECTION 23 05 94 - TEST AND BALANCE COORDINATION

PART 1 - GENERAL

GENERAL CONDITIONS

This work is to be completed by the TAB Vendor in accordance with a separate contract with Leon County Schools. Construction Manager shall provide coordination & assistance for implementation.

a. Coordinating the activities of the Test and Balance Firm.

b. Notifying the Owner when systems are ready for test and balance. The Contractor shall bear the cost of any retesting or return visits required of the Test and Balance firm because systems are not ready.

c. Providing the Test and Balance Firm with all drawings, submittals, specifications and manufacturer's performance data needed.

d. Maintaining systems in operation during test and balance.

e. Making such alterations and corrections (within the scope of the plans and specifications) to systems and equipment as necessary for correct test and balance.

f. Making changes to pulleys, belts, or dampers, or adding dampers, as required by the Test and Balance Firm.

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION (NOT APPLICABLE)

END OF SECTION

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SECTION 23 07 10 - MECHANICAL INSULATION

PART 1 - GENERAL

GENERAL CONDITIONS

The work described hereunder shall be installed in accordance with the "Mechanical General Conditions," Section 23 01 00.

DESCRIPTION OF WORK:

Extent of the mechanical insulation required by this section is indicated on the Drawings and schedules, and by the requirements of this section.

Types of mechanical insulation specified in this section include the following:

Ductwork Systems Insulation:
Fiberglass duct wrap
Semi-rigid board
Closed-cell elastomeric

Piping System Insulation:
Cellular glass
Closed-cell elastomeric
Preformed fiberglass

RELATED WORK

Refer to Division 7 for fire caulking; not work of this section.

QUALITY ASSURANCE:

Manufacturer's Qualifications: Firms regularly engaged in the manufacture of mechanical insulation products, of types required, whose products have been in satisfactory use in similar service for not less than three (3) years.

Installer's Qualifications: Installer shall be an insulation specialty sub-contractor. A professional insulator with adequate experience and ability shall install all insulation. Firm with at least 5 years successful installation experience on projects with mechanical insulations similar to that required for this project.

Flame/Smoke Ratings: Provide composite mechanical insulation (insulation, jackets, coverings, sealers, mastics and adhesives) having flame spread index of 25 or less, and smoke developed index of 50 or less, as tested by ASTM E 84 (NFPA 255) methods.

Comply with the manufacturer's recommendations for installation of insulation materials.

SUBMITTALS

Submit to the Architect/Engineer for approval electronic copies of brochures, technical data and/or shop drawings of the following, and as many additional copies as required for Contractor use:

Each type of insulation material, performance data, etc.

Mastics, tapes, mechanical fasteners, etc.

Jacketing materials

Schedule of insulation systems that includes materials, insulation thickness, mastics, tapes, etc. for each type of system included in the project.

DELIVERY, STORAGE, AND HANDLING:

Deliver insulation, coverings, cements, adhesives and coatings to the site in containers with manufacturer's stamp or label, affixed and showing fire hazard indexes of products.

Protect insulation against dirt, water, and chemical and mechanical damage. Do not install damaged or wet insulation; remove from project site.

PART 2 - PRODUCTS

DUCTWORK INSULATION MATERIALS:

Fiberglass Duct Wrap: Federal Specification HH-1-558B, 1 pcf density, k=0.24, 2.2" thick (out of package), 1-5/8" thick (installed), R-value = 6.0 (installed), rated to 450 degrees F operating temperature. FSK reinforced foil vapor retarder. Owens / Corning SoftR or an approved equivalent.

Fiberglass Duct Board: Federal Specification HH-1-558B, 3.8 pcf density, k=0.23, 1-1/2" thick, R-value = 6.50, rated to 450 degrees F operating temperature. FSK reinforced foil vapor retarder. Owens / Corning Quiet R, Manville Type 814 or an approved equivalent.

PIPING INSULATION MATERIALS:

Cellular Glass Piping Insulation (limited to above-grade installations): ASTM C 552, 8 pcf density, k=0.38, rated to 900 degrees F operating temperature. Pittsburgh Corning Foamglass or an approved equivalent.

Cellular glass bedding mastic: Benjamin Foster 30-45

Indoor Insulation Jacket: All service kraft reinforced foil jacket with an elastomeric polymer barrier reinforced with glass fabric. Vapor permeance less than 0.02 grains/hr.sf.in.Hg. Owens/Corning ASJ/SSL-II, Lamtec 30J or equal.

Indoor Insulation Fittings: Finish with glass fabric and vapor barrier mastic. Childers CP-30 or Pittcote 300.

Exterior Insulation Jacket: Aluminum jacketing 0.016" thickness with bands and seal of same product. Childers Products or equal.

Fiberglass Pipe Insulation: ASTM C 547, 3 pcf density, k=0.26, rated to 650 degrees F operating temperature. Owens/Corning, Fiberglass

Fiberglass insulation jacket: All service kraft reinforced foil jacket. Owens/Corning, ASJ/SSL-II or an approved equivalent.

Closed Cell Elastomeric Insulation: ASTM C 534, k=0.27, rated to 200 degrees F operating temperature, maximum permeability = 0.20 perm-in. Armaflex AP or an approved equivalent.

INSULATION JACKETING

Aluminum roll jacketing conforming to ASTM B209, 3003 alloy, H-14 temper, 0.016” thick, with preformed aluminum elbows.

PART 3 - EXECUTION

INSULATION SYSTEMS:

General Duct Systems: Insulate concealed supply, return, outside air, and transfer air ductwork with fiber glass duct wrap unless otherwise specified herein. Duct that is in exposed ceilings and beyond the reach normal wear-and-tear, can be insulated with duct wrap.

Air Handler Duct Systems: Insulate new supply, return, and outside air ducts in mechanical rooms with rigid fiberglass board up to a height of 7 feet and then transition to flexible duct wrap. If all duct is below 7 feet, extend rigid insulation to 6” beyond the mechanical room walls.

Interior Refrigerant Piping: Insulate with 3/4" closed-cell elastomeric insulation.

Exterior Refrigerant Piping: Insulate with 3/4" elastomeric foam. Cover hard piping with aluminum jacketing and soft piping with 13-ply Venture Tape (or equal) with aluminum foil cover.

Exterior, and Under Roof Hot Water Piping (above grade): Insulate with 2” thick foam glass finish with vapor-barrier and cover with aluminum jacketing.

Exterior Heating Hot Water Piping (below grade): Insulate with 2” thick foam glass, provide finish vapor barrier coat, and cover with polyguard jacketing.

Interior Chilled Water Piping: Insulate with 2” thick foam glass with ASJ cover for pipes 6” and above, and 1-1/2” thick for all others sizes. Finish with vapor barrier coat.

Interior Heating Hot Water Piping: Insulate with 1.5” thick fiberglass insulation, cover with ASJ.

Miscellaneous Cold Drain Piping: Interior: Insulate with 3/4" closed cell elastomeric insulation. Seal all seams joints, etc. Exterior: No insulation is required.

GENERAL INSTALLATION REQUIREMENTS:

Examine areas and conditions under which mechanical insulation is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

Surfaces shall be clean and dry before attempting to apply insulation. Mechanical systems shall be turned off and the system shall be at room temperature before insulating. A professional insulator with adequate experience and ability shall install insulation.

Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purpose. Seal all joints, seams, etc. air and water tight.

Rated floors and partitions shall be penetrated only with insulation materials and techniques UL listed to maintain rated assembly. Consult with firestopping product vendors and technicians in advance. Any questions shall be referred to the Architect/Engineer.

Exposed/exterior piping shall be finished with an aluminum jacketing.

INSTALLATION OF DUCT WRAP

Application: The insulation shall be applied over 4" wide brushed strips of Foster's 85-20 adhesive spaced 12" on center. The insulation shall be overlapped approximately 2" and stapled in place. All ducts 24" or larger in width shall have the insulation additionally secured with mechanical fasteners spaced approximately 18" on center. Mechanical fasteners shall be bonded to the duct with the appropriate mastic/adhesive. Self-stick type pins are prohibited.

Insulation shall be cut and applied to the ductwork with not less than 2" overlap of backing on each edge and on the linear seams. Insulation shall be removed from all overlapping tabs.

On rectangular ducts install so insulation is not excessively compressed at corners.

Seams shall be stapled approximately 6" on center with outward clinching staples.

Seal all seams, tears, punctures, penetrations for hanger straps, or any other breaches of duct wrap facing with tape or mastic to provide a vapor tight system.

INSTALLATION OF FIBERGLASS DUCT BOARD INSULATION

Application: The insulation joints shall be lapped, butted, or mitered and taped in place. All ducts 24" or larger in width shall have the insulation additionally secured with mechanical fasteners spaced approximately 18" on center. Tape all joints and staple with outward clinching staples. Final tape over staples.

Seal all seams, joints, tears, punctures, penetrations or any other breaches of insulation facing with tape to provide a vapor-tight permanent system.

Use mastic over final taped joints for the connections to air handlers, fan coil units, etc.

INSTALLATION OF FIBERGLASS AND ELASTOMERIC PIPING INSULATION:

Insulation is not to be installed until the piping systems have been checked and found free of all leaks, and piping is dry (achieved room temperature) and free of debris.

Provide hanger type and support shields of 18-gauge galvanized steel over or embedded in the insulation. Shield shall extend halfway up the pipe insulation cover and at least 6" on each side of the hanger. Insulation shield edges shall be hemmed. Use incompressible inserts at each hanger/support to prevent compressing insulation due to weight of pipe.

Provide standoffs and clamps for wall/floor mounted piping to accommodate insulation thickness. Insulate over clamp and seal all joints, gaps, etc. air and water tight. Use incompressible inserts at each hanger/support to prevent compressing insulation due to weight of pipe.

Securely fasten shield with straps at each end. Insulate anchors adequately to prevent moisture condensation problems.

Install insulation materials with smooth and even surfaces. Insulate each continuous run of piping with full-length units of insulation, with single cut piece to complete run. Do not use pieces or scraps abutting each other.

Clean and dry pipe surfaces prior to insulating. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered.

Maintain integrity of vapor-barrier jackets, and protect to prevent puncture or other damage. Gaps and openings in chilled water insulation vapor barrier will not be tolerated.

Cover valves, fittings and similar items in each piping system with equivalent thickness and composition of insulation applied to adjoining pipe. Optional: install factory molded, precut or job fabricated units.

Extend piping insulation without interruption through walls, floors and similar piping penetrations, except where otherwise indicated.

Exposed/outdoor piping with elastomeric insulation shall be protected by aluminum jacketing.

INSTALLATION OF CELLULAR GLASS PIPE INSULATION:

Install continuous coat of insulation adhesive/bedding on piping and on insulation butt and longitudinal ends. Install insulation sections and stagger joints. Butt ends tight, wipe excess bedding, and secure insulation with aluminum bands and wrap with vapor barrier jacket along entire length and butted ends. Apply additional vapor-barrier tape where needed. Seal ends air and water tight with approved mastic.

Apply vapor-barrier jacket in accordance with the manufacturer's instructions. Ensure integrity of the vapor barrier with properly applied butt strips. Repair all punctures, penetrations, and holes with tape approved by the manufacturer.

INSTALLATION OF ALUMINUM JACKETING:

Install aluminum jacketing only after insulation installation is completed. Install full-length sections and overlap joints 2" minimum. Orient longitudinal seams at bottom of piping. Install aluminum or stainless-steel bands to secure insulation on 2' maximum centers. Install prefabricated aluminum fittings at elbows/offsets. Seal all seams joints, openings, etc. water tight with clear/gray silicone sealant.

PROTECTION AND REPLACEMENT:

Replace damaged insulation which cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.

Protection: Insulation installer shall advise Contractor of required protection for insulation work during remainder of construction period, to avoid damage and deterioration.

SEALING WALL & FLOOR PENETRATIONS

Seal rated wall/floor penetrations to maintain fire rating. Coordinate firestopping in advance of installation.

Seal all wall/floor penetrations water tight.

END OF SECTION

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SECTION 23 09 10 - VARIABLE FREQUENCY DRIVES

PART 1 - GENERAL

SCOPE OF WORK

Furnish all labor, materials equipment and incidentals required and install variable frequency drives as shown on the Drawings and as specified here.

These specifications are intended to give a general description of what is required but do not cover all details that will vary in accordance with the requirements of the equipment furnished. They are, however, intended to cover the furnishing, the shop testing, the delivery and complete installation and field testing of all materials equipment and appurtenances for the variable frequency drives specified here.

DESCRIPTION OF SYSTEM

The variable frequency drives specified here will become part of a complete mechanical control system as specified in Division 23. The intention of these specifications is that the mechanical system Supplier shall furnish and coordinate the supply of the Variable Speed Drives with the balance of the equipment and controls installation so as to provide unit responsibility.

The variable frequency drives shall operate standard induction motors. Remote or automatic control of the variable frequency drive shall be as specified. The drives furnished herein shall be totally compatible with the motors to be controlled and the controls supplied.

The intent of these specifications is to provide a completely self-contained and fully featured unit with rectifier, inverter, controls, bypass feature, disconnect and circuit protection features in a single unit. Drives that are composed of modular, but integrated components are acceptable. Branch circuit protection may be fuses or circuit breakers. The approved equipment will commonly be referred to as a drive package or drive pack.

REFERENCES

Comply with the latest applicable standards: UL-508, National Electric Code, NFPA 70, and IEEE.

QUALIFICATIONS

Variable speed drives shall be of sufficient size for the duty to be performed and shall not exceed their full rated capacity when the driven equipment is operating as specified.

All equipment furnished under these Specifications shall be new and unused and shall be the standard catalog product of the manufacturer.

The drives covered by these specifications are intended to be equipment of proven ability as manufactured by reputable manufacturers having 10 years' experience in the production of similar units. The equipment furnished shall be designed, constructed and installed in accordance with the best practice and methods, and shall operate satisfactorily when installed.

For the equipment specified herein, the manufacturer shall be ISO 9001 certified.

The variable frequency drive manufacturer shall maintain and staff engineering service and repair shops throughout the United States with personnel trained to do start-up service, emergency service calls, repair work, service contracts and training of customer personnel. In addition, the drive manufacturer shall maintain such a service and repair facility within 200 miles of the project site.

SUBMITTALS

Copies of all materials required to establish compliance with the Specifications shall be submitted electronically. Submittals shall include at least the following:

1. Shop Drawings showing all important details of construction, dimensions and anchor bolt locations.

2. Descriptive literature, bulletins, and catalog product sheets of the equipment.

3. Data on the characteristics and performance of the variable frequency drives. Data shall include certification that the variable frequency drives are warranted for use with the motors furnished and the equipment specified in Division 23 and is to be compatible with the instrumentation and control devices installed.

4. Complete Drawings shall be furnished for approval and shall consist of power and control connection diagrams, elementary or control schematics, including coordination with other electrical control devices operating in conjunction with the Variable Frequency Drive, and suitable outline drawings with sufficient details for locating conduit locations and field wiring.

OPERATING INSTRUCTIONS

Three copies of the operating and maintenance manuals shall be furnished. The manuals shall be prepared specifically for this installation and shall include all required cuts, drawings, equipment lists, descriptions, etc. that are required to instruct operating and maintenance personnel unfamiliar with such equipment.

TOOLS AND SPARE PARTS

One (1) set of all special tools required for normal operation and maintenance shall be provided.

The manufacturer shall provide two spares per drive of all Owner-replaceable items such as fuses, pilot lamps, etc.

PRODUCT HANDLING

All parts shall be properly protected so that no damage or deterioration will occur from the time of shipment until installation is completed and the units and equipment are ready for operation.

Factory assembled parts and components shall not be dismantled for shipment or installation unless explicitly stated in manufacturer's installation instructions.

START-UP COMMISSIONING

The manufacturer shall provide start-up commissioning of each VFD supplied by a factory certified service technician who is experienced in start-up and repair services.

Start-up services shall include checking for verification of proper operation and installation of the VFD, its options and all interface wiring to the building automation system. All parameters of the VFD shall be checked and adjusted to within manufacturer's recommended operating ranges.

WARRANTY AND SERVICE AGREEMENT

All equipment supplied under this section shall be covered by a warranty and service agreement. This warranty and service agreement shall be for three (3) years from the date of Owner acceptance. The warranty shall be provided by the drive manufacturer (factory warranty).

The manufacturer's warranty shall be unconditional.

A maintenance and repair service agreement shall be included as part of the drive manufacturer's submittal. Drive manufacturers who cannot provide factory trained service and maintenance are not acceptable.

PART 2 - PRODUCTS

GENERAL

The Contractor shall furnish and install complete Variable Frequency Drives as described in this specification and as detailed on the applicable Drawings.

The Contractor shall be responsible for the installation and startup of the equipment covered by this specification.

The motor(s) to be controlled are rated for 208 volt, 3-phase.

CONSTRUCTION

Each Variable Frequency Drive shall consist of a 460-volt rated, three-phase rectifier and variable-frequency inverter with features, functions and options as specified.

The Variable Frequency Drives shall be rated for the specified horsepower, NEC full load current, and motor speed at 104 deg F. The variable frequency drives shall be designed to provide continuous speed adjustment of three phase motors. The variable frequency output voltage shall provide constant volts-per-Hertz excitation to the motor terminals up to 60 hertz. Two or more selectable V/Hz patterns shall be available and shall be controlled through software or adjustable hardware.

Controllers shall be rated for an ambient temperature of 0 degrees Celsius to 40 degrees Celsius, an altitude of up to 3,000 feet above sea level and humidity of 0 to 95% non-condensing.

Controller enclosures shall be NEMA Type 1 or Type 12, wall mounted, ventilated if required by equipment manufacturer and as approved by the Engineer. The inverters shall have complete front accessibility with easily removable assemblies.

The following standard basic control features shall be provided on the inverter:

1. Start, Stop, Power On indicating lights and speed control potentiometer. Terminations for remote mounted operator control devices shall be furnished.
2. Unidirectional operation, coast to rest upon stop.
3. Variable linear independent timed acceleration.
4. Variable torque performance from 4 to 60 Hertz.
5. Dual speed stepover, to prevent operation at two discrete speeds, adjustable.
6. The installation shall meet IEEE 519 Standards for five per cent distortion.
7. Frequency stability of 0.5% for 24 hours with voltage regulation of +-2% of maximum rated output voltage.
8. 115V AC isolated control power supply for operator devices.
9. Phase insensitive to input power.
10. Automatic restart upon return of power following a utility outage.
11. A HAND-OFF-AUTO switch (H-O-A) shall be provided and interface with the control sequence specified.
12. Each VFD shall have a non-resettable 0 to 99999.9 hour elapsed run time meter.
13. Each VFD shall have an optically isolated 4-20 mA input for remotely setting motor speed.

14. Each VFD shall have an optically isolated 4-20 mA output signal proportional to the motor speed. Accuracy of the signal shall be verified by comparing the signal to actual motor speed as measured in the field and set to match if required.

The following protective features shall be provided on the drive:
1. Input short circuit protection. The drive shall be protected against short circuits up 50,000 amperes symmetrical.
2. Input phase loss and phase reversal protection.
3. Electronic overcurrent trip for instantaneous overload protection.
4. Undervoltage protection of output.
5. Over frequency protection.
6. Overtemperature protection.
7. Integral transient protection from input AC line transients meeting ANSI/IEEE Standard C62.41.
8. Electrical isolation between the power and logic circuits, as well as between the 115V AC control power and the static digital sequencing.
9. Drive shall be capable of withstanding output terminal line short or open circuits without component damage.
10. di/dt and dv/dt protection for converter semiconductors.
11. Units shall have an alpha-numeric or light emitting diodes for diagnostic display of over frequency, instantaneous overcurrent, DC overvoltage, AC undervoltage/loss of phase, emergency stop, overload, overtemperature, inverter pole trip and standby modes; unit mounted.
12. A protective coating shall be applied to both sides of all printed circuit boards.
13. All potentiometers, including pots on printed circuit boards, shall be sealed.
14. Input disconnect switch with overcurrent and short circuit protection.

The following standard independent adjustments shall be provided on the inverter:
1. Minimum speed (as required).
2. Maximum speed (as required).
3. Acceleration time 2 to 60 seconds (minimum).
4. Deceleration time 2 to 60 seconds (minimum).
5. Critical frequency avoidance.
6. Volts per Hertz profile.

The following shall be furnished with the controller:
1. Run indicating relay contacts (closes when VFD is supplying power to the motor) to be wired to Distributed Control Unit.
2. Delayed motor failure indicating relay contact (opens on failure) to be wired to Distributed control Unit.
3. Door mounted output load ammeter, voltmeter, and speed output indicating meters.
4. Built-in self-diagnostics.

BYPASS

Where scheduled, provide a manual or automatic (selectable by keypad input) bypass controller, microprocessor based. Controller shall consist of a a built-in motor starter and a three position DRIVE/OFF/BYPASS switch controlling two contactors. In the DRIVE position, the motor is operated at an adjustable speed from the drive. In the OFF position, the motor and drive are disconnected. In the BYPASS position, the motor is operated at full speed from the AC power line and power is disconnected from the drive so that service can be performed. Provide a normally closed dry contact interlocked with the drive safety trip circuitry to stop the motor whether in drive or bypass mode in case of an external safety fault. Start/Stop control shall shall function in both DRIVE and BYPASS MODE.

PERFORMANCE

Drives shall have an efficiency at full load and speed that exceeds 95%. The efficiency shall exceed 90% at 50% speed and load.

Drives shall maintain the line side displacement power factor at not less than 0.95, regardless of motor speed and load.

Drives shall be capable of operating any NEMA design B squirrel cage induction motor, regardless of manufacturer, with a horsepower and current rating within the capacity of the drive.

Drives shall be capable of starting into a spinning motor without any adverse effect on the motor and without exceeding normal operating parameters of the drive.

Drives shall meet or exceed IEEE 519 for reflected harmonic distortion.

APPROVED MANUFACTURERS

Furnish units by ABB, Siemens, Cutler-Hammer, Danfoss, Square D, or Allen Bradley.

PART 3 - EXECUTION

INSTALLATION

Installation shall be in strict accordance with the manufacturer's instructions and recommendations in the location shown on the Drawings. Field wiring shall be in accordance with the manufacturer's recommendations.

TESTING

Tests and checks: Variable frequency drives shall be tested with a motor load of full horsepower rating prior to shipment.

All printed circuit boards shall be functionally tested prior to unit installation.

After all operational tests have been performed, each drive shall undergo a burn-in test. The drive shall be burned in at 100% inductive or motor load without an unscheduled shutdown.

A copy of all tests and checks performed in the field, complete with meter readings and recordings, where applicable, shall be submitted to the Owner.

After the drives have been completely installed, and working under the direction of the manufacturer, conduct in the presence of the Engineer, such tests as necessary to indicate that operation conforms to the Specifications.

END OF SECTION

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Leon High School
Building 7 Gymnasium Remodeling & Renovation Project
550 East Tennessee Street
Tallahassee, Florida 32308
LCSB RFQ #504-2023
H+SA#22.133
August 25, 2023

SECTION 23 09 24 - DIGITAL HVAC CONTROLS COORDINATION

PART 1 - GENERAL

GENERAL CONDITIONS

This work is to be completed by the Controls Vendor in accordance with a separate contract with Leon County Schools. Construction Manager shall provide coordination & assistance for implementation.

Equipment Installation Subcontractors shall be responsible for the following tasks:

a. Coordinate activities with the Control Subcontractor.

b. Provide Control Subcontractor with all drawings, submittals, specifications and manufacturer's performance data needed.

c. Maintaining systems in operation during test and balance.

d. Installation of all control devices in piping and ductwork systems.

END OF SECTION

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SECTION 23 21 13 - HYDRONIC PIPING & SPECIALTIES

PART 1 - GENERAL

GENERAL CONDITIONS

The work described hereunder shall be installed in accordance with the "Mechanical General Provisions," Section 23 01 00.

DESCRIPTION OF THE WORK

The extent of the work is indicated on the Drawings. In general, the work consists of, but is not limited to, the following:

Heating hot water system

Chilled water systems

Valves

Instrumentation

Hydronic specialties

QUALITY ASSURANCE AND CODES/STANDARDS:

Construct and install piping for highest pressures and temperature in respective systems in accordance with the latest revision of the ASME Code for Pressure Piping, ANSI/ASME B31.1 and Building Services Piping, ANSI/ASME B31.9.

Qualifications for Welding Processes and Operators: ASME "Boiler and Pressure Vessel Code", Section IX, "Welding and Brazing Qualification."

Regulatory Requirements:

ASME Compliance: fabricate and stamp air separators and compression tanks to comply with ASME Boiler and Pressure Vessel Code, Section VIII, Division 1.

Quality Control Submittals:

Welders' certificates certifying that welders comply meet the quality requirements specified herein.

Certification of compliance with ASTM and ANSI manufacturing requirements for pipe, fittings, and specialties.

Submit reports/certifications specified in part 3 of this Section.

SUBMITTALS:

Submit to the Architect/Engineer for approval electronic copies of brochures, technical data and/or shop drawings and as many additional copies as required for Contractor use.

Valve Product Data: Provide data from manufacturers, for each hydronic specialty and special duty valve specified. Include rated capacities of selected models, weights (shipping, installed, and operating), furnished specialties and accessories, and installation instructions. Submit manufacturer's installation instructions.

Pipe Product Data: Submit data from manufacturer regarding material properties, test data, properties data.

Pipe Fitting Data: Submit manufacturer’s product data including certifications, material properties, test data, etc.

Submit copies of the Welders’ qualifications, certificates, and driver’s licenses.

MAINTENANCE DATA:

Maintenance Data: for hydronic specialties and special duty valves, for inclusion in operating and maintenance manual specified in Division 1 and Division 23 Section "Basic Mechanical Requirements."

PART 2 - PRODUCTS

PIPE AND TUBING MATERIALS:

General: Refer to Part 3 Article "PIPE APPLICATION" for identification of systems where the below specified pipe and fitting materials are used.

Steel Pipe: ASTM A53B or A106B, Schedule 40, seamless or ERW, black steel pipe, beveled ends for weld pipe.

CPVC Plastic Pipe: ASTM D2846.

FITTINGS:

Cast-Iron Threaded Fittings: ANSI B16.4, Class 125, standard pattern, for threaded joints. Threads shall conform to ANSI B2.1.

Malleable-Iron Threaded Fittings: ANSI B16.3, Class 150, standard pattern, for threaded joints. Threads shall conform to ANSI B2.1.

Steel Fittings: ASTM A234B, seamless or welded, for welded joints.

Cast-Iron Threaded Flanges: ANSI B16.1, Class 125, raised ground face, bolt holes spot faced.

Steel Flanges and Flanged Fittings: ANSI B16.5.

Gasket Material: thickness, material, and type suitable for fluid to be handled, and design temperatures and pressures.

CPVC Plastic Fittings: ASTM D 2846 solvent cemented joints.

SPECIAL DUTY VALVES:

Two-Way Control Valves: Pressure-independent, characterized control valves, forged brass body, nickel plated; chrome plated brass ball and stem, fiberglass reinforced Teflon PTFE seat, Viton O-rings, stainless steel spring, 200 psi close-off rating, 0 to 212 deg F temperature range, 5 to 50 psid maximum differential pressure across valve, 400 psi minimum pressure rating with 24 volt multi-function operator, 2 to 10 VDC, 4-20 mA operating range, spring return, 45 in-lb torque (minimum), 95 deg max rotation, and 100 second running time.

Three-Way Control Valves: Same as two-way but not pressure independent and A-port equal percentage and B-port modified for common port flow.

Automatic Flow Control Valves: Spring type constructed with stainless steel wear surfaces and spring, variable side porting and single orifice end hole with minimum flow restriction capable of controlling flowrates to +/- 5% of design, and two integral pressure/temperature ports.

Calibrated Plug Valves (Circuit Setter): 125 psig water working pressure, 250 deg F maximum operating temperature, bronze body, plug valve with calibrated orifice. Provide with connections for portable differential pressure meter with integral check valves and seals. Valve shall have integral pointer and calibrated scale to register degree of valve opening. Valves 2 inch and smaller shall have threaded connections and 2-1/2-inch valves shall have flanged connections.

Pressure Reducing Valves: Diaphragm operated, cast-iron or brass body valve, with low inlet pressure check valve, inlet strainer removable without system shut-down, and noncorrosive valve seat and stem. Select valve size, capacity, and operating pressure to suit system. Valve shall be factory-set at operating pressure and have the capability for field adjustment.

Safety Relief Valves: Unless specified otherwise, one hundred twenty-five (125) psig working pressure and 250 deg F maximum operating temperature; designed, manufactured, tested, and labeled in accordance with the requirements of Section IV of the ASME Boiler and Pressure Vessel Code. Valve body shall be cast-iron, with all wetted internal working parts made of brass and rubber. Select valve to suit actual system pressure and Btu capacity.

BUTTERFLY VALVES:

Comply with MSS SP-67, Butterfly Valves. Provide butterfly valves designed for tight shut-off. Provide gear operators on all butterfly valves 6" and larger. Provide lever operators for valves under 6 inches.

Wafer type valves are prohibited.

Types of Butterfly (BF) Valves: Lug Type 3" and Larger (BF1): 200 CWP, cast iron body, cadmium plated ductile iron disc, Type 410 stainless steel stem, EPT seat. Stockham LG-712. Nibco LD 2110-3. Nibco WD 2110-5. Crane 44-FXB-TL. Milwaukee ML123B-8416.

Lug Type 3" and Larger (BF2): 150/200 CWP, cast iron body, cadmium plated ductile iron disc, Type 410 stainless steel stem, EPT seat. Stockham LG-722 and LG-721. Nibco LD 2110-5. Crane 44-FXB-G. Milwaukee ML 123B-8115.

Lug Type 4" and Larger (BF3): 175 WWP, cast iron body, nickel-plated ductile or aluminum bronze disc, Type 410 stainless steel stem, EPT seat, UL listed. Stockham LG-72U. Nibco LD 3510-8.

Grooved Type 4" and Larger (BF4): 175 WWP, cast iron body, nickel plated ductile iron or aluminum bronze disc, Type 410 stainless steel stem, EPT seat, UL listed. Stockham LG-82U. Nibco GD 1765-2.

BALL VALVES:

General: Select valve size equal to or greater than connecting pipe area, include seat ring designed to hold sealing material.

Construction: Ball valves shall be rated for 150 psi saturated steam and 600 psi non-shock cold water. Pressure containing parts shall be constructed of ASTM B-584 alloy 844, or ASTM B-124 alloy 377. Valves shall be furnished with blowout proof bottom loaded stem constructed of ASTM B-371 alloy 694 or other approved low zinc material. Provide TFE packing, TFE thrust washer, chrome plated ball and reinforced Teflon seats. Valves 1" and smaller shall be full port design. Valves 1 ¼" and larger shall be conventional port design. Stem extensions shall be furnished for use in insulated piping where insulation exceeds ½" thickness.

Comply with the following standards:

MSS SP-72. Ball Valves with Flanged or Butt-Welding Ends for General Service.

MSS SP-110. Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

Types of Ball Valves:

Threaded Ends 3" and Smaller: Bronze two-piece full port body with adjustable stem packing. Nibco T-585-70. Stockham S216-BR-R-T. Milwaukee BA 125. Apollo 77-100.

Soldered Ends 3" and Smaller: Bronze three-piece full port body with adjustable stem packing. Nibco S-595-Y-66. Milwaukee BA350. Apollo 82-200.

Threaded Ends 3" and Smaller: Bronze two-piece full port body, UL listed (UL842) for use with flammable liquids and LP gas. Nibco T-585-70-UL.

Threaded Ends 2" and Smaller: 175 WWP, bronze two-piece body, gear operator with handwheel, indicator flag, accepts tamper switch, for fire protection, UL listed. Nibco T-505-4 and G-505-4.

Threaded Ends 2" and Smaller: 400 WWP, bronze two-piece body, for fire protection service. Nibco KT-580.

Threaded Ends 2 ½" and Smaller: 300 WWP, bronze three-piece body, gear operator with handwheel, indicator flag, accepts tamper switch, for fire protection, UL listed. Nibco T-505-4 and G-505-4.

Flanged Ends 2 ½" and Larger: Class 150, carbon steel full bore two-piece body with adjustable stem packing. Nibco F515-CS series. Apollo 88-240.

Manual Air Vent: Bronze body and nonferrous internal parts; 150 psig working pressure, 225 deg F operating temperature; manually operated with screwdriver or thumbscrew: and having 1/8-inch discharge connection and 1/2-inch inlet connection.

Automatic Air Vent: Designed to vent automatically with float principle; bronze body and nonferrous internal parts; 150 psig working pressure, 240-degree F operating temperature; and having 1/4-inch discharge connection and 1/2 inch inlet connection.

Y-Pattern Strainers: Cast-iron body (ASTM A 126, Class B), flanged ends for 2-1/2 inch and larger, threaded connections for 2 inch and smaller, bolted cover, perforated Type 304 stainless steel basket, bottom drain connection; 125 psig working pressure.

Flexible Pipe Connections: Rubber-bellows type for chilled water service and stainless steel reinforced for heating hot water systems. Working pressure rating shall be 150 psig (minimum) at 200 deg F. Rubber bellows shall include multi-layered Kevlar tire cord fabric and solid steel retention ring for higher ratings. Flexible pipe connectors shall be same size as the connecting pipe and either screwed or ANSI flanged.

INSTRUMENTATION:

ASME and ISA Compliance: Comply with applicable portions of ASME and Instrument Society of America (ISA) standards pertaining to construction and installation of meters and gages.

Pressure Gauges: ASME B40.1, Grade A, phosphor bronze bourdon-tube type, bottom connection. Drawn steel or brass case, glass lens, 4-1/2 inches diameter. White coated aluminum scale with permanently etched markings. Accuracy of 1% of range span. Range of 2 times operating pressure.

Gauge Syphon: 1/4-inch NPS straight coil constructed of brass tubing with threads on each end.

Gauge Snubber: 1/4-inch NPS brass bushing with corrosion-resistant porous metal disc. Disc material shall be suitable for fluid served and rated pressure.

Mercury-in-glass Thermometers: Die cast case, aluminum finished in baked epoxy enamel, glass front, spring secured, 9 inches long. Adjustable joint finished to match case, 180-degree adjustment in vertical plane, 360-degree adjustment in horizontal plane, with locking device. Tube shall be red reading, mercury filled, magnifying lens. Scale shall be satin-faced, nonreflective aluminum, with permanently etched markings. Stem shall be copper-plated steel, aluminum or brass, for separable socket, length to suit installation. Accuracy shall be plus or minus 1 percent of range span or plus or minus one scale division to maximum of 1.5 percent of range span. Temperature ranges for services listed as follows:

Chilled Water	0 to 100
Hot Water	30 to 240

Thermometer Wells: Brass or stainless steel, pressure rated to match piping system design pressure; with 2-inch extension for insulated piping and threaded cap nut with chain permanently fastened to well and cap.

Test/Pete's Plugs: Shall be nickel-plated brass body, with 1/2-inch NPS fitting and 2 self-sealing valve-type core inserts suitable for inserting a 1/8-inch OD probe assembly from a dial-type thermometer or pressure gauge. Core material shall be EPDM or neoprene. Test plug shall

have gasketed and threaded cap with retention chain and body of length to extend beyond insulation.

PART 3 - EXECUTION

PIPE APPLICATIONS:

Heating Hot Water: Use steel pipe with threaded joints and fittings for 2 inch and smaller, and with welded joints for 2-1/2 inch and larger.

Chilled Water: Use steel pipe with threaded joints and fittings for 2 inch and smaller, and with welded joints for 2-1/2 inch and larger.

PIPING INSTALLATIONS:

Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate the general location and arrangement of piping systems. Locations and arrangements of piping take into consideration pipe sizing and friction loss, expansion, pump sizing, and other design considerations. So far as practical, install piping as indicated.

Install piping generally parallel to walls and column center-lines, unless shown otherwise on the Drawings. Space piping, including insulation, to provide one (1) inch minimum clearance between adjacent piping or other surface.

Slope water supply and return piping at a uniform grade of 1 inch in 40 feet upward in the direction of flow.

Install branch connections to mains using Tee fittings in main with take-off out the bottom of the main, except for up-feed risers which shall have take-off out the top of the main line.

Install unions in pipes 2 inch and smaller, adjacent to each valve, at final connections each piece of equipment, and elsewhere as indicated. Unions are not required on flanged devices.

Install flanges on valves, apparatus, and equipment having 2-1/2 inch and larger connections.

Install flexible connectors at inlet and discharge connections to pumps (except inline pumps) and other vibration producing equipment. Support piping so no weight bears on connector. Use retention rods and/or rings when recommended by the manufacturer.

Install strainers on the supply side of each control valve, pressure reducing valve, pressure regulating valve, solenoid valve, inline pump, and elsewhere as indicated. Install nipple and ball valve in blow down connection of strainers 2 inch and larger.

Locate and orient valves to permit proper operation and access for maintenance of packing, seat and disc. Generally, locate valve stems in overhead piping in horizontal position.

Provide a union adjacent to one end of all threaded end valves. Control valves usually require reducers to connect to pipe sizes shown on the Drawings.

Install butterfly valves with the valve open as recommended by the manufacturer to prevent binding of the disc in the seat.

Offset equipment connections to allow valving off for maintenance and repair with minimal removal of piping. Provide flexibility in equipment connections and branch line take-offs with 3-elbow swing joints where noted on the Drawings.

Thermometer Wells: In pipes 2-1/2 inch and smaller increase the pipe size to provide free area equal to the upstream pipe area.

Threaded Joints: Note the internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint. Align threads at point of assembly. Apply appropriate tape or thread compound to the external pipe threads (except where dry seal threading is specified). Assemble joint wrench tight. Wrench on valve shall be on the valve end into which the pipe is being threaded.

Flanged Joints: Align flanges surfaces parallel. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly using torque wrench.

PIPE WELDING:

All welding shall be performed by qualified and certified welders. Welders' qualifications/certification shall be current, i.e., not more than 12 months since issuance, and fully completed by a reputable source. Welders shall submit copy of certificate and driver's license to contractor for review, submit for review/approval to the engineer. Maintain copies of certificates/licenses onsite. Welders shall be qualified on the size pipe utilized for this project.

Unless otherwise specified, welding shall be performed using Shielded Metal Arc Welding (SMAW), otherwise referred to as "stick" welding.

Welds require preparation of surfaces, beveling, and multiple passes.

All welds shall be inspected. The engineer reserves the right to utilize any examination procedure listed in Chapter VI of ANSI/ASME B31.1 to verify integrity of any welds in question. If welds are found to be in compliance, then testing costs shall be paid by the project. Otherwise,

the contractor shall bear all related testing costs, weld/pipe replacement costs, additional engineering inspection or reporting costs, etc.

VALVE APPLICATIONS:

General Duty Valve Applications: The Drawings indicate valve types to be used. Where specific valve types are not indicated the following requirements apply:

Shut-off duty: use gate, ball, and butterfly valves.

Throttling duty: use globe and ball valves.

Install shut-off duty valves at supply connection to each piece of equipment, and elsewhere as indicated.

Install throttling duty valves as indicated.

Install calibrated plug valves on the outlet of each heating or cooling element and elsewhere as required to facilitate system balancing.

Install drain valves at low points in mains, risers, branch lines, and elsewhere as required for system drainage.

Install check valves on each pump discharge and elsewhere as required to control flow direction.

Install safety relief valves on hot water generators, boilers, and elsewhere as required by ASME Boiler and Pressure Vessel Code. Pipe discharge to floor without valves. Comply with ASME Boiler and Pressure Vessel Code Section VIII, Division 1 for installation requirements.

Install pressure reducing valves on make-up water system, and elsewhere as required to regulate system pressure.

VALVE FEATURES

General: Provide valves with features indicated and where not otherwise indicated, provide proper valve features as determined by Installer for installation requirements. Comply with ANSI B31.1.

Valve features specified or required shall comply with the following:

Flanged: Provide valve flanges complying with ANSI B16.1 (cast iron), ANSI B16.5 (steel), or ANSI B16.24 (bronze).

Threaded: Provide valve ends complying with ANSI B2.1.

Solder-Joint: Provide valve ends complying with ANSI B16.18.

Trim: Fabricate pressure-containing components of valve, including stems (shafts) and seats from brass or bronze materials, of standard alloy recognized in valve manufacturing industry unless otherwise specified.

Non-Metallic Disc: Provide non-metallic material selected for service indicated in accordance with manufacturer's published literature.

Renewable Seat: Design seat of valve with removable disc, and assemble valve so disc can be replaced when worn.

Extended Stem: Increase stem length by 2: minimum, to accommodate insulation applied over valve.

Mechanical Actuator: Provide factory fabricated gears, gear enclosure, external chain attachment and chain designed to provide mechanical advantage in operating valve for all valves 4" and larger that are mounted more than 7' 0" above the floor, or are otherwise difficult to operate regardless of height.

HYDRONIC SPECIALTIES INSTALLATION:

Install manual air vents at high points in the system, at heat transfer coils, and elsewhere as required for system air venting. Pipe air vent drains using ¼" soft copper and terminate at nearest safe waste. Support piping on 2' centers.

Install automatic air vents at high points in the system, heat transfer coils, and elsewhere as required for system air venting.

Install pressure/temperature ports across cooling and heating coils, control valves that do not include these fittings, and as needed for proper testing, adjusting, and balancing.

Install drain valves at low points in mains, risers, branch lines, and elsewhere as required for system drainage.

Use dielectric unions or flanges to isolate dissimilar materials.

FIELD QUALITY CONTROL

Preparation for testing: Coordinate tests with the engineer three days in advance and prepare hydronic piping in accordance with ASME B 31.9 and as follows:

Leave joints including welds uninsulated and exposed for examination during the test.

Flush system with clean water. Clean strainers.

Isolate equipment that is not to be subjected to the test pressure from the piping. If a valve is used to isolate the equipment, its closure shall be capable of sealing against the test pressure without damage to the valve. Flanged joints at which blinds are inserted to isolate equipment need not be tested.

Use ambient temperature water as the testing medium, except where there is a risk of damage due to freezing.

Examine system to see the equipment and parts that cannot withstand test pressures are properly isolated.

Subject piping system to a hydrostatic test pressure which at every point in the system is not less than 1.5 times the design pressure. The test pressure shall not exceed the maximum pressure for any vessel, pump, valve, or other component in the system under test.

After the hydrostatic test pressure has been applied for at least 15 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components as appropriate, and repeat hydrostatic test until there are no leaks. Document all tests by recording test area, setup, participants names, test pressure, duration, and final results.

FLUSHING AND CLEANING:

Water treatment will be provided by the owner’s water treatment contractor. Coordinate flushing and cleaning operation with owner's representative.

Flush entire water piping system. Remove, clean, and replace strainer screens.

Circulate cleaning solution for 4 hours if recommended by the water treatment contractor.

Final flush entire water piping system if cleaning operations were carried out. Remove, clean and replace strainer screens.

Close and fill system as soon as possible after final flushing to minimize corrosion.

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SECTION 23 21 23 - HVAC PUMPS

PART 1 - GENERAL

GENERAL CONDITIONS

The work described hereunder shall be installed in accordance with the "Mechanical General Conditions.

DESCRIPTION OF THE WORK

The extent of the work is indicated on the Drawings. In general, the work consists of, but is not limited to, the following:

Close-Coupled End Suction Pumps
Frame Mounted End Suction Pumps
Inline Circulators

QUALITY ASSURANCE

Manufacturer's Qualifications: Firms regularly engaged in manufacture of general-use centrifugal pumps with characteristics, sizes and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.

Compliance with the following codes and standards is required:

UL Compliance: Design, manufacture, and install HVAC pumps in accordance with UL 778 "Motor Operated Water Pumps."

UL and NEMA Compliance: Provide electric motors and components which are listed and labeled by Underwriters Laboratories and comply with NEMA standards.

Certification, Pump Performance: Provide pumps whose performances, under specified operating conditions, are certified by manufacturer.

SUBMITTALS

Product Data: Identify pumps as referenced in the construction documents; submit manufacturer's pump capacities/ratings, installation and start-up instructions, current/accurate pump characteristic performance curves with selection points clearly indicated. Include motor data, seal and sleeve types, materials of construction, dimensions and weights, and any other pertinent data to ensure comprehensive review/approval by the engineer.

Submit to the Architect/Engineer for approval electronic copies of brochures, technical data and shop drawings of the above information.

MAINTENANCE DATA

Submit maintenance data and parts lists for each type of pump, control, and accessory; including "trouble-shooting" maintenance guide. Include this data, product data, shop drawings, and wiring diagrams in maintenance manual; in accordance with requirements of Division 1.

PRODUCT DELIVERY, STORAGE, AND HANDLING

Manufacturer's Preparation for Shipping: Clean flanges and exposed machined metal surfaces and treat with anticorrosion compound after assembly and testing. Protect flanges, pipe openings, and nozzles with wooden flange covers or with screwed-in plugs.

Store HVAC pumps and components in clean dry place. Protect from weather, dirt, fumes, water, construction debris, and physical damage.

Comply with Manufacturer's rigging and installation instructions for unloading HVAC pumps, and moving them to final location.

PART 2 – PRODUCTS

GENERAL REQUIREMENTS

Furnish pumps complete with motors, impellers, drive assemblies, bearings, coupling guards, where required, lubrication ports/fittings/extensions to ensure access even when insulated, and accessories as hereinafter specified.

Select motor with sufficient horsepower rating for non-overloading operation over entire pump curve.

Pumps shall meet or exceed operating efficiencies specified on the plans/schedules.

Where pump is indicated for parallel operation, scheduled conditions are for that pump with two pumps in operating; i.e. total system flow rate is twice that scheduled for single pump. When only one of the two pumps is operating, operating point of that pump must fall within manufacturer’s recommended operating range.

Furnish each pump and motor with nameplate giving manufacturer's name, serial number of pump, model number, impeller size, horsepower, voltage, frequency, speed and full load current.

Pumps shall operate without objectionable noise or vibration.

After testing, each pump shall be thoroughly cleaned and painted with at least one coat of high-grade machinery enamel prior to shipment and preserved/protected for shipping/storage.

Pumps shall be of same manufacturer for each project unless otherwise approved in advance by the engineer.

Unless otherwise specified, pump and motor bearings shall be permanently lubricated, sealed for life, meeting all industry standards for a minimum L 10 life of 60,000 hours.

CLOSE-COUPLED END SUCTION PUMPS

General: Provide close-coupled end suction pumps where indicated, and of capacities and having characteristics as scheduled.

Type: Horizontal mount, single stage, designed for 175 psi working pressure. Pump volute or casing shall be center-line discharge for positive air venting constructed of class 30 cast iron with integrally cast mounting feet. The pump shall have a self-flushing seal design or a positive external seal flushing line. Pump may be furnished with a seal flush line and a Purocell # 900 replaceable cartridge filter with shut-off isolation valve installed in the seal flushing line. The filter shall have the ability to remove particles down to five microns in size.

Casing: Cast iron, 125 psi ANSI flanges, tappings for gage and drain connections. The pumps shall have case wear rings. Mounting feet shall be integrally cast into the casing to allow servicing without disturbing piping connections.

Shaft: Steel with bronze or stainless-steel replaceable shaft sleeve.

Seal: Shall be mechanical with carbon seal ring and ceramic seat rated at 250 deg F.

Motor: Motor shall meet EPAC/NEMA specifications and shall be the size, voltage and enclosure (ODP/TEFC) called for on the plans and as specified in related Division 15 sections. Motors shall be premium efficiency and rated for inverter duty (where scheduled) with 1.15 minimum service factor.

Impeller: The impeller shall be bronze and hydraulically balanced by either back vanes or balancing holes. The impeller shall be dynamically balanced to ANSI Grade G6.3 and shall be fitted to the shaft with a key.

FRAME MOUNTED END SUCTION PUMPS

Same as above with the following exceptions. The base shall be made of structural steel and include an integral drain pan. A flexible coupler suitable for both across-the-line starting applications as well as variable-torque loads associated with variable-frequency drives shall connect the pump to the motor and shall be covered by an OSHA-approved coupler guard. Frame mounted pumps shall be aligned by a millwright after installation per the manufacturer's recommendations and tolerances.

IN-LINE PUMPS (CIRCULATORS)

General: Provide inline pumps with capacities as shown on plans. Pumps shall be in-line type for installation in vertical or horizontal piping. Pump must be capable of being serviced without disturbing piping connections.

Pump body shall be of cast iron, rated 175 psi working pressure, with gauge ports at nozzles, and with vent and drain ports. Impeller shall be cast bronze s material, enclosed type, dynamically and hydraulically balanced, keyed to the shaft and secured by a locking cap screw or nut.

An internally-flushed mechanical seal with ceramic seal seat, and carbon seal ring shall seal off the liquid cavity at the motor shaft, suitable for continuous operation at 225^{o} deg. F. A cupro-nickel shaft sleeve shall completely cover the wetted area under the seal.

Pump bearing bracket shall have oil lubricated bronze sleeve bearings or regreaseable or permanently lubricated ball bearings. Bracket shaft shall be alloy steel having ground and hardened thrust bearing faces. A flexible coupling to dampen starting torque and torsional vibrations shall be employed.

Motors shall be EPAC/NEMA rated, premium efficiency, and shall be of the size, voltage, and enclosure (ODP/TEFC) as outlined in the plans and specifications. In general, pumps specified for use with a variable frequency drive shall be inverter duty rated with Class F insulation per the Motors section.

PART 3 - EXECUTION

INSPECTION

Examine areas and conditions under which HVAC pumps are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

EQUIPMENT SUPPORTS/PADS

All pumps in mechanical rooms shall be supported on concrete housekeeping pads. In-line pumps shall be supported by 3” NPS, schedule 40, steel pipe support on concrete pad.

INSTALLATION / START-UP OF PUMPS

General: Install HVAC pumps where indicated, in strict accordance with manufacturer's published installation instructions to avoid stress, minimize noise, maximize life, and ensure alignment; complying with recognized industry practices to ensure that HVAC pumps comply with requirements and serve intended purposes over the expected service life.

Access: Provide access space around HVAC pumps for service as indicated, but in no case less than that recommended by manufacturer. Provide access to all lubrication fittings, including extensions to accommodate depth of insulation, where applicable.

Piping Connections: Refer to the Hydronic Specialties section for piping-related work. Provide piping, valves, accessories, gages, supports, and flexible connections as indicated. Provide concentric (for vertical piping) and eccentric (for horizontal piping) reducers, increasers where pump connection sizes are not identical to connecting piping.

Support/Alignment: Install base-mounted and foot-mounted pumps on minimum of 4" high concrete base, secure with anchor bolts. Vertical inline pumps shall be supported in accordance with the manufacturer’s recommendations. Set and level pump, grout under pump base with non-shrink grout. Align all flexible coupled pumps after grouting is complete/set in accordance with the manufacturer’s recommendations. Record and submit written report/results of alignment to engineer for review/approval. After alignment is complete, pin pump and motor to base.

Verify piping system has been flushed, cleaned, and filled prior to startup. Prime pump, vent air from system/casing, and verify pump rotation. Do not start pumps in a dry condition as this will damage the seals. Remove start-up strainers once the system has been circulated and verified “clean”.

Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division-16 sections. Do not proceed with equipment start-up until wiring installation is acceptable to equipment installer.

Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

END OF SECTION

SECTION 23 31 13 - METAL AND FLEXIBLE DUCTWORK AND ACCESSORIES

PART 1 - GENERAL

GENERAL CONDITIONS

The work described hereunder shall be installed in accordance with the "Mechanical General Conditions," Section 23 01 00.

DESCRIPTION OF WORK:

Extent of metal ductwork is indicated on drawings and in schedules, and by requirements of this section. In general, the work consists of, but is not limited to, the following:

A system of heating and air-conditioning supply and return air ductwork.

Smoke/fire dampers, air diffusers, and miscellaneous accessories.

Miscellaneous volume/control dampers.

Ventilation air ductwork.

Exhaust air ductwork.

RELATED WORK

Insulation is specified under Section 23 07 10.

QUALITY ASSURANCE:

Manufacture's Qualifications: Firms regularly engaged in manufacture of metal ductwork products of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

Installer's qualifications: Firm with at least three (3) years of successful installation experience on projects with metal ductwork systems similar to that required for project.

Codes and Standards:

SMACNA Standards: Comply with SMACNA's "HVAC Duct Construction Standards, Metal and Flexible" for fabrication and installation of metal ductwork.

NFPA Compliance: Comply with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilation Systems".

NFPA Compliance: Comply with NFPA 96 "Standard for the Installation of Equipment for the Removal of Smoke and Grease-Laden Vapors from Commercial Cooking Equipment".

SUBMITTALS:

Submit to the Architect/Engineer for approval electronic copies of brochures, technical data and/or shop drawings of the following, and as many additional copies as required for Contractor use:

Ductwork and materials

Mastics

Grilles & accessories

Smoke and fire dampers, miscellaneous dampers and installation instructions

DELIVERY, STORAGE AND HANDLING:

Handle ductwork and equipment carefully to prevent damage. Do not install damaged sections or components; replace with new.

Store ductwork and equipment in clean dry place. Protect from weather, dirt, fumes, water, construction debris, and physical damage.

PART 2 - PRODUCTS

DUCTWORK MATERIALS:

Sheet Metal: Except as otherwise indicated, fabricate ductwork from galvanized sheet steel complying with ASTM A 527, lock forming quality; with G-90 zinc coating in accordance with ASTM A 525.

Single-Wall Spiral Round Duct: Round duct with mechanical fastening, spiral flat seams, complying with ASTM A527, with G-90 zinc coating in accordance with ASTM A 525.

MISCELLANEOUS MATERIALS:

General: Provide miscellaneous materials and products of types and sizes indicated and, where not otherwise indicated, provide type and size required to comply with ductwork system requirements including proper connections of ductwork and equipment.

Duct Sealant: Non-hardening, non-migrating mastic or liquid elastic sealant, type applicable for fabrication/installation detail, as compounded and recommended by manufacturer specifically for sealing joints and seams in ductwork.

Ductwork Support Materials: Except as otherwise indicated, provide hot-dipped galvanized steel fasteners, anchors, rods, straps, trim and angles for support of ductwork.

Flexible Ducts: Insulated spiral-wound spring steel with flame proof vinyl sheathing complying with UL 181, Class I air duct (duct connectors will not be accepted).

Smoke Dampers: Dampers shall meet the requirements listed in NFPA 90A, 92A and 92B and shall be classified as leakage rated dampers for use in smoke control systems in accordance with the UL555S. Provide factory installed electric actuators qualified under UL555S. For each damper provide an access door 4" smaller than sheet metal size in width (up to 18") and 18" in length.

Fire Dampers: Dampers shall meet UL 555 for dynamic systems and shall be provided with angles, hardware, etc. Dampers shall be airfoil blade type or Style “B” out of the airstream type. Damper procurement and installation shall accommodate existing conditions. Provide damper access either via the duct or grille.

Smoke Damper Actuators: Actuators to be normally closed (powered open), spring return (selectable), 120 VAC with end position indication (two built in auxiliary switches), overload protection with disconnect switch. It will meet UL555 and UL555S requirements and be factory mounted to the smoke damper.

Grilles & Registers: Provide as scheduled on the drawings or an approved equivalent.

FABRICATION:

Duct sizes are internal free area unless otherwise noted.

Shop fabricate ductwork of gages and reinforcement complying with SMACNA "HVAC Duct Construction Standards".

Construct supply duct for 2” static pressure.

Construct return ducts for 2” negative static pressure.

Construct exhaust ducts for 1” negative static pressure and outside air ducts for 1” positive static pressure.

Construct rectangular taps with mitered fittings.

Limit angular tapers to 30 degrees for contracting tapers and 20 degrees for expanding tapers.

PART 3 - EXECUTION

INSTALLATION OF METAL DUCTWORK

Examine areas and conditions under which metal ductwork is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to installer.

Install metal ductwork in accordance with SMACNA HVAC "Duct Construction Standards". Assemble and install ductwork in accordance with recognized industry practices, which will achieve airtight and noiseless systems, capable of performing each indicated service. Install each run with minimum number of joints. Support ducts rigidly with suitable ties, braces, hangers and anchors of type which will hold ducts true-to-shape and to prevent buckling.

Use single-wall spiral seam round duct where specified and/or as needed to accommodate existing conditions.

Duct sizes shown are internal dimensions. Maintain free area equivalence when making transitions or when transforming between round and/or rectangular duct.

Seal all transverse and longitudinal joints, seams, etc. regardless of pressure class with approved duct mastic.

Routing: Field verify duct route prior to any fabrication. Coordinate layout with existing structure, suspended ceiling and lighting layouts and similar finished work.
Hangers for steel ducts shall be fabricated from sheet metal. Ducts shall be supported from the structure.

Penetrations: Where ducts pass through interior partitions and exterior walls, conceal space between construction opening and duct or duct insulation with sheet metal flanges/collars two gauges heavier than duct. Minimum width of flanges/collars shall be 1-1/2” or as required to completely seal opening. Overlap opening on rectangular openings by at least 1-1/2". Fasten to duct and substrata. Where ducts pass through fire-rated floors, walls, or partitions, provide in accordance with approved UL listed details and accepted industry practice.

Hard Ceiling or Sidewall Connections: Provide insulated sheet metal boots sized to fit the grille size as indicated. Secure boot to ceiling structure. Boot insulation shall be semi-rigid foil faced where exposed to the air stream and sealed with tape.

INSTALLATION OF SMOKE/FIRE DAMPERS:

General: Install dampers in accordance with the manufacturers' installation instructions in order to maintain the UL listing. Fire dampers shall be out of the air stream as specified on the plans.

INSTALLATION OF FLEXIBLE DUCTS:

Maximum Length: For any duct run using flexible ductwork, do not exceed ten (10) feet extended length – use round spiral seam steel duct for longer runs. Install shortest possible length.

Installation: Install in accordance with Section III of SMACNA "HVAC Duct Construction Standards, Metal and Flexible". No bends shall be made with center-line radius of less than one duct diameter.

Flexible duct hangers shall be constructed from hanger wire and 3" wide sheet metal saddles. Wire gauge shall be per SMACNA and saddles shall have hemmed edges and corners. Support as needed to avoid kinks and flow obstructions.

END OF SECTION

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SECTION 23 34 10 - FANS

PART 1 - GENERAL

GENERAL CONDITIONS

The work described hereunder shall be installed in accordance with the "Mechanical General Conditions," Section 23 01 00.

DESCRIPTION OF THE WORK

The extent of the work is indicated on the Drawings. In general, the work consists of, but is not limited to, the following:

In-line Direct-Drive Cabinet Fans

RELATED WORK

Electrical wiring is specified in the Electrical Sections.

Control wiring is specified under other sections, provide any control devices as described on the schedule.

QUALITY ASSURANCE

Rate fans according to appropriate Air Moving and Conditioning Association, Inc. (AMCA) approved test codes and procedures. Supply fans with sound ratings below the maximums permitted by AMCA standards. All fans provided must be licensed to bear the Certified Ratings Seal.

WARRANTY

Provide a full parts warranty for one year from start-up or 18 months from shipment, whichever occurs first.

SUBMITTALS

Submit to the Architect/Engineer for approval electronic copies of brochures, technical data and/or shop drawings of the following, and as many additional copies as required for Contractor use:

Fans

Fan accessories/options, etc.

MAINTENANCE DATA:

Submit operation and maintenance data. Include manufacturer's descriptive literature, start-up instructions, and maintenance procedures.

DELIVERY, STORAGE AND HANDLING:

Handle equipment carefully to prevent damage. Do not install damaged sections or components; replace with new.

Store equipment in clean dry place. Protect from weather, dirt, fumes, water, construction debris, and physical damage.

Comply with manufacturer's rigging and moving instructions for equipment unloading and moving to final location.

PART 2 - PRODUCTS

FAN SCHEDULE

Provide fan type, arrangement, rotation, capacity, size, motor horsepower, and motor voltage accessories as scheduled on the Drawings or specified hereafter.

Provide fan accessories as scheduled on the Drawings or required in these specifications.

IN-LINE DIRECT-DRIVE CABINET FANS

Provide in-line direct-drive cabinet centrifugal fans with forward curved dynamically balanced fan wheel and square galvanized steel housing with venturi throat inlet. The housing interior shall be lined with ½" thick acoustical insulation. The outlet duct collar shall include an aluminum backdraft damper and be adaptable to horizontal or vertical discharge. The access for wiring shall be external. The motor disconnect shall be internal and of the plug type. The motor shall be mounted on vibration isolators.

FAN ACCESSORIES

Provide fan accessories as scheduled on the Drawings or required in these specifications.

Wall caps shall include insect screens and backdraft dampers.

PART 3 - EXECUTION

Install fans in accordance with manufacturer's installation instructions.

Verify existing roof construction prior to compiling shop drawings for curbs and/or adapters.

Coordinate the installation with the controls' contractor.

Locate inline fans directly above a single lay-in tile for motor/fan access/replacement. Support fan from structure. Install flexible duct connectors to ductwork. Install axial restraints across flexible connector on fans with over ½ hp motors.

Ensure that fans are wired properly, with correct motor rotation, and includes electrical motor grounding.

Verify motor amperage and voltage.

Verify proper operation of backdraft dampers.

Verify control functions of fan.

END OF SECTION

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SECTION 23 52 00 - HYDRONIC HEATING BOILERS

PART 1 - GENERAL

RELATED DOCUMENTS:

The work described hereunder shall be installed in accordance with the "Mechanical General Conditions," Section 23 01 00.

QUALITY ASSURANCE:

Manufacturer's Qualifications: Firms regularly engaged in manufacture of hydronic boilers, of types and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.

Guarantee: Guarantee all parts and workmanship for a period of one year.

Codes and Standards:

NFPA Compliance: Install gas-fired boilers in accordance with NFPA code 54 "National Fuel Gas Code".

ASME Compliance: Construct boilers in accordance with ASME Boiler and Pressure Vessel Code, Section IV "Heating Boilers".

UL and NEMA Compliance: Provide boiler ancillary electrical components which have been listed and labeled by UL, and comply with NEMA standards.

Furnish and install equipment having the characteristics and accessories indicated on the drawings or in these specifications. The manufacturer's specifications for the models shown on the drawings or given as basis for design, plus all features, options, and accessories indicated on the drawings or in these specifications, whether or not standard for the model scheduled or offered as a substitute, shall constitute the minimum requirements for equipment furnished under this section.

SUBMITTALS:

Product Data: Submit manufacturer's technical product data, including rated capacities of selected model clearly indicated, weights (shipping, installed, and operating), furnished specialties and accessories; and installation and start-up instructions.

Wiring Diagrams: Submit manufacturer's ladder-type wiring diagrams for interlock and control wiring required for final installation of boilers and controls.

Submit to the Architect/Engineer for approval six (6) copies of brochures, technical data and/or shop drawings of the following, and as many additional copies as required for Contractor use:

Boilers

MAINTENANCE DATA:

Submit maintenance data and parts list for each boiler, control, and accessory; including "trouble-shooting" maintenance guide. Include this data, product data, and wiring diagrams in maintenance manual.

DELIVERY, STORAGE, AND HANDLING:

Handle boiler equipment carefully to prevent damage. Do not install damaged sections or components; replace with new.

Store boiler and equipment in clean dry place. Protect from weather, dirt, fumes, water, construction debris, and physical damage.

Comply with manufacturer's rigging and moving instructions for unloading boilers, and moving them to final location.

PART 2 - PRODUCTS

PACKAGED GAS-FIRED HYDRONIC HEATING BOILERS:

Warranty: The boiler to be shock proof for a period of ten years.

The entire boiler shall be factory assembled and fire-tested, requiring only connection to the water circulating system, fuel and electric utilities and the flue gas vent.

The boiler shall be AGA design-certified and shall not release any condensate during operation.

The boiler shall be constructed and stamped in accordance with Section IV of the ASME Code for low pressure heating boilers with a maximum water working pressure if 160 PSI.

Tubes shall be 7/8" I.D. finned copper, rolled into top and bottom collectors. Tubes shall be straight without bends.

The gas burner shall be the radial-fired, power type and be constructed of steel. The burner shall utilize a screen-type diffuser to produce a full 360-degree flame pattern.

The trim shall include a combination temperature/pressure gauge and an ASME-rated pressure relief valve set at 125 PSI.

The control system shall be supplied for 120 Volts, single phase, 60 Hertz. The limit circuit shall include separate operating and high-limit temperature controllers (with field adjustable ranges of 100 degrees to 240 degrees F), water flow switch, differential pressure switch to sense air flow to the burner and a manual reset low gas pressure switch. Boiler shall be equipped with a control panel which will give visual indication of each stage of the firing control sequence as well as any safety lockouts in the limit circuits. The boiler will include an interrupted-type pilot system with electric spark ignition.

Control system shall conform to the requirements of ASME CDS-1.

The combustion chamber shall be constructed of corrosion-resistant aluminum.

The outer cabinet shall be 16-gauge steel finished, both inside and outside, with a baked epoxy finish and be equipped with a heat-resistant glass port for observation of the burner operation.

Main gas manifold shall consist of AGA approved, lubricated manual plug cock, pressure regulator, low gas pressure switch and two separate, solenoid operated, diaphragm valves. Pilot gas manifold shall consist of AGA-approved pilot cock, pressure regulator, gas filter and solenoid valve.

PART 3 - EXECUTION

INSTALLATION OF BOILER:

General: Install boiler in accordance with manufacturer's installation instructions, in accordance with State and local code requirements, and in accordance with requirements of local Utility Company. Install units plumb and level, to tolerance of 1/8 inch in 10'-0" in both directions. Maintain manufacturer's recommended clearances around and over boilers.

Erection: Assemble boiler trim shipped loose, or unassembled for shipment purposes. Follow manufacturer's installation instructions.

Verify that electrical work: installation is in accordance with manufacturer's submittal and installation requirements of Division 26 Sections. Do not proceed with equipment start-up until electrical work is acceptable to equipment Installer.

Gas Piping: Connect gas piping to boiler, full size of boiler gas train inlet, provide union with sufficient clearance for burner removal and service.

Hot Water Piping: Refer to Division 23 section "Hydronic Piping and Specialties". Connect supply and return boiler tappings as indicated, with shutoff valve and union or flange at each connection.

Gas Vent Lines: Individually vent the gas pressure regulator and the low gas pressure switch.

Relief Valve: Pipe relief valve to floor drain.

FIELD QUALITY CONTROL:

Flush and clean boilers upon completion of installation, in accordance with manufacturer's start-up instructions.

Hydrostatically test assembled boiler and piping in accordance with applicable sections of ASME Boiler and Pressure Vessel Code.

Start-up boilers, in accordance with manufacturer's start-up instructions, and in the presence of boiler manufacturer's representative. Test controls and demonstrate compliance with requirements. Adjust burner for maximum burning efficiency. Replace damaged or malfunctioning controls and equipment.

CLOSEOUT PROCEDURES:

Owner's Instructions: Provide services of a technical representative to instruct Owner's personnel in operation and maintenance of boilers.

Schedule training with Owner, provide at least 7-day notice to Contractor and Engineer of training date.

END OF SECTION

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SECTION 23 64 26 Air-Cooled, Rotary-Screw Water Chillers

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes design, performance criteria, refrigerants, controls, and installation requirements for air-cooled rotary screw packaged chillers.

1.02 REFERENCES

A. AHRI 550/590 - Standard for Water Chilling Packages using the Vapor Compression Cycle
B. AHRI 370 - Sound Rating of Large Outdoor Refrigerating and Air-Conditioning Equipment
C. ASHRAE 15 - Safety Code for Mechanical Refrigeration
D. ASHRAE 90.1 - Energy Efficient Design of New Buildings
E. ASME - Boiler and Pressure Vessel Code Section VIII, Division 1

1.03 SUBMITTALS

A. Submit dimensional plan and elevation view drawings, weights and loadings, required clearances, location and size of all field connections, electrical requirements and wiring diagrams.
B. Submit product data indicating rated capacities, accessories and any special data.
C. Submit manufacturer's installation instructions.

1.04 QUALITY ASSURANCE

A. Comply with codes and standards specified.
B. Factory Tested: Packaged chiller shall be pressure tested, evacuated, and fully charged with refrigerant and oil, and be functionally run-tested at the factory.
C. Chiller must be built in an ISO 9001 classified facility.
D. Factory trained and authorized service personnel shall perform pre-startup checks and startup procedures.

1.05 VERIFICATION OF CAPACITY AND EFFICIENCY

A. All proposals for chiller performance must include an AHRI approved selection method.

1.06 DELIVERY, HANDLING AND STORAGE

A. Comply with manufacturer's installation instructions for rigging, unloading, and transporting chillers.
B. Chillers shall be delivered to the job site completely assembled and charged with refrigerant and oil by the manufacturer.
C. If unit is to be stored, comply with manufacturer instructions for storage

1.07 WARRANTY

A. Provide a complete manufacturer 5-year parts, labor, and refrigerant warranty.

1.08 MANUFACTURER STANDARD CONSTRUCTION

A. Exception to these specifications: It is not the intent that any supplier is locked out based on the specifics of that manufacturer's standard construction. Bids will be considered that do not materially differ from the specification so long as construction items differing from this specification are highlighted in the bid submittal and the units will fit into the space without adversely affecting duct layout, maintenance space requirements, and original design intent. The engineer reserves the right to determine which units are acceptable.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Trane, Daikin, Carrier, York

2.02 CHILLER DESCRIPTION

A. The contractor shall furnish and install air-cooled water chiller with screw compressors as shown as scheduled on the contract documents. The chillers shall be installed in accordance with this specification and perform at the specified conditions as scheduled.

2.03 CHILLER OPERATION

A. Low ambient operation; Chiller shall be able to start and operate in ambient conditions down to 0ºF and up to 105ºF. Low ambient operation is accomplished with factory installed and tested protection.
B. Chiller shall be capable of operating with a leaving solution temperature range 40ºF to 68ºF (4.4 to 20ºC) without glycol.

C. Chiller shall be capable of starting up with 95ºF (35ºC) entering fluid temperature to the evaporator. Maximum water temperature that can be circulated with the Chiller not operating is 108ºF (52ºC)
D. Chiller shall provide evaporator freeze protection and low limit control to avoid low evaporator refrigerant temperature trip-outs during critical periods of chiller operation. Whenever this control is in effect, the controller shall indicate that the chiller is in adaptive mode. If the condition exists for more than 30 seconds, a limit warning alarm relay shall energize.

2.04 COMPRESSORS

A. Construct chiller using semi-hermetic, variable speed drive, helical rotary screw compressor per circuit.
B. Compressors shall be vibration isolated from the frame by neoprene compression mounts and include an internal discharge compressor muffler.
C. Provide compressor motor that is suction gas cooled with robust construction and system design protection.
D. Provide oil lubrication system with oil charging valve and oil filter to ensure adequate lubrication during starting, stopping, and normal operation.
E. Provide compressor heater to evaporate refrigerant returning to compressor during shut down. Energize heater when compressor is not operating.
F. Provide compressor with automatic capacity reduction equipment consisting of capacity control via variable speed drive and/or slide valve. Compressor must start unloaded for soft start on motors.
G. Chiller shall be capable of operation down to 20% load without hot gas bypass.

2.05 EVAPORATOR

A. The evaporator shall be designed, tested, and stamped in accordance with ASME code for a refrigerant side working pressure of 200 psig. Waterside working pressure shall be 150 psig.
B. Insulate the evaporator with a minimum of 1.25-inch (K=0.28) UV rated insulation.
C. Evaporator heaters shall be factory installed and shall protect chiller down to -20ºF (-29ºC). Contractor shall wire separate power to energize heat tape and protect evaporator while chiller is disconnected from the main power.
D. Provide parallel plate of shell and tube type evaporator, seamless or welded steel construction with cast iron or fabricated steel heads; dual circuit, brazed plate-to-plate type heat exchanger consisting of parallel stainless-steel plates, or seamless internally and externally finned copper tubes, roller expanded into tube sheets.

E. Provide ability to remove evaporator plates or tubes from the heat exchanger.
F. Evaporator shall have cleanable tubes
G. Provide water drain connection, vent and fittings. Factory installed leaving water temperature control and low temperature cutout sensors.
H. Water connections shall be grooved pipe.
I. Proof of flow shall be provided by the equipment manufacturer, mechanically installed and electrically wired, at the factory of origin.

2.06 FANS

A. Low sound propeller-type fans shall be balanced and direct driven.
B. All condenser fan TEAO motors have permanently lubricated ball bearings and external overload protection.
C. Each condenser fan shall have an integrated drive to provide variable speed for optimized efficiency and lower part load sound.

2.07 CONDENSER

A. Coil shall be microchannel design and shall have a series of flat tubes containing multiple, parallel flow microchannels layered between the refrigerant manifolds. Tubes shall be 9153 aluminum alloy.
Or:
B. Construct condenser coils of aluminum fins mechanically bonded to internally finned copper tube. The condenser coils shall have an integral subcooling circuit and shall be designed for 350 psig or higher working pressure. Leak tested at 1.1 times working pressure.

2.08 ENCLOSURES/CHILLER CONSTRUCTION

A. Unit panels, structural elements and control boxes are constructed of galvanized steel and mounted on a bolted galvanized steel base. Unit panels, control boxes and the structural base are finished with a baked-on powder paint.
B. Control panel doors shall have door stays.
C. Mount starters and Terminal Blocks in a UL 1995 rated weatherproof panel provided with full opening access doors. The circuit shall be a lockable, through-the-door type with an operating handle and clearly visible from outside of chiller indicating if power is on or off.
D. The coating or paint system shall withstand 500 hours in a salt-spray fog test in accordance with ASTM B117.

2.09 ELECTRICAL PANEL

A. Unit shall have a single point power connection.
B. High short circuit current rating (SCCR) of 65A.
C. Fan motors shall have inherent overload protection and compressor motors shall have three-phase motor overload protection.
D. Power semi-conductor and capacitor cooling shall be from a liquid or air cooled heatsink.
E. A molded case standard interrupting capacity circuit breaker shall be factory pre-wired with terminal block power connections and equipped with a lockable external operator handle, making it available to disconnect the chiller from main power.
F. A control power transformer shall be factory-installed and factory-wired to provide unit control power.
G. Unit wiring shall run in liquid-tight conduit.
H. Factory-supplied power components shall include:
    1. Individual contactors and circuit breakers for fan motors,
    2. Circuit breakers and factory-mounted transformers for each control-circuit,
    3. Unit power terminal blocks for connection to remote disconnect switch,
    4. Terminals for power supply to the evaporator heater circuit.
    5. Fan motors shall have inherent overload protection and compressor motors shall have three-phase motor overload protection.

2.10 CHILLER MOUNTED ADAPTIVE FREQUENCEY DRIVE (AFD)

A. The water chiller shall be furnished with a fluid cooled Adaptive Frequency Drive (AFD) as shown on the drawings.
B. The AFD efficiency shall be 97% or better at full speed and full load. Fundamental displacement power factor shall be a minimum of 0.96 at all loads for AFD. All other starters shall have a minimum displacement power factor of 0.85.

2.11 REFRIGERANT CIRCUIT

A. All chillers shall have independent circuits for each compressor.
B. Provide for refrigerant circuit:
    1. Liquid line shutoff valve
    2. Suction service valve
    3. Discharge service valve
    4. Filter (replaceable core type)
    5. Liquid line sight glass.

6. Electronic expansion valve sized for maximum operating pressure
7. Charging valve
8. Discharge and oil line check valves
9. High side pressure relief valve
10. Integrated oil loss sensor

C. Full operating charge of R134a and oil.

2.12 CONTROLS

A. A color, touch sensitive liquid crystal display (LCD) shall be unit mounted and a minimum of 7" diagonal. Graphical Icons provide links to sub menus on the subsystem's operations.
B. Display shall consist of a menu driven interface with easy touch screen navigation to organized sub-system reports for compressor, evaporator, and motor information as well as associated diagnostics.
C. The chiller control panel shall provide password protection of all setpoints
D. The controller shall have the ability to display all primary sub-system operational parameters on dedicated trending graphs.
E. Chilled water temperature control shall be microprocessor-based, proportional and integral controller to show water and refrigerant temperature, refrigerant pressure, and diagnostics.
F. The front of the chiller control panel shall display the following in clear language, without the use of codes, look-up tables, or gauges:
    1. Run time.
    2. Number of starts.
    3. Current chiller operating mode.
    4. Chilled water set point and set point source.
    5. Electrical current limit set point and set point source.
    6. Entering and leaving evaporator water temperatures.
    7. Saturated evaporator and condenser refrigerant temperatures.
    8. Evaporator and condenser refrigerant pressure.
    9. Oil tank pressure.
    10. Intermediate oil pressure in the compressor.
    11. Compressor motor current per phase.
    12. Compressor motor percent RLA.
    13. Compressor motor voltage per phase.
    14. Phase reversal/unbalance/single phasing and over/under voltage protection.
    15. Low chilled water temperature protection.
    16. High and low refrigerant pressure protection.
    17. Load limit functions (both current based or pulldown rate based) to limit compressor loading on high return water temperature.

18. Condenser fan sequencing to automatically cycle fans in response to load, expansion valve pressure, condenser pressure, and differential pressure to optimize chiller efficiency.
19. Display diagnostics.
20. Oil pressure control based off of maintaining system differential pressure.
21. Compressors: Status (on/off), %RLA, anti-short cycle timer, and automatic compressor lead-lag.
22. Oil loss indication.

G. Weatherproof control panel shall be mounted on chiller, containing starters, power and control wiring, factory wired with terminal block power connection. Provide primary and secondary fused control power transformer.

H. The chiller controller will automatically take action to prevent chiller shutdown due to abnormal operating conditions associated with: evaporator refrigerant temperature, high condensing pressure and motor current overload.

I. Provide the following safety controls with indicating lights or diagnostic readouts.
1. Low chilled water temperature protection.
2. High refrigerant pressure.
3. Low oil flow protection.
4. Loss of Oil diagnostic
5. Loss of chilled water flow.
6. Contact for remote emergency shutdown.
7. Motor current overload.
8. Phase reversal/unbalance/single phasing.
9. Over/under voltage.
10. Failure of water temperature sensor used by controller.
11. Compressor status (on or off).

J. Provide the following operating controls:
1. A variable method to control capacity in order to maintain leaving chilled water temperature based on PI algorithms. Five-minute solid state anti-recycle timer to prevent compressor from short cycling. Compressor minimum stop-to-start time limit shall be 2 minutes.
2. Load limit functions to limit compressor loading on high return water temperature to prevent nuisance trip outs.
3. High condenser pressure limit controls that unloads compressors to keep head pressure under control and help prevent high pressure nuisance trip outs on days when outside ambient is above design.
4. Compressor current limit controls that unloads compressors to help prevent current overload nuisance trip outs.
5. Low ambient lockout control with user adjustable setpoint.

6. Condenser fan sequencing which adjusts the speed of all fans automatically in response to ambient, condensing pressure and expansion valve pressure differential thereby optimizing chiller efficiency.

K. Provide user interface on the front of the panel. If display is on the inside of the panel, then a control display access door shall be provided to allow access to the display without removal of panels. Provide user interface with a minimum of the following features:
   1. Leaving chilled water setpoint adjustment from touch panel input
   2. Entering and leaving chilled water temperature output
   3. Percent RLA output for each compressor
   4. Pressure output of condenser
   5. Pressure output of evaporator
   6. Ambient temperature output
   7. Voltage output
   8. Current limit setpoint adjustment from LCD input.

L. The chiller control panel shall provide leaving chilled water temperature reset based upon return water temperature.

M. Digital Communications to BAS system shall consist of a BACnet MS/TP interface via a single twisted pair wiring.

2.13 SOUND

A. Acoustics: Manufacturer must provide both sound power and sound pressure data in decibels, per AHRI 370. A-weighted sound pressure at 30 feet should be provided at 100%, 75%, 50% and 25% load points to identify the full operational noise envelope.

B. If manufacturer cannot meet the noise levels, sound attenuation devices and/or barrier walls must be installed to meet this performance level.

C. Chiller shall ship with a muffler on each rotary screw compressor and very low noise condenser fans to meet the scheduled sound levels. If chiller does not meet sound levels, chiller manufacturer shall provide additional attenuation features.

2.14 OPTIONS AND ACCESSORIES

A. Chiller shall have full architectural louvers panels.

B. Chiller shall ship with elastomeric Isolators

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's requirements.

1. Level the chiller using the base rail as a reference. The chiller must be level within 1/2" in over the entire length and width. Use shims as necessary to level the chiller.

3.02 SERVICE AND START-UP

A. Startup - Provide all labor and materials to perform startup. Startup shall be performed by a factory-trained technician. Technician shall confirm that equipment has been correctly installed and passes specification checklist prior to equipment becoming operational and covered under OEM warranty. This shall be done in strict accordance with manufacturer's specifications and requirements.

B. A start-up log shall be furnished by the factory approved start-up technician to document the chiller's start-up date and shall be signed by the owner or his authorized representative prior to commissioning the chillers.

END OF SECTION

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SECTION 23 73 10 – VARIABLE AIR VOLUME AIR HANDLING UNITS

PART 1 - GENERAL

GENERAL CONDITIONS

The work described hereunder shall be installed in accordance with the "Mechanical General Provisions," Section 23 01 00.

DESCRIPTION OF THE WORK

In general, the work consists of, but is not limited to, the following:

Provide and install air handling units including factory start-up and warranties per schedule and plans.

RELATED WORK

Electrical power wiring is specified in the Electrical Sections.

All utility connections, including power, control, drains, chilled water, heating hot water; are described elsewhere.

QUALITY ASSURANCE

Air Handling Units: Certify capacity, static pressure, fan speed, horsepower and selection procedures in accordance with ARI 430.

Air Coils: Certify capacities, pressure drops and selection procedures in accordance with ARI 410.

Air-handling Unit Assembly: Shall have UL certification for safety, including use with electric heat. Units requiring electric connection shall be listed and classified by ETL and CSA as suitable for the purpose specified and indicated.

Air-handling Unit Assembly: Shall meet NFPA 90A requirements.

MANUFACTURER'S STANDARD CONSTRUCTION

Exception to these specifications: It is not the intent that any supplier is locked out based on the specifics of that manufacturer's standard construction. Bids will be considered that do not materially differ from the specification so long as construction items differing from this

specification are highlighted in the bid submittal and the units will fit into the space without adversely affecting duct layout, maintenance space requirements, and original design intent. The engineer reserves the right to determine which units are acceptable.

SUBMITTALS

Submit to the Architect/Engineer for approval electronic of brochures, technical data and/or shop drawings and as many additional copies as required for Contractor use.

Performance data indicating nominal capacity, sound data in accordance with AMCA 300, performance curves per ARI, fan power required, entering & leaving water temperatures, flow rates, and pressure drops.

Submit product data: materials of construction and corrosion protection, required clearances, field connections, weight, motor data, specialties and accessories.

Submit installation instructions, including field-wiring diagrams, required utility connections and manufacturer's recommendations. Provide a list of components which will be shipped loose for field assembly. Identify any special handling and storage procedure necessary to protect the equipment prior to operation.

Provide O&M manuals: Include manufacturer's descriptive literature, wiring diagrams, start-up instructions, and maintenance procedures. Provide a schedule of recommended periodic inspection and preventive maintenance procedures. Provide a list of any spare parts recommended for start-up or on-site storage.

WARRANTY

Provide manufacturer's standard one-year full parts and labor warranty.

PART 2 - PRODUCTS

GENERAL

Provide double-walled air handling unit specifically designed for the intended service. The unit shall be factory fabricated, assembled and tested. Units shall ship fully assembled unless directed otherwise. The unit shall perform as indicated in the Schedule and shall be configured to include all components/sections indicated on the Drawings.

CASING

Unit shall be constructed of galvanized steel casing panels with 2" thick polyurethane foam filled

insulation. Coils shall be removable without cutting any panels.

Top or side lugs shall be provided for supporting the unit.

Base rails of 6” height shall be provided to support the cabinet.

Construct unit casing exterior panels of G90 galvanized steel.

The unit shall have a complete double wall internal liner of G60 galvanized steel.

Side panels shall be easily removable from both sides of unit for access to unit and shall seal against a full perimeter automotive style neoprene gasket to ensure a tight seal.

The panel retention system shall comply with UL 1995 which states all moving parts (for example, fan blades, blower wheels, pulleys, and belts) that, if accidentally contacted, could cause bodily injury, shall be guarded against accidental contact by an enclosure requiring tools for removal.

Accessibility options shall be as follows:

a. Hinged double-wall access door with quarter-turn latch on fan side with removable access panel(s) on the other side.
b. Hinged double-wall access doors on access sides.
c. Removable double-wall access panels on opposite side of hinged door.
d. Hinged double-wall access door to filter with quarter-turn latch.

Fan supports, structural members, panels, or flooring shall not be welded, unless aluminum, stainless steel, or other corrosion-resistant material is used. Painted welds on unit exterior steel or galvanized steel are not acceptable.

All sections shall be double-wall construction with insulation sealed between the inner and outer panels. Panel assemblies shall not carry an R-value of less than 13.

Access Doors: Access doors shall be one piece, double-wall construction with insulation sealed between the inner and outer panels. Panel assemblies shall not carry an R-value of less than 13.

Cooling Coil Drain Pans: Drain pans for cooling coils shall be stainless steel construction. The pan shall be sloped in four (4) directions toward the drain fitting. Drain pan shall have recessed bottom drain connections. Drain pan shall allow no standing water and comply with ASHRAE Standard 62.

Heating Coil Drain Pans: Provide anti-microbial galvanized steel double-sloped drain pan with drain fitting.

Finish: Galvanized or Manufacturer standard paint

FANS

Provide direct-drive plenum fan. Fan assemblies including fan, motor and sheaves shall be dynamically balanced by the manufacturer on all three planes and at all bearing supports. Manufacturer must ensure maximum fan RPM is below the first critical speed.

Fan and motor assembly shall be mounted on vibration isolators inside cabinetry.

Units shall be certified in accordance with the central station air handling unit's certification program, which is based on AHRI Standard 430.

BEARINGS AND DRIVES

Bearings: Basic load rating computed in accordance with AFBMA - ANSI Standards, L-50 life at 200,000 hours heavy-duty pillow block type, self-aligning, grease lubricated ball bearings, with lubrication fittings. Provide extended grease lines to drive/access side of unit casing, for all fan bearings, rigidly attached for easy service access.

Shafts shall be solid, hot rolled steel, ground and polished, keyed to shaft, and protectively coated with lubricating oil. Hollow shafts are not acceptable.

V-Belt drives shall be adjustable cast iron or steel sheaves, dynamically balanced, bored to fit shafts and keyed.

Fixed and adjustable pitch motor sheaves shall be provided.

Final RPM is obtained with sheaves set at mid-position and rated motor horsepower.

Contractor to furnish fixed sheaves at final RPM as determined by balancing contractor.

MOTORS AND DRIVES

Units shall have internal motor and drives and shall be provided with a full-size removable service door on the drive side of the fan(s).

All three-phase motors shall have a ± 10% voltage utilization range and a 1.15 minimum service factor. Motor shall be compliant with EPACT where applicable.

Fan motors shall be heavy duty, premium efficiency, open drip proof (ODP) with Class F insulation. Motor shall be rated for VFD inverter duty and labeled accordingly.

COILS

All coil sections shall be provided with drain pans for condensate removal and cleaning operations. The drain pan shall extend under the complete coil and coil-access section.

Water Coils

All coils shall be enclosed in an insulated coil section. Coil headers and U-bends shall not be exposed.

Coil connections shall be MPT and constructed of bronze or suitable dielectric fitting/coupling.

Coils shall be counter flow design, constructed of copper tubes, aluminum plate fins, copper header and nozzles, stainless steel tube sheet and coil casing.

Coils shall be leak tested to 320-psig air pressure under water.

Fins shall have collars drawn, belled and firmly bonded to the tubes by means of mechanical expansion of the tubes. No soldering or tinning shall be used in the bonding process. Coils shall be mounted in the unit casing to be accessible for service and can be removed from the unit either through the side or top. Capacities, pressure drops and selection procedure shall be certified in accordance with ARI Standard 410.

FILTERS

Provide factory fabricated filter section of the same construction and finish as unit casing with filter guides and hinged, removable double-wall access doors.

Provide flat pre-filter section to accommodate two-inch thick 30% efficient filters. Provide a final filter section to accommodate four-inch-thick MERV 11 filters. Filters shall be removable from one side of the filter section.

Provide two sets of pleated media equal to FARR 30-30.

ACCESS SECTIONS

Access shall be supplied as shown on the plans. Access doors shall be provided on one side of each section.

ADDITIONAL SECTIONS

If scheduled, include energy recovery wheel.

Access section shall be provided for access between components.

Energy recovery wheel shall be constructed of corrugated synthetic fibrous media, with a desiccant intimately bound and uniformly and permanently dispersed throughout the matrix structure of the media. Rotors with desiccants coated bonded, or synthesized onto the media are not acceptable due to delaminating or erosion of the desiccant material. Media shall be synthetic to provide corrosion resistance and resistance against attack from laboratory chemicals present in pharmaceutical, hospital, etc. environments as well as attack from external outdoor air conditions. Face flatness of the wheel shall be maximized in order to minimize wear on inner seal surfaces and to minimize cross leakage. Rotor shall be constructed of alternating layers of flat and corrugated media. Wheel layers should be uniform in construction forming uniform aperture sizes for airflow. Wheel construction shall be fluted or formed honeycomb geometry so as to eliminate internal wheel bypass. Wheel layers that can be separated or spread apart by airflow are unacceptable due to the possibility of channeling and performance degradation.

Desiccant Material: The desiccant material shall be a molecular sieve, and specifically a 4A or smaller molecular sieve to minimize cross contamination. Wheel Media Support System: The wheel frames shall consist of evenly spaced steel spokes, galvanized steel outer band and rigid center hub. The wheel construction should allow for post fabrication wheel alignment. Wheel Seals: The wheel seals shall be full contact nylon brush seals or equivalent. Seals should be easily adjustable. Wheel cassette: Cassettes shall be fabricated of heavy duty reinforced galvanized steel or welded structural box tubing. Cassettes shall have a built-in adjustable purge section minimizing cross contamination of supply air as shown on unit schedule. Bearings shall be inboard, zero maintenance, permanently sealed roller bearings, or alternatively, external flanged or pillow block bearings. Drive systems shall consist of fractional horsepower AC drive motors with multi-link drive belts.

Certification: The wheel shall be AHRI certified by the energy recovery wheel supplier to AHRI Standard 1060 and must bear the AHRI certification stamp. The wheel shall be listed or recognized by UL or equivalent.

PART 3 EXECUTION

AIR HANDLING UNIT DELIVERY AND SETTING

Protect units on site from physical damage and internal access. Handle carefully to avoid

damage to components, enclosures, and finish. Protect coils.

Entire installation shall be in accordance with the applicable requirements of the manufacturer.

Support unit on ½" thick neoprene isolation pads located below base rails on 2' centers or as required by manufacturer. Locate units in space to facilitate maintenance, duct and piping layouts, and to comply with the manufacturer's access requirements.

PIPING

Install coil piping, valves, flexible pipe connections, etc. Support piping so no weight bears on coil headers. See plans.

Install condensate piping and terminate in the nearest hub drain, see plans.

DUCTWORK

Install ductwork per plans. Space ducts to allow for insulation. Route ductwork as high as possible to optimize ceiling heights. Coordinate installation with other trades.

CONTROLS

Install controls per plans.

START-UP

Vacuum and wet wipe interior or unit.

Remove shipping restraints at fan assembly.

Install new air filters, lubricate bearings, verify condensate is properly trapped, piping configuration is correct, belts aligned and tensioned, all shipping braces have been removed, and fan has been test-run under observation.

Test controls, motor rotation, zone dampers, safeties, etc. prior to startup.

Perform startup per the manufacturer's recommendations.

END OF SECTION

Leon County Schools
Leon High School
Building 7 Gymnasium Remodeling & Renovation Project
550 East Tennessee Street
Tallahassee, Florida 32308
LCSB RFQ #504-2023
H+SA#22.133
August 25, 2023

SECTION 23 81 16 – ROOM AIR-CONDITIONERS

PART 1 - GENERAL

GENERAL CONDITIONS

The work described hereunder shall be installed in accordance with the "Mechanical General Provisions," Section 23 01 00.

DESCRIPTION OF THE WORK

In general, the work consists of, but is not limited to, the following:

Provide and install fan coil or blower coil units including warranties per schedule and plans.

RELATED WORK

Electrical power wiring is specified in the Electrical Sections.

All utility connections, including power, control, drains, chilled water, heating hot water; are described elsewhere.

QUALITY ASSURANCE

Fan Coil and Blower Coil Units: Certify capacity, static pressure, fan speed, horsepower and selection procedures in accordance with ARI 410 or 440.

Air Coils: Certify capacities, pressure drops and selection procedures in accordance with ARI 410.

Unit Assembly: Shall have UL certification for safety, including use with electric heat. Units requiring electric connection shall be listed and classified by ETL and CSA as suitable for the purpose specified and indicated.

Air-handling Unit Assembly: Shall meet NFPA 90A requirements.

MANUFACTURER'S STANDARD CONSTRUCTION

Exception to these specifications: It is not the intent that any supplier is locked out based on the specifics of that manufacturer's standard construction. Bids will be considered that do not materially differ from the specification so long as construction items differing from this specification are highlighted in the bid submittal and the units will fit into the space without

adversely affecting duct layout, maintenance space requirements, and original design intent. The engineer reserves the right to determine which units are acceptable.

SUBMITTALS

Submit to the Architect/Engineer for approval electronic of brochures, technical data and/or shop drawings and as many additional copies as required for Contractor use.

Performance data indicating nominal capacity, sound data in accordance with AHRI 260, performance curves per ARI, fan power required, entering & leaving water temperatures, flow rates, and pressure drops.

Submit product data: materials of construction and corrosion protection, required clearances, field connections, weight, motor data, specialties and accessories.

Submit installation instructions, including field-wiring diagrams, required utility connections and manufacturer's recommendations. Provide a list of components which will be shipped loose for field assembly. Identify any special handling and storage procedure necessary to protect the equipment prior to operation.

Provide O&M manuals: Include manufacturer's descriptive literature, wiring diagrams, start-up instructions, and maintenance procedures. Provide a schedule of recommended periodic inspection and preventive maintenance procedures. Provide a list of any spare parts recommended for start-up or on-site storage.

WARRANTY

Provide manufacturer's standard warranty.

PART 2 - PRODUCTS

GENERAL

Provide double-walled blower coils or single wall fan coils specifically designed for the intended service. The unit shall be factory fabricated, assembled and tested. Units shall ship fully assembled unless directed otherwise. The unit shall perform as indicated in the Schedule and shall be configured to include all components/sections indicated on the Drawings.

CASING

Unit shall be constructed of galvanized steel casing panels with 1" thick closed cell foam insulation. Coils shall be removable without cutting any panels.

Top or side lugs shall be provided for supporting the unit.

For vertical units, base rails of 3" height shall be provided to support the cabinet. Horizontal units shall be provided with support brackets for hanging from above.

Construct unit casing exterior panels of galvanized steel panels to meet 125-hour salt spray test.

Side panels shall be easily removable from one sides or bottom of unit for access to unit and shall seal against a full perimeter neoprene gasket to ensure a tight seal.

The panel retention system shall comply with UL 1995 which states all moving parts (for example, fan blades, blower wheels, pulleys, and belts) that, if accidentally contacted, could cause bodily injury, shall be guarded against accidental contact by an enclosure requiring tools for removal.

Fan supports, structural members, panels, or flooring shall not be welded, unless aluminum, stainless steel, or other corrosion-resistant material is used.

Panel assemblies shall not carry an R-value of less than 6.

Access Doors: Access doors shall be one piece with insulation sealed between the inner and outer panels. Panel assemblies shall not carry an R-value of less than 6.

Cooling Coil Drain Pans: Drain pans for cooling coils shall be stainless steel construction and extend to complete unit.

Finish: Manufacturer's standard paint.

FANS

Provide forward curved fans with ECM motors. Fan assemblies including fan and motor shall be dynamically balanced by the manufacturer.

Motor shall be capable of accepting a 2-10 VDC output from BAS.

COILS

All coils shall be ARI 410 certified and tagged with an ARI 410 label.

All cooling and heating coils shall optimize rows, circuit count, and fin density to meet the specified capacity. Coils shall have seamless copper tubes and shall be mechanically expanded

to provide an efficient, permanent bond between the tube and fin. Fins shall have high efficiency aluminum surface optimized for heat transfer, air pressure drop and carryover.

All coils shall be hydrostatically tested at 450 PSIG air pressure under water, and rated for a maximum of 450 PSIG working pressure at 200°F.

Direct expansion cooling coils shall include a fixed orifice distributor. All evaporator coils shall be factory sealed and charged with a minimum 5 PSIG nitrogen or refrigerated dry air. Steam coils shall be standard steam type suitable for temperatures above 35°F and 15 PSIG maximum working pressure.

All coils shall be provided with a manual air vent fitting to allow for coil venting.

FILTERS

Provide factory fabricated filter section of the same construction and finish as unit casing with filter guides and hinged, removable double-wall access doors.

Provide flat pre-filter section to accommodate two-inch thick MERV 11 filters.

ACCESS SECTIONS

Access shall be supplied as shown on the plans. Access doors shall be provided on one side of each section.

PART 3 EXECUTION

AIR HANDLING UNIT DELIVERY AND SETTING

Protect units on site from physical damage and internal access. Handle carefully to avoid damage to components, enclosures, and finish. Protect coils.

Entire installation shall be in accordance with the applicable requirements of the manufacturer.

Support unit on ½" thick neoprene isolation pads located below base rails on 2' centers or as required by manufacturer. Locate units in space to facilitate maintenance, duct and piping layouts, and to comply with the manufacturer's access requirements.

PIPING

Install coil piping, valves, flexible pipe connections, etc. Support piping so no weight bears on coil headers. See plans.

Install condensate piping and terminate in the nearest hub drain, see plans.

DUCTWORK

Install ductwork per plans. Space ducts to allow for insulation. Route ductwork as high as possible to optimize ceiling heights. Coordinate installation with other trades.

CONTROLS

Install controls per plans.

START-UP

Vacuum and wet wipe interior or unit.

Remove shipping restraints at fan assembly.

Install new air filters, lubricate bearings, verify condensate is properly trapped, piping configuration is correct, belts aligned and tensioned, all shipping braces have been removed, and fan has been test-run under observation.

Test controls, motor rotation, zone dampers, safeties, etc. prior to startup.

Perform startup per the manufacturer's recommendations.

END OF SECTION

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SECTION 26 00 00 ELECTRICAL GENERAL REQUIREMENTS

PART 1 - GENERAL

APPLICATION

The work described hereunder shall be installed subject to the Contractual Conditions for the entire Specifications.

These provisions apply to all sections of Division 16 of this project except as specified otherwise in each individual section. Codes, standards, policies and requirements contained in this Section are applicable to all contract documentation.

CORRELATION

This Section of the Specifications and its accompanying Drawings are made separate for the convenience of the General Contractor / Construction Manager in preparing his bid and in no way relieves the General Contractor / Construction Manager of his responsibility to correlate the work under this Section with that of all other trades as regards the items to be furnished by various Subcontractors, the exact location of all equipment and materials and the necessity of planning the work of all trades to avoid interference.

DESCRIPTION OF WORK

Furnish all labor, materials, equipment and incidentals required to complete all electrical work as specified in this Division and as shown on the Contract Drawings. Division 16 work shall include the installation of a complete and properly operating electrical system.

Refer to other Divisions of this specification for electrical requirements of factory installed motors, controllers, power supplies, etc. Electrical connections to equipment furnished as specified in other sections of these Specifications or shown on other than the Electrical Drawings shall be governed by this Division of the Specifications.

The bidder shall inspect the present jobsite conditions before preparing his bid. The submission of a bid will be considered evidence that such a visit and inspection was performed by the bidder and that he takes full responsibility for all factors governing his work.

The electrical work shall be complete, fully operational, and suitable in every way for the service required. Drawings are generally diagrammatic in nature and do not show all details, devices and incidental materials necessary to accomplish their intent. Therefore, it shall be understood that such devices and incidental materials required shall be furnished at no cost to the Owner.

RELATED WORK

Drawings and general provisions of Contract, including General Conditions, Supplementary General Conditions, and Special Conditions sections apply to work specified in Division 16.

The Contractor shall be aware that other divisions of these Specifications may apply to related work required to perform Division 16 requirements. All related work shall be performed in accordance with those divisions.

CONFORMANCE

If the Contractor takes no exceptions to these Specifications in the Submitted Bid, the Contractor will be held totally responsible for failure to comply.

Any exception to the Specification shall reference the affected paragraph(s), subject(s), and list benefit to the Owner.

The Owner reserves the right to have the Contractor replace installed material or equipment which does not comply with these Specifications at the Contractor's expense.

SUBMITTALS

Obtain approval before procurement, fabrication, or delivery of items to the job site. Submit manufacturers' data on the equipment listed below and as directed in other Sections of Division 16. Follow the procedures required in Division 1 of this specification. Data shall be in the form of manufacturer’s descriptive data sheets and engineering drawings and will be reviewed by the Architect/Engineer before materials and equipment are delivered to the work site. Review of the submittal by the Architect/Engineer is to check for general conformance to the design intent and will not relieve the Contractor of the responsibility for the correctness of all dimensions, conformance and the proper fitting of all parts of the work.

Panelboards and Circuit Breakers
Disconnect Switches
Plugs and Receptacles
Motor Starters
Transformers
Surface Mounted Raceway and Installation Drawings
Pullboxes
Wire Guards
Surge Protection Devices
Lighting Fixtures
Lighting Controls and Installation Drawings*

Fire Alarm System and Devices and Installation Drawings*

* prepared by Manufacturer or System Supplier

Submit manufacturers' names and catalog numbers for the following materials:

Conduit, Fittings, and Couplings
Boxes and Fittings
600 Volt Wire and Cables
Grounding Equipment

The Contractor shall thoroughly check the submittal for accuracy and compliance with the contract requirements. Shop drawings and data sheets shall bear the date checked and shall be accompanied by the Contractor's statement that they have been checked for conformity to the Specifications and Drawings. Submittals not so checked and noted will be returned without review.

Deliver the entire electrical submittal to the Architect/Engineer complete and in one package. An incomplete submittal will be returned to the Contractor without review.

EQUIPMENT SUBSTITUTIONS

Substitutions that do not increase installation value will not be accepted.

Contractor proposed substitutions may result in necessary changes to the construction documents. Coordination effort due to Contractor proposed substitutions shall be the complete responsibility of the Contractor. All potential conflicts are to be addressed. The Contractor shall also be responsible for any work of any other trades made necessary by the substitution. All potential conflicts with other trades are to be addressed.

The Architect's review of the proposed substitutions and coordination documents is for the benefit of the Owner and not the Contractor and does not relieve the Contractor of responsibility for making any corrections necessary to insure the Owner receives full benefit of the original design intent.

Detailed coordination documents shall be provided for any equipment that, in the opinion of the Architect/Engineer, materially differs from the design documents. This difference includes but is not limited to any equipment having:

- access requirements that differ from the design / specification
- operating characteristics that differ from the design / specification
- footprints or elevations that differ from the design / specification
- connection requirements or locations that differ from the design / specification
- venting or combustion air requirements that differ from the design / specification

- electrical characteristics that differ from the design / specification
- control requirements that differ from the design / specification
- hydronic characteristics that differ from the design / specification
- plumbing requirements that differ from the design / specification

Documentation shall include a detailed listing of all differences from the design / specification. Also included will be a detailed explanation as to why these differences should be considered equal or an improvement.

Any physical differences shall be coordinated with drawings. All Coordination Drawings shall be produced by a competent drafts person and shall be equivalent in quality, detail, and scope to the Construction Drawings.

Acceptance of the substitution as an equal will be the sole descretion of the Architect/Engineer. Items of necessary coordination or review omitted from the documentation shall be grounds for rejection of the substitution.

No cost increase to the Owner for any changes due to coordination will be considered. The Architect/Engineer shall be compensated for any and all efforts associated with review and coordination of non-conforming equipment

CODES, INSPECTION AND FEES

Comply with the indicated edition of the following codes and ordinances. Where specific edition is not indicated, comply with the latest published edition.

American National Standards Institute - ANSI
C2 – 1994 - The National Electrical Safety Code
ANSI/IEEE C37.90.1 2012 Surge Withstand Capability (Swc) Tests For Relays And Relay Systems Associated With Electric Power Apparatus
C62.41 - 1980 Transient Voltage Surge Suppressors
American Society for Testing and Materials - ASTM
National Fire Protection Association - NFPA
NFPA 70; The National Electrical Code
NFPA 72; The National Fire Alarm Code
NFPA 90A; Standard for the Installation of Air Conditioning and Ventilating Systems
NFPA 101; The Life Safety Code
Florida Building Code
FBC-B 2020; The Florida Building Code 7th Edition
FPC 2020; The Florida Fire Prevention Code 7th Edition
FBC-M 2020; The Florida Mechanical Code 7th Edition
FBC-P 2020; The Florida Plumbing Code 7th Edition
FBC-A 2020; The Florida Accessibility Code 7th Edition

State Requirements for Educational Facilities, 2014 Edition
Electronic Industries Association/Telecommunications Industries Association - EIA/TIA
568C - Commercial Buildings Telecommunications Cabling Standards
569 - Commercial Buildings Standard for Telecommunications Pathways and Spaces
606 - Administrative Standard for Telecommunications Infrastructure of Commercial Buildings
607B - Commercial Building Grounding and Bonding Requirements for Telecommunications
Federal Communications Commission - FCC
Insulated Cable Engineers Association - ICEA
Institute of Electrical and Electronic Engineers – IEEE (latest edition)
383 Vertical Flame Test
587 Transient Voltage Surge Suppressors
802 Specifications for Local Area Networks
1547 Interconnecting Distributed Resources with Electric Power Systems
1547.1 Standard Conformance Test Procedures for Equipment Interconnecting Distributed Resources with Electric Power Systems
National Electrical Manufacturers Association
NEMA ICS 1 – 2000; Industrial Control and Systems General Requirements
NEMA ICS 2 – 2000; Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts
NEMA AB3 - 2013 “Molded Case Circuit Breakers”.
Serving Utility Company Policies
City of Tallahassee Municipal Codes and Requirements
Underwriters Laboratories - UL
5 Surface Raceway
444 Communications Cable
467 Electrical Grounding and Bonding Equipment
506 Enclosures 514A Outlet Boxes and Fittings
514C Non-metallic Outlet Boxes and Fittings
1449 Transient Voltage Surge Suppressors
1863 Communications Devices

Obtain all permits required. Contractor shall pay all fees for permits and inspections.

COMPLIANCE AND REVIEW

Within two weeks of the awarding of the contract, and before any work is commenced, the Contractor shall meet with all legal authorities having jurisdiction, review all materials and details of this project, and agree on any required revisions. A letter shall be forwarded to the Architect/Engineer listing the names, dates and place of such review and the revisions required. A copy of the letter shall also be sent to the reviewing authority.

The Contractor shall also meet with each serving utility and repeat the above procedure. A letter certifying each meeting shall also be written with the information as described above.

TEMPORARY LIGHTING AND POWER

Provide temporary lighting and power during construction. The Contractor may utilize existing building distribution power for temporary and construction power. Temporary power shall be 120/208 volt, single phase.

Temporary wiring shall be done in a safe and neat manner. See Article 590 of the NEC.

Provide a minimum of one (1) 100 watt incandescent lamp for every 300 square feet of interior space being constructed.

Provide 30 amp, 120/240 volt single phase power points throughout the construction area such that a power point will be within fifty feet of where any saws, drills, or other electrical tool is being used. Each power point shall have a disconnecting safety switch.

Provide 20 amp receptacles with ground fault interrupting circuitry. Outdoor or otherwise exposed receptacles shall have weatherproof covers. Provide any necessary special outlets required.

Size temporary power conductors so that voltage drop is kept below 5% at maximum designed load at the delivery point.

RECORD DOCUMENTS

Prepare record documents in accordance with Division 1 requirements. Record documents shall be complete and accurate and clearly show deviations to the Contract Drawings. Additionally, indicate major raceway sizes and routings, locations of all control devices, all equipment and locations to scale, and fuse and circuit breaker ratings and arrangements.

Record documents shall reflect the complete contract record, including all changes, supplements and addenda as issued. All drawings, sketches and notations describing the work and as issued by the Architect/Engineer shall be incorporated.

Prepare bound sets of equipment Operation and Maintenance Instructions. These instructions shall include the name and location of the system, the name and telephone number of the Contractor, and all subcontractors installing the system or equipment, and the name and telephone number of each local manufacturer's representative for the system or equipment. Routine maintenance actions shall be clearly identified and include a listing of approved disposable materials necessary.

Furnish bound copies of all test results required in other sections of this division.

GUARANTEES

Equipment: one (1) year from final acceptance by the Owner. Materials and labor: one (1) year from final acceptance by the Owner.

All equipment shall be warranted to be free from defects in workmanship, design and materials. If any part of the equipment should fail during the warranty period, it shall be replaced and the unit(s) restored to service at no expense to the Owner.

In addition to the guarantee of equipment by the manufacturer the Contractor shall also guarantee such equipment for a period of one (1) year from final acceptance by the Owner. The Contractor's one (1) year guarantee shall be for equipment, materials, and labor.

The manufacturer's warranty period shall run concurrently with the Contractor's warranty period. No exception to this provision will be allowed.

Additional guarantee requirements specific to certain parts or assemblies or installations may be in the General and Special Conditions, or other Sections of these Specifications.

PART 2 - PRODUCTS

EQUIPMENT AND MATERIALS

Furnish materials or equipment specified by manufacturers named.

Materials furnished shall be new, undamaged and packed in the original manufacturer's packing.

All equipment and apparatus shall bear the seal of approval of the Underwriter's Laboratory where testing and listing performance criteria has been established for like items.

Protect equipment and materials from mechanical and water damage during construction. Suitable storage facilities shall be provided. Equipment shall not be stored out-of-doors except as follows:

> Concrete items, plastic conduit if protected from sunlight, rigid metal conduit if protected from water and debris, padmounted equipment for outdoor installation if maintained in a normal weathertight condition, ground rods, and large spools of cables with ends properly sealed. In no case will materials be stored directly on the ground. Provide suitable timbers or billets on which items will be stored out of direct contact with the earth.

All items to be installed shall be free of rust and dirt. Damaged materials and equipment shall be replaced by the Contractor at no cost to the Owner.

All electrical panels, enclosures, raceways, conduit, and boxes shall be fabricated of metal unless indicated otherwise.

EQUIPMENT AND MATERIALS STANDARDS

Design and fabrication of electrical equipment and materials:

> The American National Standards Institute (ANSI)
> The American Society of Mechanical Engineers (ASME)
> The American Society for Testing and Materials (ASTM)
> The Institute of Electrical and Electronic Engineers (IEEE)
> The National Electrical Manufacturers Association (NEMA)
> The Occupational Safety and Health Administration (OSHA)
> The Underwriters Laboratories (UL)
> The National Fire Protection Association (NFPA)

Comply with the latest edition and revisions of these codes and standards.

EQUIPMENT RATINGS

Horsepower and wattages of equipment shown on the Drawings are estimated and comply with a certain basis of design. It is the Contractor's responsibility to coordinate with, and furnish proper connections to equipment substituted and accepted as equivalent to the basis of design.

Conduit, wire, disconnects, fuses, and circuit breakers shall be sized to suit the horsepower and wattage of equipment actually furnished. However, conduit, boxes, wire or disconnects shall not be sized smaller than shown on the Drawings.

PART 3 - EXECUTION

QUALITY ASSURANCE

Installer's Qualifications: At least three years of successful installation experience on projects with electrical work similar to that required for this project.

Manufacturer's Qualifications: Manufacturers regularly engaged in the manufacture of electrical components and equipment of the types and sizes required, whose products have been in satisfactory use in similar service for not less than five years.

Electrical work shall be performed by experienced persons skilled in the trade.

Work shall be done neatly and in keeping with good practice and conventions of the trade. The electrical installation shall be of high quality, and of the performance level associated with top level commercial electrical installations as determined by the Architect/Engineer and the National Electrical Code.

IDENTIFICATION

Provide laminated plastic nameplates for each panelboard, safety disconnect, equipment enclosure and all other major pieces of equipment installed or modified as part of this contract.

Furnish all starters, disconnect switches and control panels with engraved name plates identifying the equipment served. Attach nameplates to equipment, aligned with structural features of equipment, with two pressure pins or #4 stainless steel screws, nuts, and lockwashers.

Panelboards shall have typewritten directories with all loads thoroughly described for each circuit. Update existing panelboards and their directories to reflect new work.

CLEANING AND PAINTING

Clean all equipment and boxes thoroughly inside and outside at the completion of installation. Do not leave dirt and debris inside panelboard and equipment cabinets, device and junction boxes, etc.

All painting shall be done according to the Finishes Section of these specifications.

Paint all exposed conduit and wiremold installed on painted surfaces to match surrounding surface. Paint exposed threads on conduits and touch up all scratches in galvanized pipe and fittings with a high quality cold galvanizing compound.

Touchup scratched or marred surfaces of lighting fixtures, panelboards, motor control centers, switchboards, etc. with paint furnished by the equipment manufacturer specifically for the purpose.

Plywood backboards shall be of fire retardant plywood, painted with two coats of fire-resistive finish. See plans for TTB location.

EXCAVATION, TRENCHING AND BACKFILLING

Perform all excavation and trenching to install raceways indicated on the drawings.

No tunneling shall be allowed unless written permission is received by the Architect/Engineer.

Excavated material not suitable for backfill shall be removed from the job site.

Insure that the bottom of trenches are uniform, without large rocks or lumps of dirt which could damage the raceway or conductors.

Backfill with material that will compact readily. Compact backfill material from bottom of excavation up, to within 2” of surrounding undisturbed material.

Cover shall not be less than surrounding grade and no greater than 2" above surrounding grade.

All trenching in and around rooted areas shall be by hand. Contractor shall take all steps necessary to protect existing root growth from damage by trenching or digging. Trenching in proximity to trees and other growth shall be directed radially away from the main trunk so as not to cut across major roots.

All trenching routing shall be coordinated with and approved by the Architect/Engineer before digging. Contractor shall contact the Architect/Engineer twenty four hours before work is

scheduled to begin. Conduit routing shall be clearly laid out with paint or staking before inspection takes place. The Architect/Engineer reserves the right to specify final routing before digging begins, or at any point during the operation.

TESTS

Contractor shall test all wiring for shorts and all equipment for proper grounding before energizing. Equipment shall be thoroughly checked and adjusted for proper operation. Check motors for proper rotation before energizing and adjust if necessary.

END OF SECTION

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Leon County Schools
Leon High School
Building 7 Gymnasium Remodeling & Renovation Project
550 East Tennessee Street
Tallahassee, Florida 32308
LCSB RFQ #504-2023
H+SA#22.133
August 25, 2023

SECTION 26 05 00 BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

SCOPE OF WORK

Furnish all labor, materials and equipment and incidentals required to construct and install the complete electrical systems as indicated on the Drawings and as specified in this Section.

STANDARD OF MATERIALS

All materials, equipment and apparatus covered by this specification shall be new, of current manufacture and shall bear the seal of approval of the Underwriters' Laboratories.

All equipment and materials shall have ratings established by a recognized independent agency or laboratory. The Contractor shall apply the items used on this project within the ratings and subject to any stipulations or exceptions established by the independent agency or laboratory.

All conduits and raceways, wire, devices, panelboards, switches, etc. of a given type shall be the product of one manufacturer.

SUBMITTALS

Manufacturer's data and shop drawings for all components, fixtures, assemblies and accessories indicated in this Division. Submit in accordance with Division 1.

PART 2 - PRODUCTS

HOUSEKEEPING PADS

Housekeeping pads shall be provided for all floor-mounted equipment such as switchgear, motor control centers, transformers, etc. Pads shall be made of concrete extending 3 to 4 inches vertically above finished floor and extending 6 inches horizontally around equipment.

CONDUCTORS

Compliance: Provide wires, cables and connectors that comply with the following standards as applicable:

UL Standard 83	Thermoplastic Insulated Wires and Cables
UL Standard 486A	Wire Connectors and Soldering Lugs for Use with Copper Conductors
UL Standard 854	Service Entrance Cable
NEMA/ICEA WC-5	Thermoplastic Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy

NEMA/ICEA WC-8	Ethylene Propylene Rubber Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy
IEEE Standard 82	Test procedures for Impulse Voltage Tests on Insulated Conductors

Wire and cable manufactured more than twelve months before delivery to the jobsite shall not be used.

All conductors shall be soft-drawn copper of not less than ninety-eight percent (98%) conductivity, with NEC Type THW, THHN, or THWN for No. 4 and smaller, and Type RHW, THW, or THWN for No. 2 and larger, 600 volt insulation.

Jackets: Factory applied nylon or PVC external jacketed wires and cables for installation in raceways and where indicated.

Color coding of all ungrounded service, feeder, and branch circuits conductors shall be required according to the following convention:

120/240 Volt, 1 phase: black and red
120/208 Volt, 3 phase: black, red, and blue
277/480 Volt, 3 phase: brown, orange, and yellow

Ground wires shall be green and neutrals shall be white or gray or other combination per NEC. Isolated grounding conductors shall be green with yellow stripe or green with applied yellow tape to indicate isolated ground. Ground and grounded wire colors shall be used for these purposes only. Where grounded conductors of different systems are installed in the same raceway, box, auxiliary gutter, or other type of enclosure, each grounded conductor shall be individually identified by system. Additional grounded conductors shall be white with a readily distinguishable colored stripe, other than green, running along the insulation.

Conductors No. 12 AWG through No. 10 AWG shall be solid and No. 8 AWG and larger shall be stranded. No conductors smaller than No. 12 AWG shall be used except as otherwise noted.

Acceptable manufacturers: Anaconda Wire and Cable Co., General Electric Co., Okonite Co., Southwire Co., or Rome Cable Co.

CABLES AND CABLE ASSEMBLIES

Cables and cable assemblies for variable frequency drive (VFD) application shall conform to the following: 4-conductor, (3) stranded tinned copper ungrounded conductors plus (1) grounding conductor with cross linked polyethylene XLP insulation. Overall metal foil shielding plus tinned copper braided shielding not less than 85 per cent coverage. Tinned copper drain wire, polyvinyl chloride PVC jacket. Grounding wire shall be not less than #10AWG.

Acceptable manufacturer: Belden Type 2950x, rating as noted on plans.

CABLE AND WIRE SPLICES

General: the materials shall be compatible with the conductors, insulations and protective jackets of the respective cables and wires. Use connectors with ampacity and temperature ratings equal to or greater than those of the wires upon which used.

In manholes and other locations where moisture might be present, the splice shall be watertight and submersible.

Connectors: UL 486A. Aluminum and aluminum alloy fittings will not be accepted. Connectors shall be plated with tin or tin alloy.

Conductor Sizes No. 6 AWG and Larger: Splices in conductors shall be made with indenter, crimp connectors and compression tools or with bolted clamp type connectors to insure a satisfactory mechanical and electrical joint.

WIRE AND CABLE MARKERS

Wire and cable markers shall be "Omni-Grip" as manufactured by Brady Worldwide, Inc., or equal.

Wire and cables with diameters exceeding the capacity of the “Omni-Grip” shall be marked with pre-printed, self-adhesive vinyl tapes as manufactured by Brady Worldwide, Inc., 3M Co., or equal.

RECEPTACLES

Receptacles shall be furnished and installed where shown on the drawings and shall conform to the following requirements:

Grounding type duplex receptacle: rated 20 amperes, 125 volt, 2 wire, 3 pole with grounded shunt (yoke permanently grounded to third clip), NEMA Configuration No. 5-20R, and conforming to Federal Specification W-C-596F (submit proof of compliance).

All receptacles listed on the drawings shall be specification grade receptacles.

Tamper resistant receptacles shall be in compliance with the intent of the NEC Article 517.18(C). The design of the tamper resistant receptacle shall not incorporate any switching mechanism.

All exterior devices shall be designed for the application and shall be installed in a waterproof enclosure with proper cover.

Acceptable manufacturer: Eagle, GE, Hubbell, Leviton or Pass and Seymour.

SWITCHES

Flush, enclosed type, specification grade, rated at 20 amperes, 120/277 volts, alternating current only, quiet operation, and shall comply with Federal Specification W-S-896F (submit proof of compliance). Switch housing shall be color coded for current rating.

Acceptable manufacturer: Eagle, GE, Hubbell, Leviton or Pass and Seymour.

Motor switches with inherent thermal overload protection shall be Square D, Type F for flush or surface mounting as required by the location of the unit. Units shall be furnished with pilot lights as indicated.

DEVICE PLATES

All plates for switch, receptacles and telephone outlets located on finished walls shall be UL listed with the number of gangs required for the application. Nylon or plastic plates shall match device color. All plates for outlets located on unfinished walls or on condulet type fittings shall be zinc coated sheet metal with rounded or beveled edges.

Weatherproof receptacle covers shall be of impact resistant plastic, gasketed, in-use type. Switch covers shall be gasketed metal.

Device plates shall be factory engraved where indicated on the drawings. Letters shall be black filled.

GROUNDING AND BONDING

Conductors: type THW, THHN/THWN, or RHW to match power supply wiring.

Bonding Jumper Braid: copper braided tape, constructed of 30 gage bare copper wires and properly sized for application.

Flexible Jumper Strap: flexible flat conductor, 48,250 circular mils, with copper bolt hole ends sized for 3/8” diameter bolts.

Grounding Electrodes: solid steel core with a heavy uniform covering of electrolytic copper, 5/8" X 10'. Provide sectional rods if required. Threads, on sectional rods, shall be rolled (not cut) into the composite metal after the copper covering has been applied. Sectional rod couplings shall be of a corrosion resistant alloy.

Plate Electrodes: plate electrodes are not permitted. If sufficiently low resistance cannot be obtained with driven rods, the Architect shall be notified and will provide written instruction on grounding methodology.

NAMEPLATES

Nameplates: 0.125 inch thick laminated plastic; white and black finish; rectangular shaped; minimum of 1.0 X 2.5 inches with 0.25 inch high block style engraved lettering.

PART 3 - EXECUTION

WIRING

All conductors shall be carefully handled to avoid kinks or damage to insulation.

All wires, cables and each conductor of multi-conductor cables shall be uniquely identified at each end by color or with wire and cable markers. Lighting and receptacle wiring shall be distinctly differentiated and junction boxes marked.

Lubrications shall be used, if required, to facilitate wire pulling. Lubricants shall be UL approved for use with the insulation specified.

Neutral wires shall be pigtailed to receptacles so that a receptacle can be removed for replacement without the neutral connection to other receptacles on the circuit being disconnected.

Tighten electrical connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values. Where manufacturer's torqueing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL 486A.

All 600 Volt wire insulation shall be tested with a "megger" after installation. Tests shall be made at not less than 500 Volts.

DEVICES

Unless indicated otherwise on the drawings all light switches shall be mounted with the centerline of the device 48" above the finished floor.

Unless indicated otherwise on the drawings or in the specifications all receptacles shall be mounted with the centerline of the device 18" above the finished floor.

Receptacles shall be installed with the grounding contact at the top. Where receptacles are required to be mounted horizontally they shall be installed with the neutral contact at the top.

Receptacles above counters shall have major axis horizontal to counter surface and device centerline 6" above counter surface or backsplash (if present).

Mount all devices so that the cover plate edges are in contact with the wall and are parallel to building features.

GROUNDING

Ground all non-current carrying metal parts of the electrical system to provide a low impedance path for ground fault current. Route ground connections and conductors to ground and protective devices in shortest and straightest paths as possible.

Insulated grounding bushings shall be required for all raceways, service entrance panels, distribution panels, all raceways one inch and larger and any raceway entering a concentric knock-out.

In general a ground wire shall be installed in every conduit. The conduit installation itself shall serve as an additional grounding means.

Where there are parallel feeders installed in more than one raceway, each raceway shall have a ground conductor.

Where conduits terminate without mechanical connection (i.e., locknuts and bushings) to panelboards, and for all terminations of conduit sizes one inch and larger; and for all sizes of metallic conduit (rigid or flexible) terminating in concentric knockouts, the following procedure shall be followed: Each conduit shall be provided with an insulated grounding bushing and each bushing connected with a bare copper conductor to the ground bus in the electrical equipment. The ground conductor shall be in accordance with Article 250 of the NEC.

Install ground rods as necessary to provide an earth ground having a test resistance of no more than 25 ohms.

Test ground rods for ground resistance value before any wire is connected. A portable ground testing megger shall be used to test each ground rod or group of rods. The instrument shall be equipped with a meter reading directly in ohms or fractions thereof to indicate the ground value of the electrode tested. Where tests show resistance to ground is over 25 ohms, reduce resistance to 25 ohms, or less, by driving additional ground rods; then retest.

Grounding connections shall be made by exothermal weld or by using a compatible mechanical connector and brazing completely over. Exothermal welds shall be made strictly in accordance with the weld manufacturer's written recommendations. Welds that have puffed up or which show convex surfaces, indicating improper cleaning, are not acceptable. No mechanical connector is required at exothermal welds.

Connect together system neutral, service equipment enclosures, exposed non-current carrying metal parts of electrical equipment, metal raceway systems, grounding conductor in raceways and cables, receptacle ground connectors, and plumbing system.

The neutral conductor(s) of the incoming electrical service shall be grounded to the ground rod system, and metal cold water piping system using Table 250-66 of the NEC for conductor sizing. Grounding conductors shall be run in rigid non-metallic conduit.

Ground the neutral of all dry type transformers to effectively grounding electrode system and metal cold water piping system as near as practicable using Table 250-66 of the NEC to size conductor.

Grounding conductors shall be attached to equipment with a bolt-on lug or approved tapered screw used for no other purpose. Use crimp-on spade lugs for stranded conductors.

IDENTIFICATION

Equipment

Equipment identification shall be made using engraved laminated plastic plates (indented tape labels will not be permitted). Characters shall be white on a black background and 1/4" high minimum. Plates shall be secured to the panels by means of screws or metal pressure pins. Cement, by itself, will not be acceptable. All nameplates shall be mounted on the outside surface of the piece of equipment.

Individually enclosed safety switches, circuit breakers, and motor starters, pull boxes, control cabinets and other such items shall be identified indicating load, electrical characteristics, and source. For example, a disconnect switch for a 7-1/2 horsepower, 208 volt, 3 phase air handling unit, Number 8 feed from Panel "MDP", Circuit Number 2 shall be labeled as follows:

AHU-8
7-1/2 HP, 208V, 3Ø
Cir: MDP-2

Service entrance panel, distribution panels, panelboards, and transformers shall be identified indicating panel designation from the drawings, electrical characteristics and source. For example, a 277/480 volt 3 phase panel "LPA" feed from "MDP" Circuit No. 3 shall be labeled as follows:

LP-A
277/480V, 3Ø
(Feeder: MDP-3)

Service entrance panel and distribution panels shall also have each circuit identified as to circuit number, load, and electrical characteristics of load. For example, a 5 HP, 208 volt, 3 phase hot water pump Number 6 feed from panel MDP, Circuit No. 4 would be labeled as follows with the plate attached adjacent to the circuit:

MDP-4
HWP-6
5 HP, 208V, 3Ø

All enclosures containing energized components shall be marked with mylar labels identifying hazards. Such warning messages as "WARNING-HAZARDOUS VOLTAGE", “480 VOLTS", "240 VOLTS", etc. are acceptable. Labels shall be EZ-Code by Thomas & Betts or similar product.

Junction Box Identification: Each junction box cover shall be labeled with a permanent "magic" marker or other means to identify the circuits within. For example, a junction box containing lighting circuits 21, 23, 25 from Panel L2A would be labeled "L2A-21,23,25". Telephone junction boxes shall be labeled "T". Fire

alarm system junction boxes shall be labeled “FA”. Public address, nurse call, and other system junction boxes shall be labeled accordingly.

Conductor Identification: All cables and wires shall be color coded as to phase per convention. See color coding above.

Raceway Identification: All raceways leaving the service entrance panel and distribution panels shall be clearly marked as to their circuit number. For example, a conduit containing conductors for Panel MDP, Circuit No. 5 would be marked MDP-5. Empty conduits shall be marked "empty".

Device Identification: When it is not clear what a wall switch or what a receptacle is dedicated for then the device plate shall be engraved appropriately. Blank plates for future devices shall be engraved "FUTURE". All plates shall be factory-engraved.

Ungrounded Conductor Identification within Panelboards: All panelboards shall have a label indicating the ungrounded conductors color schedule as noted below. Labels shall be at least 2” x 4”, laminated in plastic, and affixed to the inside of the equipment door.

For 120/208 Volt, 3 phase panels:
- AØ Conductors – Black
- BØ Conductors – Red
- CØ Conductors – Blue

For 277/480 Volt, 3 phase panels:
- AØ Conductors – Brown
- BØ Conductors – Orange
- CØ Conductors – Yellow

Warranty Signage Identification: Provide equipment tags to identify equipment and warranty information on all electrical equipment including panelboards, motor control centers, transformers, starters, etc. See sample format below. Labels shall be at least 2” x 4”, laminated in plastic, and affixed to equipment in conspicuous location.

Equipment Information Tag
Unit ID: PANEL ‘N1A’
Manufacturer: Siemens
Model No. : CDP-7
Serial No. : 56742 OG1
Warranty Period Ends: December 12, 2013
Warranty Contact: Short Circuit, Inc. 123.456.7890

FIREPROOFING

All conduit and boxes passing through or installed within fire walls and smoke walls shall be installed so as to maintain the integrity and rating of the wall through which it passes. Boxes shall be installed within 1/8" of wall surface. Conduits penetrating rated floors shall be installed to maintain the fire rating of the floor using UL approved sealing materials.

END OF SECTION

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Leon County Schools
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550 East Tennessee Street
Tallahassee, Florida 32308
LCSB RFQ #504-2023
H+SA#22.133
August 25, 2023

SECTION 26 05 05 ELECTRICAL SELECTIVE DEMOLITION

PART 1 - GENERAL

RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

SUMMARY

This Section includes all labor, material, equipment and services necessary and incidental to complete all the demolition and removal of electrical work as shown on the Drawings or as required.

The demolition drawings do not necessarily indicate all the conditions, details, or work required. The Contractor shall examine the building to determine the actual conditions and extent of the work. Any details not clear to this Contractor shall be referred to the Engineer for clarification prior to bidding.

The Contractor shall be responsible for demolition and removal of all existing electrical systems where shown for demolition. No portion of electrical systems shown for demolition may be abandoned in place.

SUBMITTALS

Shop Drawings: Indicate demolition and removal sequence and location of salvageable items.

Schedules: Submit schedule showing time and detailed sequence of demolition, removal of materials and arranged coordination of anticipated electrical interruptions.

1. Schedule demolition and removal work to ensure uninterrupted progress of Owner's on-site operations.

Project Record Documents: Submit in accordance with Section 16010.

1. Accurately record actual locations of abandoned or dead ended utilities.

QUALITY ASSURANCE

Contractor shall verify the extent of the demolition work. Any questions as to which systems are to be removed versus which systems are to remain shall be referred to the Engineer for clarification prior to commencing demolition work.

The demolition work shall be a phased operation and shall comply with the construction sequence schedule.

Do not close or obstruct egress width of fire exits or access.

Do not disable or disrupt building fire or life safety systems without written permission from the Owner. In all cases, permission shall have been granted not less than ten (10) working days prior to the intended interruption.

PROJECT CONDITIONS

Owner will vacate demolition area prior to start of demolition work.

Owner will continuously occupy areas of building immediately adjacent to selective demolition areas.

Conduct selective demolition work in manner that will minimize need for disruption of Owner's normal operations.

Provide minimum of ten (10) working days advanced notice to Owner of demolition activities which will severely impact Owner's normal operations.

Maintain free and safe passage to and from Owner occupied areas.

Condition of Structures: Owner assumes no responsibility for actual condition of areas to be demolished.

Traffic and Passageways: Maintain accessibility for fire fighting apparatus.

1. Conduct demolition operations and debris removal to avoid interference with adjacent occupied facilities.

2. Obtain written permission from authorities having jurisdiction prior to closing or obstructing adjacent occupied facilities.

3. Provide alternate routes when closing or obstructing traffic ways when required by governing authorities.

4. Ensure safe passage of persons around area of demolition. Provide and maintain temporary covered passageways; comply with requirements of governing authorities.

Protection: Perform work in manner to eliminate hazards to persons or property and avoid interference with adjacent areas.

1. Maintain existing utilities that are to remain in service and protect from damage during demolition operations.

2. Do not interrupt existing utilities serving occupied facilities, except when authorized by Owner in writing. Provide temporary services during interruptions.

3. Coordinate in advance with Owner electrical interruptions.

4. Protect existing floors with suitable coverings when necessary.

COORDINATION

The Contractor shall be responsible for coordinating demolition of all affected electrical systems to prevent disruption to the Owner and minimize downtime.

The Contractor shall be responsible for coordinating demolition by other Divisions of the Specifications to prevent disruption to the Owner and minimize downtime.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

EXAMINATION

Beginning alterations to existing building systems means the installer accepts existing conditions.

PREPARATION

Provide, erect, and maintain temporary barriers, warning notifications (signs) and other security devices as may be required for personnel safety.

Inventory each panelboard where circuits are indicated to be reused. Sequentially consolidate existing circuits within each panelboard with regard to area served. Maximize capacity for service to the project area by including existing spares with the group of circuits breakers to be disconnected as a result of this selective demolition. Prepare a current directory, post demolition, for each panelboard as the base upon which the final directories will be compiled.

Temporarily tag every circuit breaker serving systems outside the demolition area. The tag shall be an OSHA compliant, commercially preprinted, 3¼ inch by 5-5/8 inch, accident prevention card with write on matte finish plastic surface, ¼ inch reinforced grommet and attachment string loop. The message on the card front shall read: “DANGER, DO NOT OPEN” and the message on the reverse side shall read: “DANGER, DO NOT REMOVE THIS TAG. NECESSARY DISCIPLINARY ACTION WILL BE TAKEN IF THESE ORDERS ARE DISREGARDED. SEE OTHER SIDE.” The tags shall remain in place until the demolition and renovation are complete.

TEMPORARY CONDITIONS

The Contractor shall include all temporary connections necessary to permit the Owner to occupy areas of the building during the various construction phases.

SALVAGEABLE MATERIAL AND EQUIPMENT

Carefully remove, store and protect the salvage materials and equipment shown on the Drawings for Owner's use. Deliver to location directed by Owner.

Carefully salvage, remove and store, and protect for re-installation the materials and equipment shown on the Drawings.

Materials Retained by Contractor:

1. Items of salvageable value not indicated as Owner salvaged or scheduled for reinstallation may be removed as work progresses.

2. Salvaged items must be removed from site as they are removed. Storage or sale of salvaged items on site will not be permitted.

REMOVAL OF DEMOLITION MATERIAL

Contractor shall remove existing systems, shown or specified, necessary or reasonably inferred, for completion of his/her work. Owner will have the option of retaining any item of material removed under this contract. Item or materials not retained by Owner will become the property of the Contractor, removed from the premises and legally disposed off-site.

Contractor shall dispose of fluorescent lamps, ballasts, and other hazardous materials in accordance with all Local, State and Federal regulations.

Contractor shall remove all wiring determined to be disconnected and abandoned, and remove all conduit and junction boxes determined to be empty and not intended to be used during the reconstruction phase.

Remove abandoned wiring to source of supply.

Remove all exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Remove all junction boxes and conduit supports associated with conduit being removed.

Repair adjacent construction and finishes damaged during demolition and extension work.

Maintain continuity of circuits, which remain in service.

Remove all existing luminaires, switches, receptacles, and other electrical equipment and devices and associated wiring from walls, ceilings floors, and other surfaces scheduled for demolition unless specifically shown as retain or relocate on drawings.

Remove auxiliary and signal systems (IE: fire alarm, security, telephone, data, sound/paging and the like) not scheduled for reuse or relocation. Remove associated devices, appliances and cabling complete.

Remove electrical systems associated with equipment (IE: Elevators, motorized doors/shades/gates/ dampers, mechanical HVAC and plumbing equipment, landscape, civil, kitchen and other equipment served by the electrical systems) not scheduled for reuse or relocation on the drawings. Remove switchboards, motor control centers, panelboards, busway, electrical junctions boxes, pull boxes, conduit, raceway systems (IE: bus gutter, cable tray, plugmold), wiring, safety switches, enclosed circuit breakers, control panels, Energy management systems, relays and contactors associated with equipment scheduled for removal.

PERFORMANCE

Perform drilling, cutting, block-offs, and demolition work required for removal of necessary portions of electrical system. Do not cut joists, beams, girders, trusses, or columns without prior written permission from Engineer.

CLEANING

Broom clean demolition areas of dust, dirt, and debris caused by demolition operations. Return adjacent areas to condition existing prior to start of work.

Remove temporary work and protection when no longer needed.

Unless noted otherwise, existing fixtures that are to remain shall be cleaned and lamps and ballasts replaced with new lamps and ballasts.

END OF SECTION

SECTION 26 05 30 RACEWAY SYSTEMS

PART 1 - GENERAL

SCOPE OF WORK

Furnish all labor, materials and equipment and incidentals required to construct and install the complete electrical systems as indicated on the Drawings and as specified in this Section.

STANDARD OF MATERIALS

All materials, equipment and apparatus covered by this specification shall be new, of current manufacture and shall bear the seal of approval of the Underwriters' Laboratories.

All equipment and materials shall have ratings established by a recognized independent agency or laboratory. The Contractor shall apply the items used on this project within the ratings and subject to any stipulations or exceptions established by the independent agency or laboratory.

All conduits and raceways, wire, devices, panelboards, switches, etc. of a given type shall be the product of one manufacturer.

SUBMITTALS

Manufacturer's data and shop drawings for all components, fixtures, assemblies and accessories indicated in this Division. Submit in accordance with Division 1.

PART 2 - PRODUCTS

RIGID CONDUIT, TUBING AND FITTINGS

Rigid steel conduit: zinc coated, threaded type conforming to the requirements of UL 6 and ANSI C80.1 standards. Zinc coating shall be applied to both inner and outer surfaces.

Intermediate metal conduit: hot-dipped galvanized, threaded type conforming to the requirements of UL 1242 and ANSI C80.6 standards.

A fitted thread protector shall protect threaded ends from damage during shipment and handling.

Fittings for rigid steel and IMC conduit: zinc coated, threaded type, conforming to Federal Specification W-F-408.

Electrical Metallic Tubing (EMT): UL 797 and ANSI C80.3 standards.

Fittings for electrical metallic tubing: Federal Specification W-F-408. Steel compression or set-screw type, galvanized or cadmium plated, and suitable for location of installation. Conduit bushings shall be metallic with insulated throats. Insulating grounding type bushings shall be provided where required under "Grounding". EMT connectors shall be similar to T&B "Insuline" with completely insulated throats. Field applied insulated throats are not acceptable.

Plastic conduit for direct burial: UL labeled Schedule 40 PVC manufactured to NEMA TC-2 specifications, and UL 651 specifications. Plastic conduit concrete encased may be Type EB.

Plastic interduct for installation in PVC conduits: UL labeled and listed for installation of inside/outside communication cable.

Couplings, fittings, pipe straps and spacers used with rigid plastic conduit shall be fabricated of plastic.

Fittings for plastic conduit: manufactured to NEMA TC-3 specifications.

Acceptable Metal Conduit and Tubing Manufacturers:

EMT: Allied Tube & Conduit Co.
Wheatland Tube Co.
Triangle PWC, Inc.

Fittings: Steel City
Thomas & Betts (T&B)
Raco Inc.

FLEXIBLE METAL CONDUIT, COUPLINGS AND FITTINGS

Flexible metal conduit for dry interior applications: Federal Specification WW-C-566 and UL 1, continuous, spiral wound galvanized steel type.

Fittings (connectors) for flexible metal conduit: UL E 23018. Squeeze Type of galvanized steel or malleable iron zinc plated.

Flexible metal conduit for damp or exterior applications: liquid tight, UL listed, spiral wound galvanized steel with PVC outer jacket.

Fittings for liquid tight conduit: Federal Specification W-F-406. Provide cadmium plated, malleable iron fittings with compression type steel ferrule and gasket sealing rings and insulated throats.

Acceptable Metal Conduit and Fittings Manufacturers:

FMC:	Alflex Corp. American Flexible Conduit Co. Anaconda Metal Hose, ANAMET Inc.
FMC Fittings:	Steel City Thomas & Betts (T&B) Raco Inc.

CONDUIT MOUNTING EQUIPMENT

Hangers, rods, backplates, beam clamps etc. shall be hot-dipped galvanized iron or steel. They shall be as manufactured by the Appleton Electric Co., Thomas and Betts Co., Unistrut Corp., or approved equal.

JUNCTION BOXES

Sheet Steel Outlet Boxes: conform to UL 514A, “Metallic Outlet Boxes, Electrical”, UL 514B, “Fittings for Conduit and Outlet Boxes, Covers, and Box Supports”, and NEMA OS1, “Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports”.

Sheet Steel: Flat-rolled, code gauge galvanized steel.

Acceptable Manufacturers: Sheet-steel boxes shall be manufactured by RACO, Steel City or equal.

All junction boxes and pull boxes shall be sized per NEC requirements and be of the proper NEMA classification for the locations where they are installed. Where boxes occur above other than lift-out ceilings, access panels must be provided.

Wet location covers shall meet NEC wet location requirements (shall comply with NEC). Covers shall be “in-use” type and shall mount vertically or horizontally and be of gasketed heavy-duty polycarbonate construction with clear cover with lockable hasp for 1/8" shank lock.

OUTLET BOXES

Switch, receptacle and wall or ceiling mounted junction boxes shall be the 4" X 2 1/8" square type. Tile, dry wall, or flat cover plates for one or two devices shall be furnished for each box as required.

TELEPHONE AND DATA SYSTEM OUTLETS

Wall outlets shall in general consist of four inch (4") square boxes with single gang switch ring. Conduits shall be supplied turned out of wall above ceiling assembly. Conduits shall be 1” or larger, with insulated bushing installed on all bare ends.

Install finished blank plates on all unused openings.

OUTDOOR BOXES

Cast Aluminum Boxes: exposed, exterior locations; copper free aluminum, threaded raceway entries, and features and accessories suitable for each location including mounting ears, threaded screw holes for devices, and closure plugs.

Boxes shall have a rear opening in addition to necessary top and bottom openings. Boxes shall be provided complete with a minimum of two closure plugs and self-threading ground screw. Boxes shall have a thermoset, baked enamel silver gray finish. Weatherproof cover plates for one or two devices shall be furnished for each box as required.

Covers shall be of heavy duty die-cast construction. Mounting screws shall be stainless steel. Covers shall have a thermoset, baked enamel silver gray finish and be equipped with a sealing gasket. Covers shall be equipped with a hasp-type locking tab.

Nonmetallic boxes shall be thermoplastic or polyester fiberglass types as manufactured by Carlon or Pass & Seymour.

LOCATION OF OUTLETS

The approximate locations of outlets, etc. are shown on the drawings. The exact locations shall be determined at the building.

It is the responsibility of the Contractor to note the locations and heights of cabinets, counters, shelving units, etc. before the installation of outlets.

CONDUIT BODIES

Conduit bodies shall be constructed of galvanized or cadmium plated malleable iron or copper-free aluminum. Galvanized steel or aluminum covers and gaskets shall be supplied.

LB's 3" and greater shall be mogul type with domed covers.

PART 3 - EXECUTION

RACEWAY INSTALLATION

All interior and above grade exterior wiring shall be installed in a metal conduit and all embedded in concrete or below grade wiring shall be in PVC conduit unless indicated otherwise on the drawings.

Exterior low voltage (less than 50 volts) wiring may be installed in liquid tight, non-metallic flexible conduit ("Sealtite") where installation is above grade and not subject to damage.

No conduit smaller than 3/4 inch electrical trade size shall be used, nor shall any have more than three 90 degree bends in any one run. Pull boxes shall be provided as required or directed.

No wire shall be pulled until the conduit system is complete in all details.

The ends of all conduits shall be tightly plugged to exclude dust and moisture during construction.

Conduit support shall be spaced at intervals of 8 ft. or less, as required to obtain rigid construction.

Single conduits shall be supported by means of two-hole pipe clamps. Multiple runs of conduits shall be supported on trapeze type hangers with steel horizontal members and threaded hanger rods. The rods shall be not less than 3/8 inch diameter. The channel shall be not less than 1 1/2" nominal size.

Conduit hangers shall be attached to structural steel by means of beam or channel clamps.

All conduits on exposed work shall be run at right angles to and parallel with the surrounding walls and shall conform to the form of the ceiling. No diagonal runs will be allowed. Bends in parallel conduit runs shall be concentric. All conduit shall be run straight and true.

Conduit terminating in sheet steel boxes shall have double locknuts and insulated bushings.

Flexible metal conduit shall be used for all motor terminations and other equipment where vibration is present. Flexible conduit length shall not exceed 1'-6" in length for this application.

Provide expansion coupling every 100 feet for long runs of conduit and at concrete expansion joints. Provide ground bonding jumpers around expansion couplings, used on metallic conduit, sized according to Table 250-122 of the NEC.

Transitions from below grade to above grade shall be with rigid galvanized steel long sweep nineties with a bituminous coating where in contact with earth or concrete. Area of transition shall not be subject to standing puddles of water.

Seal all wall penetrations to watertight condition. Finish as applicable to location.

Steel conduit, when buried in soil, shall be treated with a protective coating of bitumastic or asphalt-base paint, or wrapped with plastic tape.

Approval by the Architect shall be required to install conduit in structural members.

In general, the conduit installation shall follow the layout shown on the plans. This layout is, however, diagrammatic only, and where changes are necessary due to structural conditions, other apparatus or other causes, such changes shall be made without additional cost to the Owner. It is recognized that branch circuit routing shown on the drawings may not always be the most economical or the most feasible method. Routing may be changed by the Contractor subject to the following provisions:

Conduits shown routed overhead may not be installed in or below slabs or in walls.

Not more than three circuits may be installed in any one conduit. Care must be taken to provide the appropriate number of neutrals where two or three circuits are on the same phase.

All conduit shall be concealed unless otherwise noted on the drawings.

Exposed conduit will be permitted only as shown on the drawings. Exposed conduit shall be run parallel with or at right angles to the building walls.

All empty conduits shall be provided with a plastic pull wire rated for a minimum of 200 lbs.

Conduit stub-ups at panels shall be secured in place by use of Unistrut and clamps.

Conduit and tubing shall be kept at least twelve (12) inches from parallel runs of flues, steam pipes or hot water lines.

Telephone and data raceways shall be 1” minimum. This includes conduits stubbed up into ceiling cavity.

Where exposed connections to motors and equipment from overhead conduits are made without benefit of a wall for conduit mounting, the connection shall consist of vertical conduit (minimum size 1") from Type "LL", "LR" or “TT” Unilet to floor flange. Connection to equipment shall be with flexible liquid-tight from Type FDT boxes located in the vertical conduit.

Flexible conduit in all areas subject to moisture shall be liquid-tight flexible conduit.

All electrical connections to vibration isolated equipment shall be made with flexible conduit.

Connections to indoor dry type transformers shall be made with weatherproof flexible conduit.

All conduit entering the building shall be suitably sealed to prevent the entrance of moisture.

All conduit passing through a structural expansion joint shall be provided with a UL approved expansion joint fitting and bonded as required by the National Electrical Code.

Conduit in hazardous locations (as defined and classified by the National Electrical Code) shall be sealed with sealing fittings. Where hazardous locations exist, all conduit, fittings and installation shall comply with Article 500 of the NEC.

Any wiring in a finished area which cannot be concealed in conduit shall be installed in a surface metal raceway system as manufactured by Wiremold or equal. Utilization of surface metal raceway, if not indicated as such on the plans, will be accomplished only with the written approval of the Architect.

Conduit run in areas with hung ceilings shall be installed in the space above the hung ceiling as close to the structure as possible. Conduits shall be supported from the structure.

Where flex conduit is used from junction box to light fixture it shall be supported such that it does not touch ceiling tiles or interfere with their placement.

Flexible metal conduit contions to light fixtures shall be at least 4 feet but not more than 6 feet in length per NEC 410-117(c).

Where raceways are indicated installed under slabs, they shall be placed not less than 2” below surface of prepared fill. Under no circumstances shall raceways be laid directly on vapor barrier or in or on reinforcing.

Raceways concealed in ground outside building shall be a minimum of 2 feet below grade and topped with a two inch concrete cap before backfilling. Install plastic warning tape 12 inches above raceway, buried in backfill.

RACEWAY INSTALLATION - CONDITIONS

Conduit raceways shall be installed as indicated herein. Where more than one type of raceway is listed under one condition, the Contractor may exercise his option of the raceway used. Conditions of raceway installation are as follows:

Exposed Raceway Below 8'-0" from Finish Floor and in Areas Subject to Moisture: Rigid galvanized steel conduit.

Raceway Concealed Overhead, or in Walls: Rigid galvanized steel conduit, intermediate metallic conduit or electrical metallic tubing (EMT).

Raceway Concealed in Ground Outside Building: Schedule 40 PVC or rigid steel. Rigid steel conduits installed below slab-on-grade or in the earth shall have a factory-applied PVC coating, two coats of a coal-tar system, or shall be field-wrapped with 0.010 inch thick pipe-wrapping plastic tape applied with a 50-percent overlay.

Final Raceway Connection to Recessed Fixtures in Accessible Locations: Flexible steel conduit maximum of 6'-0" long.

Final Raceway Connection to Pumps, Motors, Transformers, Etc.: Liquid-tight flexible steel conduit maximum of 1'-6" long.

Raceway That Extend Through the Slab or Above Finish Grade: 90° elbows, nipples and couplings of rigid galvanized steel or IMC shall be used where any raceway extends through the slab or above finished grade. In general PVC conduit shall not be allowed above finished slab inside the building or within 1 1/2' of finished grade outside the building.

OUTLET BOXES

Outlet boxes for flush mounted lighting fixtures shall be accessible. If lighting fixture is in a non-accessible ceiling the box shall be accessible when the fixture is removed.

Set boxes plumb and such that their device mounting plane is within 1/8" of the finished wall.

Surface mounted boxes and wiremold boxes, both new or existing, shall be painted to match surrounding surfaces.

The location of boxes on the electrical plans is approximate. Review architectural drawings for specific location or if not shown center and align within architectural detail. The Architect shall reserve the right to move boxes during rough in.

END OF SECTION

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SECTION 26 27 13 SERVICE AND DISTRIBUTION

PART 1 - GENERAL

SCOPE OF WORK

Furnish all labor, materials and equipment and incidentals required to construct and install the complete electrical systems as indicated on the Drawings and as specified in this Section.

STANDARD OF MATERIALS

All materials, equipment and apparatus covered by this specification shall be new, of current manufacture and shall bear the seal of approval of the Underwriters' Laboratories.

All equipment and materials shall have ratings established by a recognized independent agency or laboratory. The Contractor shall apply the items used on this project within the ratings and subject to any stipulations or exceptions established by the independent agency or laboratory.

All conduits and raceways, wire, devices, panelboards, switches, etc. of a given type shall be the product of one manufacturer.

SUBMITTALS

Manufacturer's data and shop drawings for all components, fixtures, assemblies and accessories indicated in this Division. Submit in accordance with Division 1.

PART 2 - PRODUCTS

PANELBOARDS

Compliance: NFPA 70 National Electrical Code, UL 67, “Electric Panelboards”, NEMA Publication PB1, “Panelboards”, Federal W-P-115a Type 1, Class 1 specifications and NEMA PB 1.1, “Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less”.

Provide factory assembled panelboards in sizes and rating as indicated. Panelboards shall be UL listed and labeled.

Acceptable manufacturers: panelboards shown on the drawings shall be manufactured by Cutler-Hammer, Eaton, Square D, or Siemens.

POWER DISTRIBUTION PANELBOARDS

Provide dead front safety type power distribution panelboards as indicated, with panelboard switching and protective devices in quantities, ratings, types, and with arrangement shown; with anti-turn solderless pressure type main lug connectors approved for use with copper conductors. Select unit with feeders connecting at the top of the panel. Equip with copper bus bars with not less than 98 percent conductivity, and with full size neutral bus; provide suitable lugs on neutral bus for outgoing feeders requiring neutral connections. Provide molded case main and branch circuit breaker types for each circuit, with toggle handles that indicate when tripped. Where multiple pole breakers are indicated, provide with common trip so overload on any pole will trip all poles simultaneously. Provide panelboards with bare uninsulated grounding bars suitable for bolting to enclosures. Select enclosures which are fabricated by same manufacturer as panelboards, which mate and match properly with panelboards.

LIGHTING AND APPLIANCE PANELS

Provide dead front safety type lighting and appliance panelboards as indicated, with panelboard switching and protective devices in quantities, ratings, types, and with arrangement shown; with anti-turn solderless pressure type main lug connectors approved for use with copper conductors.

Refer to the drawings to determine each panelboards pertinent characteristics such as bus rating, main circuit breaker or lugs only, voltage rating, number of phases, number of positions required, etc.

Select unit with feeders connecting at the top of the panel. Equip with copper bus bars with not less than 98 percent conductivity, and with full size neutral bus; provide suitable lugs on neutral bus for outgoing feeders requiring neutral connections.

Interrupting ratings shall be coordinated with the available short circuit current. Provide molded case main and branch circuit breaker types for each circuit, with toggle handles that indicate when tripped. Where multiple pole breakers are indicated, provide with common trip so overload on any pole will trip all poles simultaneously.

All panels shall be provided with an equipment grounding bus similar to, but isolated from the solid-neutral bus. Provide panelboards with bare uninsulated grounding bars suitable for bolting to enclosures.

Panels shall be carefully aligned and rigidly secured in place with the top of the cabinets located 78 inches above the finished floor.

Each panel shall be furnished with an identification plate as specified in the "Equipment Identification" section of this specification.

Distribution panels which are flush mounted must have door on front of panel.

Circuit Breakers:

Panelboards shall be equipped with thermal-magnetic molded case circuit breakers with trip ratings as shown on the drawings.

Circuit breakers shall be quick-make and quick-break units with positive trip indicating mechanism and common trip on all multi-pole breakers.

Single pole 15 and 20 amp circuit breakers shall be UL listed as "Switching Breakers" and be marked SWD.

Circuit breakers shall be the bolt-on type.

Bus Assembly:

Bus bar connections to the branch circuit breakers shall be the "phase sequence" type.

Bus bars shall be of copper construction. All current carrying parts of the bus shall be plated.

Buses shall be full length with constant cross sectional area, designed for the bus current indicated.

Cable lugs shall be furnished in the quantity and size required for the size and number of conductors indicated.

Mains ratings: as shown on the drawings.

Short circuit current rating: as shown on the drawings. Panelboards, as a complete unit, shall have a short circuit current rating equal to or greater than that indicated. It shall be understood that the minimum rating for 240 and 480 volt rated panelboards shall be 10,000 and 14,000 RMS symmetrical amperes respectively.

Cabinet construction:

Panel enclosures: UL 50. Enclosures shall be furnished without knockouts. All knockouts shall be field cut.

The panelboard bus assembly shall be enclosed in a dead front safety constructed steel cabinet.

The size of the wiring gutters and gauge of steel shall be in accordance with NEMA and UL standards; except that the thickness of steel shall not be less than 16 gauge.

The box shall be fabricated from galvanized steel. Boxes intended for outdoor duty, or where indicated, shall be rated NEMA 3R.

Select enclosures which are fabricated by same manufacturer as panelboards, which mate and match properly with panelboards.

Construction shall be such that circuit breaker mounting hardware is not required when circuit breakers are added in the future.

The panelboard front cover shall be hinged 1-piece with integral door. The integral door shall have completely concealed hinges and door swings, flush lock and key mechanism, and steel door pull.

A circuit directory frame and card with a clear plastic covering shall be provided on the inside of the door. Typed directory cards shall be furnished in each panel.

All panelboards throughout project shall be keyed alike.

Special Provisions:

Where lighting and appliance panelboards are flush mounted, provide spare conduits stubbed up and capped as specified elsewhere in this section. Where surge protection is required, provide as specified in this section - **SURGE PROTECTION DEVICES (SPD)**. Surge protection device system shall be incorporated into the panelboard assembly as described in **SURGE PROTECTION DEVICES (SPD).**

CIRCUIT BREAKERS INSTALLED IN EXISTING PANELS

Circuit breakers installed in existing panels shall have an A.I.C. rating equal to that of the panel in which they are installed.

SAFETY DISCONNECT SWITCHES

Compliance: NFPA 70 National Electrical Code, UL 98, “Enclosed and Dead Front Switches”, NEMA Publication KS1, “Enclosed Switches”, and NEMA KS 250, “Enclosures for Electrical Equipment (1000 Volts Maximum)”.

Safety switches shall be provided for all motors and equipment indicated or required by the National Electrical Code.

Safety switches shall be Type "HD" (heavy duty) unless noted otherwise, fused or non-fusible as indicated with number of poles as shown or required. Safety switches for equipment may be non-fused only if equipment is UL tested with circuit breaker protection.

Fuses: general use, dual element time-delay, current limiting. Manufactured by Bussman, Littlefuse, Edison, or equivalent.

Safety switches for indoor general purpose application shall be NEMA 1 and for exterior application shall be NEMA 3R.

Acceptable manufacturer: provide safety switches manufactured by Cutler-Hammer, Square D, or Siemens.

Construction: Gray baked enamel finish. NEMA 3R enclosures shall be manufactured from galvanized steel. NEMA 4X enclosures shall be manufactured from 304 stainless steel. Corners shall be ground smooth and polished to overall finish quality. NEMA 4X enclosures shall be fitted with a condensate drain at the bottom and a vent at the top that is rated for NEMA 4X service.

Ratings: Fusible disconnects shall be 240 or 600 volt rated depending on the service voltage.

Fusible disconnects shall be furnished with Class R fuses of the indicated ampere rating (up to 600 amps) and be equipped with rejection clips.

Fusible disconnects shall be UL listed for 200,000 RMS symmetrical ampere short circuit current when equipped with Class R or Class L fuses.

Lugs shall be front removable and be UL listed for aluminum or copper conductors at 60 degrees C or 75 degrees C.

Disconnect switches shall be horsepower rated.

DRY-TYPE TRANSFORMERS

Shall meet NEMA TP1 for energy efficiency.

Shall have a 480 volt delta primary and a 208Y/120 volt secondary with a minimum of 4 full rated primary taps, two 2-1/2% below and two 2-1/2% above nominal voltage. Transformers shall be furnished with primary and secondary lugs sized to accommodate the conductors shown on the Drawings.

Transformers shall have an insulation system rated for continuous operation at 220^{O}C, but they shall be rated for continuous operation at full load with a maximum temperature rise of 115^{O}C above a 40^{O}C ambient temperature.

Transformers shall be capable of carrying a 15% overload continuously without exceeding a 150^{O}C rise above a 40^{O}C ambient temperature.

Enclosures shall be a ventilated type with feet for floor mounting.

Core and coil assemblies shall be grounded to the frame and shall be mounted on rubber isolation pads to reduce sound transmission.

The maximum sound level shall be:

0-50 KVA	45 dB
51-150 KVA	50 dB
151-300 KVA	55 dB
301-500 KVA	60 dB

Acceptable Manufacture: The transformer shall be manufactured by Cutler Hammer, General Electric, Siemens, or Square D.

SURGE PROTECTION DEVICES

General: provide hybrid high-energy filter units utilized for a facility wide protection system. Each unit in the system shall incorporate surge suppression and high frequency electrical line noise filtering. The system shall provide effective high-energy surge voltage suppression, surge current diversion, high frequency attenuation in all environments connected on the load side of the facility's main overcurrent device. Connection shall be parallel, located as shown on the Drawings. System shall feature fast response time and low clamping voltage with high current capability. SPD's shall be manufactured specifically for the intended service by a manufacturer having a least five years continuous experience designing and manufacturing power conditioning equipment of the type specified.

Manufacture units using redundant metal oxide varistors (MOV) installed in a parallel arrangement. Not less than two MOV's are required per mode regardless of suppression rating.

Standards: Surge Protective Devices shall comply with the following:

1. ANSI/IEEE Std C62.41.1™-2002, IEEE Guide on the Surge Environment in Low-Voltage (1000 V and Less) AC Power Circuits
2. ANSI/IEEE Std C62.41.2™-2002, IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits
3. ANSI/IEEE Std C62.45™ -2002, IEEE Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000 V and Less) AC Power Circuits
4. ANSI C84.1, American National Standard for Electric Power Systems and Equipment – Voltage Ratings (60 Hertz)
5. ANSI/IEEE Standard 1100-2005, IEEE Recommended Practice for Power and Grounding Electronic Equipment (Emerald Book) - Clause 8.6.1
6. National Fire Protection Association (NFPA) 70 (N.E.C.) – 2002 - Article 285
7. ANSI/UL Standards 1449-2006 Listed (UL 1449 Current Edition), UL 1283 Listed, CUL Listed & CE compliant “low-voltage directive.”
8. IEEE Standard C62.72™ - 2007 – IEEE Guide for the Application of Surge-Protective Devices for Low-Voltage (1000 V or less) AC Power Circuits

The system and each SPD module shall be UL listed for the service and conditions indicated on the Drawings and specified here and shall be enclosed in NEMA 1, 12, or 3R enclosure.

Module shall be tested in accordance with ANSI/IEEE C62.11, C62.41 and C62.45 Categories A, B and C3. Current diverter modules shall withstand one thousand Category C3 surges per IEEE C62.45.

The system shall be protected from fault currents up to 200,000 amperes by suitable integral fuse network. All components shall be protected. High current capacitors shall effectively sink harmonic currents generated by line distortion and shall effectively attenuate line noise (RFI/EMI filtering).

The system shall be equipped with built-in monitoring with status indicators, audible alarm and test switch front panel mounted. Form C dry contacts shall be provided for remote annunciation.

SPD shall be UL labeled with 20kA I-nominal (I-n) for compliance to UL 96A Lightning Protection Master Label and NFPA 780.

UL 1449 Listed Voltage Protection Ratings (VPRs) shall not exceed the following:

System Voltage	L-N	L-G	L-L	N-G
208Y/120	700V	700V	1200V	700V
480Y/277	1200V	1200V	1800V	1200V

Warranty: 10 years.

Service entrance locations: The nominal unit operating voltage shall be coordinated with the service voltage indicated. The maximum continuous operating voltage of all components utilized in the unit shall not be less than 115% of nominal operating voltage. Operating frequency shall be 60+3 hertz. Protection modes shall be (10-mode): line-to-line, line-to-neutral, line-to-ground and neutral-to-ground.

Maximum repetitive surge current capacity per phase, in amps, shall not be less than: 300kA

Minimum line noise attenuation above 10 MHz - 50 dB

Install protective module adjacent to main switchboard as indicated on the Drawings. Provide molded case circuit breaker as indicated for isolating module.

Service Entrance SPDs shall have a built-in surge counter to indicate and totalize all transients in all modes. Counter shall be LCD or LED and shall read in plain Arabic numbers.

Distribution panelboard locations: The nominal unit operating voltage shall be coordinated with the service voltage indicated. The maximum continuous operating voltage of all components utilized in the unit shall not be less than 115% of nominal operating voltage. Operating frequency shall be 60+3 hertz. Protection mode shall be (10-mode): line-to-line, line-to-neutral, line-to-ground and neutral-to-ground.

Maximum repetitive surge current capacity per phase, in amps, shall not be less than: 150kA

Minimum line noise attenuation above 10 MHz - 50 dB

Install module adjacent to each distribution panelboard as indicated on the Drawings. Provide molded case circuit breaker as indicated for isolating module.

Lighting and appliance (Branch) panelboard locations: The nominal unit operating voltage shall be coordinated with the service voltage indicated. The maximum continuous operating voltage of all components utilized in the unit shall not be less than 115% of nominal operating voltage. Operating frequency shall be 60+3 hertz. Protection mode shall be (10-mode): line-to-line, line-to-neutral, line-to-ground and neutral-to-ground.

Maximum repetitive surge current capacity per phase, in amps, shall not be less than: 100kA

Minimum line noise attenuation above 10 MHz - 50 dB

Install module adjacent to each lighting and appliance (branch) panelboard as indicated on the Drawings. Provide molded case circuit breaker as indicated for isolating module.

Conductors shall be #8AWG, stranded copper, minimum, and shall be as short (less than 24") and as straight as possible. All conductors shall cut to precisely the same length before installation. Conductor requirements apply to grounded conductor. Installer may reasonably rearrange breaker locations to ensure short and straightest possible leads to SPDs.

Recessed Panelboard Installations: Where lighting and appliance panelboards are indicated recessed, provide panelboards that include a factory installed and engineered solid state high performance suppression system or provide flush mountable external surge protection device that meet the requirements of this section for lighting and appliance panelboard locations.

PART 3 - EXECUTION

PANELBOARDS

Mount panelboards such that top most circuit breaker handles shall not be more than 6'-6" above finished floor.

Power circuits to fire alarm system control panel, auxiliary power supplies, command center console and any other fire alarm system component requiring line voltage power shall be dedicated branch circuits. Circuit disconnecting means shall be identified as follows: branch circuit breakers shall have an engraved phenolic nameplate permanently attached adjacent to the circuit breaker, reading "FIRE ALARM CONTROL PANEL", "FIRE ALARM AUXILIARY POWER SUPPLY", or other suitable wording. Provide circuit breakers with lockable ON-OFF clips.

Where panelboards are to be installed on masonry unit walls, including poured reinforced concrete or brick veneer type, install two vertical sections of galvanized steel channel between enclosure and mounting surface. Channel shall be lagged to wall in three places (each length) and the enclosure bolted to the secured channel using stainless steel or galvanized steel hardware. Galvanized channel shall run the entire length of the enclosure, but shall not be exposed at either the top or bottom of the enclosure.

Only one conductor shall be allowed under each terminal of circuit breakers. No splices are permitted in panelboards. Tighten connectors and terminals in accordance with equipment manufacturer's published torque tightening values for equipment connectors.

Complete and install a typewritten directory for each panelboard that accurately indicates all loads being served by each breaker.

DISCONNECTS

Motor circuit disconnects shall be mounted within fifty feet and in sight of the load being served.

Disconnects shall be labeled in accordance with Section 26 00 00.

Safety disconnects for fire alarm service shall be factory painted red, with engraved phenolic nameplate identifying the circuit.

END OF SECTION

Leon County Schools
Leon High School
Building 7 Gymnasium Remodeling & Renovation Project
550 East Tennessee Street
Tallahassee, Florida 32308
LCSB RFQ #504-2023
H+SA#22.133
August 25, 2023

SECTION 27 41 16 - SOUND REINFORCEMENT SYSTEM
(ADD ALTERNATE – SEE PLANS)

PART 1 - GENERAL

SUMMARY

This section includes all professional services, transportation services, supervision, coordination, etc., necessary to complete the installation of a high quality Audio System as specified. “Audio System” references the system and “Audio System Installer” references the installer. The Audio System Installer is responsible for sizing the sound cabinet, amplifiers, patch panels, transformers, etc. to ensure a complete and properly operating system in accordance with the performance criteria set forth in this specification. All installed equipment must be new and in unused condition. It is the intent of the specifications to indicate the quality, configuration, and performance of the Audio System. The Audio System installation includes the following:

1. Point Source Sound System
2. Audio Control System
3. Cables, connectors, plates and wiring
4. All necessary design, fabrication, processing and amplification equipment, and installation for a complete sound system as described

The section also includes:

1. Scope of work
2. Verification of dimensions and conditions at the job site
3. Preparation of submittal information
4. Installation in accordance with the contract documents, manufacturers recommendations, and all applicable code requirements
5. Instruction of operating personnel: provision of manuals
6. Maintenance services and warranty

REFERENCES

Audio System Design and Installation, G.H. Philip Giddings, 1990
Digital Audio Engineering - Serial Transmission Format for Two-Channel Linearly Represented Digital Audio Data, Recommended Practice (AES-3), ANSI S4.40, 1992
Handbook for Sound Engineers (Third Edition) Glen M. Ballou, 2002
Loudspeaker Components Used in Professional Audio and Sound Reinforcement, ANSI S4.26, 1984 (R1992)
Sound System Engineering (Third Edition), Don Davis and Eugene Patronis, Jr., 2006
Standard for Safety for Audio, Video, and Similar Electronic Apparatus – Safety Requirements: IEC 60065, UL 60065, EN 60065, and CAN/CSA C22.2 #60065

Information Technology Equipment – Radio Disturbance Characteristics: EN 55022:2010 / AC:2011, Class A / CISPR 22 (ed.5); am1
Electromagnetic Compatibility: EN 61000-3-2:2006 +A1:2009 +A2:2009 / IEC 61000-3-2 (ed.3); am1, am2
Electromagnetic Compatibility: EN 61000-3-3:2008 / IEC 61000-3-3 (ed.2)
Information Technology Equipment – Immunity Characteristics: EN 55024:2010 / CISPR 24 (ed.1); am1, am2; 47 CFR, Part 15:2010, §15.107 and §15.109, Class A; ICES-003, Issue 4:2004
National Electric Code

SYSTEM DESCRIPTION

The following is intended to provide an overview of the design concepts and is not an exhaustive description of the Audio System.

The Audio System consists of a main single source speaker system composed of a full-range design with built-in signal processing and limiting protection.

The Audio System includes speaker amplification and signal processing components that are self-contained within a wall mount rack. Design the system to ensure that all processing and amplification equipment meets project and manufacturer's recommendations for allowed headroom. The services of the Audio System Installer include all necessary acoustical, electrical, mechanical, and structural engineering to incorporate a complete sound system.

Scope of work includes the following: Physical mounting of speaker cabinet to the wall, speaker cable between the speaker cabinet and wall mount rack supplied by the Audio System Installer, signal cable between the control location (designated by owner) and the wall mount rack, a dedicated AC power feed (supplied by owner) to the supplied wall mount rack, and the audio control system. A licensed electrician must perform all high voltage electrical work.

Provide a main speaker cabinet with an aluminum frame covered with signage grade, vinyl mesh material. The vinyl material must be acoustically transparent and provide the capability of creating a speaker grille covering with custom printed graphics. The specified graphic art is printed using a large format, photographic quality, color printing process.

Loudspeaker

1. Safe, secure and permanent manner in their operating position.
2. The aiming direction of the mid/high loudspeakers must be adjustable by +/- 25 degrees horizontally and 5 degrees down vertically.
3. Rigging, mounting and support systems for loudspeakers reviewed and certified by a registered professional engineer.

4. Structural support members to have an appropriate safety factor (determined by a structural engineer). All fasteners to be graded and certified for use in the intended applications.
5. All loudspeakers rigidly supported inside of the sound cabinet. Wire rope and/or chain suspension of loudspeaker components inside the sound cabinet is unacceptable.

The Audio System is to achieve the following performance standards: continuous output level of 120 dBA at 1 meter with sufficient headroom to allow for peaks. The frequency response of the sound system to be at least 35 Hz to 20 kHz (-10 dB) at 1 meter.

The Audio System utilizes digital signal processing for all applications. All digital signal processing is contained within the amplifier. The digital signal processor will provide the following signal processing capability: output gain control, equalization, delay, crossover, and limiting.

SUBMITTALS

Submit the following documents with bid proposal. Failure to provide a complete set of submittals will result in disqualification. Provide shop drawings and submittal data containing sufficient information to describe the work to be performed. Prepare drawings at an appropriate scale. Submit shop drawing information at one time. Provide the following information, but not necessarily limited to:

1. System description
2. Complete system equipment list, with individual specification sheets for each piece of equipment
3. Functional system block diagram showing all major equipment and signal flow
4. Basic speaker cabinet design drawings consisting of the cabinets' overall dimensions, and estimated weight of entire system with all equipment installed
5. Proof of performance illustrations as generated by an acoustical CAD modeling program (EASE or equivalent). Illustrations to include direct field sound pressure level performance throughout the facility at 125 Hz, 250 Hz, 500 Hz, 1,000 Hz, 2,000 Hz and 4,000 Hz.

DELIVERY, STORAGE AND HANDLING

The Audio System Installer will be responsible for transporting all related audio equipment to the job site. Upon installation, audio equipment becomes the responsibility of the owner.

The Audio System Installer will be responsible for audio equipment once it is received at the job site. In addition, Audio System Installer will be responsible for unloading the shipment truck, providing safe storage of audio equipment, and installation of audio equipment.

All transportation expenses of equipment to the job site will be the responsibility of the Audio System Installer.

PROJECT CONDITIONS

Audio System Installer desiring to submit a proposal are responsible for acquiring, from the owner, any plans or documentation pertaining to the audio system installation and are encouraged to perform a pre-bid site survey.

Confirm conditions on the jobsite pertinent to this work. Give notice to the owner in writing of discrepancies, conflict, or omissions promptly upon discovery.

QUALITY ASSURANCE

Source Limitations: Obtain each type of audio equipment through one source from a single manufacturer.

Manufacturer's qualifications: A minimum of five (5) years' experience with the specified types of products and installation.

Installer's qualification: Business familiar in the installation of systems similar in complexity to those essential for this project; and fulfillment of the following:

1. The primary business of contractor shall be in the installation of sound and video systems.
2. At least (5) five years' experience with systems of the specified types and products included.
3. Experience with comparable scale sound reinforcement projects within the last three (3) years.
4. Retain a fully staffed and equipped service facility with fulltime field technicians.
5. Be a franchised dealer and approved service facility for all amplifiers, digital and analog signal processing equipment and loudspeaker products specified or proposed; if not, supply detailed description of how warranty service on these items will be obtained, and if any manufacturer's warranties will become void.
6. Installer to be factory educated in the installation and maintenance of any digital signal processed based control systems.
7. At the request of the owner, the Installer must demonstrate having:
    - Sufficient plant and equipment to complete the work within the agreed timetable
    - Sufficient staff with commensurate technical experience
    - Appropriate financial status to meet the obligations of the work
    - Capability to provide performance bonding

WARRANTY

Provide a complete system parts warranty for a minimum period of one year after completion and acceptance of audio system.

This warranty will not void specific warranties issued by manufacturers for greater periods of time. Nor will it void any rights guaranteed to the owner by law.

The Audio System Installer must provide the owner an opportunity to purchase a preventive maintenance inspection agreement or full service agreement. The minimum term of any maintenance or service agreement consists of one year.

Warranty replacement and service of equipment will not apply to any owner-furnished equipment.

PART 2 - PRODUCTS

ACCEPTABLE MANUFACTURERS

To establish the minimum functional, aesthetic and quality standards, products and product series of the manufacturers listed below are required.

Substitutions: Products of other manufacturers are acceptable provided they meet the performance and reliability standards of the recommended equipment. Any substitution to this list must be submitted and approved in writing 10 days prior to the bid date.

GENERAL

Regardless of the length or completeness of the descriptions below, each device shall meet published manufacturers' specifications.

Equipment and materials must be new and conform to applicable UL or ANSI provision.

Product quantity is as required. If a quantity is given, Audio System Installer shall provide at least the given amount.

MAIN SPEAKER CLUSTER

Engineered single source speaker system

1. Frequency response (-10 dB @ 1 m): 35 Hz to 20 kHz
2. Max SPL (@ 1 m): 120 dBA
3. Overall coverage: 45 V X 150 H

4. Acceptable products:
   - Daktronics Sportsound® SSN-150 System (@ 1)
     - Protective aluminum sound cabinet w/ front customized logo/graphics
     - JBL CBT 70J-1 + 70JE-1 Array System (@ 1) and ASB6112 (@ 1)

CONTROL RACK

Rack

1. Tilt-out wall rack with 4RU of rack space
2. Tamper resistant design ideal for use in non-secure areas
3. Vented design for effective passive thermal management
4. Acceptable products:
   - Middle Atlantic TOR-4-20SP (@ 1)

Amplifier

1. 4 Channel; 625 W per channel
2. Frequency Response: (at 8 ohm, 20 Hz to 20 kHz): +/-0.5 dB
3. Total Harmonic Distortion (at full rated power, 20 Hz to 20 kHz): 1%
4. Monitoring and control capabilities
5. IEC Power Connector: 15 A IEC
6. On-board Digital Signal Processing (DSP) with:
   a. 4x4 internal mixer
   b. Crossover
   c. 5-band parametric EQ
   d. Delay
   e. RMS and peak limiting
7. Acceptable products:
   - QSC CXD 4.3 (@ 1)

AUDIO CONTROL SYSTEM

Equipment Rack

1. 4RU vertical rackmount
2. Rear Access Panel
3. Acceptable product:
    - SKB Shallow Roto Rack / 1SKB-R4S

Audio Mixer

1. Four mic inputs with bass cut for vocal microphones and phantom power
2. Two mic/line (XLR/TRS) switchable inputs
3. Two stereo RCA inputs
4. One 1/8" music input
5. Individual input channel metering and output meters
6. Two outputs, XLR and 1/4", each with selectable ducking and limiting functions
7. Fire Alarm interface, Normally Open (NO) or Normally Closed (NC), selectable
8. Acceptable products:
    - Daktronics Multimedia Mixer

Audio Signal Switch

1. Style: 2 Position
2. Operator action: maintained
3. 1 RU standard rack space, black
4. Laser etched text
5. Acceptable products:
    - Daktronics Signal Switch

Laptop Interface

1. 1/8" (3.5 mm) male input
2. Balanced XLR male output
3. Adjustable output volume control
4. Acceptable products:
    - LTIBLOX Laptop Interface

USB Audio Interface

1. 24-bit, 96 kHz quality audio
2. Two balanced XLR outputs (left and right)
3. 3.5mm TRS headphone output
4. Ground lift and mono-sum switches
5. Acceptable product:
    - Radial® Engineering USB-Pro™

Wireless Microphone Receiver

1. 1/2 RU unit
2. 24 bit digital audio
3. XLR balanced mic/line outputs
4. RF Sensitivity: −97 dBm at 10^{-5} BER
5. Audio Frequency Response: 20 Hz to 20 kHz, +/- 1 dB
6. Audio Dynamic Range: > 120 dB (A)
7. Total Harmonic Distortion: < 0.1%
8. Acceptable products:
    - Electro-Voice RE3-RX

Additional Wireless Microphone Receiver

1. 1/2 RU unit
2. 24 bit digital audio
3. XLR balanced mic/line outputs
4. RF Sensitivity: −97 dBm at 10^{-5} BER
5. Audio Frequency Response: 20 Hz to 20 kHz, +/- 1 dB
6. Audio Dynamic Range: > 120 dB (A)
7. Total Harmonic Distortion: < 0.1%
8. Acceptable products:
    - Electro-Voice RE3-RX

Wireless Handheld Transmitter

1. Microphone element: Cardioid, Dynamic Vocal Microphone
2. Working Range: 100 m (328')
3. Battery life: 9+ hours
4. RF Output: Selectable 1 mW or 10 mW
5. Acceptable products:
    - Electro-Voice RE3-HHT76

Additional Wireless Handheld Transmitter

1. Microphone element: Cardioid, Dynamic Vocal Microphone
2. Working Range: 100 m (328')
3. Battery life: 9+ hours
4. RF Output: Selectable 1 mW or 10 mW
5. Acceptable products:
    - Electro-Voice RE3-HHT76

Wireless Bodypack Transmitter

1. Connector: 4-pin male mini connector (TA4M) for microphone or mute switch
2. Working Range: 100 m (328')
3. Battery life: 9+ hours
4. RF output: Selectable 1 mW or 10 mW
5. Acceptable products:

- Electro-Voice RE3-BPT

Referee Headset

1. Electret condenser microphone element
2. Unidirectional cardioid polar pattern
3. Acceptable product:
   - Electro-Voice HM7

High Gain Antenna Kit

1. Cardioid directional antenna
2. 6 dB gain
3. Acceptable product:
   - Shure PA805 @ 2

Single-Muff Headset

1. Neodymium magnet
2. Cardioid condenser microphone
3. Acceptable product:
   - Beyerdynamic DT 287

CABLE AND CONTROL WIRING

All cables must be installed in conduit or closed raceway areas. Use plenum cable as necessary. Exposed cable is not acceptable, unless approved by owner. Cable specifications are as follows:

1. 1 pair, 12 AWG speaker cable (@ 2) from speaker cabinet to amplifier rack location
2. 1 pair, 22 AWG signal cable from amplifier rack to input plate
3. Microphone level cables: No. 22 shielded jacketed - Belden 9451 with black jacket

PART 3 - EXECUTION

GENERAL

Coordinate work with other trades to prevent delays in the construction schedule.

Verify dimensions and location of equipment to be mounted.

INSTALLATION

Mount equipment and enclosures square and plumb. Permanently installed equipment to be held firmly and safely in place. All mounting brackets must be approved by a structural engineer.

Input Plates shall be 1/8" thick aluminum, standard EIA sizes, brushed black anodized finish unless otherwise noted. Plastic plates are not acceptable. A maximum of 4 inputs may be distributed in venue. It is the Installer’s responsibility to determine the exact quantity and location of microphone input plates needed. Verify with the owner.

Remote mount antennas from control rack location to venue for clear line of sight with transmitters. Refer to plans for notes regarding proposed locations for remote mount wireless mic antennas.

SYSTEM WIRING

For all analog audio interfaces, take precautions to prevent and guard against electromagnetic and electrostatic hum. For analog line level audio signals, float cable shield at the receiver end of the cable. Shields not connected to be folded back over cable jacket and covered with heat-shrink tubing. Do not cut off unused shields.

Exercise care in wiring; damaged cables or equipment are not acceptable. Isolate cables of different signals or different levels; and separate, organize, and route to restrict channel crosstalk or feedback oscillation in any amplifier section. Keep wiring separated into groups for microphone level circuits, loudspeaker circuits, and power circuits.

Make joints and connections with rosin-core solder or with audio grade mechanical connectors; where spade lugs are used, crimp properly with ratchet type tool. Spade lugs mounted on 22 gauge or smaller cable to be soldered after crimping.

Microphone, line, and control wiring from receptacle plate/chassis to patch panel/rack to be unbroken and unspliced unless specifically indicated on drawings. Remove spliced cables and replace without additional charge to the owner.

Connect cable to active components through screw terminal connections and spade lugs whenever available. Make connections to speaker transformers with properly sized closed end connectors crimped with factory approved ratchet type tool. Wire nut or Scotchlock connectors are not acceptable. Do not wrap audio cable splices or connections with adhesive backed tape.

Execute wiring in strict adherence to professional installation standards, as excerpted from Audio System Design and Installation P. Giddings (1st Edition), Howard W. Sams, 1990, and Appendix II "Recommended Wiring Practices", Sound System Engineering. (3rd Edition), D. Davis.

Wiring in rack to be neatly tied in manageable bundles with cable lengths cut to minimize excess cable slack but still allow for service and testing. Provide horizontal support bars if cable bundles sag. Eliminate excess AC power cable from rack mounted equipment. Rack wiring to be handled with plastic cable ties or lacing twine; electrical tape and adhesive backed cable tie anchors are not acceptable.

Connect loudspeakers electrically in phase, using the same wire color code for speaker wiring throughout the project.

Wiring and connections shall be completely visible and labeled in rack.

EQUIPMENT AND CABLE LABELING

Provide printed labels on the front and rear of active equipment mounted in racks. Mount labels in a neat, plumb and permanent manner.

On multiple input devices such as mixers, provide a printed label over each control that describes the function or purpose of the control. Label size to be adjusted to fit available space.

Equipment labels to have 1/8" high characters minimum. Labels to be black with white characters, except where indicated.

Cables and wiring to be logically, legibly, and permanently labeled for easy identification. Labels on cables shall be adhesive strip type. Self-laminating type labels are acceptable. Hand-written labels are not acceptable.

FIELD QUALITY CONTROL

Upon completion of installation and initial test adjustments, the audio system installer will conduct a performance evaluation in the presence of the owner or the owner’s representative. The audio system installer will notify the owner or the installer’s representative of the testing schedule.

END OF SECTION

Leon County Schools
Leon High School
Building 7 Gymnasium Remodeling & Renovation Project
550 East Tennessee Street
Tallahassee, Florida 32308
LCSB RFQ #504-2023
H+SA#22.133
August 25, 2023

SECTION 28 01 10 – ACCESS CONTROL SYSTEM

PART 1 – GENERAL

SUMMARY

This document includes a general description, functional requirements, operational characteristics, and criteria for the Security Management System (SMS). This specification uses the terminology “card”, “card reader”, and “key fob” interchangeably, but it is the owner’s intent to receive a system that utilizes a key fob similar to devices used at other Leon County School facilities. Cards/badges will not be used.

REFERENCES

The Codes and Regulations listed below form a part of this specification to the extent referenced. Work shall be performed in accordance with the applicable international, federal, state, and local codes or standards current at the commencement of installation. The following list summarizes applicable standards:

UL 294
UL 1076
CE
FCC – Part 15, Part 68
NFPA 70, NEC
IEEE, RS 170 variable standard
Microsoft® Open Database Connectivity (ODBC) interface
ISO Software Coding Standards
RoHS

Where more than one code or regulation is applicable, the more stringent shall apply.

Cable installation, identification and termination shall be performed in addition to the applicable codes above.

SYSTEM DESCRIPTION

The Security Management System outlined in this section and detailed in Part 2 of this document is the key central component for managing physical security for this project. The system shall provide a variety of integral functions including the ability to regulate access; provide identification credentials; monitor, track and interface alarms.

The SMS shall be able to seamlessly interface with and monitor Open Architecture system control panels (SCPs), reader interface modules, and field I/O panels (SIOs).

The SMS shall be able to communicate with system control panels via TCP-IP/Ethernet or RS-485.

All tasks shall be accessible from any compatible client workstation on the network utilizing one or all of the following:

Traditional client server (TCP/IP) architecture

SUBMITTALS

Shop Drawings: Provide complete shop drawings which include the following:

Indicate all system device locations on architectural floor plans. No other system(s) shall be included on these plans.

Include full schematic wiring information on these drawings for all devices. Wiring information shall include cable type, conductor routings, quantities, and connection details at device.

Include a complete SMS one-line, block diagram.

Product Data: Provide complete product data that includes the following:

Manufacturer's technical data for all material and equipment at the system and sub system level to be provided as part of the SMS.

A system description including analysis and calculations used in sizing equipment required by the SMS. The description shall show how the equipment will operate as a system to meet the performance requirements of the SMS. The following information shall be supplied as a minimum:

Server(s) processor(s), disk space and memory size
Description of site equipment and its configuration
Network bandwidth, latency and reliability requirements
Backup/archive system size and configuration
Start-up operations
System expansion capability and method of implementation
System power requirements and UPS sizing
Device / component environmental requirements (cooling and/or heating parameters)

Contract Close-Out Submittals: Provide four (4) sets of hard copy manuals and electronic format manuals including operating instructions, maintenance recommendations and parts list including wiring and connection diagrams modified to reflect as-built conditions.

As-Built Drawings: During system installation, the Contractor shall maintain a separate hard copy set of drawings, elementary diagrams, and wiring diagrams of the SMS to be used for record drawings. This set shall be accurately kept up to date by the Contractor with all changes and additions to the SMS. Copies of the final as-built drawings shall be provided to the end user in DWG format.

QUALITY ASSURANCE

Manufacturer Qualifications

Manufacturer of the SMS shall be an established organization with referenced and documented experience delivering and maintaining Security Management Systems of equal or higher sophistication and complexity as compared to the system detailed in this specification.

SMS Manufacturer's manufacturing facilities shall be certified ISO-9000:2000 operations, utilize ISO-9000:2000 manufacturing procedures and maintain their ISO certifications.

WARRANTY

Contractor shall warrant all equipment and associated installation labor for a period of one (1) year from date of substantial completion.

PART 2 - PRODUCTS

MANUFACTURERS/SYSTEMS

RS2 Technologies Access It! Universal

MANUFACTURED UNITS

System Control Processor (SCP)

The System Control Processor (SCP) shall link the SMS Software to all “down-stream” field hardware components (SIOs,). The SCP shall provide full distributed processing of access control / Alarm Monitoring rules and operations. A fully loaded and configured SCP shall respond in less than one-half (0.5) second to grant or deny access to cardholder.

The SCP shall continue to function normally (stand-alone) in the event that it loses communication with the SMS software. While in this off-line state, the SCP shall make access granted/denied decisions and maintain a log of the events which occur. Events shall be stored in the SCP local memory, and then uploaded automatically to the SMS database after communication has been restored.

In addition, the SCP shall incorporate the following features:

UL 294 and CE Certified
Support for Host Communications Speed of 115,200 bps
Support Direct Connect, Remote Dial Up, or Local Area Network (LAN) Connection
Support for up to 6 MB of On-Board Memory
LAN Support shall utilize RJ45 (10/100baseT) Ethernet Interface
Flash Memory for real time program updates and overall host communications
Support 2 wire RS-485 downstream ports - downstream ports shall be for connecting SIO panels via RS-485 multi-drop wiring configuration
Initial base memory download between SCP with standard memory from the SMS shall require no more than ten (10) seconds
Support for up to 32 SIO devices
Support of multiple card technologies
Supervised Communications between SCP and SMS Software
Support of up to eight card formats and facility codes
Integration to other manufacturer’s OSDP (Open Supervised Device Protocol), Magnetic (Clock and Data) and Wiegand (Data 1, Data 0) card readers
Uninterruptible Power Supply (UPS) with battery backup for 24 hour standby
32-bit Microprocessor
An SCP downstream serial port shall multi-drop up to 32 access control SIO field hardware devices using an RS-485 UL 1076 Grade A communication format allowing a distance of 4,000 feet using Belden 9842 cable or equivalent
12-24 VDC input power
Issue Code Support for OSDP (Open Supervised Device Protocol), Magnetic (Clock and Data) and Wiegand (Data 1, Data 0) Card Formats
Individual Shunt Times
Up to Nine Digit PIN Codes

Downstream serial RS-485 device support over CAT 5, 6e cable
Status LEDs for normal component and communication status
RoHS Compliance

Input Sub Input / Output module (SIO)

The Input Control Module shall provide 16 UL 1076 Grade B, A or AA alarm input zones and monitor / report line fault conditions, alarm conditions, power faults and tampers. Status LEDs shall provide information about the sixteen alarm zone inputs, cabinet tamper, and power fault.

In addition, the SIO shall incorporate the following features:

UL 294 and CE Certified
Alarm contact status scanning at up to 180 times per second for each zone
Eight configuration DIP switches to assign unit addresses and communications speed
Variable resistor values for line supervision
A low power CMOS microprocessor
Filtered data for noise rejection to prevent false alarms
Up to 16 Grade B, A, or AA Supervised Inputs in any Combination
12 or 24 VDC Input Power
2 Form C 5A, 30 VDC Contacts for load switching
2 dedicated inputs for tamper and power status
RoHS Compliance
Support for RS-485 over CAT 5, 6e cable

Output Sub Input / Output module (SIO)

The Output Control Modules shall provide 16 Form-C 5A 30 VDC relay contacts for load switching. The relays shall be configurable for fail-safe or fail-secure operation. Each relay shall support “On” “Off” and “Pulse” operation.

In addition, the SIO shall incorporate the following features:

12 or 24 VDC input power
Two dedicated digital inputs for tamper and power failure status
RS-485 communications, multi-dropped (2-wire or 4-wire RS-485)
Up to 16 OUTs per SCP
Onboard termination jumpers
DIP switch selectable addressing
Status LEDs for communication to the host, heartbeat and relay status
RoHS Compliance
Support for RS-485 over CAT 5, 6e cable

Single Reader Sub I/O module (SIO)

The Single Reader module shall provide an interface between the SCP and authentication devices. The module must operate with any authentication device that produces a standard Wiegand, Data 1 / Data 0, Clock and Data communication, or OSDP output.

In addition, the single reader shall incorporate the following features:

- 12 or 24 VDC power supply
- Reader communications (Clock/Data, Wiegand Data1/Data0, or OSDP)
- Two Form-C relay outputs (5 A Door Strike and 1 A Aux relays)
- Up to 8 different card formats
- Issue code support for Magnetic, Wiegand and OSDP formats
- Door contact Open or Closed, Supervised or Non-Supervised.
- REX push-button monitor – Open or Closed Supervised or Non-supervised
- Strike Control output
- Dedicated tamper and power failure circuits
- Bicolor or two wire status LED support
- Beeper control
- Support for offline reader access mode
- UL 294 listed and CE approved
- RoHS Compliance
- Support for RS-485 over CAT 5, 6e cable

Dual Reader Sub Input/Output module (SIO)

The Dual Reader module shall provide a dual interface between the SCP and authentication devices. The module must operate with any authentication device that produces a standard Wiegand, Magnetic or OSDP (Data 1 / Data 0 or Clock and Data) communication output.

In addition the dual reader shall incorporate the following features:

- 12 or 24 VDC power supply
- Reader communications (Magnetic Clock/Data, Wiegand Data1/Data0 or OSDP) - more than 150 different readers approved for use
- Six Form-C 5 A at 30 VDC relay outputs
- Up to 8 different formats
- Issue code support for Magnetic, Wiegand or OSDP formats
- Door contact supervision (Open/Closed)
- REX push-button monitor (Open/Closed, Supervised or Non-Supervised).
- Strike Control output
- Bi-color status LED support and 2-wire LED support
- Beeper control

Dedicated tamper and power failure circuits
Support for offline reader access mode
Onboard jumpers for termination
Onboard jumpers for 5 VDC or 12 VDC reader support
DIP switch selectable addressing
UL 294 listed and CE approved
RoHS Compliance
Support for RS-485 over CAT 5, 6e cable

COMPONENTS

System Functionality

Time Intervals

The SMS shall be capable of creating and storing an unlimited number of Time Intervals, limited only by the available hard drive space.

Each Interval may be defined with a 50 character name.

Each Interval will consist of a start time, an end time and the selected days the interval is to be active. Selected from a 15 day per week Calendar consisting of Sun thru Sat for 7 days and 8 Holiday Types / Categories which together will produce the 15 day per Interval Week for the individual Time Interval. Time Intervals shall be allowed to belong to any or all TimeZones so that the Time Interval only has to be defined once.

Time Zones

The SMS shall be capable of creating and storing up to two hundred fifty five (255) time zones. Each time zone shall have a minimum of Twelve (12) Time Intervals. Each Time Interval shall be assignable to each and every TimeZone.

Each time zone shall be assignable to an alphanumeric name of up to 50 characters. Time zones shall be applied to access levels, card reader modes, alarm inputs, and alarm outputs. Time zones shall be allowed to belong to any or all access levels so that the time zone only has to be defined once.

Access Levels

The SMS shall be capable of defining a minimum of 32,000 access levels with a minimum of 32 access levels per cardholder card. Access Levels shall consist of a combination of card readers and time zones.

Each Access Level shall be assignable to an alphanumeric name using up to 50 characters.

Card readers shall have the ability to be assigned to any or all access levels defined in the SMS. Individual card readers shall be capable of having a distinct time zone assigned to it.

The SMS shall allow a 'First Card Unlock' option to be assigned on a Combination of TimeZone and Allowed Card Group.

Temporary Access Levels shall be enabled at the Site level.

The SMS shall be capable of assigning Temporary Access Levels inclusive of the 32,000 assignable Access Levels.

Each Temporary Access Level shall be assignable to an alphanumeric name using up to 50 characters.

Each Temporary Access Level shall be definable with a start and end date.

Temporary Access Levels shall be stored in the SCP and functionality shall be maintained in the event of disconnection with the SCP.

Precision Access is enabled at the Site level and allows each Cardholder to have a TimeZone assigned separately for Access to each Reader.

Holidays

The SMS shall provide a minimum of 255 Holiday assignments using an embedded calendar. Holidays shall be assigned an alphanumeric name using up to 50 characters and shall be grouped into eight (8) types of holidays, and shall be assignable individually. Access rights, card reader modes, and schedules must be able to be altered when the current date is designated a Holiday.

Daylight Savings Time changes shall take effect automatically, based on the SMS Server time which may be synchronized using an NTP Server or the NIST Time synchronization.

The SMS shall support Holiday Ranges that allow a single holiday to span across multiple calendar days.

First Card Unlock

The SMS shall provide a First Card Unlock feature that when configured records a pre-determined time zone activated unlock command until a valid credential has been presented and granted access to the portal.

Database Segmentation

The SMS shall be required to support data Sites (segmentation, partition) whereby each Site (segmentation, partition) shall have its own set of cardholders, field hardware and system parameters (time zones, access levels etc.). This Site (segmentation, partition) shall expand the limitations of the SMS parameters (i.e. access levels and time zones) to the maximum capacity of each parameter multiplied by the number of Sites. The following list shall be made available for segmentation:

Access Group
Access Levels
Actions
Alarm Inputs
Alarm Outputs
Areas
Badge Types
Card Formats
Cardholders
Card Readers
Holidays
Maps
User Groups
Time Zones
User Permission Groups

Field Hardware Communications

The SMS shall communicate with the SCPs by the following protocols:

RS-485
Communication baud rate shall be system selectable with a rage between 1,200 to 115,200 bits per second.

TCP/IP

Download communication between the SMS and the SCP shall be fully multi-tasking and shall not interfere with operational functions.

Upon loss of communications between the SMS Server and the SCP an alarm shall be created with a time stamp. Upon re-established communication the SMS and the SCP shall automatically re-synchronize from the point of communication loss without operator intervention.

Panel Support

The panel support shall be used in conjunction with other SCP wiring support such home-run wire architecture, and advanced distributed network architecture.

Extended Unlock times

The SMS shall support Extended Unlock Times that shall allow a card reader's strike to be active for an extended period of time beyond the pre-determined standard strike time on a per cardholder basis. The extended strike time shall be user definable up to 255 seconds. Extended strike times shall be set on a card reader by card reader basis.

Extended Allowed Open Time

The SMS shall support Extended Allowed Open Time that allows a card reader's door to be held open for an extended period of time beyond the pre-determined standard held open time on a per cardholder basis. The extended held open time shall be user definable up to 131,070 seconds. Extended held open times shall be set on a card reader by card reader basis.

Graphical System Overview

A graphical system overview shall display a graphical representation of all field hardware (including SCPs, intrusion detection devices) that has been configured in the SMS. Users with appropriate permissions shall be able to modify a device that is depicted on the graphical system overview or see its properties by double clicking on the icon and the SMS shall bring them to the appropriate form.

Alarm/Event/Log Options

All alarms and events in the SMS shall by default, always be recorded in the database. The SMS shall give Users with appropriate permissions the ability to select the SMS to “Disregard”, “Log and Display”, “Alarm” or “Log only” specific events to the database.

Macro Scheduling Utility

The SMS shall provide an integral Macro Scheduling Utility. The Scheduling Utility integral to “Macros” shall allow Users with appropriate permissions to schedule Macros to occur on a one-time or a recurring basis. Recurring schedules shall be configured to begin immediately, last indefinitely, or have optional start and end dates.

The Scheduling Utility shall be available with the appropriate User Permission, from the Macro selection,

The types of actions that shall be schedulable via Macro include but are not limited to:

Execute Task
Enable Task
Disable Task
Execute Program Hidden
Execute Program and Activate
Execute Program Minimized and Activate
Execute Program Maximized and Activate
Execute Program
Execute Program Minimized
Print Report
Send String To Video Switcher
Email Recipient
Email Report
Send Direct Command to SCP Hardware
Send Direct Command to 2g Hardware
Arm Intrusion Area
Bypass Intrusion Area
Reset Intrusion Area
DE energize Intrusion Output
Pulse Intrusion Output
Activate Card
Deactivate Card
Delete Card
Delete Card and Cardholder
Assign Access Level

Revoke Access Level
Lock IP Lockset
Unlock IP Lockset
Enable IP Lockset Panic Mode
Disable IP Lockset Panic Mode
Execute Macro
Reset all Panels
By having a Macro being capable of Executing a Task and Executing another Macro a chain of Actions/Commands may be Executed, and while Tasks are limited to the SCP they are assigned to, a Macro may be constructed in such a manner as to Execute a Task on one SCP, and then Execute a Task on another SCP, and by then Executing another Macro, a Global Command String may be created. A Global Command may be utilized to Lock Down multiple Sites with a single Action if Desired.

Alarm/Event Filtering/Escalation

The SMS shall be capable of allowing Users having the appropriate User Permission to construct and / or utilize Filters for alarms and events.

A Filter permits a User to display specific Events / Alarms at a Workstation

The SMS shall be capable of automatic routing of an alarm to all workstations. The SMS shall implement network synchronization that in the event alarm/event is filtered by multiple client workstations. When an alarm occurs, the service will automatically distribute the event to all workstations configured to receive events.

Once an alarm is acknowledged it is immediately acknowledged on all workstations (it is not removed).

Once an alarm is cleared it is immediately cleared from all workstations.

If a workstation is not logged in, and alarm/events occur they are queued within the database and pushed out once the workstation logs in. If another workstation acknowledges / clears the alarm while the workstation is not logged in the alarm / event will not be displayed on the workstation when the workstation is logged in. This is to eliminate confusion concerning currently active alarms.

Text Instructions

The SMS shall allow for a set of text instructions to be associated with each alarm that arrives into the SMS. The text instruction function shall allow Users with the appropriate User Group Permissions to enter text for procedures to follow for each alarm that arrives at the client workstations. Each alarm or event in the SMS shall be capable of having its own unique set of text instructions should instructions be desired.

Customizable Audio Annunciation

The SMS shall allow for a customizable audio annunciation to be associated with SMS alarms. The customizable audio annunciation shall allow a User with appropriate permissions select a unique audio annunciation for each event/alarm generated.

Event/Alarm Filter Attributes

Users with appropriate permissions shall have the ability to configure how the SMS handles the annunciation of alarms on an individual basis. Each alarm and/or event shall have the option(s) to:

Display at one or more client workstation using the appropriate filter.
Filter higher priority alarms to be displayed on the client workstation ahead of lower priority alarms, by sorting the Priority column in ascending or descending order.
Require the field device, which generated the alarm to be restored to its normal state before the alarm is cleared.
Print the alarm to a local event printer.
Have the alarm Annunciate the Alarm in the Alarm window should the User be working in another application. The
Annunciation and flashing Alarm Window ICON shall serve to call the User's attention to new alarms.
Allow Users with appropriate permissions to modify / add to the journal entry once the alarm has been acknowledged.
Display text instructions outlining the procedures to follow when responding to the alarm.
Automatically call-up associated maps.
Automatically call up the associated cardholder photo.
Require acknowledgment to clear.
Allow mandatory journal entry upon acknowledgment.
Automatically send an e-mail message.
Automatically send an alphanumeric page.
Have the alarm appear in the Alarm Monitoring window with a colored coded bar across the alarm for high priority alarms.
Have the alarm, when acknowledged, display an alternative color coded bar across the alarm than for the original alarm color.

Event/Alarm Filter Mappings

The SMS Event/Alarm Filters shall be assignable containing any or all devices that contain an event description. Thus, the 'door forced open' event attributes shall apply to any door with a card reader that is forced opened in the SMS. The SMS shall have the capability to assign unique event attributes to specific device/event combination to override the system SMS wide settings for specific case settings. For example, Users may assign a different set of attributes to be applied to a 'door forced open' at a bank vault or research facility than they would if the front door was forced open. The SMS must include this type of flexibility. Each device/event combination shall have the ability to have its own unique attribute set if desired. Each device/event must be capable of being designated to be an alarm with a common or unique priority setting.

System Downloads

The SMS shall provide for the downloading of data to the SCPs. Downloads shall load SMS information (time zones, access levels, alarm configurations, etc.) into the SCPs first, followed by cardholder information and card reader configurations.

All SCPs on the SMS shall be capable of either full or selective downloads to individual SCPs. and bi-directionally so that alarms will still report to their respective Alarm Monitoring client workstations as cardholder information is being downloaded.

A complete database download of 10,000 cardholder records to all SCPs (regardless of the number of SCPs) must be complete within ten (10) minutes per site.

Operational Information on cardholder status, badge status, time zones or access levels shall download to the SCPs in real time as they are added, modified, or deleted from the SMS.

Card Reader Options

The SMS shall include the following options for each reader on the system:

Allow User Commands
Rename Auxiliary Inputs
Rename Auxiliary Outputs
Independently Supervise REX and DPS
Configure REX and DPS as Normally Open or Normally Closed
Deny if Duress
Assume Door Used
Activate Outputs
Two Card Control
Do Not Activate Strike on REX
The ability to allow Users with appropriate permissions to determine to log and display, disregard, log only, or alarm on a card reader by card reader, event by event basis:
Access Grants
Access Denied

Card Reader Status Alarms

The SMS shall allow for user definable door strike functionality for each card reader in the SMS.

The SMS shall allow for each card reader to be selected as either an ‘Entrance Reader’, Exit Reader’, or ‘none’ to allow for ease of reporting time and attendance basic ‘time in’ and ‘time out’ data.

Use ‘Use Limit’ – This option shall enable Card Use Limits at the card reader limiting the number of times that cardholders may use their credential to gain access at the card reader.

Door Contact Settings –Shall permit the SMS to select card reader door contact selection of Normally Open, Normally Closed, Normally Open Supervised, Normally Closed Supervised for each Card Reader Door configured for the SMS.

Request to Exit Settings -- Shall permit the SMS to select card reader door contact selection of Normally Open, Normally Closed, Normally Open Supervised, Normally Closed Supervised for each Card Reader Door configured for the SMS.

The SMS shall allow for commands to be entered from a Command Keypad. The commands shall activate a Task which at a minimum shall be capable of:

Enable Input
Disable Input

Deactivate Output
Activate Output
Pulse Output
Disable Reader
Unlock Reader / Door
Lock Reader / Door
Set Reader to Facility Code
Set Reader to Card Only Mode
Set Reader to PIN Only Mode
Set Reader to Card & PIN Mode
Set Reader to Card or PIN Mode
Enable 2 Card Mode
Disable 2 Card Mode
Enable Biometric Verify
Disable Biometric Verify
Disable Reader Temporary
Unlock Reader/Door Temporary
Lock Reader/Door Temporary
Set Reader to Facility Code Only Temporary
Set Reader to Card Only Temporary
Set Reader to PIN Only Temporary
Set Reader to Card & PIN Temporary
Enable Door Forced
Enable Door Held
Disable Door Held
Grant Access
Dial Host
Execute Macro
Temporary TimeZone Deactivate
Temporary TimeZone Activate
TimeZone Deactivate
TimeZone Activate
Return TimeZone to Normal
Refresh TimeZone
Delay (Seconds) Abort Delayed Task
Resume Delayed Task
Issue Free Pass to all Cards
Temporary Reader LED Control
LCD Text Output
Disarm Alarm Zone
Override Alarm Zone
Force Arm Alarm Zone
Arm Alarm Zone

Override Arm Alarm Zone
Disarm Enhanced Alarm Zone
Arm Away Enhanced Alarm Zone
Arm Stay Enhanced Alarm Zone
Arm Instant Enhanced Alarm Zone
Send Data Out RS-485 Port
Disable Access Area
Enable Access Area
Set Access Area Occupancy Count

Input Configuration – The ability to specify each specific Input contact on an SIO as:

Normally Open
Normally Closed
Normally Open Supervised
Normally Closed Supervised
Current Status Indication

Device Group Support the SMS shall provide a visual status that displays the current status of all devices configured as a part of the SMS including devices downstream from the primary device. Additionally there shall be a display of card readers, SCPs and SIOs that are off line.

The SMS shall support device grouping for uniform command and control of groups of devices within the system. Beneath each SCP there shall be an expandable selection to visually and graphically show the status of the following devices reporting to each SCP:

Installed SIOs
Installed Readers
Installed Inputs
Installed outputs
Intrusion Detection Panels
IP Locksets

Color Coding for Alarm Priorities

The SMS shall have the capability to display alarms in the Alarm window with a colored bar across the alarm (background color) and display the Alarm Text in a separate User selected Color based upon priority.

Acknowledged alarms may be set with alternate color-coding. A minimum of 255 colors must be available for assignment to a minimum of 4 User definable Priority ranges.

Color Coding of Events

The SMS shall provide a method for Users having the appropriate permission level, the ability to select for each User Group events which will display using distinct Background colors with distinct text colors for each event.

Alarm Acknowledgment Responses

Frequently used alarm responses can be saved and re-used by adding them to the alarm responses in the database. This is accomplished by selecting the edit alarm responses from the file option on the system menu or from the right click menu and entering the alarm response name and the alarm response text to be saved. The alarm response name(s) will be displayed in the acknowledgement screen and the alarm response text will be filled in automatically once the alarm response name has been selected. This feature is useful if there are alarm response messages that are commonly re-used.

Request to Exit Event

The SMS shall provide an optional setting to annunciate an event when a REX device is used. Normally a REX event is not annunciated.

Alarm/Event Monitoring – Sites and Events Display Configuration

The SMS shall allow Users with appropriate permissions to define which Sites are displayed in the Event/Alarm Window and which Events. Using selectable Filters Users shall also be able to select the appropriate Filter for Events and for Alarms.

The SMS shall have buttons displayed above the column headers in the Alarm/Event Monitoring displays. These buttons may be utilized to perform the specific action referred to on the Alarm/Event highlighted in the Alarm/Event display without performing a right click first. A Users ability to utilize these buttons shall be controlled by their User Group Permissions.

Alarm point Enable / Disable

The SMS shall support the ability for Users with the appropriate permission to Enable / Disable of alarm points.

Sorting Capabilities

The SMS shall allow Users to arrange the way that alarms and/or events in the Event / Alarm window are listed by sorting the alarms and events. Sort criteria shall be based on time/date, Site Name, Card #, Facility Code, Description, and Location, for Events. Date/Time, Site Name, Card #, Facility Code, Cardholder, Description, and Location, Priority, Acknowledged By, and Unsecured, for Alarms to sort click on the appropriate column heading.

Credential Management

The SMS shall incorporate a Credential Management and Enrollment module that is integral to the SMS source code with the ability to create and maintain the Cardholder database. Features shall include the ability to:

Add, Modify and Delete records based upon permissions.
Capture photo images, biometric information and signatures based upon permissions.
Print Credentials based upon permissions.

Customization of screen layout and field names.

Users having the appropriate permissions, shall have the capability to modify User Field Names Displayed, whether fields are mandatory or optional, have text, masks to control data entry, alphabetical, numeric, date values, pull down lists for data validation/selection without requiring data entry, etc.

Assign Access Levels and Access Groups with appropriate user permissions.

Bulk Assignment/Modification/Deletion of Access Levels with appropriate user permissions.

Bulk Deletion of Cardholder Records with appropriate user permissions.

The SMS shall support the following credential types and allow for direct Thermal Dye Sublimation printing onto the credential surface.

Composite Credentials - 3.375” x 2.125”, UPVC Composite credentials with an ISO standard 30 mil thickness.
Proximity credentials
Smart Cards – Contact and Contact-less
Credential Management Enrollment Features

The SMS shall allow for automation of enrollment procedures with the following attributes based upon badge type:

Default Deactivation Date
Default Access Levels
Badge Design Layout

PART 3 - EXECUTION

Installation

Provide all equipment, wiring, conduit, outlet boxes, software, and programming required for the installation of a complete and operating system in accordance with applicable local, state and national codes, the manufacturer's recommendations, these plans and specifications. Color coded wires shall be used throughout.

Wiring shall conform to the National Electrical Code Article 725.

Door Switch Mounting

Unless otherwise indicated, magnetic switch components shall be mounted on the inside of doors. The magnetic switch shall be installed where it will be safe from tampering from the inside of the building or the outside. Switches shall be carefully connected in accordance with manufacturer's instructions to avoid degrading defeat-resistance. The operating portion of the switch shall be mounted on the door frame, with the associated magnet mounted on the door. Double leaf doors shall be protected by two switches, one on each door.

Testing and Inspections

The manufacturer's authorized representative shall provide supervision of final system panel connections, perform a complete functional test of the system and submit a written report to the contractor attesting to the proper operation of the system.

All equipment and wiring shall be guaranteed against defects in materials and workmanship for a one year period from the start up and beneficial use of the system. Warranty service for the equipment shall be provided by the system supplier's factory trained representative during normal working hours, Monday through Friday, excluding holidays.

Upon completion of the installation, the electrical contractor shall provide to the engineer, with a copy to the system supplier's representative, a signed written statement attesting that all system equipment was installed in accordance with these specifications and in accordance with wiring diagrams, instructions and directions provided to the contractor by the system supplier.

The completed system shall be inspected and tested in the presence of the Owner's representative.

END OF SECTION

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Leon County Schools
Leon High School
Building 7 Gymnasium Remodeling & Renovation Project
550 East Tennessee Street
Tallahassee, Florida 32308
LCSB RFQ #504-2023
H+SA#22.133
August 25, 2023

SECTION 28 31 00 FIRE DETECTION AND ALARM

PART 1 - GENERAL

EXISTING SYSTEM CLARIFICATION

The campus fire alarm system is to remain. Building 7 shall be reconfigured as shown on the plans and shall maintain connectivity with overall campus system. All fire alarm scope shall be completed in accordance with this specification.

DESCRIPTION

This section of the specifications includes the furnishing, installation, and connection of the microprocessor controlled, intelligent reporting fire alarm equipment, with integrated voice evacuation, required to form a complete coordinated system ready for operation. It shall include, but not be limited to, alarm initiating devices, alarm notification appliances, control panel(s), auxiliary control and monitoring devices, annunciators, communicators and wiring as shown on the drawings and specified here.

The fire alarm system installation shall comply with requirements of NFPA Standard No. 72 requirements for protected premises signaling systems except as modified and supplemented by this specification. The system shall be electrically supervised and monitor the integrity of all conductors.

The FACP and peripheral devices shall be manufactured 100% by a single manufacturer (or division thereof).

The ability for selective input/output control functions based on ANDing, ORing, NOTing, timing and special coded operations is to also be incorporated in the resident software programming of the system.

To accommodate and facilitate job site changes, initiation circuits shall be individually configurable on-site to provide either alarm/supervisory/trouble operation, alarm only, supervisory only, trouble only, current limited alarm, no alarm, normally closed device monitoring, a non-latching circuit or an alarm verification circuit.

To accommodate and facilitate job site changes, notification appliance circuits shall be individually configurable on-site to provide, upon activation, a temporal code until reset upon any output circuit.

BASIC PERFORMANCE

Alarm, trouble and supervisory signals from all intelligent reporting devices shall be encoded onto an NFPA Class B signaling line circuit. No T-taps will be permitted in system wiring.

Initiation Device Circuits (IDC) shall be wired Class B.

Notification Appliance Circuits (NAC) shall be wired Class B.

Alarm signals arriving at the main FACP shall not be lost following a power failure (or outage) until the alarm signal is processed and recorded.

BASIC SYSTEM FUNCTIONAL OPERATION

When a fire alarm condition is detected and reported by one of the system initiating devices, the following functions shall immediately occur:

The System Alarm LED shall flash.

A local audible signal in the control panel and remote annunciator panel shall sound.

A backlit LCD display shall indicate all information associated with the Fire Alarm condition, including the type of alarm point and its location within the protected premises.

History storage equipment shall log the information associated with each new fire alarm control panel condition and print on integrated control panel system printer, along with time and date of occurrence.

All system output programs assigned via control by event equations to be activated by the particular point in alarm shall be executed, and the associated System Outputs (alarm notification appliances and/or relays) shall be activated.

A supervised signal to notify the local fire department or an approved central station is to be activated. This circuit shall be configured as required to properly interface with the existing digital communicator.

The mechanical controls shall activate the air handling systems for shutdown and/or fan control.

Selectively close doors normally held open by magnetic door holders.

Refer to fire alarm matrix for additional site specific alarm actions**.**

When a supervisory condition is detected and reported by the system, such as a tamper switch, the following functions shall immediately occur:

Activate the system supervisory service audible signal and illuminate the LED at the control unit and the remote annunciator.

Pressing the Supervisory Acknowledge Key will silence the supervisory audible signal while maintaining the Supervisory LED "on" indicating off-normal condition.

Record the event in the FACP historical log and print to the integrated control panel system printer.

Transmission of supervisory signal to the supervising station.

Restoring the condition shall cause the Supervisory LED to clear and restore the system to normal.

Refer to fire alarm matrix for additional site specific supervisory actions**.**

When a trouble condition is detected and reported by the system, such as a loss of AC power at control panel, the following functions shall immediately occur:

Activate the system trouble service audible signal and illuminate the LED at the control unit and the remote annunciator.

Pressing the Trouble Acknowledge Key will silence the trouble audible signal while maintaining the Trouble LED "on" indicating off-normal condition.

Record the event in the FACP historical log and print to the integrated control panel system printer.

Transmission of trouble signal to the supervising station.

Restoring the condition shall cause the Trouble LED to clear and restore the system to normal.

Refer to fire alarm matrix for additional site specific trouble actions**.**

Priority of Signals: Fire alarm events have highest priority. Subsequent alarm events are queued in the order received and do not affect existing alarm conditions. Supervisory and Trouble events have second-, and third-level priority, respectively. Signals of a higher-level priority take precedence over signals of lower priority even though the lower-priority condition occurred first. Annunciate all events regardless of priority or order received.

Fire Suppression Monitoring

Water flow: Activation of a water flow switch shall initiate general alarm operations.

Sprinkler valve tamper switch: The activation of any valve tamper switch shall activate system supervisory operations.

SUBMITTALS

General:

Submit manufacturer's data to the Engineer for review in accordance with Division 1 requirements.

For equipment other than that specified, the contractor shall supply proof that such substitute equipment equals or exceeds the features, functions, performance, and quality of the specified equipment.

Shop Drawings:

Shop Drawings shall comply with all NFPA 72 requirements.

Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.

Include manufacturer's name(s), model numbers, ratings, power requirements, and performance in the form of standard data sheets.

Provide equipment layout, device arrangement, complete wiring point-to-point diagrams, and conduit layouts drawn to scaled floor plan depiction.

Provide system power requirements and battery sizing calculations for review.

Indicate each panels maximum connected load data in amperes at the 120V supply power level.

Show remote annunciator or secondary panel layout, configurations, and terminations.

Indicate interface of Owner furnished equipment and existing equipment to remain.

Manuals:

Submit simultaneously with the shop drawings, complete operating and maintenance manual listing the manufacturer's name(s) including technical data sheets.

Wiring diagrams shall indicate internal wiring for each item of equipment and the interconnections between the items of equipment.

Provide a clear and concise description of operation that gives, in detail, the information required to properly operate the equipment and system.

Software Modifications:

Provide the services of a factory trained and authorized technician to perform all system software modifications, upgrades or changes. Response time of the technician to the site shall not exceed 4 hours.

Provide all hardware, software, programming tools and documentation necessary to modify the fire alarm system on site. Modification includes addition and deletion of devices, circuits, zones and changes to system operation and custom label changes for devices or zones. The system structure and software shall place no limit on the type or extent of software modifications on-site. Modification of software shall not require power-down of the system or loss of system fire protection while modifications are being made.

The Contractor’s base bid shall include all programming and software modifications necessary to provide a fully functioning and properly operating system. Any modifications necessary for component additions or deletions to the system prior to system acceptance, and any modifications during the warranty period shall be included unconditionally in the base bid.

Certifications:

Together with the shop drawing submittal, submit a certification from the major equipment manufacturer indicating that the proposed supervisor of installation and the proposed performer of contract maintenance is an authorized representative of the major equipment manufacturer. Include names and addresses in the certification.

Installing contractors shall have NICET Level 2 certification.

GUARANTY

All work performed and all material and equipment furnished under this contract shall be free from defects and shall remain so for a period of at least one (1) year from the date of acceptance. The full cost of maintenance, labor, programming, materials, and testing required to correct any defect during this one year period shall be included in the submittal bid.

The fire alarm control panel manufacturer shall certify that the control panel and components will be supported for a minimum of 10 years following the project.

APPLICABLE STANDARDS AND SPECIFICATIONS

The specifications and standards listed below form a part of this specification. The system shall fully comply with all relevant standards currently adopted by the Florida Fire Prevention Code.

National Fire Protection Association (NFPA) - USA:

No. 15	Water Spray Systems.
No. 70	National Electric Code.
No. 72	National Fire Alarm Code.
No. 101	Life Safety Code.

Underwriters Laboratories Inc. (UL) - USA:

No. 268	Smoke Detectors for Fire Protective Signaling Systems.
No. 864	Control Units for Fire Protective Signaling Systems.
No. 268A	Smoke Detectors for Duct Applications.
No. 521	Heat Detectors for Fire Protective Signaling Systems
No. 464	Audible Signaling Appliances.
No. 38	Manually Actuated Signaling Boxes.
No. 346	Waterflow Indicators for Fire Protective Signaling Systems.
No. 1971	Visual Notification Appliances.

Local and State Building Codes

All requirements of the Authority Having Jurisdiction (AHJ).

The system shall be listed by the national agencies as suitable for extinguishing release applications.

APPROVALS

The system shall have proper listing and/or approval from the following nationally recognized agencies:

UL Underwriters Laboratories Inc.

PART 2 - PRODUCTS

EQUIPMENT AND MATERIAL, GENERAL

All equipment and components shall be new, and the manufacturer's current model. The materials, appliances, equipment and devices shall be tested and listed by a nationally recognized approvals agency for use as part of a protective signaling system, meeting the National Fire Alarm Code.

All equipment and components shall be installed in strict compliance with manufacturers' recommendations. Consult the manufacturer's installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc., before beginning system installation.

All equipment shall be attached to walls and ceiling/floor assemblies and shall be held firmly in place (e.g., detectors shall not be supported solely by suspended ceilings). Fasteners and supports shall be adequate to support the required load. Ceiling mounted equipment shall be installed tight and flush up against ceiling. Gaps between devices and ceiling will not be accepted.

CONDUIT AND WIRE

Conduit shall be in accordance with The National Electrical Code (NEC), local and state requirements, and Section 16100 of these specifications.

All wiring shall be installed in a metal conduit or raceway. Conduit fill shall not exceed 40 percent of interior cross sectional area where three or more cables are contained within a single conduit.

Power limited circuits must be separated from any open conductors of Power, or Class 1 circuits, and shall not be placed in any conduit, junction box or raceway containing these conductors, as per NEC.

All circuits shall be provided with transient suppression devices and the system shall be designed to permit simultaneous operation of all circuits without interference or loss of signals.

Conduits shall not enter the Fire Alarm Control Panel, or any other remotely mounted Control Panel equipment or backbox except where conduit entry is specified by the FACP manufacturer. Field modification of Control Panels that differs from manufacturer’s instructions is not permitted.

Conduit shall be 3/4 inch minimum.

Wire:

All fire alarm system wiring shall be new.

Wiring shall be in accordance with local, state and national codes (e.g., NEC Article 760) and as recommended by the manufacturer of the fire alarm system. Number and size of conductors shall be as recommended by the fire alarm system manufacturer.

All wire and cable shall be listed and/or approved by a recognized testing agency for use with a protective signaling system.

Wiring used for the multiplex communication loop shall be twisted and shielded and support a minimum wiring distance of 10,000 feet. Initiating device circuits and notification appliance circuits shall not be laid along the same pathways or installed in the same conduit with each other, or with the communication loop (if applicable). This requirement does not apply specifically to junction boxes, device boxes or terminal cabinets where terminations or taps are made.

All field wiring shall be completely supervised by the Control Panel.

Terminal Boxes, Junction Boxes and Cabinets:

All boxes and cabinets shall be UL listed for their use and purpose.

Initiating circuits shall be arranged to serve like categories (manual, smoke, water flow). Mixed category circuitry shall not be permitted except on signaling line circuits connected to intelligent reporting devices.

The Fire Alarm Control Panel shall be connected to a separate dedicated branch circuit, maximum 20 amperes. This circuit shall be labeled at the Power Distribution Panel as FIRE ALARM CONTROL PANEL. The Control Panel Cabinet shall be grounded securely to service ground bus in main electrical panel. The control panel cabinet shall have the power circuit designation labeled inside the control panel door.

MAIN FIRE ALARM CONTROL PANEL

Approved models for Fire Alarm Control Panel:

Johnson Controls (Simplex) - 4100ES

The FACP shall contain a microprocessor based Central Processing Unit (CPU) and integrated voice evacuation system. The CPU shall communicate with and control the following types of equipment used to make up the system: intelligent detectors, addressable modules, annunciators, and other system controlled devices.

System Capacity and General Operation

The control panel shall support 1024 device addresses and be capable of expansion to 2048 intelligent/addressable devices.

The system shall include capability for at least thirty-two (32) form C alarm and trouble relays rated at a minimum of 2.0 amps @ 30 VDC. It shall also include sixteen (16) Class B programmable Notification Appliance Circuits with a minimum of four (4) spare notification appliance circuits for future use.

The system shall support up to 96 programmable EIA-485 driven relays.

The Fire Alarm Control Panel shall include a full featured operator interface control and annunciation panel that shall include a backlit Liquid Crystal Display, individual, color coded system status LEDs, and an alphanumeric keypad for the field programming and control of the fire alarm system.

All programming or editing of the existing program in the system shall be achieved without special equipment and without interrupting the alarm monitoring functions of the Fire Alarm Control Panel.

The FACP shall provide the following features:

Drift Compensation to extend detector accuracy over life.

Sensitivity Test, meeting requirements of NFPA 72.

Maintenance Alert to warn of excessive smoke detector dirt or dust accumulation.

System Status Reports to display or printer.

Alarm Verification, with verification counters.

Rapid manual station reporting (under 3 seconds).

Non-Alarm points for general (non-fire) control.

Periodic Detector Test, conducted automatically by software.

Check for two detectors set to same address.

Day/Night automatic adjustment of detector sensitivity.

Walk Test or Service Groups

Central Microprocessor:

The Microprocessor unit shall communicate with, monitor, and control all external interfaces with the control panel. It shall include EPROM for system program storage; non-volatile memory for building specific program storage; and a "watch dog" circuit to detect and report microprocessor failure.

The Microprocessor Unit shall contain and execute all control-by-event programs for specific action to be taken if an alarm condition is detected by the system. Such control-by-event programs shall be held in non-volatile programmable memory, and shall not be lost even if system primary and secondary power failure occurs.

The Microprocessor Unit shall also provide a real-time clock for time annotation of system displays, printer, and history file. The time-of-day and date shall not be lost if system primary and secondary power supplies fail. The real time clock may also be used to control non-fire functions at programmed time-of-day, day-of-week, and day-of-year.

Display:

The display shall provide all the controls and indicators used by the system operator and may also be used to program all system operational parameters.

The display shall include status information and custom alphanumeric labels for all intelligent detectors, addressable modules, and software zones.

The Display shall provide a minimum 80-character back-lit alphanumeric Liquid Crystal Display (LCD). It shall also provide Light Emitting Diodes (LEDs), that indicate the status of the following system parameters: AC POWER, SYSTEM ALARM, SYSTEM TROUBLE, SIGNAL SILENCED, SUPERVISORY.

The Display shall provide a key-pad with control capability to command all system functions, entry of any alphabetic or numeric information, and field programming. Two different access (password) levels shall be provided, one to prevent unauthorized system control, one to prevent programming.

The Display shall include the following operator functions: SIGNAL SILENCE, RESET, DRILL, and ACKNOWLEDGE.

Signaling Line Circuits (SLC):

The SLC Interface shall provide power to and communicate with up to 99 intelligent detectors (Ionization, Photoelectric, or Thermal) and 99 intelligent modules (monitor or control) for a system capacity of 198 devices. This shall be accomplished over a single SLC loop. System shall have capability to support up to six (6) SLC's and include a minimum of two (2) spare SLC's for future use.

The Loop Interface Board shall receive analog information from all intelligent detectors that shall be processed to determine whether normal, alarm, or trouble conditions exist for each detector. The software shall automatically maintain the detector's desired sensitivity level by adjusting for the effects of environmental factors, including the accumulation of dust in each detector. The analog information shall also be used for automatic detector testing and for the automatic determination of detector maintenance requirements.

The detector software shall meet NFPA 72, chapter 14 requirements and be certified by UL as a calibrated sensitivity test instrument.

The detector software shall allow manual or automatic sensitivity adjustment.

Serial Interfaces:

An EIA RS-485 port for the serial connection of the Annunciators and remote LCD displays shall be provided.

The EIA RS-232 interface shall include special protocol methods that allow off-site monitoring of the FACP over standard dial-up phone lines. This ancillary capability shall allow remote readout of all status information, including analog values, and shall not interfere with or degrade FACP operations when used. It shall allow remote FACP Acknowledge, Reset, or Signal Silence in this mode. It shall also allow adjustment of detector sensitivity and readout of the history file.

The EIA RS-485 interface may be used for network connection to a Proprietary Receiving Unit.

Modular Network Interfaces:

A modular network connection shall be provided with provisions for Fiber Optic and Wired media card adapter.

Fiber optic media card shall be provided.

Media card shall be compatible with 62.5/125 or 50/125 fiber cable.

Enclosures:

The control panel shall be housed in a UL listed cabinet suitable for surface mounting. Cabinet and front shall be corrosion protected, given a rust-resistant prime coat, and manufacturer's standard finish.

The door shall provide a key lock and shall include a glass or other transparent opening for viewing of all indicators.

All interfaces and associated equipment are to be protected so that they will not be affected by voltage surges or line transients consistent with UL standard 864.

A relay module shall provide four (4) form C relays rated at 2.0 amps. The relays shall track programmable software zones and are in addition to the required alarm/trouble contacts.

Power Supply:

The Power Supply shall operate on 120 VAC, 60 Hz; shall be power-limited, and shall provide all necessary power for the FACP.

It shall provide notification appliance power using a switching 24 VDC regulator. Power capacity shall be sufficient to drive all audible/visual devices provided within project plus an additional 20% spare capacity. In no case shall capacity be less than 6 amps. An expansion power supply is acceptable to meet the required system capacity.

It shall provide a battery charger for 24 hours of standby followed by 15 minutes of alarm using dual-rate charging techniques for fast battery recharge.

It shall provide a very low frequency sweep earth detect circuit, capable of detecting earth faults on sensitive addressable modules.

Field Wiring Terminal Blocks:

All panel I/O wiring shall utilize terminal blocks with sufficient capacity for 18 to 12 AWG wire.

Operators Controls

Acknowledge Switch:

Activation of the control panel Acknowledge switch in response to new alarms and/or troubles shall silence the local panel audible signal and change the Alarm and Trouble LEDs from flashing mode to steady-ON mode.

Where multiple conditions exist, advancement of the LCD display to previous or subsequent Alarm or Trouble conditions shall be a feature.

Depression of the Acknowledge switch shall also silence all remote annunciator sounders.

Signal Silence Switch: Activation of the Signal silence switch shall cause all programmed alarm notification appliances and relays to return to the normal condition after an alarm condition. The selection of notification circuits and relays that are silenceable by this switch shall be fully field programmable within the confines of all applicable standards. The FACP software shall include silence inhibit and auto-silence timers.

System Reset Switch: Activation of the system reset switch shall cause all electronically-latched initiating devices, appliances or software zones, as well as all associated output devices and circuits, to return to their normal condition.

A lamp test function shall be available.

Drill (Evacuate) Switch.

The Drill switch shall activate all notification appliance circuits. The drill function shall latch until the panel is silenced, reset, or until the drill switch is pushed a second time.

The fire alarm control panel shall include integrated push buttons and labels for disabling the functions noted on the drawings.

Field Programming:

The system shall be programmable, configurable and expandable in the field without the need for special tools or electronic equipment and shall not require field replacement of electronic integrated circuits.

All field defined programs shall be stored in non-volatile memory.

The programming function shall be enabled with a password that may be defined specifically for the system when it is installed. Two access levels with password protection shall be provided in addition to a key-lock cabinet

Program edit shall not interfere with normal operation and fire detection. If a fire condition is detected during programming operation, the system shall exit programming and perform functions as programmed.

An off-line programming function, with batch upload/download, shall also be available.

Specific System Operations:

Smoke Detector Sensitivity Adjust: Means shall be provided for adjusting the sensitivity of any or all analog intelligent smoke detectors in the system from the System keypad. Sensitivity range shall be within the allowed UL window.

Alarm Verification: Each of the intelligent addressable smoke detectors in the system may be independently selected and enabled to be an alarm verified detector. The Alarm Verification delay shall be programmable from 5 to 30 seconds and each detector shall be able to be selected for verification. The FACP shall keep a count of the number of times that each detector has entered the verification cycle. These counters may be displayed and reset by the proper operator commands.

Point Disable: Any Device in the system may be Enabled or Disabled through the system keypad.

Point Read: The system shall be able to display or print the following point status diagnostic functions:

Device status
Device type
Custom device label
View analog detector values
Device zone assignments
All Program Parameters

System Status Reports: Upon command from an operator of the system, a status report will be generated, stored, and printed on the integrated control panel system printer, listing all system status.

System History Recording and Reporting: The Fire Alarm Control Panel shall contain a History Buffer that will be capable of storing up to 600 system alarms/troubles/operator actions. Each of these actions will be stored and time and date stamped with the actual time of the activation. The contents of the History Buffer may be manually reviewed, one event at a time, or printed on the integrated control panel system printer in its entirety.

Although the foreground history buffer may be cleared for user convenience, a background, non-erasable buffer shall be maintained which provides the last 600 system events.

The History Buffer shall use non-volatile memory. Systems that use volatile memory for history storage are not acceptable.

Automatic Detector Maintenance Alert: The Fire Alarm Control Panel shall automatically interrogate each intelligent smoke detector and shall analyze the detector responses over a period of time.

If any intelligent smoke detector in the system responds with a reading that is below or above normal limits, then the system will enter the Trouble Mode, and the particular detector will be annunciated on the system display, and printed on the panel printer. This feature shall in no way inhibit the receipt of alarm conditions in the system, nor shall it require any special hardware, special tools or computer expertise to perform.

Software Zones: The FACP shall provide 99 software zones. All addressable devices shall be capable of control-by-zone through field programming for control activation and annunciation purposes.

ONE-WAY VOICE COMMUNICATION

The system shall incorporate one-way voice communication and tone generating capabilities.

A central audio control module shall be provided for the necessary alarm message/tone generation, main and remote microphone connections, auxiliary inputs, and mixer/pre-amplifier circuits. Continuous supervision shall be provided along with specific information as to the type of failure should a problem occur (eg. main microphone trouble, tone trouble, etc.). Audio outputs shall have individual gain control.

A hand-held, push-to-talk microphone shall be provided, recessed within a protective panel-mounted enclosure. The microphone shall be a noise-canceling communication type with a frequency range of 200 Hz to 4000 Hz and shall be equipped with a self-winding five-foot coiled cable. An LED indicator shall be provided to indicate the microphone push-to-talk button has been pressed and speaker circuits are ready for transmission. The microphone shall be supervised for disconnection.

An audio control switch module shall be furnished to provide manual access to audio operations for authorized personnel. The module shall include an "ALL Circuits" switch, "Aux Tone 1" switch, "Aux Tone 2" switch, tone generator stop switch, and "Audio Trouble Reset" switch. These switches and associated LED indicators shall be supervised for disarrangement or failure.

Audio power amplifiers shall be furnished with a self-contained filtered 24VDC power supply, transformer, and amplifier monitor circuits. The amplifiers shall provide a 25 Volt RMS output with a frequency response of 120 Hz to 12,000 Hz. Provide sufficient amplification to operate all system speakers simultaneously plus twenty (20) percent spare capacity.

The speaker circuits shall be capable of supplying 25 Volt RMS audio power from the system amplifiers. Supervision for open, short, or ground fault conditions shall be provided. Individual and distinct trouble indications shall be provided for each fault. Provide one circuit for each zone or area of distinct communication. System shall be configured with no more than one floor per speaker zone.

Digitized tones for alarm and auxiliary requirements (horn, etc.) shall be provided.

A pre-recorded digitized voice message capability is to be provided for automatic transmission to building occupants during alarm conditions. The automatic message player shall not rely on a tape or other mechanical means of transmitting the evacuation message. A standard evacuation message shall be provided under this contract; however, the message player must be capable of transmitting a minimum of six (6) custom messages of up to sixty seconds long and repeating. A self-contained speaker will provide testing of the message(s) without disturbing the occupants of the facility. AHJ will have final authority on which message is used.

Automatic Voice Evacuation Sequence:

The audio alarm signal shall consist of an alarm tone for a maximum of 15 seconds followed by automatic pre-selected voice evacuation messages. At the end of each voice evacuation message, the alarm tone shall resume and the cycle shall repeat. The alarm tones and voice messages shall sound alternately until the alarm silence switch at the fire alarm control panel has been operated.

All audio alarm operations (speaker circuit selection and alarm tone/voice message timing variations) shall be activated by the system software so that any required future changes to the evacuation sequence can be facilitated by authorized personnel without any component rewiring.

Manual Voice Paging Sequence:

The system shall be configured to allow selective voice paging. Upon activation of any speaker manual control switch, two (2) attention getting beeps shall sound over the speakers indicating an impending voice message will occur.

If any speaker manual control switches are activated, the control panel operator shall be able to make announcements via the push-to-talk paging microphone over the pre-selected speakers.

Facility for total building evacuation and paging shall be provided to allow for activation of all speakers. This shall be accomplished by the means of an "All Circuit" switch.

SYSTEM COMPONENTS

Notification appliances shall have wattage and candela setting visible without removing device from wall or ceiling.

Speakers:

Provide speakers that are UL listed, with high quality tone and voice reproduction. Speakers for alarm notification shall be supervised.

Provide with internal taps for 1/2W, 1W, and 2W power output. Minimum sound pressure output shall be 88dB at 3 meters.

Ceiling mounted speakers shall have painted metal grilles and backboxes for each speaker. Provide supports, tile bridges and other installation accessories as required.

Speakers for exterior use, including parking areas, shall be corrosion resistant and listed for the service.

Provide exterior speakers of the double re-entrant horn type, bracket mounted with all purpose, multi-position bracket.

Strobe Lights:

Shall operate on 24 VDC nominal and shall be LED type.

Shall meet the requirements of the ADA as defined in section 702.1 of FBC Accessibility Chapter 7 and shall meet the following criteria:

The strobe intensity shall meet the requirements of section 702.1 of FBC Accessibility Chapter 7.

The flash rate shall meet the requirements of section 702.1 of FBC Accessibility Chapter 7.

The appliance shall be placed 80 inches above the highest floor level within the space, or 6 inches below the ceiling, whichever is the lower.

If visual alarm devices are installed in different configuration than as shown on the plans, fire alarm contractor shall confirm spacing is in accordance with NFPA 72 requirements.

Audible/Visual Combination Devices:

Shall meet the applicable requirements above for audibility.

Shall meet the requirements above for visibility.

Units shall provide a common enclosure for the fire alarm audible and the visual alarm devices. The unit shall be clearly marked with "Fire" lettering visible from a 180 degree field of view.

Addressable Devices - General

Addressable Devices shall provide an address-setting means. This may be software coded.

Detectors shall be Intelligent and Addressable, and shall connect with two wires to the Fire Alarm Control Panel Signaling Line Circuits.

Addressable smoke and thermal detectors shall provide an LED. LEDs shall identify normal, alarm, or trouble conditions. An output connection shall also be provided in the base to connect an external remote alarm LED.

Smoke detector sensitivity shall be set through the Fire Alarm Control Panel and shall be adjustable in the field through the field programming of the system. Sensitivity may be automatically adjusted by the panel on a time-of-day basis.

Using software in the FACP, detectors shall automatically compensate for dust accumulation and other slow environmental changes that may affect their performance. The detectors shall be listed by UL as meeting the calibrated sensitivity test requirements of NFPA Standard 72, Chapter 7.

The detectors shall be ceiling-mount and shall include a separate twist-lock base with tamper proof feature.

The detectors shall provide a test means whereby they will simulate an alarm condition and report that condition to the control panel. Such a test may be initiated at the detector itself (by activating a switch) or initiated remotely on command from the control panel.

Detectors shall also store an internal identifying type code that the control panel shall use to identify the type of device (PHOTO, THERMAL).

Smoke detectors shall be photoelectric type only. Multi-criteria type are not permitted.

Addressable Pull Box (manual station)

Addressable Pull Boxes shall, on command from the Control Panel, send data to the panel representing the state of the manual switch. They shall use a key operated test-reset lock, and shall be designed so that after actual emergency operation, they cannot be restored to normal use except by the use of a key.

Operating stations shall be double acting type.

All operated stations shall have a positive, visual indication of operation and utilize a key type reset.

Manual Stations shall be constructed with clearly visible operating instructions provided on the cover. The word FIRE shall appear on the front of the stations in raised letters, 1.75 inches or larger.

Stations shall be suitable for semi-flush mounting, and shall be installed not less than 42 inches, nor more than 48 inches above the finished floor.

Intelligent Photoelectric Smoke Detector:

The detectors shall use the photoelectric (light-scattering) principal to measure smoke density and shall, on command from the control panel, send data to the panel representing the analog level of smoke density.

Intelligent Thermal Detectors:

Thermal Detectors shall be intelligent addressable devices adjustable for activation temperature by software. Initial programming for all units shall be 135 degrees F and have a rate-of-rise element rated at 15 degrees F per minute. It shall connect via two wires to the Fire Alarm Control Panel Signaling Line Circuit. Up to 99 intelligent heat detectors may connect to one SLC loop.

The detectors shall use an electronic sensor to measure thermal conditions caused by a fire and shall, on command from the control panel, send data to the panel representing the analog level of such thermal measurements.

Intelligent Duct Smoke Detector:

In-Duct Smoke Detector Housing shall accommodate either an intelligent ionization sensor or an intelligent photoelectric sensor, of that provides continuous analog monitoring and alarm verification from the panel.

When sufficient smoke is sensed, an alarm signal is initiated at the FACP.

Provide remote alarm/power LED indicator where noted on the Drawings.

Addressable Dry Contact Monitor Module:

Addressable Monitor Modules shall be provided to connect one supervised IDC zone of conventional Alarm Initiating Devices (any N.O. dry contact device) to one of the Fire Alarm Control Panel Signaling Line Circuit (SLC) Loops.

The Monitor Module shall mount in a 4-inch square, 2-1/8" deep electrical box. An LED shall be provided that shall flash under normal conditions, indicating that the Monitor Module is operational and in regular communication with the control panel.

The IDC zone may be wired for Class B operation. An LED shall be provided that shall flash under normal conditions, indicating that the Monitor Module is operational and in regular communication with the control panel.

Two Wire Detector Monitor Module:

Addressable Monitor modules shall be provided to connect one supervised IDC zone of conventional 2-Wire smoke detectors or alarm initiating devices (any N.O. dry contact device).

The Two-Wire Monitor Module shall mount in a 4-inch square, 2-1/8" deep electrical box or with an optional surface backbox. An LED shall be provided that shall flash under normal conditions, indicating that the Monitor module is operational and in regular communication with the control panel.

Addressable Control Module:

Addressable Control Modules shall be provided to supervise and control the operation of one conventional Notification Appliance Circuit (NAC) of compatible, 24 VDC powered, polarized Audio/Visual Notification Appliances. For fan shutdown and other auxiliary control functions, the control module may be set to operate as a dry contract relay.

The Control Module shall mount in a standard 4-inch square, 2-1/8" deep electrical box, or to a surface mounted backbox.

The control module NAC circuit may be wired with up to 1 Amp of inductive A/V signal, or 2 Amps of resistive A/V signal operation, or as a dry contact (Form C) relay. The relay coil shall be magnetically latched to reduce wiring connection requirements, and to insure that 100% of all auxiliary relay or NACs may be energized at the same time on the same pair of wires.

Audio/visual power shall be provided by a separate supervised power loop from the main fire alarm control panel or from a supervised, UL listed remote power supply.

The control module shall provide address-setting means and shall also store an internal identifying code that the control panel shall use to identify the type of device. An LED shall be provided that shall flash under normal conditions, indicating that the control module is operational and is in regular communication with the control panel.

The control module shall be suitable for pilot duty applications and rated for a minimum of .5 amps at 30 VDC.

Isolator Module:

Isolator modules shall be provided to automatically isolate wire-to-wire short circuits on an SLC loop. The isolator module shall limit the number of modules or detectors that may be rendered inoperative by a short circuit fault on the SLC Loop. At least one isolator module shall be provided for each floor or protected zone of the building.

If a wire-to-wire short occurs, the isolator module shall automatically open-circuit (disconnect) the SLC loop. When the short circuit condition is corrected, the Isolator Module shall automatically reconnect the isolated section.

The Isolator Module shall not require any address-setting, and its operations shall be totally automatic. It shall not be necessary to replace or reset an Isolator Module after its normal operation.

The Isolator Module shall mount in a standard 4-inch deep electrical box or in a surface mounted backbox. It shall provide a single LED that shall flash to indicate that the Isolator is operational and shall illuminate steadily to indicate that a short circuit condition has been detected and isolated.

Sprinkler Valve Supervisory Switches:

Each sprinkler system water supply control valve riser or zone control valve shall be equipped with a supervisory switch. Standpipe hose valves, and test and drain valves shall not be equipped with supervisory switches.

Each Post Indicator Valve (PIV) or main gate valve shall be equipped with a supervisory switch.

Mount switch so as not to interfere with the normal operation of the valve and adjust to operate within two revolutions toward the closed position of the valve control, or when the stem has moved no more than one-fifth of the distance from its normal position.

The mechanism shall be contained in a weatherproof aluminum housing that shall provide a 3/4 inch tapped conduit entrance and incorporate the necessary facilities for attachment to the valves.

Switch housing to be finished in red baked enamel.

The entire installed assembly shall be tamper proof and arranged to cause a switch operation if the housing cover is removed, or if the unit is removed from its mounting.

Valve supervisory switches shall be provided and connected under this section and installed by mechanical contractor.

All valve switches shall have dedicated address. Multiple valve switches sharing a single address is not permitted.

Serially Connected Annunciator Requirements

The Annunciator shall communicate with the fire alarm control panel via an EIA 485 communications loop and shall annunciate all zones in the system.

The annunciator shall be supervised.

The annunciator shall provide a red Alarm LED per zone, and a yellow Trouble LED per zone. The annunciator will also have an "ON-LINE" LED, local piezo sounder, local acknowledge/lamp test switch, and custom zone/function identification labels.

The annunciator switches may be used for System control such as, Global Acknowledge, Global Signal Silence, and Global System Reset.

LCD Alphanumeric Display Annunciator:

The Alphanumeric display annunciator shall be a supervised, remotely located back-lit LCD display containing a minimum of eighty (80) characters for alarm annunciation in clear English text.

The LCD annunciator shall display all alarm and trouble conditions in the system.

The annunciator shall connect to a two-wire EIA- 485 interface. The two-wire connection shall be capable of distances of 6,000 feet.

The annunciator shall include microphone module and capability to provide one-way voice communication as noted above, similarly to FACP.

TERMINAL CABINETS

Provide manufacturer's standard surface mounted terminal cabinets for termination of circuits as required. Terminate all conductors on designated terminal blocks or strips with identification of each conductor in the cabinet.

Use of standard NEMA 1 control enclosure is acceptable. Construction shall be 16 gauge steel with hinged front cover with flush latch operated with coin or screwdriver. Provide units with separate backpanel for mounting terminal blocks. Do not mount terminal block directly to back of enclosure.

All terminal cabinets, whether new or existing, shall be painted red and have "Fire Alarm Terminal Cabinet" stenciled in white letters.

BATTERIES

Shall be 12 volt, gel cell (SLA) type (at least two required).

Battery shall have sufficient capacity to power the fire alarm system for not less than twenty-four hours plus 15 minutes of alarm upon a normal AC power failure.

The batteries are to be completely maintenance free. Liquid electrolytes are not acceptable. To prevent spills and leakage, fluid level checks or refilling shall not be required.

PART 3 - EXECUTION

INSTALLATION

Installation shall be in accordance with the NEC, NFPA 72, local and state codes, as shown on the drawings, and as recommended by the equipment manufacturer. The manufacturer's authorized representative shall provide onsite supervision of installation.

All conduit, junction boxes, conduit supports and hangers shall be concealed in finished areas and may be exposed in unfinished areas. Smoke detectors shall not be installed prior to the system programming and test period. If construction is ongoing during this period, measures shall be taken to protect smoke detectors from contamination and physical damage.

All fire detection and alarm system devices, control panels and remote annunciators shall be flush mounted when located in finished areas and may be surface mounted when located in unfinished areas.

TEST

Provide the service of a competent, factory-trained engineer or technician authorized by the manufacturer of the fire alarm equipment to technically supervise and participate during all of the adjustments and tests for the system. All testing shall be in accordance with NFPA 72.

Pretesting: Contractor shall determine, through pretesting, the conformance of the system to the requirements of the Drawings and Specifications. Correct deficiencies observed in pretesting. Replace malfunctioning or damaged items with new and retest until satisfactory performance and conditions are achieved.

Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.

Close each sprinkler system flow valve and verify proper supervisory alarm at the FACP.

Verify activation of all flow switches.

Open initiating device circuits and verify that the trouble signal actuates.

Open and short signaling line circuits and verify that the trouble signal actuates.

Open and short Notification Appliance Circuits and verify that trouble signal actuates.

Ground all circuits and verify response of trouble signals.

Check presence and audibility of tone at all alarm notification devices.

Check installation, supervision, and operation of all intelligent smoke detectors using the Walk Test.

Check activation and operation of the agent release sequence.

Each of the alarm conditions that the system is required to detect should be introduced on the system. Verify the proper receipt and the proper processing of the signal at the FACP and the correct activation of the control points.

When the system is equipped with optional features, the manufacturer's manual should be consulted to determine the proper testing procedures. This is intended to address such items as verifying controls performed by individually addressed or grouped devices, sensitivity monitoring, verification functionality and similar.

Verify all signals transmit properly to monitoring center.

Retesting: Correct deficiencies indicated by tests and completely retest work affected by such deficiencies. Verify by the system test that the total system meets the Specifications and complies with applicable standards.

FINAL INSPECTION

At the final inspection a factory trained representative of the manufacturer of the major equipment shall demonstrate to the Engineer and AHJ that the systems function properly in every respect.

CLOSEOUT

Provide a spare parts kit that shall include one of every type of field device (one pull station, one speaker, one combination a/v, one strobe, one smoke detector, one heat detector, one relay control module, one relay monitor module).

Provide any special tools, equipment, programming devices and cables needed to maintain or repair the system shall be provided.

OPERATION MANUALS

General: The manuals shall include installation, operation, and service manuals.

AS-BUILT DRAWINGS

Point-to-point Wiring Diagram: A point-to-point wiring diagram shall be included with the "as-built" drawings.

CAD Format As-Built Drawings: All as-built drawings shall be submitted on flash drive (USB) in AutoCAD format (check for latest acceptable release). Contractor is responsible for modifying as-builts during construction and maintaining clear and accurate drawings.

Field Devices: All field devices installed in the fire alarm control panel shall be included in all diagrams. These devices include, but are not limited to, air handler shut down relays and remote reporting relays.

Function Diagram: A one-line function diagram of the fire alarm control panel shall be provided.

Detailed Plan Views: Floor plans shall indicate all detailed conduit routing, all control panels, all terminal cabinets, all junction boxes, all pull boxes, all disconnect switches, all circuit breaker locations serving fire alarm equipment or shunt trip circuits, all fire alarm devices, all surge protection devices, and end of line resistors. Plan views shall indicate device addresses, dB, candela ratings, and other specific device information adjacent to each fire alarm device.

Accuracy: As-built drawings shall be verified by contractor and 100% accurate with actual installation conditions in the field.

Refer to drawings for additional as-built requirements.

INSTRUCTION

Provide instruction as required for operating the system. Hands-on demonstrations of the operation of all system components and the entire system including program changes and functions shall be provided.

The Contractor and/or the Systems Manufacturer's representatives shall provide a typewritten "Sequence of Operation" to the owner.

END OF SECTION

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