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DELAWARE STATE POLICE FIRING RANGE
HVAC UPGRADE & ROOF REPLACEMENT
OMB/DFM CONTRACT # MJ1002000012 & MJ1002000008

ADDENDUM #6

SUBSTITUTION REQUESTS

1. Samsung Ductless Split Systems have been found as an acceptable manufacturer for DS-1.
2. Zehnder / Rittling have been found as an acceptable manufacturer for FC-1.
3. York YVAA series chillers have been found as an acceptable manufacturer for CH-1 and CH-2.
4. Multistack ASP series chillers have been found as an acceptable manufacturer for CH-1 and CH-2.
5. Carrier 30XV series chillers have been found as an acceptable manufacturer for CH-1 and CH-2.
6. Thermal Solutions EVCA series boilers have been found as an acceptable manufacturer for B-3.
7. TMI Climate Solutions custom air handling units have been found as an acceptable manufacturer for ERU-1. Updated specification sent in Addendum #4... Below is a list of clarifications....
 - a. Anticipated internal dimensions of mechanical spaces are 218" x 122½" x 412" (L x H x W). These dimensions are required to achieve clearances of all devices to be field mounted within this mechanical room space. The mechanical space to be provided with double doors.
 - b. Filters to meet specs and schedule. Frames, MERV ratings, and bag in bag out configuration.
 - c. The submittal did not specifically indicate that the Konvekta system was being utilized. The Konvekta control, pump, exchanger, coil, skid shall be provided as part of this unit as no alternative data was provided to support a substitution to this system.
 - d. The alternative layout does not appear to meet the intent of the specification and has not been accepted.

It is the contractor's responsibility for any costs associated with deviating from the basis of design that subsequently become apparent or that are apparent now. Costs associated could include but are not limited to additional structure, space constraints for equipment service, electrical power requirements (breaker/fuse sizing and wire sizing changes), and piping connection location modifications. The contractor shall ensure approved as equal equipment meets or exceeds all requirements found both on the drawings and in the specifications provided for this project. Any approved as equal equipment submitted may be rejected that does not satisfy the specifications. The engineer has not redesigned the project around this substitution.

QUESTIONS:

1. There is a \$14,000 allowance for the installation of the new transformer by the electric utility company during off hours. Please clarify if the \$14,000 covers the entire cost of furnishing and installing the transformer, or if it just covers the costs associated with overtime installation.
 - a. We have an estimated cost from the electrical utility of \$14,000 for the utility work associated with this project. The contractor shall coordinate and pay the electrical utility for the electrical utility work described on the contract documents. The intent is that the contractor will pass the electric utility installation cost to the owner as an allowance cost.



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2. Please confirm that any soil, concrete, or steel testing will be by the owner.
 - a. Confirmed, Duffield will be performing these tests.
3. Drawing M-101 refers to a misc. allowance of \$50,000. Please confirm that this is referring to the \$36,000 general allowance plus the \$14,000 transformer allowance.
 - a. The Electric Utility allowance is a portion of the \$50,000 allowance for this project.
4. Regarding detail 4/M103, what is the material on the face of the soffit?
 - a. This material shall be ½" gyp-board finished and painted with a coat of primer and 2 coats of finish white paint. Final color to be selected during submittal. Colors to be selected from a standard color pallet.
5. What is the intent of the note on 1/M104 that states "contractor to seal bullet trap penetrations..."? What type of material is to be used to seal the penetrations? How many penetrations are there and what size are they on average? I suggest an allowance be issued for this work.
 - a. The intent is to seal the envelope of the range so that the differential pressure from the building to the range can be achieved. The contractor shall inspect the range envelope and seal any holes found with silicone based caulk and backer rod as necessary. This work shall be part of the base bid and if during testing the range envelope is found to not hold pressure the contractor will be required to do further investigation.
6. Regarding 5/M301, please confirm that the owner will pay for any fees associated with replacing the gas meter.
 - a. We do not expect any fees associated with the gas utility work. The contractor may request to utilize the allowance for any fees associated with the gas utility work (replacing the meter).
7. 1/M101 shows four bollards in front of the chiller pad, while 1/E100 shows four bollards in front of the switchboard and transformer. It appears that there may be some overlap here. Please confirm how many bollards are in this area all together.
 - a. Both drawings are correct we expect 8 bollards to be equally spaced and in line in front of the electrical and mechanical equipment.
8. There are two different bollards details on the drawings, see 4/M501 and 1/E301. I'm assuming that you want the same bollard style throughout the project. Please clarify which detail we should follow.
 - a. The bollard detail on drawing E-301 shall be utilized for the transformer side of the service access road. The bollard detail on drawing M-501 shall be utilized for in front of the ERU.
9. 1/MD101 states "chiller pad is to have all cracks repaired and the pad is to be refinished". The pad does not appear to have any cracks. Can you please clarify the intent of this note? Also, what product or process do you have in mind regarding refinishing the pad?
 - a. An epoxy concrete patching product that is suitable for outdoor use will be sufficient.
10. 2I/S101 shows a duct support detail and D/S102 shows a pipe support detail, but I don't see these details referenced anywhere on the structural drawings. Please clarify where these details apply.



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- a. The duct support is to be utilized inside the range and they shall be spaced according to SMACNA standards for duct sizing.
- b. The pipe supports are identified on drawing 1/S-103.

DRAWING REVISIONS:

M-601: Updated AHU-3 schedule.

SPECIFICATION REVISIONS:

23 73 13: Replace section in its entirety.

ADDITIONAL INFORMATION:

Existing Range Targeting system installation instructions and operational manuals.

Addendum #6

1. Addendum #6 Summary (this document) (3 pages)
2. Drawings (1 pages)
 - a. M-601
3. Specification (8 pages)
 - a. 23 73 13
4. Additional Info (27 pages)
 - a. Action Target Installation Instructions
 - b. Track Runner V2 Operations/Maintenance Manual

Summarized By: DEDC, LLC
Matt Lano

Date: November 21, 2018

DRAWING REDACTED

SECTION 23 73 13
MODULAR CENTRAL-STATION AIR-HANDLING UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Casing construction.
- B. Fan section.
- C. Coil section.
- D. Filter and air cleaner section.
- E. Damper section.
- F. Access section.
- G. Diffuser section.
- H. Controls.
- I. Roof mounting curb.

1.02 RELATED REQUIREMENTS

- A. Section 23 05 13 - Common Motor Requirements for HVAC Equipment.
- B. Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment.
- C. Section 23 09 69 - Variable Frequency Controllers
- D. Section 23 07 19 - HVAC Piping Insulation.
- E. Section 23 40 00 - HVAC Air Cleaning Devices.

1.03 REFERENCE STANDARDS

- A. ABMA STD 9 - Load Ratings and Fatigue Life for Ball Bearings; 2015.
- B. AHRI 410 - Standard for Forced-Circulation Air-Cooling and Air-Heating Coils; 2001 (R2011).
- C. AMCA (DIR) - [Directory of] Products Licensed Under AMCA International Certified Ratings Program; <http://www.amca.org/certified/search/company.aspx>.
- D. AMCA 99 - Standards Handbook; 2010.
- E. AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating; 2007.
- F. AMCA 300 - Reverberant Room Method for Sound Testing of Fans; 2014.
- G. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data; 2014.
- H. AMCA 500-D - Laboratory Methods of Testing Dampers for Rating; 2012.
- I. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating; 2012.
- J. ASHRAE Std 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size; 2012, with 2015 amendments.
- K. ASHRAE Std 62.1 - Laboratory Method of Testing to Determine the Sound Power in a Duct; 2013.
- L. ASHRAE Std 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings; 2013, Including All Addenda.
- M. ASTM B177/B177M - Standard Guide for Engineering Chromium Electroplating; 2011.
- N. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2015.
- O. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005.
- P. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate the work with other trades for installation of roof mounted air handling units on roof curbs.
- B. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.
- C. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data:
 - 1. Published Literature: Indicate dimensions, weights, capacities, ratings, gages and finishes of materials, and electrical characteristics and connection requirements.
 - 2. Filters: Data for filter media, filter performance data, filter assembly, and filter frames.
 - 3. Fans: Performance and fan curves with specified operating point clearly plotted, power, RPM.
 - 4. Sound Power Level Data: Fan outlet and casing radiation at rated capacity.
 - 5. Electrical Requirements: Power supply wiring including wiring diagrams for interlock and control wiring, clearly indicating factory-installed and field-installed wiring.
- C. Shop Drawings: Indicate assembly, unit dimensions, weight loading, required clearances, construction details, field connection details, and electrical characteristics and connection requirements.
- D. Executed Warranty: Submit documentation of final executed warranty completed in State of Delaware OMB - Division of Facilities Management's name and registered with manufacturer.
- E. Manufacturer's Instructions: Include installation instructions.
- F. Maintenance Data: Include instructions for lubrication, filter replacement, motor and drive replacement, spare parts lists, and wiring diagrams.
- G. Maintenance Materials: Furnish the following for State of Delaware OMB - Division of Facilities Management's use in maintenance of project.
 - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
 - 2. Extra Fan Belts: One set for each unit.
 - 3. Extra Filters: One set for each unit.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.07 REGULATORY REQUIREMENTS

- A. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified and indicated.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Accept products on site in factory-fabricated protective containers, with factory-installed shipping skids and lifting lugs. Inspect for damage.
- B. Store in clean dry place and protect from weather and construction traffic. Handle carefully to avoid damage to components, enclosures, and finish.
- C. Do not operate units until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

1.09 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Carrier Corporation; : www.carrier.com.
- B. Daikin Applied: www.daikinapplied.com.
- C. York International Corporation / Johnson Controls Inc: www.york.com.
- D. Ventus (VTS): www.vtsgroup.us
- E. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 CASING CONSTRUCTION

- A. Full Perimeter Base Rail:
 - 1. Construct of galvanized steel.
 - 2. Provide base rail of sufficient height to raise unit for external trapping of condensate drain pans.
- B. Casing:
 - 1. Construct of one piece, insulated, double wall panels.
 - 2. Provide mid-span, no through metal, internal thermal break.
 - 3. Construct outer panels of galvanized steel and inner panels of galvanized steel.
 - 4. Casing Air Pressure Performance Requirements:
 - a. Able to withstand up to 8 inches w.g. positive or negative static pressure.
 - b. Not to exceed 0.0042 inches per inch deflection at 1.5 times design static pressure up to a maximum of plus 8 inches w.g. in positive pressure sections and minus 8 inches w.g. in negative pressure sections.
- C. Access Doors:
 - 1. Construction, thermal and air pressure performance same as casing.
 - 2. Provide surface mounted handles on hinged, swing doors.
 - 3. Provide shatterproof viewing window designed to withstand operating pressures.
- D. Outdoor Unit Roof:
 - 1. Factory install single layer outer roof above inner roof.
 - 2. Slope at a minimum of 0.125 inches per foot from one side of unit to the other side, or from center to sides of unit.
 - 3. Roof assembly to overhang each unit wall or base rail to overhang curb to facilitate water runoff and prevent water intrusion into roof curb to base connection.
- E. Outside Air and Exhaust Air Weather Hood:
 - 1. Fabricate from same material as casing outer panel.
 - 2. Extend hood past perimeter of unit casing opening so as not to obstruct airflow path.
 - 3. Paint hoods with same finish as external surface of outdoor units.
 - 4. Provide inlet hood for each fresh air damper with a sine wave moisture eliminator to prevent entrainment of water into the unit from outside air.
 - 5. Provide exhaust hoods for each exhaust air opening.
 - 6. Size each hood for 100 percent of nominal fresh air damper capacities.
 - 7. Protect each hood with bird screen to prevent nesting at intake or exhaust air flow paths.
- F. Unit Flooring: Construct with sufficient strength to support expected people and equipment loads associated with maintenance activities.
- G. Casing Leakage: Seal joints and provide airtight access doors so that air leakage does not exceed one percent of design flow at the specified casing pressure.
- H. Insulation:
 - 1. Provide minimum thermal thickness of 12 R throughout.
 - 2. Completely fill panel cavities in each direction to prevent voids and settling.

3. Comply with NFPA 90A.
- I. Drain Pan Construction:
 1. Provide cooling coil sections with an insulated, double wall, stainless steel drain pan complying with ASHRAE Std 62.1 for indoor air quality and sufficiently sized to collect all condensate.
 2. Slope in two planes to promote positive drainage and eliminate stagnate water conditions.
 3. Locate outlet of sufficient diameter at lowest point of pan to prevent overflow at normal operating conditions.
 4. Provide threaded drain connections constructed of drain pan material, extended sufficient distance beyond the base to accommodate field installed, condensate drain trapping.
- J. Louvers: Stationary, of galvanized steel, 4 inch deep with plenum, nylon bearings, 1/2 inch mesh, 0.04 inch galvanized wire bird screen in aluminum frame, and bearing AMCA Certified Ratings Seal in accordance with AMCA 500-L. Furnish adjustable louvers with hollow vinyl bulb edging on blades and foam side stops to limit leakage to maximum 2 percent at 4 inch wg differential pressure when sized for 2000 fpm face velocity.
- K. Finish:
 1. Outdoor Units:
 - a. Coat external surface of unit casing with primer and minimum 1.5 mil, enamel paint finish.
 - b. Comply with salt spray test in accordance with ASTM B177/B177M.
 - c. Color: Manufacturer's standard color.

2.03 FAN SECTION

- A. Type: Air foil, single width, single inlet, centrifugal plug type fan, conforming to AMCA 99.
- B. Performance Ratings: Determined in accordance with AMCA 210 and labeled with AMCA Certified Rating Seal.
- C. Sound Ratings: AMCA 301; tested to AMCA 300 and label with AMCA Certified Sound Rating Seal.
- D. Bearings: Self-aligning, grease lubricated, with lubrication fittings extended to exterior of casing with plastic tube and grease fitting rigidly attached to casing.
- E. External Motor Junction Box: Factory mount NEMA 4 external junction box and connect to extended motor leads from internally mounted motors.
- F. Motor Wiring Conduit: Wire fan motor wiring to the unit mounted variable frequency drive provided by the BAS contractor.
- G. Fan Accessories:
- H. Flexible Duct Connections:
 1. For separating fan, coil, and adjacent sections.
- I. Drives:
 1. Conform to AMCA 99.
 2. Bearings: Heavy duty pillow block type, ball bearings, with ABMA STD 9, L-10 life at 50,000 hours.
- J. Shafts: Solid, hot rolled steel, ground and polished, with key-way, and protectively coated with lubricating oil.
- K. V-Belt Drive: Cast iron or steel sheaves, dynamically balanced, bored to fit shafts, and keyed. Variable and adjustable pitch sheaves for motors 15 hp and under selected so required rpm is obtained with sheaves set at mid-position; fixed sheave for 20 hp and over, matched belts, and drive rated as recommended by manufacturer or minimum 1.5 times nameplate rating of the motor.

- L. Belt Guard: Fabricate to SMACNA (DCS); 0.106 inch thick, 3/4 inch diamond mesh wire screen welded to steel angle frame or equivalent, prime coated. Secure to fan or fan supports without short circuiting vibration isolation, with provision for adjustment of belt tension, lubrication, and use of tachometer with guard in place.

2.04 COIL SECTION

- A. Casing: Provide access to both sides of coils. Enclose coils with headers and return bends exposed outside casing. Slide coils into casing through removable end panel with blank off sheets and sealing collars at connection penetrations.
- B. Drain Pans: 24 inch downstream of coil and down spouts for cooling coil banks more than one coil high.
- C. Eliminators: Three break of galvanized steel, mounted over drain pan.
- D. Air Coils:
 - 1. Certify capacities, pressure drops, and selection procedures in accordance with AHRI 410.
- E. Fabrication:
 - 1. Tubes: 5/8 inch OD seamless copper expanded into fins, brazed joints.
 - 2. Fins: Aluminum.
 - 3. Casing: Die formed channel frame of galvanized steel.
- F. Water Heating Coils:
 - 1. Headers: Cast iron, seamless copper tube, or prime coated steel pipe with brazed joints.
 - 2. Configuration: Drainable, with threaded plugs for drain and vent; serpentine type with return bends on smaller sizes and return headers on larger sizes.
- G. Water Cooling Coils:
 - 1. Headers: Cast iron, seamless copper tube, or prime coated steel pipe with brazed joints.
 - 2. Configuration: Drainable, with threaded plugs for drain and vent; threaded plugs in return bends and in headers opposite each tube.

2.05 FILTER AND AIR CLEANER SECTION

- A. General: Provide filter sections with filter racks, minimum of one access door for filter removal, and filter block-offs to prevent air bypass.
- B. Pleated Media Filters:
 - 1. Media: 2 inch, 100 percent synthetic fibers, continuously laminated to a grid with water repellent adhesive, and capable of operating up to a maximum of 625 fpm without loss of efficiency and holding capacity.
 - 2. Frame: Steel wire grid.
 - 3. Minimum Efficiency Reporting Value: MERV 7 when tested in accordance with ASHRAE 52.2.
- C. Differential Pressure Gage:
 - 1. Provide factory installed dial type differential pressure gage, flush mounted with casing outer wall, and fully piped to both sides of each filter to indicate status.
 - 2. Maintain plus/minus 5 percent accuracy within operating limits of 20 degrees F to 120 degrees F.

2.06 DAMPER SECTION

- A. Mixing Section: Provide a functional section to support the damper assembly for modulating the volume of outdoor and return air.
- B. Damper Blades:
 - 1. Double-skin airfoil design with metal, compressible jamb seals and extruded-vinyl blade-edge seals on each blade.

2. Self-lubricating stainless steel or synthetic sleeve bearings.
 3. Comply with ASHRAE Std 90.1 for rated maximum leakage rate.
 4. Provide leakage testing and pressure ratings in compliance with AMCA 500-D test methods.
 5. Arrange in parallel or opposed-blade configuration.
- C. Barometric Relief Dampers:
1. Frame: Roll formed galvanized steel.
 2. Blades: Roll formed galvanized steel.
 3. Blade Seals: Extruded vinyl, mechanically attached to the blade edge.
 4. Material:

2.07 ACCESS SECTION

- A. Provide for fan, coils, and filter to allow for inspection, cleaning, and maintenance of field installed components.
- B. Construct access doors same as previously specified within this Section.

2.08 DIFFUSER SECTION

- A. Provide diffuser section immediately after fan section.
- B. Diffuser provides equal air distribution to blow-thru components immediately downstream of the diffuser.

2.09 ELECTRICAL

- A. Main Power Connection
 1. All power wiring shall be tied into a single source such as a main control panel, panel-board, motor control center or power distribution block at the air handling unit.
 2. Electrical components, devices, and materials shall be sized in accordance with NEC requirements for 40 degrees C operating conditions.
 3. Install fused safety disconnect switches at motor loads and major equipment as required.
- B. Wiring and Conduits
 1. All electrical wiring shall be installed in electrical metallic tubing (EMT) conduit, minimum size of 3/4" inch or within cable trays. Devices subject to vibration or movement such as motors or transformers to be connected with liquid-tight flexible metallic conduit (LFMC) when on the exterior or vestibule and with flexible metallic conduit when installed in the air plenum.
 2. Liquid tight flexible metallic conduit (LFMC) shall be used across section splits to facilitate unit installation. If internal to the air plenum, flexible metallic conduit shall be used per NEC.
 - a. Separate conduit systems shall be provided as follows:
 - 1) Power
 - 2) Lighting
 - 3) Control and Instrumentation
 - b. All conduit connections to boxes and fittings shall be supported not more than 12 inches from connection point. All conduit bends shall be supported not more than 12 inches from each change in direction.
 - c. Exposed conduits shall be securely clamped and supported with pipe hangers or galvanized one-hole pipe straps fastened to structure with bolts, screws, and anchors. The spacing of supports for horizontal runs of 3/4" conduit or larger shall be not more than 8 feet. The spacing of supports for vertical runs of 3/4 inch, and 1 1/4" conduits shall be not more than 7 feet. The spacing of supports for vertical runs of 1 1/2" or larger conduits shall be not more than 7 feet.
 - d. All unit wiring for external connections shall be terminated on the left hand side of the outgoing terminal blocks.

- e. When multiple vertical rows of terminal boards are located in the same terminal box, a minimum of four inches clear space shall be provided between adjacent vertical rows.
- f. Power and control and instrumentation wiring shall be separated from each other and shall not be terminated on the same terminal blocks.

2.10 CONTROLS

- A. Combination VFD - Disconnects:
 - 1. Provide factory mounted, combination VFD - disconnect in accordance with Section 23 09 69 for each fan motor. VFD shall be supplied by BAS contractor.
 - 2. Mount VFD-disconnect on fan section internally in a NEMA 4 equivalent unit casing within a dedicated controls section or housed fan section.
 - a. Internal Enclosure Construction Characteristics:
 - 1) Integral part of unit casing to allow for thermal venting to casing interior.
 - 2) Accessible from unit exterior via access door.
 - 3) Construction of access doors same throughout unit.
 - 3. Allow enclosure entry via a concealed defeater mechanism when the handle is in the ON position.
 - 4. Include control transformer with sufficient capacity to support the following items:
 - a. VFD and controls.
 - b. Binary output on-off wiring.
 - c. Analog output speed-signal wiring.
 - d. Wires that interface between VFD and direct digital controller.
 - 5. Provide bypass relays and bypass circuitry with VFD-OFF-BYPASS selector switch.

2.11 ROOF MOUNTING CURB

- A. Roof Vibration Isolation Mounting Curb: 14 inches high galvanized steel, channel frame with gaskets and nailer strips.
- B. Include roof curb accessories for each roof mounted unit.

2.12 DAMPERS

- A. Mixing Boxes: Section with factory mounted outside and return air dampers of galvanized steel with vinyl bulb edging and edge seals in galvanized frame, with galvanized steel axles in self-lubricating nylon bearings, in parallel blade arrangement with damper blades positioned across short air opening dimension. Provide removable, full width rack for supporting freeze protection thermostat, with removable end panel to permit rack removal.
- B. Damper Leakage: Maximum 2 percent at 4 inch wg differential pressure when sized for 2000 fpm face velocity.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Bolt sections together with gaskets.
- C. Isolate fan section with flexible duct connections.
- D. Install flexible duct connections between fan inlet and discharge ductwork and air handling unit sections. Ensure that metal bands of connectors are parallel with minimum one inch flex between ductwork and fan while running.
- E. Install assembled unit on vibration isolators. Install isolated fans with resilient mountings and flexible electrical leads. Install restraining snubbers as indicated. Refer to Section 23 05 48. Adjust snubbers to prevent tension in flexible connectors when fan is operating.
- F. Provide fixed sheaves required for final air balance.

- G. Make connections to coils with unions or flanges.
- H. Hydronic Coils:
 - 1. Hydronic Coils: Connect water supply to leaving air side of coil (counterflow arrangement).
 - 2. Provide shut-off valve on supply line and lockshield balancing valve with memory stop on return line.
 - 3. Locate water supply at bottom of supply header and return water connection at top.
 - 4. Provide manual air vents at high points complete with stop valve.
 - 5. Ensure water coils are drainable and provide drain connection at low points.

3.02 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.

3.03 SYSTEM STARTUP

- A. Provide manufacturer's field representative to perform systems startup.
- B. Prepare and start equipment and systems in accordance with manufacturers' instructions and recommendations.
- C. Adjust for proper operation within manufacturer's published tolerances.

3.04 CLOSEOUT ACTIVITIES

- A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.
- B. See Section 01 79 00 - Demonstration and Training, for additional requirements.
- C. Demonstrate proper operation of equipment to State of Delaware OMB - Division of Facilities Management's designated representative.
- D. Training: Train State of Delaware OMB - Division of Facilities Management's personnel on operation and maintenance of system.
 - 1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
 - 2. Provide minimum of two hours of training.
 - 3. Instructor: Manufacturer's training personnel.
 - 4. Location: At project site.

END OF SECTION

DRAWINGS REDACTED