



Pennsylvania
Duane Morris Plaza
30 S. 17th Street
Suite 830
Philadelphia, PA 19103
Phone
267.804.7286

Delaware
315 S. Chapel Street
Newark, DE 19711
Phone
302.738.7172
Fax
302.738.7175
www.dedc-eng.com

LEGISLATIVE HALL
CORE BUILDING HVAC REPLACEMENT
OMB/DFM CONTRACT # MJ1002000036
ADDENDUM #2

CLARIFICATIONS:

1. York/JCI has been found as an acceptable manufacturer for the AHUs.
2. JCI/Enviro Tec has been found as an acceptable manufacturer for the VAVs.
3. York has been found as an acceptable manufacturer for the RHCs.

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. Please confirm if temporary heating or cooling is required for the spaces that will be offline during the periods when the existing or new equipment is not available. If so, please provide the requirements for temporary conditioning.

Response: The intent is to un-occupy a portion of the building while the air handling units are being replaced. This un-occupied portion shall be maintained at a reasonable temperature (between 83°F and 60°F) and below 65% relative humidity. The contractor shall be responsible for providing temporary conditioning as required to maintain these set points.

2. Is humidity control a concern to maintain the condition of the large quantity of existing wood trim? If so, please provide the requirements for temporary dehumidification.

Response: The intent is to un-occupy a portion of the building while the air handling units are being replaced. This un-occupied portion shall be maintained at a reasonable temperature (between 83°F and 60°F) and below 65% relative humidity. The contractor shall be responsible for providing temporary conditioning as required to maintain these set points.

3. Please confirm that the ceiling removal refers to the existing ATC or Drywall ceilings that are visible from the floor only. No additional layers that may exist above the visible ceiling should be included.



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Response: To our knowledge the ceiling removal is the ceiling that is visible from the floor.

4. It is noted on the drawings that the accessible path to bring in the new AHU unit sections “will utilized the pull down stairs or the hoist way”. Has the design team confirmed with unit manufacture/supplier that the required sections for these units will fit through these openings? If not, please confirm if other means of access would be acceptable.

Response: Specification section 23 73 14 3.03 indicates that these units are to be built in place and will ship from the factory in pieces. This method allows the contractor to utilize the existing openings into the attic areas. Alternative methods could be utilized but these methods shall be approved by DFM and DEDCC prior to utilization.

5. Specifications allow for the use of materials that would require work with an open flame. Such as soldering or welding of these materials. As this work would require modifications to the use of the fire alarm system, is it assumed that all installations that require work with an open flame be completed on off hours? Or is the intent to utilize mechanical means of connection.

Response: Specification section 23 21 13 allows the use of mechanical press fit fittings and solder for copper tubing which is the majority of the piping in finished ceiling spaces. The use of open flame shall be performed in a controlled and safe environment and may be done during normal hours in un-occupied portions of the building. Any open flame work completed in the attic space will require the contractor to provide adequate means of protecting the space below from hot falling objects. We recommend to limiting open flame work within the building and will not accept open flame work being completed in an un-safe and or un-controlled environment. The contractor must provide a separate fire watch person for all open flame work. Also the contractor must perform a Job Hazard Analysis prior to performing any open flame work for each work shift. The Job Hazard Analysis should result in a report identifying the following information: who is performing the work, where the work will be performed, what tools will be used, what protections of adjacent materials will be used, what PPE will be provided and used by all involved, how the area will be accessed, who the fire watch is, what fire suppression is being used for the duration of the shifts open flame work, and any other pertinent information that addresses the needs for performing this work in a safe manner.



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DRAWING REVISIONS:

1. Drawing M003:
 - a. Revised capacities and pipe sizes to AHU's.
2. Drawing M-202:
 - a. Revised pipe sizes to AHUs.
3. Drawing M404:
 - a. Removed return fan from AHU's 3 & 4.
4. Drawing M601:
 - a. Revised AHU schedule.
 - b. Revised Reheat Coil schedule.
 - c. Added Backflow Preventer schedule.
5. Drawing ED-103:
 - a. Revised wire and conduit sizes.
 - b. Revised panel schedules.
 - c. Removed demolished of motor starters on AHU-6 & AHU-8.
6. Drawing E-103:
 - a. Revised wire and conduit sizes.
 - b. Revised panel schedules.
 - c. Removed installation of VFDs on AHU-6 & AHU-8.

SPECIFICATION REVISIONS:

- 01 20 00: Added section 1.06 regarding initial progress payment procedures.
- 01 35 53: Replace specification in its entirety.
- 01 70 00: Revised section 1.05, C.1
- 23 73 14: Replace specification in its entirety.



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Addendum #2

1. Addendum #2 Summary (this document) (4 pages)
2. Drawings (6 pages)
 - a. M-003
 - b. M-202
 - c. M-404
 - d. M-601
 - e. ED-103
 - f. E-103
3. Specification (17 pages)
 - a. 01 20 00
 - b. 01 35 53
 - c. 01 70 00
 - d. 23 73 14

Summarized By: DEDC, LLC
 Matt Lano
Date: December 13, 2019

SECTION 01 20 00
PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Procedures for preparation and submittal of applications for progress payments.
- B. Change procedures.

1.02 SCHEDULE OF VALUES

- A. Forms to be used: AIA G703.
- B. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit draft to DEDC, LLC for approval.
- C. Forms shall be typed. Forms filled out by hand will not be accepted.
- D. Submit Schedule of Values in duplicate within 5 days after date of Pre-Construction Meeting.

1.03 APPLICATIONS FOR PROGRESS PAYMENTS

- A. Payment Period: Submit at intervals stipulated in the Agreement.
- B. Form to be used: AIA G702.
- C. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit sample to DEDC, LLC for approval.
- D. Forms shall be typed. Forms filled out by hand will not be accepted.
- E. Execute certification by signature of authorized officer.
- F. Submit three copies of each Application for Payment.
- G. Include the following with the application:
 - 1. OMB/DFM Project Number.
 - 2. Contractors Purchase Order Number from the State.
 - 3. Transmittal letter as specified for submittals in Section 01 30 00.

1.04 MODIFICATION PROCEDURES

- A. For minor changes not involving an adjustment to the Contract Sum or Contract Time, DEDC, LLC will issue instructions directly to Contractor.
- B. For other required changes, DEDC, LLC will issue a document signed by State of Delaware OMB - Division of Facilities Management instructing Contractor to proceed with the change, for subsequent inclusion in a Change Order.
 - 1. The document will describe the required changes and will designate method of determining any change in Contract Sum or Contract Time.
 - 2. Promptly execute the change.
- C. For changes for which advance pricing is desired, DEDC, LLC will issue a document that includes a detailed description of a proposed change with supplementary or revised drawings and specifications, a change in Contract Time for executing the change with a stipulation of any overtime work required and the period of time during which the requested price will be considered valid. Contractor shall prepare and submit a fixed price quotation within 5 days.
- D. Computation of Change in Contract Amount: As specified in the Agreement and Conditions of the Contract.
- E. Execution of Change Orders: DEDC, LLC will issue Change Orders for signatures of parties as provided in the Conditions of the Contract.
- F. After execution of Change Order, promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Sum.

- G. Promptly revise progress schedules to reflect any change in Contract Time, and revise sub-schedules to adjust times for other items of work affected by the change.
- H. Promptly enter changes in Project Record Documents.

1.05 APPLICATION FOR FINAL PAYMENT

- A. Prepare Application for Final Payment as specified for progress payments, identifying total adjusted Contract Sum, previous payments, and sum remaining due.
- B. Application for Final Payment will not be considered until the following have been accomplished:
 - 1. All closeout procedures specified in Section 01 70 00.

1.06 INITIAL PROGRESS PAYMENT PROCEDURES

- A. The following items must be complete and submitted to the owner prior to acceptance and/or payment of the initial application for payment:
 - 1. Approved Schedule of Values
 - 2. Complete Listing of Subcontractors
 - 3. Contractors Safety Plan
 - 4. Emergency Action Plan and Emergency Contacts
 - 5. Contractors Certificates of Insurance
 - 6. Contractors Submittal Schedule
 - 7. Approved Contractors Construction Schedule (Preliminary if not final)

END OF SECTION

SECTION 01 35 53
SECURITY PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Security measures including entry control, personnel identification, and miscellaneous restrictions.

1.02 RELATED REQUIREMENTS

- A. Section 01 10 00 - Summary: use of premises and occupancy.

1.03 ENTRY CONTROL

- A. Restrict entrance of persons and vehicles into Project site and existing facilities.
- B. Allow entrance only to authorized persons with proper identification.
- C. Maintain log of workers and visitors, make available to State of Delaware OMB - Division of Facilities Management and Capitol Police on request.
- D. State of Delaware OMB - Division of Facilities Management and Capitol Police will control entrance of persons and vehicles related to State of Delaware OMB - Division of Facilities Management's operations.

1.04 PERSONNEL IDENTIFICATION AND BACKGROUND CHECK

- A. All contractors shall have their employees and their subcontractors complete and submit to Capitol Police a request for criminal history record information. The background check takes approximately one week from the date of receipt to be processed. Without this background check, workers will not be permitted to enter the project premises and/or the construction site.

1.05 SPECIAL REQUIREMENTS

- A. Materials shall be moved through the buildings using rubber tired vehicles which shall be properly controlled at all times to avoid damage to existing walls, floors, and ceiling surfaces, including doors and door and/or window frames.
- B. Water damage will not be tolerated and it is incumbent upon the contractor to take all steps necessary to keep the existing premises dry at all times.
- C. All welding and cutting shall be performed by qualified and certified welders. Certificates shall be on file with the Construction Manager prior to commencement of any welding.
- D. Existing streets, pavements, lawns, curbs, and other finished surfaces disturbed or damaged by excavation or other construction activities shall be repaired and restored to their original conditions to the satisfaction of the Owner, Construction Manager, and local authorities.
- E. Open trenches must be barricaded. Nothing which can be used as a weapon or could conceal an inmate can be used as a barricade. Contractors are directed to use plastic tape and the existing trees, shrubbery, or fences where available.
- F. No dumping will be allowed on the project site. Trash, debris, and waste must be removed from the compound daily and from the site as required or directed.

1.06 FIRE PROTECTION

- A. Protect and maintain fire department facilities (e.g., sprinkler heads, hydrants, wire, cables, ducts, manholes, posts, poles, signals, alarm boxes, etc.) at all times.
- B. Maintain unobstructed access to the following at all times: Fire hydrants, and fire alarm boxes.
- C. Immediately notify the Fire Department in the event of accidental damage to fire department facilities.
- D. Immediately restore damage facilities to original conditional at no increase to the Contract Sum.

1.07 RESPONSIBILITY FOR DAMAGE AND CARE OF STATE PROPERTY

- A. The contractor in the performance of this Contract will be held financially responsible for any damage to the grounds, buildings, or equipment caused by them, their subcontractors or employees, or other persons engaged in the performance of the Contract.
- B. Every reasonable effort shall be made by workmen to proceed with the work as described in these specifications in a manner in trade circles as the highest level of workmanship. The successful bidder for this work shall be responsible for all damage to other work caused by his workmen or through the neglect of his workmen on the site.
- C. Workmanlike care shall be expected at all times in performing the work. It shall be the responsibility of the successful bidder to repair or replace all damaged property, the damage for which they or anyone working under his direction is responsible.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 70 00
EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Examination, preparation, and general installation procedures.
- B. Requirements for alterations work, including selective demolition, except removal, disposal, and/or remediation of hazardous materials and toxic substances.
- C. Pre-installation meetings.
- D. Cutting and patching.
- E. Cleaning and protection.
- F. Starting of systems and equipment.
- G. Demonstration and instruction of State of Delaware OMB - Division of Facilities Management personnel.
- H. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.
- I. General requirements for maintenance service.

1.02 RELATED REQUIREMENTS

- A. Section 01 10 00 - Summary: Limitations on working in existing building; continued occupancy; work sequence; identification of salvaged and relocated materials.
- B. Section 01 30 00 - Administrative Requirements: Submittals procedures, Electronic document submittal service.
- C. Section 01 74 19 - Construction Waste Management and Disposal: Additional procedures for trash/waste removal, recycling, salvage, and reuse.
- D. Section 01 78 00 - Closeout Submittals: Project record documents, operation and maintenance data, warranties and bonds.
- E. Section 01 79 00 - Demonstration and Training: Demonstration of products and systems to be commissioned and where indicated in specific specification sections
- F. Section 01 91 13 - General Commissioning Requirements: Contractor's responsibilities in regard to commissioning.
- G. Section 07 84 00 - Firestopping.

1.03 REFERENCE STANDARDS

- A. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2013.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
 - 1. Structural integrity of any element of Project.
 - 2. Integrity of weather exposed or moisture resistant element.
 - 3. Efficiency, maintenance, or safety of any operational element.
 - 4. Visual qualities of sight exposed elements.
 - 5. Work of State of Delaware OMB - Division of Facilities Management or separate Contractor.
 - 6. Include in request:
 - a. Identification of Project.
 - b. Location and description of affected work.
 - c. Necessity for cutting or alteration.

- d. Description of proposed work and products to be used.
- e. Effect on work of State of Delaware OMB - Division of Facilities Management or separate Contractor.
- f. Written permission of affected separate Contractor.
- g. Date and time work will be executed.

C. Project Record Documents: Accurately record actual locations of capped and active utilities.

1.05 PROJECT CONDITIONS

- A. Use of explosives is not permitted.
- B. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.
- C. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.
 - 1. Provide dust-proof barriers between construction areas and areas continuing to be occupied.
- D. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.
 - 1. Outdoors: Limit conduct of especially noisy exterior work to the hours of 8 am to 5 pm.
 - 2. Indoors: Limit conduct of especially noisy interior work to the hours of 6 pm to 7 am.
- E. Pest and Rodent Control: Provide methods, means, and facilities to prevent pests and insects from damaging the work.

1.06 COORDINATION

- A. See Section 01 10 00 for occupancy-related requirements.
- B. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.
- C. Notify affected utility companies and comply with their requirements.
- D. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
- E. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on drawings. Follow routing indicated for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
- F. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
- G. Coordinate completion and clean-up of work of separate sections.
- H. After State of Delaware OMB - Division of Facilities Management occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of State of Delaware OMB - Division of Facilities Management's activities.

PART 2 PRODUCTS

2.01 PATCHING MATERIALS

- A. New Materials: As specified in product sections; match existing products and work for patching and extending work.
- B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.

- C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.
- B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.
- C. Examine and verify specific conditions described in individual specification sections.
- D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.
- E. Verify that utility services are available, of the correct characteristics, and in the correct locations.
- F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

3.02 PREPARATION

- A. Clean substrate surfaces prior to applying next material or substance.
- B. Seal cracks or openings of substrate prior to applying next material or substance.
- C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.03 PREINSTALLATION MEETINGS

- A. When required in individual specification sections, convene a preinstallation meeting at the site prior to commencing work of the section.
- B. Require attendance of parties directly affecting, or affected by, work of the specific section.
- C. Notify DEDC, LLC four days in advance of meeting date.
- D. Prepare agenda and preside at meeting:
 - 1. Review conditions of examination, preparation and installation procedures.
 - 2. Review coordination with related work.
- E. Record minutes and distribute copies within two days after meeting to participants, with two copies to DEDC, LLC, State of Delaware OMB - Division of Facilities Management, participants, and those affected by decisions made.

3.04 GENERAL INSTALLATION REQUIREMENTS

- A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.
- B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.
- C. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.
- D. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.
- E. Make neat transitions between different surfaces, maintaining texture and appearance.

3.05 ALTERATIONS

- A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
 - 1. Verify that construction and utility arrangements are as indicated.
 - 2. Report discrepancies to DEDC, LLC before disturbing existing installation.

3. Beginning of alterations work constitutes acceptance of existing conditions.
- B. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.
 1. Where openings in exterior enclosure exist, provide construction to make exterior enclosure weatherproof.
 2. Insulate existing ducts or pipes that are exposed to outdoor ambient temperatures by alterations work.
- C. Remove existing work as indicated and as required to accomplish new work.
 1. Remove items indicated on drawings.
 2. Relocate items indicated on drawings.
 3. Where new surface finishes are to be applied to existing work, perform removals, patch, and prepare existing surfaces as required to receive new finish; remove existing finish if necessary for successful application of new finish.
 4. Where new surface finishes are not specified or indicated, patch holes and damaged surfaces to match adjacent finished surfaces as closely as possible.
- D. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove, relocate, and extend existing systems to accommodate new construction.
 1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow access or provide access panel.
 2. Where existing systems or equipment are not active and Contract Documents require reactivation, put back into operational condition; repair supply, distribution, and equipment as required.
 3. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
 - a. Disable existing systems only to make switchovers and connections; minimize duration of outages.
 - b. See Section 01 10 00 for other limitations on outages and required notifications.
 - c. Provide temporary connections as required to maintain existing systems in service.
 4. Verify that abandoned services serve only abandoned facilities.
 5. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification; patch holes left by removal using materials specified for new construction.
- E. Protect existing work to remain.
 1. Prevent movement of structure; provide shoring and bracing if necessary.
 2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
 3. Repair adjacent construction and finishes damaged during removal work.
- F. Adapt existing work to fit new work: Make as neat and smooth transition as possible.
- G. Patching: Where the existing surface is not indicated to be refinished, patch to match the surface finish that existed prior to cutting. Where the surface is indicated to be refinished, patch so that the substrate is ready for the new finish.
- H. Refinish existing surfaces as indicated:
 1. Where rooms or spaces are indicated to be refinished, refinish all visible existing surfaces to remain to the specified condition for each material, with a neat transition to adjacent finishes.
 2. If mechanical or electrical work is exposed accidentally during the work, re-cover and refinish to match.
- I. Clean existing systems and equipment.

- J. Remove demolition debris and abandoned items from alterations areas and dispose of off-site; do not burn or bury.
- K. Do not begin new construction in alterations areas before demolition is complete.
- L. Comply with all other applicable requirements of this section.

3.06 CUTTING AND PATCHING

- A. Whenever possible, execute the work by methods that avoid cutting or patching.
- B. See Alterations article above for additional requirements.
- C. Perform whatever cutting and patching is necessary to:
 - 1. Complete the work.
 - 2. Fit products together to integrate with other work.
 - 3. Provide openings for penetration of mechanical, electrical, and other services.
 - 4. Match work that has been cut to adjacent work.
 - 5. Repair areas adjacent to cuts to required condition.
 - 6. Repair new work damaged by subsequent work.
 - 7. Remove samples of installed work for testing when requested.
 - 8. Remove and replace defective and non-conforming work.
- D. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.
- E. Employ original installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.
- F. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.
- G. Restore work with new products in accordance with requirements of Contract Documents.
- H. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- I. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07 84 00, to full thickness of the penetrated element.
- J. Patching:
 - 1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
 - 2. Match color, texture, and appearance.
 - 3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

3.07 PROGRESS CLEANING

- A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.
- B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.
- C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.
- D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

3.08 PROTECTION OF INSTALLED WORK

- A. Protect installed work from damage by construction operations.

- B. Provide special protection where specified in individual specification sections.
- C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.
- D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
- E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
- F. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
- G. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

3.09 SYSTEM STARTUP

- A. Coordinate schedule for start-up of various equipment and systems.
- B. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.
- C. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
- D. Verify that wiring and support components for equipment are complete and tested.
- E. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.
- F. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.10 DEMONSTRATION AND INSTRUCTION

- A. See Section 01 79 00 - Demonstration and Training.

3.11 ADJUSTING

- A. Adjust operating products and equipment to ensure smooth and unhindered operation.

3.12 FINAL CLEANING

- A. Use cleaning materials that are nonhazardous.
- B. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.
- C. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.
- D. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.
- E. Clean filters of operating equipment.
- F. Clean debris from roofs, gutters, downspouts, scuppers, overflow drains, area drains, and drainage systems.
- G. Clean site; sweep paved areas, rake clean landscaped surfaces.
- H. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

3.13 CLOSEOUT PROCEDURES

- A. Make submittals that are required by governing or other authorities.
 - 1. Provide copies to DEDC, LLC.

- B. Accompany Project Coordinator on preliminary inspection to determine items to be listed for completion or correction in the Contractor's Correction Punch List for Contractor's Notice of Substantial Completion.
- C. Notify DEDC, LLC when work is considered ready for DEDC, LLC's Substantial Completion inspection.
- D. Submit written certification containing Contractor's Correction Punch List, that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for DEDC, LLC's Substantial Completion inspection.
- E. Conduct Substantial Completion inspection and create Final Correction Punch List containing DEDC, LLC's and Contractor's comprehensive list of items identified to be completed or corrected and submit to DEDC, LLC.
- F. Correct items of work listed in Final Correction Punch List and comply with requirements for access to State of Delaware OMB - Division of Facilities Management-occupied areas.
- G. Notify DEDC, LLC when work is considered finally complete and ready for DEDC, LLC's Substantial Completion final inspection.
- H. Complete items of work determined by DEDC, LLC listed in executed Certificate of Substantial Completion.

3.14 MAINTENANCE

- A. Provide service and maintenance of components indicated in specification sections.
- B. Maintenance Period: As indicated in specification sections or, if not indicated, not less than 2 years from the Date of Substantial Completion or the length of the specified warranty, whichever is longer.
- C. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.
- D. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.
- E. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of the State of Delaware OMB - Division of Facilities Management.

END OF SECTION

SECTION 23 73 14
INDOOR AIR HANDLING UNITS

PART I. GENERAL

1.01 REFERENCES

- A. AMCA 210 - Laboratory Methods of Testing Fans for Rating Purposes
- B. Eurovent Certification - Certifies the performance ratings of air-conditioning and refrigeration products according to European and international standards.
- C. CSN EN 1886 - Ventilation for buildings - Air handling units - Mechanical performance
- D. ARI 410 - Forced-Circulation Air-Cooling and Air-Heating Coils
- E. ASTM B117 – Standard Practice for Operating Salt Spray Apparatus
- F. ASHRAE Std. 52.2 – Method of Testing Air-Cleaning Devices for Removal Efficiency by Particle Size
- G. IBC – International Building Code
- H. ISO 9000 - Quality management
- I. NEMA MG1 - Motors and Generators
- J. NFPA 70 - National Electrical Code
- K. NFPA 90A – Standard for the Installation of Air Conditioning and Ventilating Systems
- L. SMACNA - HVAC Duct Construction Standards - Metal and Flexible
- M. UL 900 - Test Performance of Air Filter Units
- N. UL 1995 – Standard for Heating and Cooling Equipment

1.02 SUBMITTALS

- A. Submit under provisions of General Conditions and Division 1 as applicable.
- B. Shop Drawings: Indicate assembly drawings, unit dimensions, weight loading, required clearances, construction details, field connection details, electrical characteristics and connection requirements.
- C. Product Data:
 - 1. Provide literature, which indicates dimensions, weights, capacities, ratings, fan performance, gauges and finishes of materials, electrical characteristics and connection requirements.
 - 2. Provide data on filter media, filter performance data, filter assembly, and filter frames.
 - 3. Provide fan curves with specified operating point clearly plotted. In the case of fans that will be controlled by VFDs or ECMs, the fan curve is to have the minimum and maximum operating points clearly plotted.
 - 4. Submit sound power level data for the air handling unit outlet, inlet and casing radiated at rated capacity and specified pressure.
 - 5. Submit electrical requirements for power supply including wiring diagrams for interlock and control wiring, clearly indicating factory installed and field installed wiring.
 - 6. Applicable warranty certificates.

1.03 OPERATION AND MAINTENANCE DATA

- A. Submit under provisions of General Conditions and Division 1 as applicable.
- B. Maintenance Data: Include instructions for inspection, maintenance, lubrication, filter replacement, motor and drive replacement, adjustments, spare parts lists and wiring diagrams.
- C. Manufacturer's Installation Instructions.

1.04 QUALIFICATIONS

- A. Manufacturer: Company specializing in the design and manufacture of the products specified in this section with a minimum of ten (10) years documented experience, and which issues complete catalog data on the total product.
- B. Each unit shall bear an ETL label, conforming to UL Standard 1995.

1.05 WARRANTY

- A. The unit shall be provided with a parts and labor only warranty covering the first two years of operation. The warranty period shall commence on the date of substantial completion.

1.06 EXTRA MATERIALS

- A. For belt drive fans, provide a spare fan belt.
- B. Provide a set of replacement filters.

1.07 QUALITY ASSURANCE

- A. Conform to all information documented in approved submittal package and construction notes.
- B. Fan vibration test results shall be available for review prior to any air handling unit shipment to the jobsite.
- C. Manufacturer shall have a documented quality assurance plan for providing consistent product quality. The quality assurance plan shall include component quality check lists, random product inspections, fan balance reports, coil and piping leak test reports, electrical system test reports, etc. Copies of these reports shall be made available to the engineer upon request.

1.08 DELIVERY STORAGE AND HANDLING

- A. Access to the final location of the Air Handling equipment is limited and requires that the air handling units be constructed in place.
- B. Deliver, store, protect and handle under the supervision of the owner and in accordance with the manufacturer's Operation & Maintenance manuals.
- C. The units shall be shipped in a combination of modules and knockdown, as documented in the specifications or instructed by contractor. The units and/or modules shall be equipped with adequately sized and removable lifting lugs for field rigging and handling.
- D. The units must be handled carefully in the field to avoid damaging internal components, cabinet walls and exterior finish while being moved into place by the contractor.
- E. Factory applied shrink wrap is intended to protect the units while in transit to the job site. The units must be stored in a dry, clean environment protected from the outdoor weather. The units must not be stored with the factory applied shrink wrap. The intention of the shrink wrap is to protect the units during transit.
- F. The units must not be operated, for temporary or permanent purposes, until the official start-up is completed by the mechanical contractor and witnessed by a manufacturer's representative.

PART II - PRODUCTS

2.01 MANUFACTURERS

- A. VTS
- B. Daikin
- C. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 CABINET

- A. Housing
 - 1. All units casing shall be constructed by a non-skeleton structure made by a "C" shape sandwich of 1.6 inch thick polyurethane foam with double side zinc coated, 25 gauge, galvanized steel to provide the best thermal and thermal bridges insulation. Exterior surface also includes an organic polyester coating for corrosion resistance.

2. The sandwich panel is fire resistant and odorless compound to provide thermal, vibration and acoustical insulation. All the elements are connected with sealed joints. The casing is in compliance with EN 1886 standard.

B. Access

1. Piping connection and VFD mounting location are in the opposite side of the inspection panels, which can be located at the right or left side of the unit. In particular cases, the piping connection may be located on the same side as the inspection panels.
2. At minimum access sections shall be provided for the filters, heating coil, chilled water coil, and fans.

2.03 INTERNAL COMPONENTS

A. Direct Drive Fans (approved equals)

1. All units shall be equipped with Direct Driven Plenum Fans, with air foil or backward-curved impellers. Beltless configuration and motor/fan pair is placed on a common frame isolated from the unit structure by rubber vibration isolators. Multiple fans may be utilized to achieve the required static pressure and air volume.
2. If multiple fans are provided the unit manufacturer shall provide interal wiring to a single point of connection for both fans to be operated by a single VFD.
3. Unit Shall have a minimum SCCR of 60 KAIC.
4. Maximum fan RPM to be 1800. The fan operating point shall not exceed the fan motor speed rating. Fans to be selected at a maximum of 60 HZ.

B. Fan Assemblies (basis of design)

1. The fan array will be arranged with high performance direct drive, single inlet, plenum fans with backwards inclined, high efficiency welded-aluminum or high-performance composite impeller with galvanized or aluminum support frame.
 - a. The fans are driven by long-life, low-temperature brushless DC electronically commutated motor (EC-Motor) with external rotor and integrated maintenance-free electronic circuitry and electronics. The motor is manufactured with maintenance-free, permanently lubricated ball bearings and shall be statically and dynamically balanced in accordance with ISO 1940 part 1. The motor shall be closed, protection level IP 54, thermal class 155 with permissible operating temperature of -13°F to 140°F. Motor efficiency class shall comply with IE4. Fan characteristic curves indicate measurements on a chamber test in accordance with ISO5801. The three-phase external rotor motor integrated into the fan hub meets the requirements for circulating electric machines set forth in DIN EN 60 034-1 (VDE 0530 Part 1).
 - b. Backdraft dampers shall be provided to block fan airflow in lieu of blank-off plates.
 - c. Fan Array shall be listed per UL 1995.
 - d. Fan assemblies shall be prewired with wire whips and plug connectors.
 - e. Fan system manufacturer must stock replacement parts in North America.
 - f. The fan bulkhead wall shall be constructed in a manner for easy field assembly, constructed of 14 gauge G90 formed sheet metal. The bend profile at each panel's seam shall provide vertical structural support for the bulkhead wall.
 - g. Each fan assembly shall be provided with a control panel and an external fused disconnect, shall be UL or ETL listed, and shall have a minimum SCCR of 60 KAIC. Each panel contains a lockable Hand/Off/Auto switch for optional manual speed control. The panel accepts a 0-10VDC signal when in Auto mode, and can be controlled locally when in Hand Mode.
 - h. There is a system alarm contact that the BAS can use to check the status of the Q-PAC System. There is a system enable contact that the BAS can use to enable or disable the Q-PAC System, along with a safety circuit terminations.
 - i. All Q-PAC components shall be sized to fit through a 20" x 40" access opening.
 - j. Maxmim fan RPM to be 2200.

C. Coils

1. Water Coils

- a. Coils are to have one row (more rows are acceptable) for hot water, and a minimum of eight (AHU-1 & AHU-2) or six (AHU-3 & AHU-4) rows for chilled water. All water coils are tested at 493 PSI, the maximum main coil working pressure is 246 PSI. Maximum entering water temperature is 200° F, and the maximum glycol content can be 50%. Tubes and U-bends are ½" inch O.D. copper. Fins are aluminum and are mechanically bonded to the copper tubes, with a 10 Fins per Inch configuration. All coils have built-in manual vent. In the case of heating and cooling applications only 1 source of heating can be used at the pre-heat or re-heat position.
 - b. Hot water coils to be in the pre-heat location for AHU-1 & AHU-2.
 - c. Hot water coils to be in the pre-heat location for AHU-3 & AHU-4. A separate duct mounted re-heat coil shall be utilized in AHU-3 & 4.
- D. Filters
1. Units shall be equipped with a 2 inch throwaway MERV8 filters.
 2. In the case of horizontal / vertical units with or without a mixing box, all the filters will be installed inside. All filters have a rating based on ASHRAE Standard.
- E. Mixing Box
1. The assembly includes fully modulating dampers with low leakage locate one at the outside air position and other at the return air position.
 2. The actuators for these dampers are to be provided by the manufacturer.
- F. Unit Controls
1. A terminal strip shall be provided for control of dampers within the unit. The BAS contractor shall control this equipment.
- G. Variable Frequency Drive (For Units that meet the requirements of 2.03A - Direct Drive Fans)
1. Variable frequency drives (VFD) shall be provided by controls contractor and shall meet the requirements of specification section 23 09 69
- H. Unit Piping
1. Chilled water and hot water coil connections shall be factory piped to the unit exterior, built-in air vents. Connection penetrations shall be factory sealed at the inside and exterior surfaces of the panel. All pipe insulation shall be supplied and installed in the field by the piping contractor and shall match that used on external piping.

2.04 UNIT TESTING AND QUALITY CONTROL

- A. Equipment Qualification
1. Prior to unit shipment, the following qualifications shall be performed and documented:
 - a. All fans shall be balanced and factory run tested to ensure design integrity.
 - b. All factory piping shall be leak tested to ensure integrity.
 - c. All electrical circuits shall be tested to ensure correct operation.
- B. Start-Up Service
1. Physical connections and start-up services are to be performed by the installing contractor.
 2. Manufacturer shall provide with each unit complete Installation, Operation & Maintenance manuals at time of shipment.
 3. Each unit shall be provided with start-up service by a manufacturer's trained representative.

PART III - EXECUTION

3.01 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle products under the supervision of the owner's representative and per the manufacturer's Installation, Operation & Maintenance Instructions. Store in a clean dry place and protect from weather and construction traffic. Handle carefully to avoid damage to components, enclosures and finish.

3.02 ENVIRONMENTAL REQUIREMENTS

- A. Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings are lubricated, and the fan(s) has been test run under observation

3.03 INSTALLATION

- A. Assemble and install in strict accordance with manufacturer's Operation & Maintenance Instructions, shop drawings and contract documents.
- B. Verify all components, accessories and appurtenances are on site.
- C. Align level and bolt in place.
- D. Install in conformance with ARI 435.
- E. Units shall be built in place type and ship from the factory in pieces for on-site assembly.

3.04 SYSTEM STARTUP

- A. Provide manufacturer's field representative to instruct 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.

3.05 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. Demonstration: Demonstrate operation of system to State of Delaware OMB - Division of Facilities Management's personnel.
 - 1. Use operation and maintenance data as reference during demonstration.
 - 2. Conduct walking tour of project.
 - 3. Briefly describe function, operation, and maintenance of each component.
- 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. Manufacturer shall include a minimum of three (3) man days and two (2) trisp for start-up and owner maintenance training and orientation.
 - 3. Instructor: Manufacturer's training personnel.
 - 4. Location: At project site.

3.06 COMMISSIONING AND DEMONSTRATION

- A. Coordinate with the Owner's CxA related to the HVAC Commissioning Requirements specified in Section 018150 - General Commissioning and 230800 - Commissioning of HVAC.
- B. Engage a factory-trained and factory-employed service representative to adjust and operate the AHUs during Commissioning activities (startup, checkout, and troubleshooting during functional performance testing). Factory representative must be knowledgeable of the equipment and systems and capable of assisting with troubleshooting and making unit adjustments as required to support the owner's commissioning process.

3.07 CLEANING

- A. Install temporary construction filters during construction, testing, commissioning period prior to receiving substantial completion from the Owner. Contractor shall replace construction filters prior to substantial completion to maintain system operation (i.e., low pressure loss across filters). Upon receiving substantial completion from the Owner, replace construction filters with specified filters at Substantial Completion.
- B. After completing system installation and testing, adjusting, and balancing air-handling unit and air-distribution systems and after completing startup service, clean air-handling units internally

to remove foreign material and construction dirt and dust. Clean fan wheels, cabinets, dampers, coils, and filter housings, and install new, clean filters.

3.08 AHU FIELD PRESSURE TEST AND INSPECTION

- A. Manufacturer's factory-trained and factory-employed service technician shall perform a field pressure test and inspection of unit and installation prior to startup. Technician shall field pressure test and inspect and verify the following as a minimum:
- B. Field Inspection
 - 1. Damage of any kind
 - 2. Level installation of unit
 - 3. Proper reassembly and sealing of unit segments at shipping splits.
 - 4. Tight seal around perimeter of unit at the roof curb or duct connections
 - 5. Installation of shipped-loose parts, including filters, backdraft dampers, air hoods, bird screens
 - 6. Completion and tightness of electrical, ductwork and piping connection
 - 7. Tight seals around wiring, conduit and piping penetrations through AHU casing.
 - 8. Supply of electricity from the building's permanent source
 - 9. Integrity of condensate trap for positive or negative pressure operation
 - 10. Condensate traps charged with water
 - 11. Removal of shipping bolts and shipping restraints
 - 12. Sealing of pipe at penetration locations
 - 13. Tightness and full motion range of damper linkages (operate manually)
 - 14. Cleanliness of AHU interior and connecting ductwork
 - 15. Proper service and access clearances
 - 16. Proper installation of filters
 - 17. Filter gauges set to zero
- C. Casing leakage testing validating that the AHU casing after assembly and installation meets the requirements of 2.02 - Cabinet.
 - 1. A field casing leakage test performed by the factory technician in accordance with AHU factory standards listed within this specification shall occur and shall be witnessed by the owner or designated representative.
 - 2. The casing leakage test shall be considered successful when the specified leakage rate (1% leakage at 125% of specified fan static) is achieved for a steady-state 2-hour period at the specified pressure rating.
 - 3. The pressure test shall be repeated if remedial measures are necessary to achieve the specified leakage rate for the unit.
 - 4. Resolve any non-compliant items prior to proceeding with the specified Startup Services.
 - 5. Prepare field casing leakage test and inspection reports.
 - 6. Contractor to install temporary blank off plates in the ductwork at the inlets and outlets of the units for this test to be performed.

END OF SECTION