

March 11, 2016

TO ALL CONTRACT BIDDERS:

**RE: ADDENDUM NO. 2
New Castle County Fire School Training Center Addition
MC1002000282**

The work herein shall be considered part of the bid documents for the referenced project and carried out in accordance with the following supplemental instructions issued in accordance with the Contract Documents without change in Contract Sum or Contract Time. Acknowledge receipt of addendum on the bid form as indicated.

This Addendum is generally separated into sections for convenience; however, all General Contractors, Sub Contractors, Material Men and other parties shall be responsible for reading the entire Addendum. The failure to list an item or items in all affected sections of this Addendum does not relieve any party affected from performing as per instructions; provided the information is set forth one time in the Addendum.

These documents shall become attached to and become a part of the construction contract for this project.

CLARIFICATIONS:

1. The work on the building automation system (BAS) must be included in the BASE BID for this project. References to pre-purchase of the BAS or purchasing as an Alternate shall be disregarded. As noted in the first addendum, the existing BAS system is to be extended to the new work as necessary for a complete operational system. The existing web-based building automation system is WebCTRL.

RFI RESPONSES:

1. **QUESTION:** For the VRF integration, can you provide any guidance on the approximate number of BACnet read/write points to be controlled by the BAS?
ANSWER: Points required for monitoring, controlling, and alarm notification are noted in specification section 230993, 3.02-3. These are the minimum required for the proper monitoring of the system, though each manufacturer has a slightly different number of points that can be monitored for alarm, trending, etc. Approximate quantities would be 12 display points per FCU, 12 control points per FCU, 3-5 alarm points, and 4-6 trend points per FCU. For the outdoor heat pump unit, 6-7 control points per system, 2-5 alarm points per system, 6-8 display points per system, and 2-4 trend points per system. This is meant as a guide only and does not preclude the need for additional points as necessary to complete the sequence of operation. Final quantities to be determined during the submittal process.
2. **QUESTION:** Is there any requirement for CO2 monitoring on the project?
ANSWER: No.
3. **QUESTION:** Energy Recovery Unit specifications indicates the use of ECM motors. Is it known what control signal voltage is used?
ANSWER: Not at this time, as it varies from manufacturer to manufacturer. This will be clarified during the submittal process.
4. **QUESTION:** Can the existing generator be utilized during the construction process?
ANSWER: Yes, for the purpose of main panel board replacement.
5. **QUESTION:** Are there times during the week that this building will not be used? (I.E Saturdays etc..)
ANSWER: There may be days and times that can be defined after the project is awarded.

- 6. QUESTION:** At what time does this building normally become unoccupied? After 4 – 5?
ANSWER: The facility is used daily for varying hours.
- 7. QUESTION:** 1/A2.1 refers to section that do not exist (7/6.1 and 2/10.2). Please provide.
ANSWER: Elevation 7/6.1 on 1/A2.1 is deleted from this plan. To see front elevation please see 3/A4.1.
- 8. QUESTION:** Is the type D wall in room 110B part of the base bid or alternate #1?
ANSWER: Wall type 'D' in room 110b is part of the base bid.
- 9. QUESTION:** Floor plan A3.1 shows new flood doors in existing frames at five door opening in the existing building. The door schedule on A6.1 shows door opening 007 through 011 as existing, but states "Flood Proof EZDAM" in the comments section. Please clarify
ANSWER: See attached for revised A6.1 for clarifications on flood barriers and revised door schedule.
- 10. QUESTION:** The drawings and specs call for fireproofing penetration in fire rated walls. However, I don't see any walls noted to be fire rated. Please confirm that there are no rated walls, and firestopping is not required.
ANSWER: Fireproofing OR sprinkler system
- 11. QUESTION:** Drawing S101 shows sections 4 and 5/S501. These sections show the new floor slab being supported by the existing foundation where the exterior wall was removed. The drawings do not show the condition where the new floor slab meets the existing wall to remain. Please clarify this condition.
ANSWER: Turn down slab 18" unless noted otherwise.
- 12. QUESTION:** Please confirm that the owner will provide testing of concrete, steel, soil, masonry, etc.
ANSWER: Contractor to own all testing.
- 13. QUESTION:** Exterior Handrail calls on A6.3 for Painted Steel Rail with Aluminum toe plate...
ANSWER: Exterior handrails, including toe plate shall be steel painted to match existing.
- 14. QUESTION:** Drawing P10.2 states to see the civil plans for a continuation of the new 4" underground rain water conductor. The civil drawings do not show a new underground storm. Please clarify.
ANSWER: The intent of the 4" underground pipe is to drain to daylight past the extent of the new handicap ramp. Provide rip rap at the area of discharge. Approximate length of pipe is 25'.
- 15. QUESTION:** Is the GC to provide any landscaping? Please note that there are small trees by the demo'd rip rap and shrubs by the existing ramp to be removed and replaced under alternate #2. In all likelihood, the trees and shrubs will need to be removed.
ANSWER: The GC is to remove and replace in kind any landscaping associated with the removal and replacement of the ramp as part of Alternate #2. The GC is to remove all landscaping associated with the removal of the rip rap area including, but not limited to small trees, ornamental grasses, and shrubbery
- 16. QUESTION:** Specification sections 055000 Metal Fabrication 2.03b.7 calls for the use of slip non-weld connections. Please confirm if this is correct? Is it acceptable for welded connections to be used.
ANSWER: Please provide welded connections for all handrail joints.
- 17. QUESTION:** The finish schedule on drawing A3.4 shows 110B Breakroom flooring as "carpet tile/VCT", however according to the finish legend the entire room gets VCT. Can you please confirm / clarify the finish desired.
ANSWER: Alternate #1 Entire room to get VCT.
- 18. QUESTION:** Can you clarify the limits of asphalt to be removed
ANSWER: Remove and replace all asphalt paving within the LOD to achieve new contours.
- 19. QUESTION:** Please provide an E & S plan for the work.
ANSWER: E & S plans have been issued in construction documents and in addendum #1.
- 20. QUESTION:** Who is responsible for CCR services and overseeing engineer?
ANSWER: Contractor to report and pay for CCR services.

SUBSTITUTIONS:

1. NONE

REVISIONS TO SPECIFICATIONS MANUAL:

1. Table of Contents 00 01 10 – Revised, See attached.
2. Wage Rates 00 73 46 – Revised, See attached.
3. Elastomeric Membrane Roofing 07 53 00 – Revised, See attached.
4. Signage 10 14 00 – Delete paragraph 2.04
5. Access Control 28 13 00 – Delete paragraph 2.03

REVISIONS TO DRAWINGS:

1. A6.1 – Door schedule has been revised and Lift out flood barrier detail was added.
2. SK-AB.6 - Sketch shows removal and replacement of recessed brick required for flood barrier installation.
3. SK-AB.7 – Sketch shows EPDM isometric detail revision – 5/8" type 'X' gyp bd. deck sheathing and vapor barrier were added to detail.

END OF ADDENDUM #2



STATE OF DELAWARE
DEPARTMENT OF LABOR
DIVISION OF INDUSTRIAL AFFAIRS

225 Corporate Boulevard, Suite 104
Newark, Delaware 19702

TELEPHONE (302) 761-8200
(302) 451-3423
Fax (302) 368-6604

Via Facsimile and Regular Mail

January 29, 2016

Mr. Phillip Conte
Studio JAED
2500 Wrangle Hill Road
Suite 110
Bear, DE 19701

Re: Contract No.:MC1002000282 NCC Fire School - Classroom Addition
New Castle County, DE

Dear Mr. Conte:

I am responding to your request for a category determination for Contract No.: MC1002000282 NCC Fire School - Classroom Addition, which is a state funded construction project located in New Castle County, DE. The work consists of classroom additions. You estimate the total cost of construction for this project to be \$967,045.00.

Based upon the information you provided the Department of Labor has determined that this project is a Building Construction project.

Delaware's Prevailing Wage Regulations provide that the rates applicable to a project are the rates in effect on the date of publication of the specifications for that project. I have enclosed a certified copy of the March 13, 2015, amended July 15, 2015, prevailing wage rates for Building Construction to be included in your bid specification. However, please be advised that, in the event that a contract for a project is not executed within one hundred and twenty (120) days from the earliest date the specifications were published, the rates in effect at the time of the execution of the contract shall be the applicable rates for the project.

If you have any questions or I can provide any additional assistance, please do not hesitate to contact me at (302) 451-3425.

Sincerely,

Signature on File

Salina Crossland
Labor Law Enforcement Officer II
Salina.crossland@state.de.us
Enclosure

STATE OF DELAWARE
DEPARTMENT OF LABOR
DIVISION OF INDUSTRIAL AFFAIRS
OFFICE OF LABOR LAW ENFORCEMENT
PHONE: (302) 451-3423

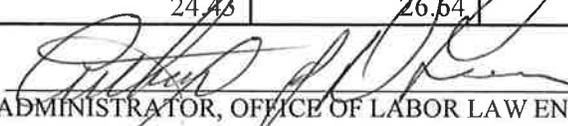
Mailing Address:
225 CORPORATE BOULEVARD
SUITE 104
NEWARK, DE 19702

Located at:
225 CORPORATE BOULEVARD
SUITE 104
NEWARK, DE 19702

PREVAILING WAGES FOR BUILDING CONSTRUCTION
EFFECTIVE MARCH 13, 2015 - AMENDED JULY 15, 2015

CLASSIFICATION	NEW CASTLE	KENT	SUSSEX
ASBESTOS WORKERS	21.87	26.94	39.20
BOILERMAKERS	39.67	33.22	48.83
BRICKLAYERS	49.39	49.39	49.39
CARPENTERS	51.86	51.86	41.22
CEMENT FINISHERS	69.27	29.11	21.20
ELECTRICAL LINE WORKERS	43.49	37.29	28.44
ELECTRICIANS	63.60	63.60	63.60
ELEVATOR CONSTRUCTORS	80.31	40.93	30.55
GLAZIERS	67.35	67.35	20.15
INSULATORS	53.38	53.38	53.38
IRON WORKERS	60.12	60.12	60.12
LABORERS	40.95	40.95	40.95
MILLWRIGHTS	65.23	65.23	51.80
PAINTERS	44.97	44.97	44.97
PILEDRIVERS	71.17	37.64	30.45
PLASTERERS	21.60	28.55	17.50
PLUMBERS/PIPEFITTERS/STEAMFITTERS	62.20	36.66	54.49
POWER EQUIPMENT OPERATORS	59.81	59.81	24.13
ROOFERS – COMPOSITION	21.82	20.45	17.63
ROOFERS – SHINGLE/SLATE/TILE	17.59	13.72	14.10
SHEET METAL WORKERS	64.16	64.16	64.16
SOFT FLOOR LAYERS	48.57	48.57	48.57
SPRINKLER FITTERS	53.52	53.52	53.52
TERRAZZO/MARBLE/TILE FINISHERS	54.11	54.11	45.45
TERRAZZO /MARBLE/TILE SETTERS	62.13	62.13	52.63
TRUCK DRIVERS	24.45	26.54	20.03

CERTIFIED: 1/29/16

BY: 
ADMINISTRATOR, OFFICE OF LABOR LAW ENFORCEMENT

NOTE: THESE RATES ARE PROMULGATED AND ENFORCED PURSUANT TO THE PREVAILING WAGE REGULATIONS ADOPTED BY THE DEPARTMENT OF LABOR ON APRIL 3, 1992.

CLASSIFICATIONS OF WORKERS ARE DETERMINED BY THE DEPARTMENT OF LABOR. FOR ASSISTANCE IN CLASSIFYING WORKERS, OR FOR A COPY OF THE REGULATIONS OR CLASSIFICATIONS, PHONE (302) 451-3423.

NON- REGISTERED APPRENTICES MUST BE PAID THE MECHANICS RATE.

**PROJECT: Contract No.: MC1002000282 NCC Fire School - Classroom Addition
New Castle County, DE**

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00 72 13 – GENERAL CONDITIONS TO THE CONTRACT (SAMPLE AIA A201)	1 page 38 pages
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END OF SECTION

SECTION 07 53 00
ELASTOMERIC MEMBRANE ROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Elastomeric roofing membrane, ballasted protected membrane, mechanically fastened conventional, and adhered conventional application.
- B. Insulation, flat and tapered.
- C. Vapor retarder.
- D. Deck sheathing.
- E. Flashings.
- F. Roofing cant strips, stack boots, roofing expansion joints, and walkway pads.

1.02 RELATED REQUIREMENTS

- A. Section 06 10 00 - Rough Carpentry: Wood nailers and curbs.
- B. Section 07 01 50.19 - Preparation for Re-Roofing.
- C. Section 07 62 00 - Sheet Metal Flashing and Trim: Counterflashings, reglets.

1.03 REFERENCE STANDARDS

- A. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
- B. ASTM C1396/C1396M - Standard Specification for Gypsum Board.
- C. ASTM D4637/D4637M - Standard Specification for EPDM Sheet Used in Single-Ply Roof Membrane.
- D. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials.
- E. ASTM E1980 - Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces.
- F. FM DS 1-28 - Wind Design; Factory Mutual Research Corporation.
- G. NRCA ML104 - The NRCA Roofing and Waterproofing Manual; National Roofing Contractors Association.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all affected installers; review preparation and installation procedures and coordination and scheduling necessary for related work.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data indicating membrane materials, flashing materials, insulation, vapor retarder, surfacing, and fasteners.
- C. Shop Drawings: Indicate joint or termination detail conditions and conditions of interface with other materials.
- D. Manufacturer's Installation Instructions: Indicate membrane seaming precautions and perimeter conditions requiring special attention.
- E. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

- A. Perform work in accordance with NRCA Roofing and Waterproofing Manual and manufacturer's instructions.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products in manufacturer's original containers, dry, undamaged, with seals and labels intact.
- B. Store products in weather protected environment, clear of ground and moisture.
- C. Protect foam insulation from direct exposure to sunlight.

1.08 FIELD CONDITIONS

- A. Do not apply roofing membrane during unsuitable weather.
- B. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.
- C. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.

1.09 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a two year period after Date of Substantial Completion.
- C. Provide 20 year manufacturer's material and labor warranty to cover failure to prevent penetration of water.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. EPDM Membrane Materials:
 - 1. Carlisle Roofing Systems, Inc; Sure-Seal EPDM: www.carlisle-syntec.com.
 - 2. Firestone Building Products, LLC: www.firestonebpc.com.
 - 3. GenFlex Roofing Systems, LLC: www.genflex.com.
 - 4. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Insulation:
 - 1. Blue Ridge Fiberboard: www.blueridgefiberboard.com.
 - 2. Dow Chemical Co: www.dow.com.
 - 3. GAF: www.gaf.com.
 - 4. Owens Corning Corp: www.owenscorning.com.

2.02 ROOFING - UNBALLASTED APPLICATIONS

- A. Elastomeric Membrane Roofing: One ply membrane, mechanically fastened, over vapor retarder and insulation.
- B. Roofing Assembly Requirements:
 - 1. Solar Reflectance Index (SRI): Minimum of 64 based on three-year aged value; if three-year aged data is not available, minimum of 82 initial value.
 - a. Calculate SRI in accordance with ASTM E1980.
 - b. Field applied coating may not be used to achieve specified SRI.
- C. Acceptable Insulation Types - Constant Thickness Application: Any of the types specified.
 - 1. Minimum 2 layers of polyisocyanurate board.
 - 2. Bottom layer of perlite board covered with single layer of polyisocyanurate board.
- D. Acceptable Insulation Types - Tapered Application: Any of the types specified.
 - 1. Tapered polyisocyanurate, perlite, or extruded polystyrene board.

2. Tapered polyisocyanurate, perlite, extruded polystyrene, or cellular glass board covered with uniform thickness composite board.
3. Uniform thickness composite board covered with tapered polyisocyanurate, extruded polystyrene, or perlite board.

2.03 ROOFING MEMBRANE AND ASSOCIATED MATERIALS

- A. Membrane: Ethylene-propylene-diene-terpolymer (EPDM); externally reinforced with fabric; complying with minimum properties of ASTM D4637.
 1. Thickness: 0.060 inch.
 2. Sheet Width: 76 inch, minimum; factory-fabricate into largest sheets possible.
 3. Solar Reflectance: 0.75, minimum, initial, and 0.64, minimum, 3-year, certified by Cool Roof Rating Council.
 4. Thermal Emittance: 0.84, minimum, initial, and 0.87, minimum, 3-year, certified by Cool Roof Rating Council.
 5. Color: White.
- B. Seaming Materials: As recommended by membrane manufacturer.
- C. Colored Finish Coating: Neoprene/hypalon, with aluminum powder concentrate; finish coat of white color.
- D. Membrane Fasteners: As recommended by and approved by membrane manufacturer.
- E. Vapor Retarder: self-adhered complying with requirements of fire rating classification; compatible with roofing and insulation materials.
 1. Fire-retardant adhesive.
 2. Vapor Permeability: .02 perm inch, measured in accordance with ASTM E96/E96M.
 3. Product: V Force Vapor Barrier manufactured by Firestone or equal.
- F. Flexible Flashing Material: Same material as membrane; conforming to the following:
 1. Tensile Strength: 1,200 psi.
 2. Elasticity: 50 percent with full recovery without set.
 3. Color: White.

2.04 DECK SHEATHING AND COVER BOARDS

- A. Deck Sheathing: Gypsum sheathing, ASTM C1396/C1396M, Type X special fire resistant type, paper face, 5/8 inch thick.
- B. Faced Polyisocyanurate Cover Board: High compressive strength board, complying with ASTM C1289, Type II, Class 4, glass fiber mat both faces, and with the following characteristics:
 1. Compressive Strength: 80 psi.
 2. Board Size: 48 by 96 inch.
 3. Board Thickness: 0.5 inch.

2.05 INSULATION

- A. Polyisocyanurate Board Insulation: Rigid cellular foam, complying with ASTM C1289, Type I, aluminum foil both faces; Class 1, non-reinforced foam core and with the following characteristics:
 1. Compressive Strength: 16 psi
 2. Board Size: 48 by 96 inch.
 3. Board Thickness: 1.5 inch. As necessary to attain 5" total thickness.
 4. Board Edges: Square.
 5. Manufacturers:
 - a. Dow Chemical Co: www.dow.com.
 - b. GAF; EnergyGuard Polyiso Insulation: www.gaf.com.
 - c. Hunter Panels, LLC; H-Shield: www.hpanels.com.

2.06 ACCESSORIES

- A. Prefabricated Roofing Expansion Joint Flashing: Sheet butyl over closed-cell foam backing seamed to galvanized steel flanges.
- B. Stack Boots: Prefabricated flexible boot and collar for pipe stacks through membrane; same material as membrane.
- C. Cant and Edge Strips: Wood fiberboard, compatible with roofing materials; cants formed to 45 degree angle.
- D. Sheathing Adhesive: Non-combustible type, for adhering gypsum sheathing to metal deck.
- E. Sheathing Joint Tape: Paper type, ____ inch wide, self adhering.
- F. Insulation Fasteners: Appropriate for purpose intended and approved by roofing manufacturer.
- G. Membrane Adhesive: As recommended by membrane manufacturer.
- H. Surface Conditioner for Adhesives: Compatible with membrane and adhesives.
- I. Thinners and Cleaners: As recommended by adhesive manufacturer, compatible with membrane.
- J. Roofing Nails: Galvanized, hot dipped type, size and configuration as required to suit application.
- K. Strip Reglet Devices: Galvanized steel, maximum possible lengths per location, with attachment flanges.
- L. Sealants: As recommended by membrane manufacturer.
- M. Walkway Pads: Suitable for maintenance traffic, contrasting color or otherwise visually distinctive from roof membrane.
 - 1. Composition: Asphaltic with mineral granule surface.
 - 2. Surface Color: White or yellow.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces and site conditions are ready to receive work.
- B. Verify deck is supported and secure.
- C. Verify deck is clean and smooth, flat, free of depressions, waves, or projections, properly sloped and suitable for installation of roof system.
- D. Verify deck surfaces are dry and free of snow or ice.
- E. Verify that roof openings, curbs, and penetrations through roof are solidly set, and cant strips are in place.

3.02 METAL DECK PREPARATION

- A. Install deck sheathing on metal deck:
 - 1. Lay with long side at right angle to flutes; stagger end joints; provide support at ends.
 - 2. Cut sheathing cleanly and accurately at roof breaks and protrusions to provide smooth surface.
 - 3. Tape joints.

3.03 VAPOR RETARDER AND INSULATION - UNDER MEMBRANE

- A. Apply vapor retarder to deck surface with adhesive in accordance with manufacturer's instructions.
 - 1. Extend vapor retarder under cant strips and blocking to deck edge.
 - 2. Install flexible flashing from vapor retarder to air seal material of wall construction, lap and seal to provide continuity of the air barrier plane.

- B. Ensure vapor retarder is clean and dry, continuous, and ready for application of insulation.
- C. Attachment of Insulation:
 - 1. Mechanically fasten first layer of insulation to deck in accordance with roofing manufacturer's instructions and Factory Mutual requirements.
- D. Lay subsequent layers of insulation with joints staggered minimum 6 inch from joints of preceding layer per manufacturer's recommendations.
- E. Place tapered insulation to the required slope pattern in accordance with manufacturer's instructions.
- F. On metal deck, place boards parallel to flutes with insulation board edges bearing on deck flutes.
- G. Lay boards with edges in moderate contact without forcing. Cut insulation to fit neatly to perimeter blocking and around penetrations through roof.
- H. Do not apply more insulation than can be covered with membrane in same day.

3.04 MEMBRANE APPLICATION

- A. Roll out membrane, free from wrinkles or tears. Place sheet into place without stretching.
- B. Shingle joints on sloped substrate in direction of drainage.
- C. Fully Adhered Application: Apply adhesive to substrate. Fully embed membrane in adhesive except in areas directly over or within 3 inches of expansion joints. Fully adhere one roll before proceeding to adjacent rolls.
- D. Overlap edges and ends and seal seams by contact adhesive, minimum 3 inches. Seal permanently waterproof. Apply uniform bead of sealant to joint edge.
- E. At intersections with vertical surfaces:
 - 1. Extend membrane over cant strips and up a minimum of 4 inches onto vertical surfaces.
 - 2. Fully adhere flexible flashing over membrane and up to nailing strips.
- F. Around roof penetrations, seal flanges and flashings with flexible flashing.
- G. Install roofing expansion joints where indicated. Make joints watertight.
 - 1. Install prefabricated joint components in accordance with manufacturer's instructions.
- H. Coordinate installation of roof drains and sumps and related flashings.

3.05 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for general requirements for field quality control and inspection.
- B. Require site attendance of roofing and insulation material manufacturers daily during installation of the Work.

3.06 CLEANING

- A. Remove bituminous markings from finished surfaces.
- B. In areas where finished surfaces are soiled by work of this section, consult manufacturer of surfaces for cleaning advice and conform to their documented instructions.
- C. Repair or replace defaced or damaged finishes caused by work of this section.

3.07 PROTECTION

- A. Protect installed roofing and flashings from construction operations.
- B. Where traffic must continue over finished roof membrane, protect surfaces using durable materials.

END OF SECTION

State of Delaware Office of Management & Budget / DFM
New Castle County Fire School Training Center Addition
Architects/Engineers: StudioJAED
Issued for Bidding

ELASTOMERIC MEMBRANE ROOFING
07 53 00
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January 19, 2016

SECTION 23 09 93

SEQUENCE OF OPERATIONS FOR HVAC CONTROLS

CONTRACTOR SHALL PROVIDE ALL CONTROLS AND INTERCONNECTING WIRING FOR THE VARIABLE REFRIGERANT FLOW (VRF) SYSTEM AS REQUIRED IN THE SPECIFICATIONS AS WELL AS ALL HEAD-END EQUIPMENT, CONTROLLERS, WIRING, LABOR, AND SOFTWARE REQUIRED TO INTEGRATE THE VRF SYSTEM INTO THE B.A.S. PROVIDE CONTROLS FOR THE ENERGY RECOVERY VENTILATORS (ERV) AND ASSOCIATED ELECTRIC HEATING UNITS TO COMPLETE THE SEQUENCES OF OPERATION AS OUTLINED BELOW.

1.01 PART 1 GENERAL

1.02 THIS SECTION DEFINES THE GENERAL OPERATING PARAMETERS FOR THE BUILDING AUTOMATION SYSTEM. IT FURTHER DEFINES THE EXPECTED OPERATING PARAMETERS OF THE VRF SYSTEM AS DEFINED IN SPECIFICATION SECTION 23 81 29.

1.03 SECTION INCLUDES

- A. This section defines the manner and method by which controls function. Requirements for each type of control system operation are specified. Equipment, devices, and system components required for control systems are specified in other sections.
- B. Sequence of operation for:
 - 1. Kitchen Exhaust Hoods / Kitchen Ventilation Systems
 - 2. Variable Refrigerant Flow (VRF) Heat Pump Systems
 - 3. Radiation and convectors.
 - 4. Energy Recovery Ventilators/Supply Air Units
 - 5. Unit Heaters

1.04 RELATED SECTIONS

- A. Section 01 91 00 - Commissioning
- B. Section 01 91 10 - Functional Testing Procedures
- C. Section 28 31 00 - Fire Detection and Alarm.
- D. Section 23 08 00 - Mechanical Systems Commissioning
- E. Section 23 09 50 - Building Automation System (BAS) General
- F. Section 23 09 51 - BAS Basic Operator Interfaces
- G. Section 23 09 53 - BAS Field Panels
- H. Section 23 09 54 - BAS Communication Devices
- I. Section 23 09 55 - BAS Software and Programming
- J. Section 23 09 59 - BAS System Commissioning
- K. Section 26 27 17 - Equipment Wiring: Electrical characteristics and wiring connections.

1.05 SYSTEM DESCRIPTION

- A. This Section defines the manner and method by which controls function. Requirements for each type of control system operation are specified. Equipment, devices, and system components required for control systems are specified in other Sections.

1.06 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Sequence of Operation Documentation: Submit written sequence of operation for entire HVAC system and each piece of equipment.
 - 1. Preface: 1 or 2 paragraph overview narrative of the system describing its purpose, components and function.

2. State each sequence in small segments and give each segment a unique number for referencing in Functional Test procedures; provide a complete description regardless of the completeness and clarity of the sequences specified in the contract documents.
 3. Include at least the following sequences:
 - a. Start-up.
 - b. Warm-up mode.
 - c. Normal operating mode.
 - d. Unoccupied mode.
 - e. Shutdown.
 - f. Capacity control sequences and equipment staging.
 - g. Temperature and pressure control, such as setbacks, setups, resets, etc.
 - h. Detailed sequences for all control strategies, such as economizer control, optimum start/stop, staging, optimization, demand limiting, etc.
 - i. Effects of power or equipment failure with all standby component functions.
 - j. Sequences for all alarms and emergency shut downs.
 - k. Seasonal operational differences and recommendations.
 - l. Interactions and interlocks with other systems.
 4. Include initial and recommended values for all adjustable settings, setpoints and parameters that are typically set or adjusted by operating staff; and any other control settings or fixed values, delays, etc. that will be useful during testing and operating the equipment.
 5. For packaged controlled equipment, include manufacturer's furnished sequence of operation amplified as required to describe the relationship between the packaged controls and the control system, indicating which points are adjustable control points and which points are only monitored.
 6. Include schedules, if known.
- C. Control System Diagrams: Submit graphic schematic of the control system showing each control component and each component controlled, monitored, or enabled.
1. Label with settings, adjustable range of control and limits.
 2. Include flow diagrams for each control system, graphically depicting control logic.
 3. Include the system and component layout of all equipment that the control system monitors, enables or controls, even if the equipment is primarily controlled by packaged or integral controls.
 4. Include draft copies of graphic displays indicating mechanical system components, control system components, and controlled function status and value.
 5. Include all monitoring, control and virtual points specified in elsewhere.
 6. Include a key to all abbreviations.
- D. Points List: Submit list of all control points indicating at least the following for each point.
1. Name of controlled system.
 2. Point abbreviation.
 3. Point description; such as dry bulb temperature, airflow, etc.
 4. Display unit.
 5. Control point or setpoint (Yes / No); i.e. a point that controls equipment and can have its setpoint changed.
 6. Monitoring point (Yes / No); i.e. a point that does not control or contribute to the control of equipment but is used for operation, maintenance, or performance verification.
 7. Intermediate point (Yes / No); i.e. a point whose value is used to make a calculation which then controls equipment, such as space temperatures that are averaged to a virtual point to control reset.
 8. Calculated point (Yes / No); i.e. a "virtual" point generated from calculations of other point values.

- E. Project Record Documents: Record actual locations of components and setpoints of controls, including changes to sequences made after submission of shop drawings.

1.07 QUALITY ASSURANCE

- A. Design system under direct supervision of a Professional Engineer experienced in design of this Work and licensed in the State in which the Project is located.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL SYSTEM DESIGN AND OPERATION STANDARDS

- A. The BAS shall control the mechanical systems within the site based upon a variable refrigerant flow (VRF) heat pump system with central energy recovery ventilators supplying outdoor air to the terminal units. Large asseby spaces are served by packed DX cooling / gas fired heating rooftop units with energy recovery and hot-gas reheat-basd dehumidification controls.
- B. Each unit shall be controlled by an individual DDC Controller and all required sensors, control valves, and appurtenances required to complete the sequence of operation. Units shall include occupied/unoccupied control, night-setback, morning warm-up/cool-down, and enthalpy-based economizer functions.

3.02 VARIABLE REFRIGERANT VOLUME HEAT PUMP SYSTEMS

- A. The variable refrigerant split system shall have a BAS DDC interface wired to the manufacturer factory central system controller to provide operation, configuration, and monitoring of the system. The manufacturer factory central controller shall operate in BACnet protocol, and be connected to manufacturer factory space temperature sensors as specified.
- B. Sequence of operation:
 - 1. Cooling Mode: Cooling mode shall be selected based on outdoor air temperatures or manually enabled or scheduled from the workstation. During the programmed occupied mode, the supply fan shall run continuously. On a rise in space temperature above the setpoint (75 degrees, adjustable), the manufacturer central controller shall energize the central compressor to provide cooling. The internal capacity control valve in the evaporator unit shall modulate to control the flow of refrigerant to maintain space temperature. On a fall in space temperature the refrigerant capacity control valve shall modulate closed.
 - 2. Heating Mode: Heating mode shall be selected based on outdoor air temperatures or manually enabled or scheduled from the workstation. During the programmed occupied mode, the supply fan shall run continuously. On a drop in space temperature below the setpoint (68 degrees, adjustable), the manufacturer central controller shall energize the central compressor to with the requisite reversing valve to provide heating to the evaporator unit as required. The internal capacity control valve in the evaporator unit shall modulate to control the flow of refrigerant to maintain space temperature. On a fall in space temperature the refrigerant capacity control valve shall modulate closed.
 - 3. The following items shall be accessible and displayed at the Operator's Terminal:
 - a. Space temperature setpoint at each fan-coil unit (user adjustable).
 - b. Actual space temperature of each fan-coil unit space.
 - c. Operational status of each fan-coil unit (heating, cooling, off, user adjustable).
 - d. Factory error codes from each unit.
 - e. Remote space temperature sensor override for each fan-coil unit (user adjustable to limit temperature adjustment range, heat/cool selection, fan speed).
 - f. Compressor Status

- C. Each terminal unit (fan coil) shall be controlled by the factory-provided wall-mounted controller. The controller shall be capable of allowing space temperature adjustment of +1 / -1 degrees (user adjustable).

3.03 SUPPLY AIR UNITS AND ENERGY RECOVERY VENTILATORS (ERV)

- A. Supply air units and ERV's shall be scheduled for occupied and unoccupied cycles based on an operator adjustable time schedule. Units may also be manually enabled and disabled at the operator workstation. Fan status shall be monitored by the BAS via the fans current sensing relay.
- B. When any heat pump in the area served by the heat recovery unit is in the occupied mode the unit shall be energized.
 - 1. The unit exhaust and outside air isolation dampers shall open.
 - 2. Provide proof of airflow for each fan and provide fan failure alarms.
 - 3. Provide temperature indication of the supply and exhaust inlet and leaving air.
 - 4. For units over 2,000 cfm a duct smoke detector shall be provided by the electrical contractor. Provide the interlock wiring to shut down the units upon activation.
 - 5. The electric heating coil shall be energized when required to maintain a minimum discharge air (supply air) temperature of 60 degrees to the units.
- C. The following items shall be displayed at the operators workstation:
 - 1. Discharge temperature.
 - 2. Return air temperature.
 - 3. Outside air temperature, humidity and enthalpy.
 - 4. Fan operational status via current sensor.
 - 5. Commanded status of fan.
 - 6. Commanded status of heating coils (as applicable).
 - 7. Commanded status of gas-train (as applicable).
 - 8. Commanded position of dampers.
 - 9. Diagram showing the layout of the unit with major components and dynamic temperatures shown where temperature sensors exist in the system.

END OF SECTION