



# THE SCHOOL DISTRICT OF PHILADELPHIA

**BOARD OF EDUCATION**  
**Office of Capital Programs**  
**440 North Broad Street, 3<sup>rd</sup> Floor – Suite 371**  
**Philadelphia, PA 19130**

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## Addendum No. 5

**Subject: SDP Contracts No. B-11 C, B-112 C, B-113 C and B-114 C of 2017/18  
Major Renovation and Addition**

**Location: Richmond Elementary School**

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**This Addendum, dated December 6, 2019, shall modify and become part of the Contract Documents. Any items not mentioned herein, or affected by, shall remain strictly in accordance with the original document.**

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**1. General Construction Contractor MUST use the REVISED Bid Proposal Form attached to this Addendum**

## 2. QUESTIONS AND ANSWERS

### A. PREVIOUS QUESTIONS FROM ADDENDUM NO 2

**Question 28:** What is the existing building keying system, is it a Pyramid PS as specified?

**Answer:** Provide Best cylinders for exterior doors. All interior door cylinders are to be Schlage Classic C-5 MKD.

**Question 32A:** Drawing S-101, "Site Soils Note" indicates that test pits must be excavated to identify the limits and extents of soil removal and replacement. The "Ground Improvement – Soil Removal & Replacement" section of this note indicates that miscellaneous fill and deleterious materials within the proposed building footprint (and outside of the footprint) must be removed, exact dimensions of such removals will be determined at the time of construction. It also indicates that over-excavation is anticipated to be at a 4' to 10' depth (or more).

a. Please clarify that test pit excavation and backfill is to be included in the base bid.

b. Since the soil exchange depth could vary greatly, please clarify the dimensions and depth of over-excavation and replacement that should be included in the base bid. Ideally, a quantity allowance should be established for soil removal and replacement to be included within the base bid and a unit price should be provided by bidders for soil exchange that exceeds the established quantity allowance.

**Answer:**

a) Yes.

b) 1. Contractor is responsible for and shall include in Lump Sum Base Bid Amount all costs of excavation, excavation support, loading, transporting and offsite disposal of all on-site site soil material

#### Addendum No. 4 (cont'd)

to reach design lines, grades and elevations, including material rendered excess by construction of the New Addition.

**NOTE: to the lack of space, onsite stockpiling of excavated soil material will not be allowed, except for temporary staging of material to be taken offsite, or approved for immediate re-use.**

2. Over-excavation beyond those lines, grades and elevations for removal and disposal of materials determined by onsite testing to be unsuitable for use as backfill shall be paid on a unit price basis per Unit Price No 1 on the Revised GC Bid Proposal Form, attached to this Addendum

3. Import of soil material determined by testing to be suitable for use as backfill to replace unsuitable soil shall be paid on a unit price basis per Unit Price No 2 on the Revised GC Bid Proposal Form, attached to this addendum.

**NOTE: Testing of on-site soils indicates they are below the levels requiring treatment as Regulated Fill per PENNDOT Clean Fill Regulations. See Soils Investigation Report attached to Addendum 02 for further information.**

**However, soils analysis or testing required by landfills selected for disposal of onsite materials is the responsibility of the contractor, as well as testing of imported soil for suitability for backfill and compliance with the Clean Fill Regulations**

**Question 32B:** The Structural Drawings have a site note stating that over excavation will be required in a range from 4' to 10'. It also states that "The exact dimension of excavations to be determined by a representative of the soil engineer at the time of the building pad is excavated." What is the quantity that our bids are to be based on? Please advise.

**Answer:** See answer to Question 32A.

**Question 32C:** Excavated soils/excess soils shall be tested per PA DEP Clean fill. Who is paying for testing and if containment, who is responsible with cost of recycling/dump fees?

**Answer:** See answer to Question 32A

#### **B. NEW QUESTIONS**

**Question 1:** Door schedule and drawings A-009, A-033 and A-101 indicates existing door frames to remain, which conflicts with demo drawings that indicate door frames to be removed. Please clarify.

**Answer:** See Addendum No. 2: Question 35 and Answer.

**Question 2:** Door schedule references new door frames to be installed in existing openings and new openings within existing walls. These frames will be drilled and dimpled for bolts used to anchor frames, as no jamb detail is provided. Please confirm this is acceptable.

**Answer:** Provide 8 3/4" deep hollow metal frames. Anchor method is acceptable.

**Question 3:** Provide specifications for wood plank ceilings shown on the RCP.

**Answer:** See attached Specification Section 09 5100 Acoustical Ceilings.

#### Addendum No. 4 (cont'd)

**Question 4:** Provide specifications for aluminum soffit at the canopy.

**Answer:** As shown in SKA-4 and SKA-6 from Addendum No. 2, Insulated Metal Panel will be used in lieu of Aluminum Soffit at the main entrance canopy and the underside of the bridge/pedestrian walkway. The Insulated Metal Panel specification is provided in the Bid Documents.

**Question 5:** Please provide a basis of design or specification for proposed 42" roof guardrails.

**Answer:** The rooftop guardrail basis of design can be found in Specification Section 07 7200-2.02A.8a (Bluewater Manufacturing Safety Rail 2000 Guardrail).

**Question 6:** Please provide details for gates at proposed dumpster enclosure.

**Answer:** See attached SKA-11.

**Question 7:** Please provide specification for cast stone at proposed dumpster enclosure.

**Answer:** Provide metal coping in lieu of cast stone at the dumpster enclosure walls. Metal coping specification is provided in the Bid Documents.

**Question 8:** Drawings indicate that roof blocking is to be fire treated. Is this correct or should roof blocking be pressure treated?

**Answer:** As indicated on the drawings, all roof blocking is to be fire treated.

**Question 9:** Drawing A-501, please provide cuts detailing guardrails, handrails, connections to the slab, etc.

**Answer:** See guardrail and handrail details on Drawing A-500. Per Specification Section 05 5100 Metal Stairs, connection attachments (including connections to the slab), reinforcing, anchorage, size and type of fasteners, and accessories are to be submitted as a shop drawing with a design engineer's seal and signature on each sheet of the shop drawings.

**Question 10:** When looking at the camera schedule on drawing T-303 the camera schedule shows model numbers and then the MP per camera. It appears to be a cut and paste error where the camera part number does not match the mp. For example camera 210 and 211 are both listed as IMP321-1RS cameras which are 3mp cameras. However, camera 210 is listed as 5mp and 211 is 3mp. Please confirm if the camera part number or the mp count should be used for determining camera.

Also, at this time we would like to ask for Avigilon to be listed as approved equal. I have attached a data sheet for the software package. Once the cameras are determined I can send data sheets for them as well.

**Answer:** If the model number of the camera does not agree with the MP value listed, the MP value shall override the catalog number. Request is premature. Substitution requests are not addressed during bidding period, but after award at the time of contractor submittals See GC-4.23 SUBSTITUTION (OR EQUAL) for procedures and requirements.

**Question 11:** The Air Handling Unit schedule on drawing M-600 lists York as the Basis of Design for the ERU and the RTU's. The York model numbers listed are those of standard commercial units.

Spec section 23 7313 and spec section 23 7323 list manufacturers of custom air handling units that are much different and **much more expensive** than the basis of design York units. As a result, we

#### Addendum No. 4 (cont'd)

were notified that many of the “other than York” manufacturers listed will not be submitting a bid in that they would not be competitive.

Can either the specification for the ERU and RTU's be relaxed and/or the schedule be revised so that multiple manufactures could submit a quote on comparably equipped/built units?

**Answer:** Specification Sections 23 7213 and 23 7323 have been revised to match the basis of design. See attached Specification Sections. Substitutions after bid award will be considered in accordance with General Conditions GC- 4.23 SUBSTITUTIONS (OR EQUAL)

**Question 12:** Please advise: Which grease interceptor we can use (as per detail on drawing P-700 or as per specs 221319 2.6B)? There is no solid interceptor shown on drawing, is there any? Solenoid valve shown on drawing P-400 for gas piping – furnish & install by Plumbing contractor? Or by other?

**Answer:** Provide the grease interceptor as shown on P-700 with all work required to recess it in the floor. Provide solids interceptor similar to a Scrap Trapper ST4-G. Terminate the sink drains over the interceptor with a 2” air gap. Locate the flow control device on the sink drain line.

The solenoid valve should be furnished with the hood suppression system and turned over the plumbing contractor for installation.

**Question 13:** Please advise: Kitchen Equipment schedule given on drawing P-600 – all remarks pressure reducing valves, backflow preventors, faucet provides air gap furnish & install by plumbing contractor? Or by other?

**Answer:** The plumbing contractor is expected to make final connections to kitchen equipment including any required shut-off valves, pressure reducing valves, backflow preventers, etc. Air gaps at the faucets are inherent in the design of the faucet. Information provided for Code Official.

**Question 14:** Please confirm that HVAC Prime is to furnish and install all roof curbs and supports for equipment.

**Answer:** Roof curbs are furnished by MC and installed by GC.

**Question 15:** Drawing A-140 (Existing Roof Plan), please confirm HVAC Prime is responsible for items #3 & #19. Please confirm Electrical Prime is responsible for items #6 & #19.

**Answer:** The MC and EC shall be responsible to remove and reinstall existing rooftop equipment including all disconnections and reconnections as shown on Drawing A-140 and referenced details. Additionally the MC and EC shall furnish curbs which are installed by the GC as required to attain height required associated with the roof replacement system.

**Question 16:** Does the Gas piping need to be painted? If so, by whom?

**Answer:** Drawing P000, Keyed Note 14 and Specification Section 226100, paragraph 3.11 require painting of gas piping.

**Question 17:** Does the Sprinkler Pipe need to need to be painted? If so, by whom?

**Answer:** Refer to specification 21 05 00, section 1.18. All exposed piping in finished areas of the building shall be painted to match the ceilings in those areas. All piping in the sprinkler riser room shall be painted red. The fire protection contractor shall be responsible for prepping the pipe to the satisfaction of the painting contractor. The painting contractor shall be responsible for painting the pipe.

**Addendum No. 4 (cont'd)**

**Question 18:** Which contractor does the "F. Clarifications.." paragraph on p.13 of Add #2 apply to?

**Answer:** The PC and Fire Protection sub-contractor shall be responsible for all piping work to 5'-0" outside the building. The GC shall provide all related piping, including the spool piece for the domestic water line, from 5'-0" outside the building to the street main connection. The GC shall also provide the meter pits. The Philadelphia Water Department will provide the water meter. Design of Water Meter Pits and new fire service line to follow in Addendum #6.

**Question 19:** Regarding Q32A [in Addendum No. 2], how can the contractor bid on this without knowing now which backfill material is appropriate?

**Answer:** See Answers to Q 32 A, B and C from Addendum No 2 above

**Question 20:** Regarding Q45A [in Addendum No. 2], there are valves shown below grade. Should these be above grade?

**Answer:** The valves on P-500 are incorrectly shown below slab. These valves are to be located above slab and are associated with a connection to the Food Service Equipment items.

**Question 21:** Regarding Q50A [in Addendum No. 2], what are the specs on the proposed water meter?

**Answer:** The water meter shall be provided by the Water Department.

**Question 22:** Regarding Q62A [in Addendum No. 2], assume the "aerial" comment applies only to the electrical service and the not gas service. Please confirm that the (GC's) site contractor replaces all surfaces on the C-Drawings.

**Answer:** The PC patches/repairs at the gas line as shown on Drawing P-001 and the EC patches/repairs the electric duct bank as shown on Drawing E-001.

**Question 23:** Regarding Q76A [in Addendum No.2], all contractors "must" provide a site trailer, or "may" provide a site trailer?

**Answer:** Due to site constraints, each prime contractor is allowed one (1) storage trailer on-site, but no office trailers are allowed on-site.

**Question 24:** Please confirm that the Plumber's scope is only to 5' outside of the building.

**Answer:** Plumbing scope is to 5' outside the building except for work associated with the gas line and the installation of water meter pit.

**Question 25:** Please confirm that the GC patches/repairs surfaces at gas line excavation along with all other surfaces as shown on the C-Drawings.

**Answer:** The PC patches/repairs at the gas line as shown on Drawing P-001 and the EC patches/repairs the electric duct bank as shown on Drawing E-001.

**Question 26:** Please confirm that the GC does the sanitary and water service work from 5' outside the building and beyond as shown on the C-Drawings.

**Answer:** Yes, confirmed.

## Addendum No. 4 (cont'd)

### **3. CHANGES TO SPECIFICATIONS:**

1. Section 102800: Toilet Bath and laundry Accessories: Paragraph 2.03A: Delete subparagraph 4.
2. Substitute the attached Specification Section 09 5100: Acoustical Ceilings which references Wood Veneer Acoustic panels added in subparagraph 2.02.F.

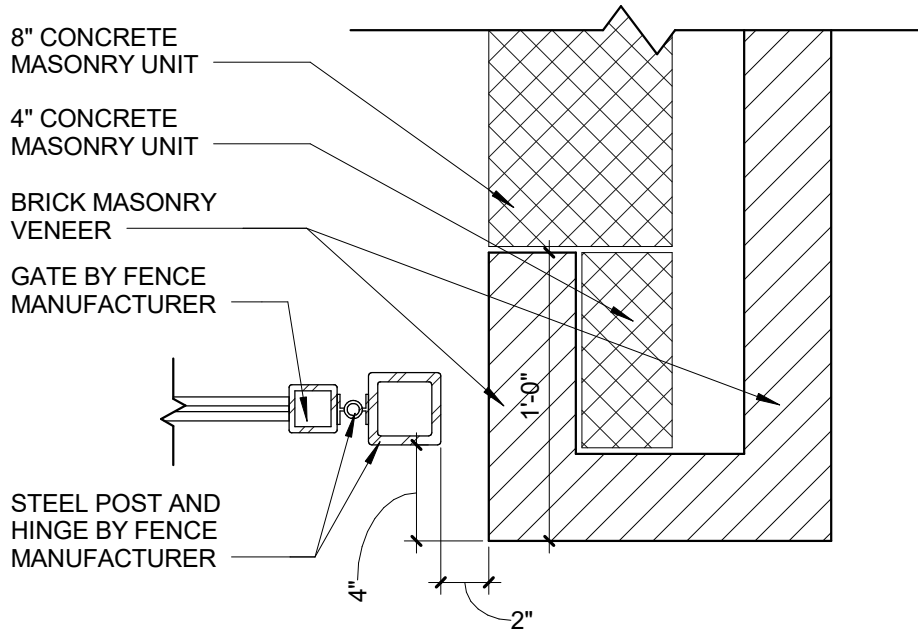
### **4. CLARIFICATIONS:**

1. Drawing P-100, revise the gas service lateral size from 4" to 6".
2. Provide an 8" fire protection water service line from the water main on E. Birch Street to the meter pit. Design of Water Meter Pits and new fire service line to follow in Addendum #6.
3. Fire Alarm Contractor is a subcontractor to the Electrical Prime, unless the Electrical prime is licensed and qualified for Fire Alarm work and elects to self-perform
4. Drawing A-703- Provide CT-1 and CWT-1 in Staff Toilet Room adjacent to Teacher's Room 311.
5. Drawing A-703 – Boys Toilet T-3-1: Delete CWT on wall. Provide paint above existing travertine wainscot.
6. Drawing A-702 – Boys Toilet T-2-1 and Girls Toilet T-2-2: Delete CWT on wall. Provide paint above existing travertine wainscot.
7. Drawing A-701 – Girls Toilet T-1-1, Toilet 105C and Toilet 109A: Delete CWT on wall. Provide paint above existing travertine wainscot.
8. Drawing A-701 –Toilet 128: Delete CWT on wall. Provide paint on walls.
9. Drawing A-702 –Toilet 207B: Delete CWT on wall. Provide paint on walls.

### **ATTACHMENTS:**

1. SKA-11 Dumpster Enclosure Jamb Detail
2. SK-S-02 Revision 1/S-102
3. SK-S-03 Revision 6&7/S-303
4. SK-S-04 Revision 2/S-404
5. SK-S-05 Revision 1/S-101, S-303
6. SK-S-06 Revision 1/S-102, S-303
7. SK-S-07 Revision to Col. Sched.
8. Specification Section 09 5100: Acoustical Ceilings
9. Specification Section 23 7213: Heat Wheel Air-to-Air Energy Recovery Unit
10. Specification Section 23 7323: Central Station Air Handling Units
11. Revised GC-Bid proposal Form

**End of Addendum 5**



NOTE: SEE SKA-7 FOR OVERALL  
DUMPSTER ENCLOSURE PLAN

**1 DUMPSTER ENCLOSURE - GATE JAMB DETAIL**  
SCALE: 1 1/2" = 1'-0"

2

ADDENDUM NO. 4



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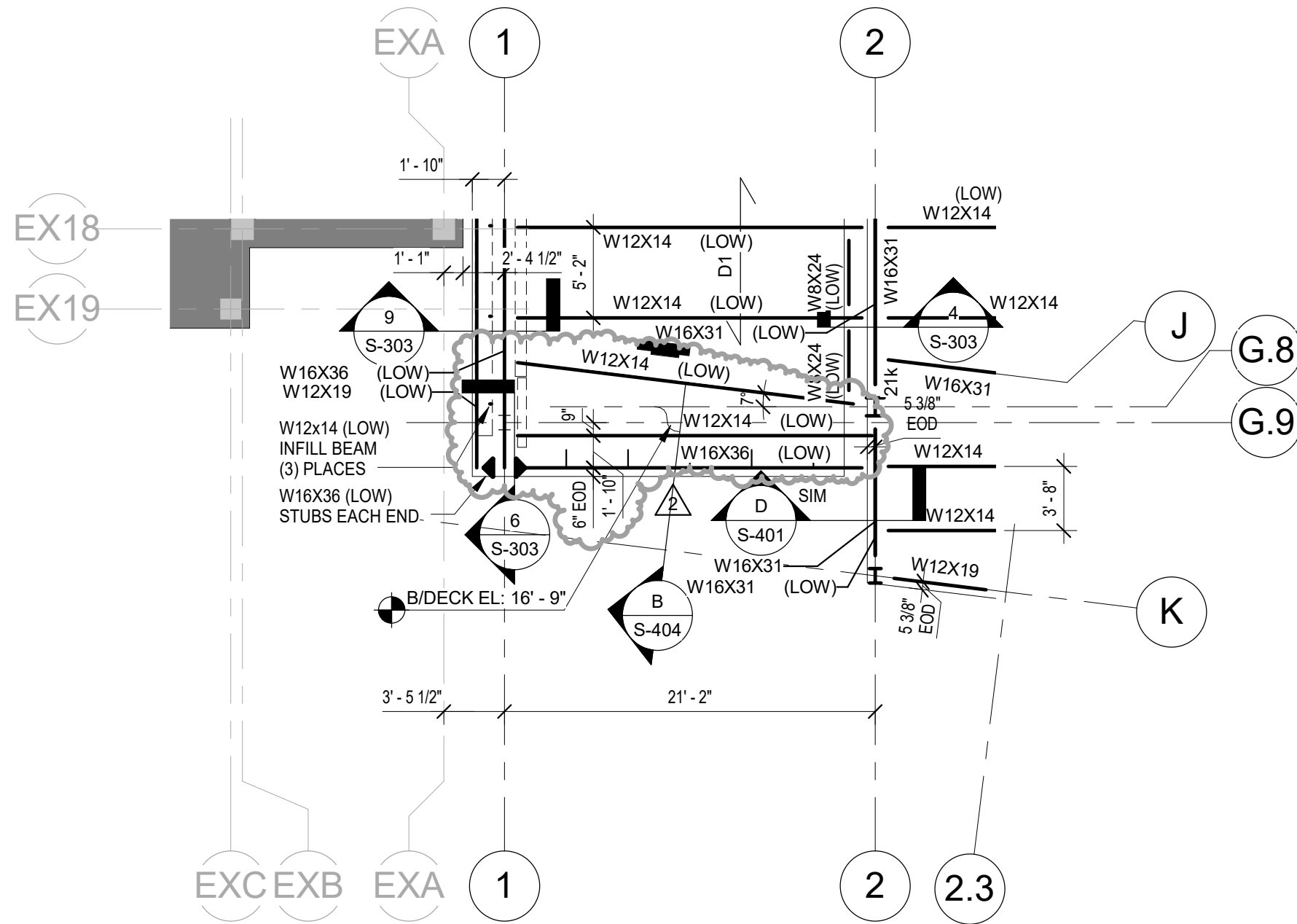
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AT  
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DUMPSTER ENCLOSURE - JAMB DETAIL	
Drawing No.: SKA-11	
Reference RFI:	Reference Drawing: SKA-7
USA Project No.: 2018-081	
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1 PARTIAL SECOND FLOOR FRAMING PLAN (REF. S-102)  
SCALE: 1/8" = 1'-0"



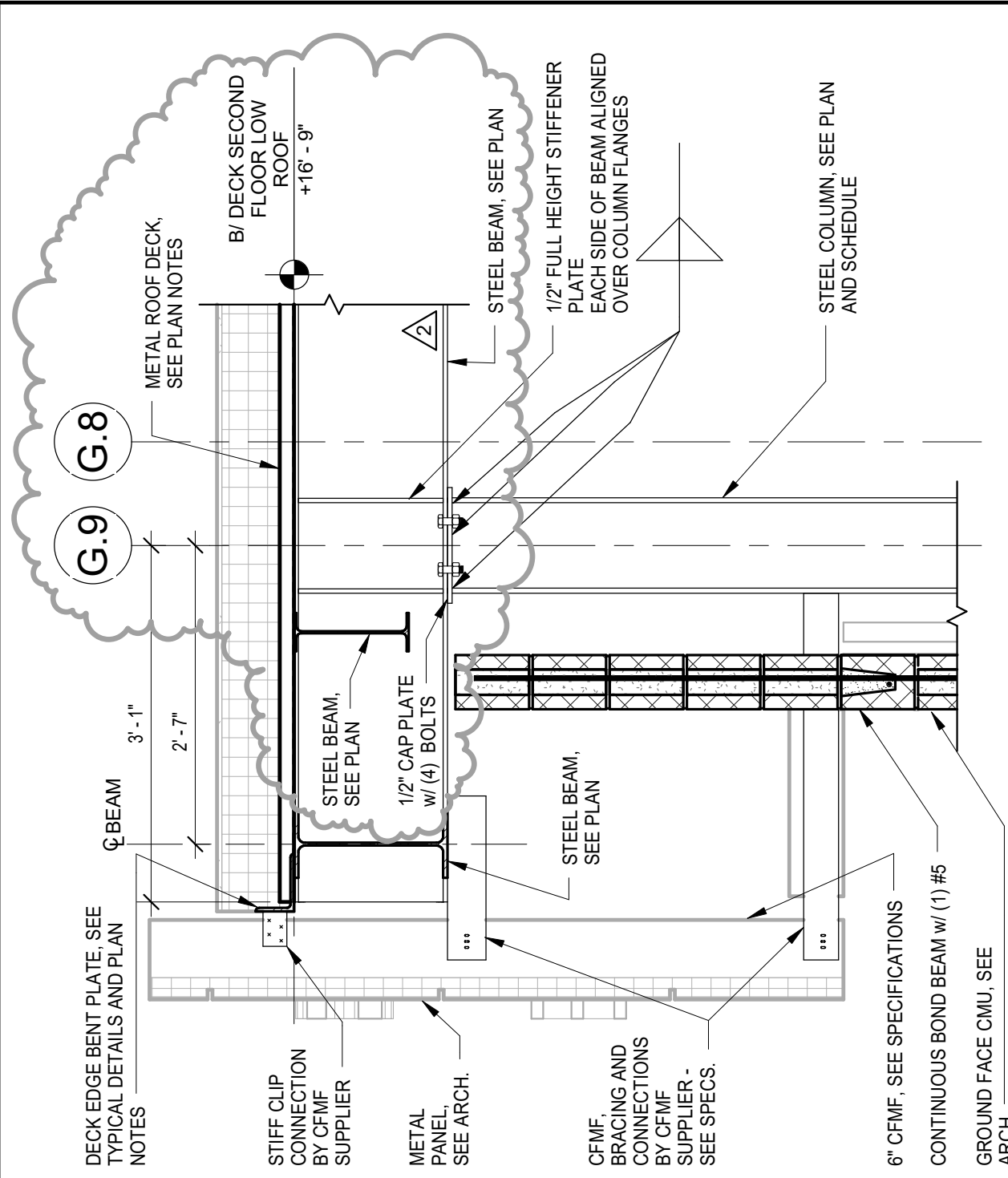
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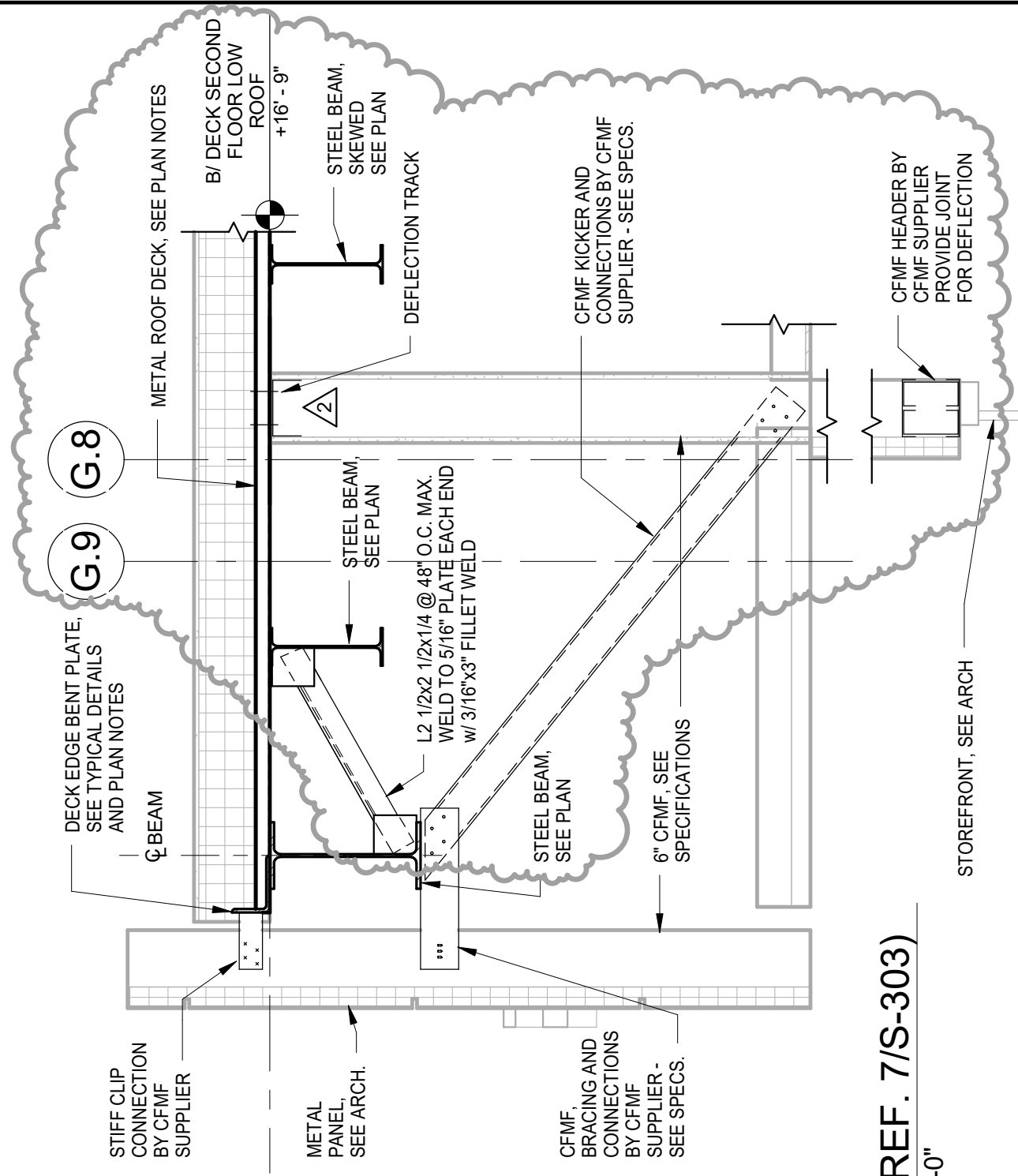
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**1 SECTION (REF. 6/S-303)**  
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**2 SECTION (REF. 7/S-303)**  
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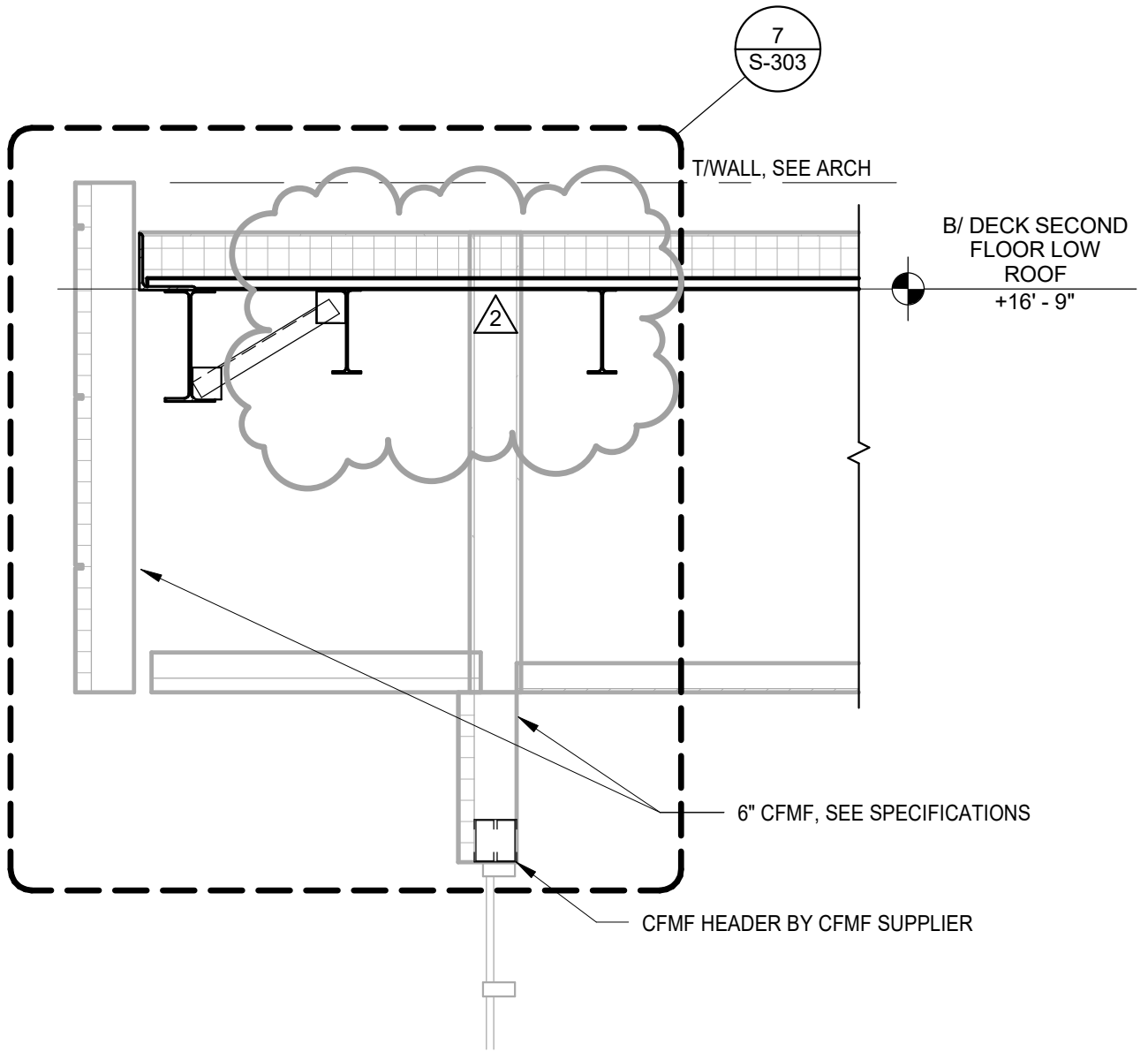
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Drawing Title: Revision 6&7/S-303	
Drawing No.: SK-S-03	
Reference RFI: --	Reference Drawing: S-303
USA Project No.: 2018-081	
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**1** WALL SECTION (REF. 2/S-404)  
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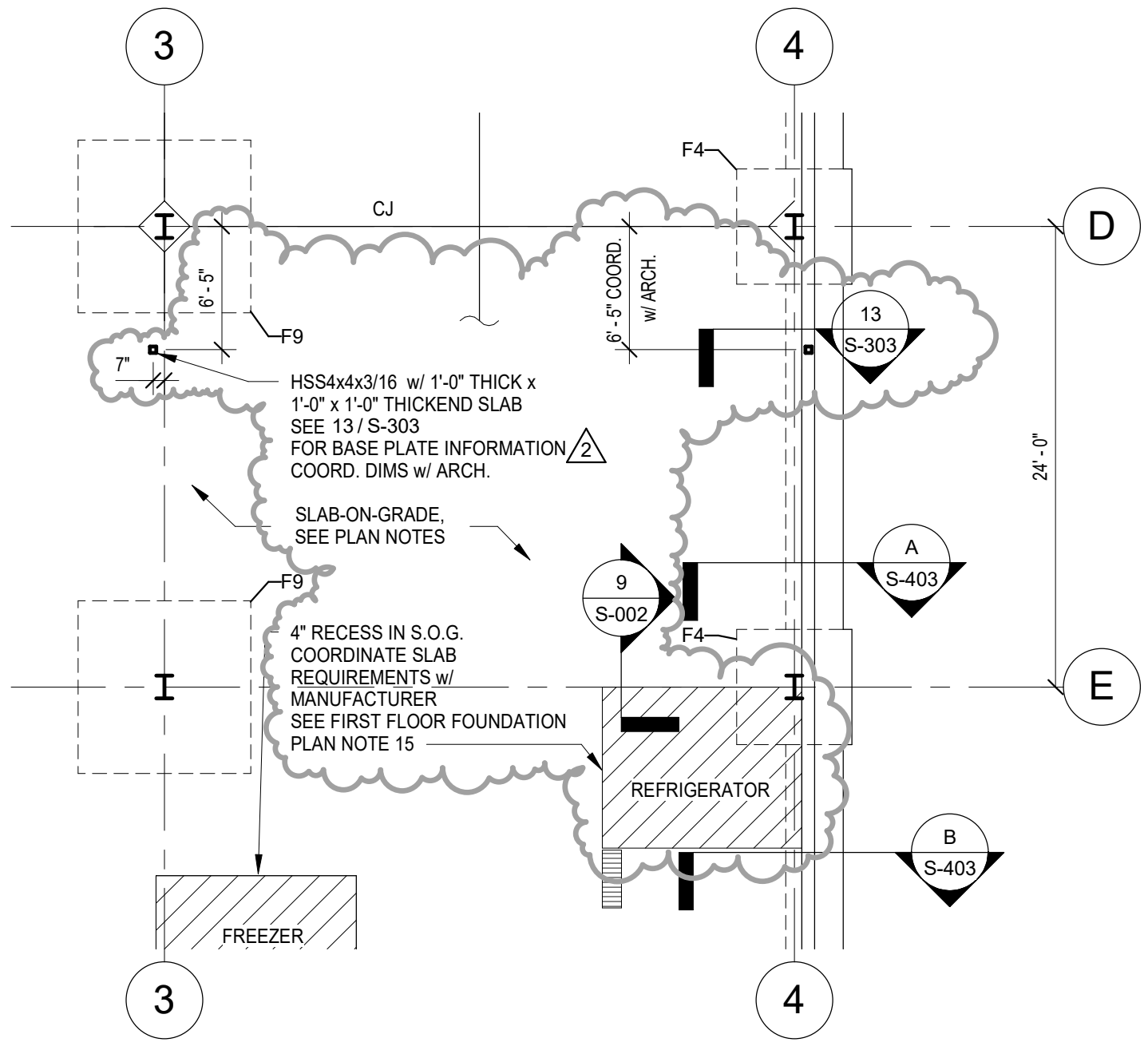
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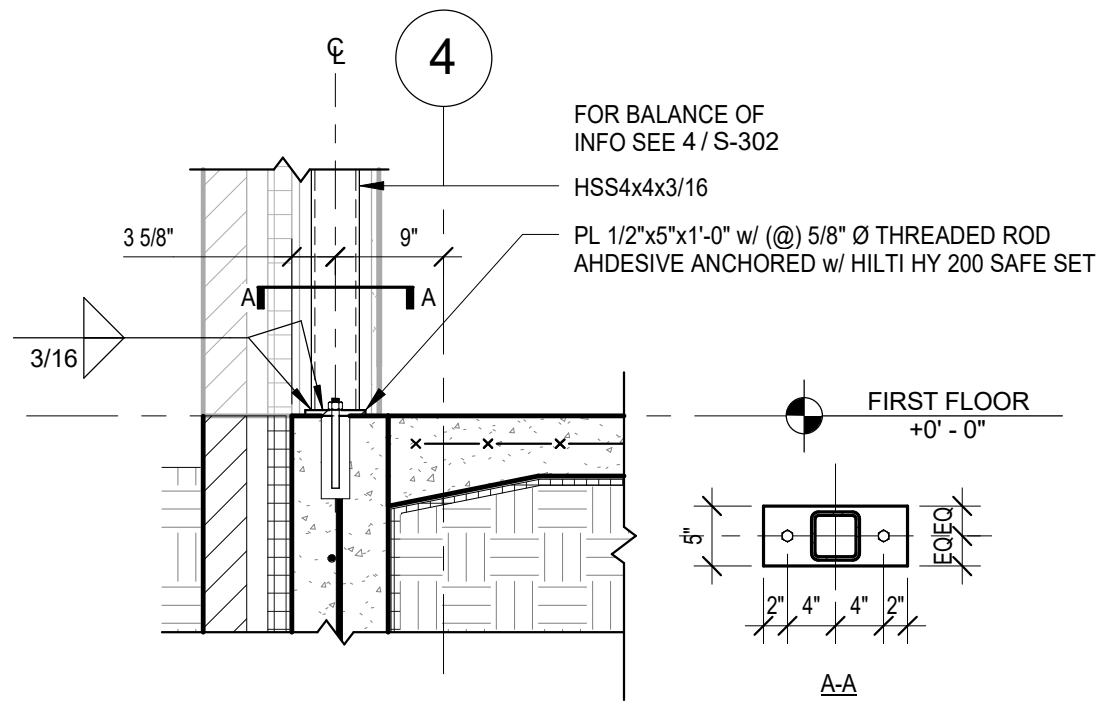
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**1** FIRST FLOOR FOUNDATION AND FRAMING PLAN (REF. S-101)  
SCALE: 1/8" = 1'-0"



**2** SECTION (REF. 13/S-303 NEW SECTION)  
SCALE: 3/4" = 1'-0"



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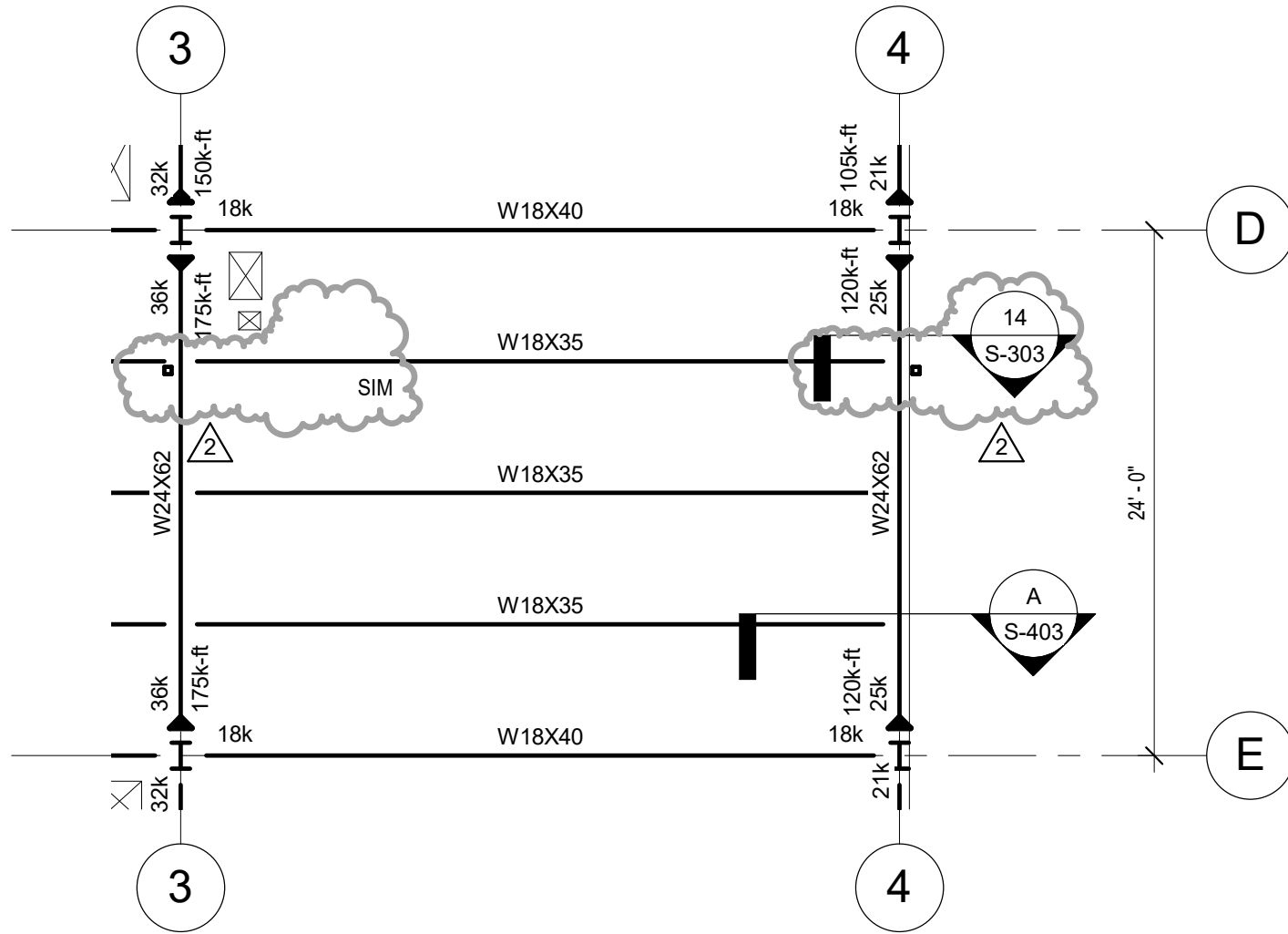
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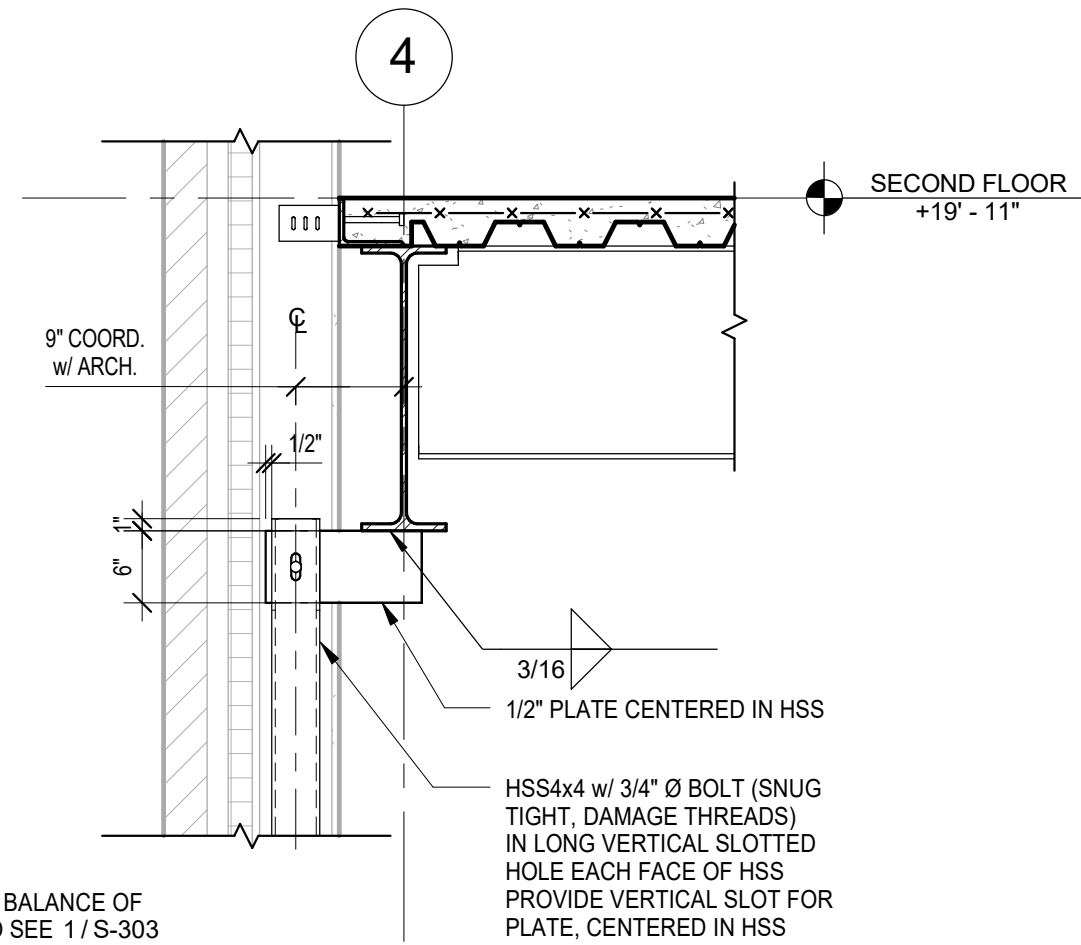
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1 SECOND FLOOR FRAMING PLAN (REF. S-102)  
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2 SECTION (REF. 14/S-303 NEW SECTION)  
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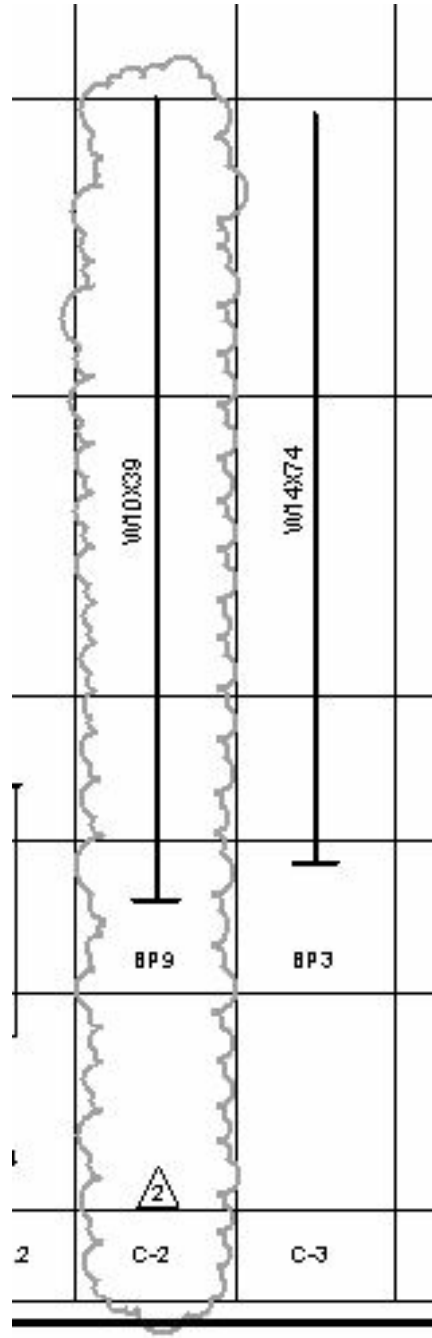


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Drawing Title: Revision 1/S-102, S-303	
Drawing No.: SK-S-06	
Reference RFI: --	Reference Drawing: S-102
USA Project No.: 2018-081	
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Date: 11.27.19	Page: 2 of 2



① COLUMN SCHEDULE (REF. S-301)



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Drawing Title: Revision to Col. Sched.	
Drawing No.: SK-S-07	
Reference RFI: -	Reference Drawing: S-301
USA Project No.: 2018-081	
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## SECTION 09 5100 - ACOUSTICAL CEILINGS

### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. Suspended metal grid ceiling system.
- B. Acoustical units.

#### 1.02 REFERENCE STANDARDS

- A. ASTM C635/C635M - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2017.
- B. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2013.
- C. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2017.
- D. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2014.

#### 1.03 ADMINISTRATIVE REQUIREMENTS

- A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.
- B. Do not install acoustical units until after interior wet work is dry.

#### 1.04 SUBMITTALS

- A. Product Data: Provide data on suspension system components.
- B. Samples: Submit two samples 4 by 4 inch in size illustrating material and finish of acoustical units.
- C. Samples: Submit two samples each, 12 inches long, of suspension system main runner, cross runner, and perimeter molding.
- D. Manufacturer's Installation Instructions: Indicate special procedures.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. Extra Acoustical Units: Quantity equal to 5 percent of total installed.

#### 1.05 FIELD CONDITIONS

- A. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

- A. Acoustic Tiles/Panels:
  - 1. Armstrong World Industries, Inc: [www.armstrong.com](http://www.armstrong.com).
  - 2. CertainTeed Corporation: [www.certainteed.com](http://www.certainteed.com).
  - 3. USG: [www.usg.com](http://www.usg.com).
  - 4. Approved equal.
- B. Wood Veneer Acoustic Panels:
- C. Suspension Systems:
  - 1. Same as for acoustical units.
  - 2. Approved equal.

### 2.02 ACOUSTICAL UNITS

- A. Acoustical Units - General: ASTM E1264, Class A.
- B. Acoustical Panels Type APC-1: Membrane faced mineral fiber, ASTM E1264 Type IV, Form 2, Pattern E, with the following characteristics:
  - 1. Size: 24 by 24 inches.
  - 2. Thickness: 3/4 inches.
  - 3. Composition: Wet felted.
  - 4. Light Reflectance: 90 percent, determined in accordance with ASTM E1264.
  - 5. NRC Range: 0.75, determined in accordance with ASTM E1264.
  - 6. Ceiling Attenuation Class (CAC): 35, determined in accordance with ASTM E1264.
  - 7. Edge: Square.
  - 8. Surface Color: White.
  - 9. Surface Pattern: Lightly textured.
  - 10. Suspension System: Exposed grid Type W.
  - 11. Products:
    - a. Armstrong Ultima #1910, Basis of Design.
    - b. CertainTeed Symphony.
    - c. USG Mars.
- C. Acoustical Panels Type APC-2: Membrane faced mineral fiber, ASTM E1264 Type IV, Form 2, Pattern E, with the following characteristics:
  - 1. Size: 24 by 48 inches.
  - 2. Thickness: 3/4 inches.
  - 3. Composition: Wet felted.
  - 4. Light Reflectance: 90 percent, determined in accordance with ASTM E1264.
  - 5. NRC Range: 0.75, determined in accordance with ASTM E1264.
  - 6. Ceiling Attenuation Class (CAC): 35, determined in accordance with ASTM E1264.
  - 7. Edge: Square.
  - 8. Surface Color: White.
  - 9. Surface Pattern: Lightly textured.
  - 10. Suspension System: Exposed grid Type W.
  - 11. Products:
    - a. Armstrong Ultima #9113, Basis of Design.
    - b. CertainTeed Symphony.
    - c. USG Mars.

- D. Acoustical Panels Type APC-4: Membrane faced mineral fiber, ASTM E1264 Type IV, Form 2, Pattern E, with the following characteristics:
1. Size: 24 by 48 inches.
  2. Thickness: 3/4 inches.
  3. Composition: Wet felted.
  4. Light Reflectance: 86 percent, determined in accordance with ASTM E1264.
  5. NRC Range: 0.70, determined in accordance with ASTM E1264.
  6. Ceiling Attenuation Class (CAC): 38, determined in accordance with ASTM E1264.
  7. Edge: Square.
  8. Surface Color: White.
  9. Surface Pattern: Lightly textured.
  10. Suspension System: Exposed grid Type W.
  11. Products:
    - a. Armstrong Ultima Health Zone #1935, Basis of Design.
    - b. CertainTeed Symphony.
    - c. USG Mars.
- E. Glass Fiber Acoustical Panels Type APC-3: Fabric faced glass fiber, ASTM E1264 Type XII, Form 1, Pattern EC, with the following characteristics:
1. Size: 24 by 48 inches.
  2. Thickness: 3/4 inches.
  3. Light Reflectance: 90 percent, determined in accordance with ASTM E1264.
  4. NRC Range: 0.95, determined in accordance with ASTM E1264.
  5. Edge: Square.
  6. Surface Color: White.
  7. Surface Pattern: Lightly textured.
  8. Suspension System: Exposed grid Type W.
  9. Products:
    - a. Armstrong Optima #3153, Basis of Design.
    - b. CertainTeed Symphony.
    - c. USG Halcyon.
- F. Wood Veneer Acoustic Panels: Medium density fiberboard (MDF) or Particle board core with wood veneer face and non-woven acoustical material backer.
1. Panel Size: 24 by 96 inches.
  2. Plank width: 4 inches.
  3. Panel Thickness: 3/4 inch.
  4. Surface Veneer Species: Maple.
  5. NRC: 0.45, determined in accordance with ASTM E1264.
  6. Suspension System: Concealed.
  7. Products:
    - a. Armstrong; Woodworks Linear #6690W1 with Maple NMP finish:  
[www.armstrongceilings.com](http://www.armstrongceilings.com).

## 2.03 SUSPENSION SYSTEM(S)

- A. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with stabilizer bars, clips, splices, perimeter moldings, and hold down clips as required.
- B. Exposed Steel Suspension System Type W: Formed steel, commercial quality cold rolled; intermediate-duty.
1. Profile: Tee; 15/16 inch wide face.
  2. Construction: Double web.



3. Finish: White painted.

#### 2.04 ACCESSORIES

- A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.
- B. Perimeter Moldings: Same material and finish as grid.
  1. At Exposed Grid: Provide L-shaped molding for mounting at same elevation as face of grid.
  2. At suspended panels and gypsum board: Provide extruded aluminum perimeter trim engineered to connect to suspension system.
    - a. Finish: Same as grid.
    - b. Height: 6 inches, unless indicated otherwise.
  3. Products:
    - a. Armstrong Axiom.
    - b. Certainteed Cloud Perimeter Trim.
    - c. USG Compasso.
- C. Touch-up Paint: Type and color to match acoustical and grid units.

### PART 3 EXECUTION

#### 3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that layout of hangers will not interfere with other work.

#### 3.02 INSTALLATION - SUSPENSION SYSTEM

- A. Install suspension system in accordance with ASTM C636/C636M, ASTM E580/E580M, and manufacturer's instructions and as supplemented in this section.
- B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.
- C. Install after major above-ceiling work is complete. Coordinate the location of hangers with other work.
- D. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
- E. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.
- F. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.
- G. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.
- H. Do not eccentrically load system or induce rotation of runners.

- I. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
  - 1. Use longest practical lengths.
  - 2. Overlap and rivet corners.

### 3.03 INSTALLATION - ACOUSTICAL UNITS

- A. Install acoustical units in accordance with manufacturer's instructions.
- B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.
- C. Fit border trim neatly against abutting surfaces.
- D. Install units after above-ceiling work is complete.
- E. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.
- F. Cutting Acoustical Units:
  - 1. Make field cut edges of same profile as factory edges.
- G. Where round obstructions occur, provide preformed closures to match perimeter molding.
- H. Install hold-down clips on panels within 20 ft of an exterior door.

### 3.04 TOLERANCES

- A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.
- B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

END OF SECTION

## **SECTION 23 7213 - HEAT-WHEEL AIR-TO-AIR ENERGY RECOVERY EQUIPMENT**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Energy recovery rotary heat wheels.

#### **1.2 SUBMITTALS**

- A. Requirements for Submittals and Product Substitutions, Division 01, apply to work specified in all Division 23 Sections.
- B. Product Data: For each type of product indicated.
- C. LEED Submittals:
  - 1. Product Data for Prerequisite EQ 1: Documentation indicating that units comply with ASHRAE 62.1-2004, Section 5 - "Systems and Equipment."
- D. Shop Drawings: For air-to-air energy recovery equipment. Include plans, elevations, sections, details, and attachments to other work.
  - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 2. Wiring Diagrams: For power, signal, and control wiring.
- E. Operation and maintenance data.

#### **1.3 QUALITY ASSURANCE**

- A. Energy Recovery Rotary Heat Wheels: Wheels shall be manufactured by a company regularly engaged in the manufacturer of such wheels and having catalogue performance data and certified test data.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. ARI Compliance:
  - 1. Capacity ratings for air-to-air energy recovery equipment shall comply with ARI 1060, "Performance Rating of Air-to-Air Heat Exchangers for Energy Recovery Ventilation Equipment."
  - 2. Capacity ratings for air coils shall comply with ARI 410, "Forced-Circulation Air- Cooling and Air-Heating Coils."

D. ASHRAE Compliance:

1. Applicable requirements in ASHRAE 62.1-2004, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."
2. Capacity ratings for air-to-air energy recovery equipment shall comply with ASHRAE 84, "Method of Testing Air-to-Air Heat Exchangers."

E. UL Compliance:

1. Packaged heat recovery ventilators shall comply with requirements in UL 1812, "Ducted Heat Recovery Ventilators"; or UL 1815, "Nonducted Heat Recovery Ventilators."

1.4 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of air-to-air energy recovery equipment that fail in materials or workmanship within specified warranty period.

1.5 COORDINATION

- A. BAS Communication Capability: Notify wheel manufacturer at time of submittal as to the desired communication protocol, so the Controller can be properly configured prior to shipment.
- B. Coordinate work of this Section with work of other Sections.

**PART 2 - PRODUCTS**

2.1 GENERAL

- A. Provide platforms, bases, wall mountings, hanger rods, inserts, and special supporting devices for equipment specified in this section as recommended by the manufacturer of a specified item.

2.2 TOTAL ENERGY RECOVERY ROTARY HEAT WHEELS

- A. Acceptable manufacturers, subject to compliance with requirements:
1. SEMCO Inc.
  2. Des Champs
  3. Venmar Ventilation Inc.
  4. Pre-approved equal.

- B. Rotor Media: Shall be made of aluminum coated to prohibit corrosion; etched or oxidized surfaces are not acceptable. Media surfaces shall be coated with adsorbent prior to being formed. Both faces of the energy recovery wheel shall be covered and sealed with a two part polymer coating for chemical resistance. Desiccant shall utilize a 3A molecular sieve certified by the manufacturer which limits adsorption to materials not larger than the critical diameter of a water molecule (2.8 angstroms). The media shall be cleanable with low pressure steam( less than 5 PSI), hot water or light detergent, without degrading the latent recovery. Dry particles up to 800 microns shall pass freely through the media. The unit shall be provided with a factory set, field adjustable purge sector to limit cross contamination to < .04 percent of exhaust air stream. Rotor shall be supplied with labyrinth seals, which at no time shall make contact with any rotating surface of the exchanger rotor face. These seals shall utilize four labyrinth stages for optimum performance. The rotor media shall be provided in segments to allow for field erection or replacement.
- C. Purge Sector: Provided with a factory set, field adjustable purge sector designed to limit cross contamination to less than 0.04 percent of that of the exhaust airstream concentration when operated under appropriate design conditions.
- D. Rotor Seals: Shall be supplied with labyrinth seals only, which at no time are required to make contact with any rotating surface of the exchanger rotor.
- E. Rotor Support System: Rotor media shall be provided in a segmented fashion to allow for field erection of one section at a time without requiring side access. The media shall be rigidly held by a structural spoke system made of extruded aluminum.
- F. Unit Housing: Shall be a structural framework which limits the deflection of the rotor due to air pressure differential to less than 1/32 of an inch. The housing shall be made of galvanized steel and shall be of tubular construction.
- G. Drive System: The rotor shall be driven by a self-adjusting urethane belt system, A/C motor and adjustable frequency drive. Motor characteristics shall comply with requirements specified in SECTION 230513 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT.
  - 1. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."
  - 2. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
- H. Temperature Control Panel: The wheel control is designed to deliver tempered air to the space/main air-handling unit year round, with enthalpy based summer/winter changeover and wheel condensation control.
  - 1. Provide UL listed control panel(s) containing all motor controllers, sequencing equipment, etc., which shall be rated to withstand the available fault current from the building's power supply system, without requiring supplemental over-current protective devices. The available fault current shall be as shown on the electrical single line diagrams, for the switchboard, panelboard, or other distribution equipment that is the source for the feeder to the equipment, unless specifically permitted otherwise by the Engineer.
  - 2. Variable speed control is accomplished by the use of a variable frequency drive (VFD). The VFD includes all digital programming with speed adjustment pot mounted on the front of the enclosure. The drive system will allow for a turndown ratio of 80:1 (20 rpm to 1/4 rpm).

3. Setpoint Control: The supply setpoint may be entered at the keypad, or received from the BAS. A local/remote setpoint switch may be toggled either through the keypad, or the BAS. The condensation control setpoint is automatically calculated and set by the controller.
4. Enthalpy Wheel Control:
  - a. If the outdoor enthalpy is less than the return enthalpy, the wheel modulates to maintain the supply temperature setpoint.
  - b. If the outdoor enthalpy is greater than the return enthalpy, the wheel rotates at full speed (20 RPM) in summer cooling mode.
  - c. If the outdoor enthalpy is less than the return enthalpy but the outdoor temperature is greater than the supply setpoint, the wheel will rotate at minimum speed (about 0.2 RPM) in economizer mode.
  - d. The controller will automatically calculate an exhaust temperature condensation control setpoint based on the space humidity.
  - e. If the exhaust temperature drops below the condensation control setpoint, the wheel will modulate slower to maintain the exhaust setpoint.
  - f. The wheel receives the minimum signal from the supply temperature and condensation control loops.
5. Hardware: Sensors include a temperature and RH sensor which should be located in the Outdoor air, supply air, and return air streams. Provide temperature point sensor for installation in the exhaust air stream. Provide rotation detector and variable frequency drive.
6. Display: Inputs, outputs, and setpoints may be viewed at the unit mounted LCD display or remotely using communications software. Setpoints may be adjusted either at the unit or remotely.
7. Alarm Functions: Digital alarm input consist of a wheel rotation detector. If an alarm trips, the alarm light on the unit will energize, and the source of the trip may be seen on the keypad.
8. Communication Capabilities: The standard IO Controller will communicate BACnet over 2-wire EIA-485 or 4-wire EIA-232, Modbus, or Johnson N2. Lontalk and BACnet over Ethernet communications are possible using optional boards or drivers. The BAS start stop command can be either a hard-wired dry contact, or a software command using one of the protocols above.
9. Digital Performance Display Module: Digital read out of the temperature readings recorded by these sensors and control set points shall be displayed by the control panel.
10. Furnish a rotation detector with sensors.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Verify dimensions by measurement at site.
- B. Verify that conditions and prior construction are acceptable for energy recovery wheel installation.
  - 1. If conditions or prior construction are not acceptable for energy recovery wheel installation, notify Architect.
  - 2. Commencing energy recovery wheel installation indicates that conditions and prior construction are acceptable.

#### **3.2 INSTALLATION**

- A. Install and adjust the energy recovery wheel(s) and automatic control system(s) in compliance with the wheel manufacturer's installation instructions.

#### **3.3 FACTORY START-UP**

- A. Installation: After the wheel(s) and their control system(s) have been installed, a factory technician shall inspect the installation and place them into operation.
  - 1. If the wheel(s) and control system(s) have been installed correctly and are operating properly, the technician shall document this in writing.
  - 2. If the wheel(s) and/or control system(s) have not been installed properly, the technician shall indicate what remedial action must be taken, and shall re-inspect and re-document the installation after the remedial action has been completed.
- B. Performance: After documenting that the wheel(s) and control system(s) are operating properly, a factory technician shall adjust all control system set-points and evaluate wheel performance.
  - 1. If the energy recovery wheel is performing properly at the time and under conditions that wheel performance was evaluated, the technician shall document all technical data in writing.
  - 2. If the wheel is not performing as predicted by factory supplied data, the technician shall trouble-shoot the cause and undertake remedial action at no additional cost to the Owner. He shall then re-evaluate and re-document wheel performance after the remedial action has been completed.
- C. Documentation in Writing: Furnish all start-up documentation to the Owner.

3.4 OWNER TRAINING

- A. A factory technician shall train Owner personnel for a period of 12 working hours at the project work site. At a minimum, training shall cover the following:
1. How the wheel and its automatic control system work.
  2. Trouble-shooting critical areas of operation, i.e. supply/exhaust airflows, wheel rotation, entering/leaving air temperatures, entering/ leaving air relative humidity, automatic controls.
  3. Routine maintenance.

**END OF SECTION 23 7213**



## **SECTION 23 7323 - CENTRAL-STATION AIR-HANDLING UNITS**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

**A. Section includes:**

1. Indoor and outdoor air handling units and components as scheduled and shown on drawings (RTUs and ERU).
2. Motor disconnects, motor starters, and variable frequency drives.

#### **1.2 SUBMITTALS**

**A. Product Data:**

1. Submit literature that indicates dimensions, weights, capacities, ratings, fan performance, gauges and finishes of materials, and electrical characteristics and connection requirements.
2. Submit data on filter media, filter performance, filter assembly, and filter frames.
3. Submit computer generated fan curves with specified operating point clearly plotted.
4. Submit computer generated psychrometric chart for each cooling coil with design points and final operating point clearly noted.
5. Calculated airflow pressure losses, fan, filter and coil performance data.
6. Value of differential pressure across housing and other loads used for strength calculations, and maximum deflection of housing permitted under these loads.
7. Application, installation and start up instructions for all components that make up the air handler. Submit within 30 days of shop drawing approval to facilitate the commissioning process.
8. Coordinate with Commissioning procedures to refine start up, check out and testing procedures for the air handling units.

**B. Shop Drawings**

1. Complete assembly shop drawings, schematic electrical drawings of electric service panels and details of electric components, lighting details, and point-to-point wiring diagrams.
2. Construction details, including methods of fastening panels, assembling sections, thermal and galvanic break techniques, and materials of construction.

**C. Field quality control test reports.**

- D. Operation and maintenance data.
- E. Warranty: Warranty period for the air handling units shall be for a period of two (2) years commencing with either substantial completion, or with the completion and Owner sign-off of a successful field test.

### 1.3 QUALITY ASSURANCE

- A. ARI Compliance:
  - 1. Comply with ARI 210/240 and ARI 340/360 for testing and rating energy efficiencies for units.
  - 2. Comply with ARI 270 for testing and rating sound performance for units.
- B. ASHRAE Compliance:
  - 1. Comply with ASHRAE 33 for methods of testing cooling and heating coils.
  - 2. ASHRAE 90.1 for unit energy efficiency.
- C. NFPA Compliance: Comply with NFPA 90A and NFPA 90B.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver equipment to the job site packaged and protected for overland trucking and for storing the equipment outside exposed to the weather. Cover duct connection openings with plywood or sheet metal caps.

## PART 2 - PRODUCTS

### 2.1 GENERAL REQUIREMENTS

- A. Acceptable Manufacturers, subject to compliance with requirements, provide products of one of the following:
  - 1. York
  - 2. Carrier
  - 3. Daikin
  - 4. Racan
  - 5. Gouvernaire

6. Miller Picking
  7. Approved equal
- B. Units shall be the factory-fabricated, factory prewired for triple-point field power connection as documented on Electrical Contract Drawings and Specifications, and prepared for field furnished and wired controls.
1. Provide all electrical wiring, devices and equipment as documented and specified by Divisions 23 and 26.
- C. Units shall consists of a structural base, insulated casing, access doors, fans, motors, motor controls, coils, filters, dampers, controls, components, and accessories; as shown on drawings, schedules, and specifications.
- D. Provide AHU to meet the specified levels of performance for scheduled items including airflow, static pressure, cooling capacity, heating capacity, electrical characteristics, sound, casing leakage, panel deflection and casing thermal performance.
- E. AHU shall maintain structural integrity when wall panels are removed.
- F. Provide internal components and accessories as specified and scheduled. Components and accessories shall be installed by the AHU manufacturer in an ISO-9002 certified facility.
- G. Units shall be shipped in one piece. Split unit(s) only where necessary for shipping and installation.
- H. Manufacturer shall provide detailed, step-by-step instructions for disassembly and reassembly.
- I. For AHU segments that must be broken down for rigging and installation: segment shall be disassembled and reassembled by manufacturer's factory-trained service personnel.
- J. Air handling units, consisting of all sections equipment and flooring indicated on the Drawings and specified in this Section shall have a total unit leakage, including infiltration cfm plus exfiltration cfm, of 1% of design cfm airflow at design static pressure.
- 2.2 BASE RAIL
- A. Unit(s) shall be provided with structural base rail under the full perimeter of the unit, formed from mill galvanized steel.
  - B. Structural steel shall be installed providing clearance for proper external trapping of drain pans and steam condensate.
  - C. Unit(s) shall be provided with base rail and lifting lug system that does not require additional support for rigging. Include base rail lifting lugs at unit corners.
- 2.3 CASING
- A. Casing construction shall not rely on the casing panels for structural integrity.

- B. Casing panels shall be 2" double-wall construction with thermal break. Thermal break shall be between interior and exterior liner of the panel assembly, and between the panel and casing framework.
- C. Provide casing with minimum thermal resistance (R-value) of 13 hr-ft<sup>2</sup>-°F/BTU. Exposed insulation is not acceptable.
- D. Casing panel insulation shall be injected polyurethane foam. Rigid foam board panels shall not be used.
- E. Casing framework downstream of cooling coil shall be filled with injected polyurethane foam insulation.
- F. Casing panels with perforated interior liners (perforated panels) shall be provided where indicated on the drawings and/or schedule. Perforated panels shall be a hybrid combination of 1" fiberboard and 1" injected polyurethane foam. Rigid foam board panels shall not be used. Minimum perforated panel thermal resistance (R-Value) shall be R11 hr-ft<sup>2</sup>-°F/BTU.
- G. All exterior and interior casing panels (roof, wall, floor, access door) shall be made of galvanized steel.
- H. Panel assembly shall meet UL standard 1995 for fire safety. Panel insulation shall comply with the requirements of NFPA 90A.
- I. Insulation system provided shall be resistant to mold growth in accordance with a standardized test method such as UL 181 or ASTM C 1338.
- J. Encapsulate insulation with sheet metal so that air does not contact insulation. Solid lined double-walled panels insulated with injected foam shall be hermetically sealed at each corner and around their entire perimeter to eliminate airflow through the panel and to eliminate microbial growth potential within the casing wall.
- K. Unit shall conform to ASHRAE Standard 111 Class 6 for casing leakage no more than 1% of design airflow at 1.25 times design static pressure up to a maximum of +8 inches w.g. in positive pressure sections and -8 inches w.g. in negative pressure sections down to a minimum of 50 CFM measurable leakage or 5,000 design CFM.
- L. Provide wall panels and access doors that deflect no more than L/240 when subjected to 1.5 times design static pressure up to a maximum of +8 inches w.g. in positive pressure sections and -8 inches w.g. in negative pressure sections. 'L' is the panel-span length and 'L/240' is the deflection at panel midpoint.
- M. Provide floors and roofs that deflect no more than L/240 when subjected to a 300 lb static load at mid-span. 'L' is the panel-span length and 'L/240' is the deflection at panel midpoint.
- N. Provide outdoor AHUs with a roof system that deflects no more than L/240 when subjected to a static snow load of 30 lb./ft<sup>2</sup>. 'L' is defined as the panel-span length and 'L/240' is the deflection at the panel midpoint.
- O. Condensation shall not form anywhere on unit exterior at 53 deg F supply air and 81 deg F DB / 73 deg F WB exterior ambient. Manufacturer shall supply an external condensation performance line, plotted on the psychrometric chart, based on actual test data. Plot will show the exterior conditions at which unit will sweat given the design supply air temperature. Manufacturer shall clearly indicate whether the design conditions will or will not result in external condensation

forming anywhere on the unit exterior. If the unit will sweat, indicate where sweating will occur. Unit exterior includes the base, base rail, roof, corners, doors, door frames, and under the cooling coil drain pan.

#### 2.4 ACCESS DOORS

- A. Provide double wall access door(s) that meet requirements for the AHU casing.
- B. Thermal break door(s) shall incorporate a thermal break in both the door frame and the door panel.
- C. Provide industrial-style stainless steel hinges that permit 180 degrees of door swing.
- D. Provide latches with roller cam mechanisms that ensure a tight seal. Rotating knife-edge or "paw" latches are not acceptable.
- E. Provide each door with a single handle linked to multiple latching points or a separate handle for each latching point. Doors serving access segments shall have an interior latch handle.
- F. Provide access doors with a locking hasp to accommodate a lockout device.
- G. Provide double-pane viewing windows. Windows shall be a non-condensing type consisting of a desiccant dehumidification layer. Minimum dimension shall be 3" x 8".

#### 2.5 COILS: HEATING AND COOLING

- A. Provide coils as specified in Section 238216, as arranged on Drawings, and with performance scheduled on Drawings.
- B. Coils shall meet or exceed performance scheduled on drawings.
- C. Coils shall be provided with performance certified in accordance with AHRI Standard 410 for coil capacity and pressure drop, wherever applicable. Coils circuits shall be designed such that the fluid velocity is within the range of certified rating conditions at design flow.
- D. Cooling coils shall be provided with a maximum face velocity as scheduled. Face velocity calculations shall be based on the finned area of the coil.
- E. Cooling coil shall be provided with drain pan that is sufficient to contain coil condensate. Drain pan shall extend a minimum of 6" downstream of the face of the coil.
- F. Coil segment casing shall accommodate full-face or reduced-face coils as scheduled. Face and bypass coil segments shall be provided with factory installed bypass damper.
- G. Access shall be provided of at least 24" between coils. Access panel or door shall be easily operable and are easily removable with no special tools, as shown on drawings.
- H. Access doors shall be located to provide clearance for pipe insulation, connectors, and accessories. Space shall allow a minimum of 90 degrees of door swing.

- I. Coils shall be built in their own full perimeter frame. Tube sheets on each end shall have fully drawn collars to support and protect tubes. Horizontal coil casing and support members shall allow moisture to drain. Casing and support members shall not block finned area.
- J. Individual coils shall be removable from the side of the AHU.
- K. Intermediate drain pan shall be provided on stacked cooling coils. Intermediate drain pan shall slope in a minimum of two planes toward a single drain connection.
- L. A single intermediate vertical coil support shall be provided on coils with a finned length greater than 62." Two vertical supports shall be provided on coils with a finned length greater than 100," and three vertical supports on coils with a finned length greater than 141."
- M. Staggered Coil bank shall be provided. Each connection shall be provided with 1/4" FPT plugged vent/drain tap. Circuiting shall allow draining and venting when installed. Vent, drain, and coil connections through AHU casing shall be extended.
- N. Gap between coil stub out connection and AHU casing, shall be insulated with a spool-shaped sleeve grommet. Adhesive rings applied to the casing walls shall not be acceptable.
- O. Water and glycol coils shall be operable at 325 psig working pressure and up to 250 deg F. Factory test water and glycol coils with 325 psig compressed air under water. Water coils shall conform to Subsection 12.3, "Water-Containing Parts," of UL-207, "Standard for Safety: Refrigerant – Containing Components and Accessories, Nonelectrical."
- P. Steam distributing coils shall be operable at 50 psig pressure and a corresponding saturated steam temperature of 298° F. Factory test steam coils with 315 psig compressed air under water. Dehydrate and seal coils prior to shipping.
- Q. Water, glycol and DX coils shall be provided with a tube OD of 1/2" or 5/8". Mechanically expand tubes shall form fin bond and provide burnished, work-hardened interior surface.
- R. Water, glycol and steam coil headers shall be made of seamless copper or brass tubing. Pipe connections shall be steel or red brass. Header connections (tubes and piping connections) shall be silver-brazed or TIG welded.
- S. Continuous aluminum or copper fins shall be provided for coils with die-formed fins. Fins shall have fully drawn collars to accurately space fins and protect tubes. Fins shall be 0.008 or 0.01" thick.

## 2.6 PRIMARY DRAIN PANS

- A. Unit(s) shall be provided with a drain pans under each cooling coil and humidifier.
- B. Provide drain pan under the complete width and length of cooling coil and humidifier sections. Drain pan shall be full width and extend a minimum of 6" downstream of cooling coil.
- C. Drain pans for cooling coils and humidifiers shall meet the requirements of ASHRAE 62.
- D. Drain connection shall be made of same material as drain pan. Dissimilar metals shall not be used to mitigate risk of galvanic corrosion. Drain connection shall be welded to the drain pan.
- E. Drain pan shall be double wall with an insulation R-value of 6.25 hr-ft<sup>2</sup>-°F/ (BTU-in).

- F. Drain pan shall have minimum of 2" of injected polyurethane foam insulation under the entire bottom surface of the drain pan. Drain pan shall be foam injected as a complete assembly and shall include thermal breaks at connection points to unit casing.
- G. Drain pan shall allow visual inspection and physical cleaning on 100% of the pan surface without removal of the coil or humidifier.
- H. Provide a minimum of 1" clearance between the drain pan and any coil casing, coil support or any other obstruction.
- I. Provide drain pan that allows the design rate of condensate drainage regardless of fan status.
- J. Provide drain pan sloped in at least two planes by at least 1/8" per foot toward a single drain. Locate drain connection at the lowest point of the pan. Pan shall have no horizontal surfaces.

## 2.7 FANS

- A. Unit[s] shall be provided with fans as shown on equipment schedule and drawings.
- B. All fans shall be direct drive type.
- C. The fan section shall be provided with an access door on the drive side of the fan.
- D. Fans shall be provided with fan inlet screens in the inlets of the fan housing.
- E. Mount the fan and motor assembly on a common adjustable base. This common base shall attach to vibration isolators, which mount to structural support channels. These channels shall span the AHU floor and mount directly to the AHU frame. Manufacturers not complying with this requirement must submit detailed structural and weight data to a licensed structural engineer for review and stamped certification. The mechanical engineer shall review these engineers' final reports prior to submittal approval.
- F. Provide vibration isolation, as scheduled.
- G. DWDI fans shall be connected to the unit casing or bulkheads with canvas flexible connection.
- H. Provide horizontal thrust restraints between AHU casing and fan housings with end discharge. This requirement applies to the following cases:
  - 1. SWSI fans operating at greater than 3" of total static pressure
  - 2. DWDI airfoil fans operating at greater than 6" of total static pressure
- I. Bearings shall be offered either with sealed bearings (permanent lubrication) or with serviceable bearings to facilitate periodic relubrication. Bearings requiring relubrication shall offer grease lines extended from the bearing to an accessible location on the fan-support bracket on the drive side of the fan.
- J. Piezometer Ring: Airflow station shall be factory installed at fan inlet. The device shall have a measurement accuracy of  $\pm 5\%$ . Tubing shall be field-installed.

K. Plenum (SWSI) Fan

1. Plenum fan wheel shall be single-width, single-inlet.
2. Plenum fan blades shall be aluminum backward-inclined airfoil.
3. Plenum fan shall be direct-driven.

L. MULTIPLE FANS - ARRAY OF DIRECT-DRIVE PLENUM FANS

1. Fans shall have a sharply rising pressure characteristic extending through the operating range and continuing to rise beyond the peak efficiency to ensure quiet and stable operation. Fans shall have a non-overloading design with self-limiting horsepower characteristics and shall reach a peak in the normal selection area.
2. Performance: Fans shall be tested in accordance with AMCA 210 and AMCA 300 test standards for air moving devices and shall be guaranteed by the manufacturer to deliver rated published performance levels.
3. Construction: Fans shall be designed without a scroll type housing and shall incorporate a non-overloading type backward inclined airfoil blade wheel, heavy-gauge reinforced steel inlet plate and structural steel frame.
4. Frame and Inlet Panel: Inlet panels shall be of heavy-gauge reinforced steel construction. The inlet panel incorporates a removable spun inlet cone designed for smooth airflow into the accompanying inlet retaining ring of the fan wheel. A square, formed lip suitable for attachment of a boot connector shall surround the unit.
5. Wheel: Wheels shall have a spun non-tapered style blade retaining ring on the inlet side to allow higher efficiencies over the performance range of the fan. Wheels shall have airfoil-shaped extruded aluminum blades. All hollow blade wheels shall be continuously welded around all edges. Wheels shall have twelve blades for better sound quality. All wheels shall be statically and dynamically balanced per ANSI/AMCA 204.
6. Finish and Coating: Entire fan assembly shall be thoroughly degreased and deburred before application of a rust-preventative coating. Aluminum components shall be unpainted.
7. Motors: Provide TEFC Premium Eff. with Aegis Shaft Grounding factory installed. Motor frames shall be cast iron – rolled steel frames are not acceptable.
8. Fan Balancing: All fans prior to shipment shall be individually balanced. Maximum vibration shall be within the limits of ANSI/AMCA 204 Fan Application Category BV-3. Balance readings shall be taken by electronic type equipment in the axial, vertical, and horizontal directions on each of the bearings.
9. Vibration Isolation: Fans shall not require spring isolators in order to meet the ANSI/AMCA 204 Fan Application Category BV-3 rating.
10. Factory Run Test: All fans prior to shipment shall be completely assembled and test run as a unit at the specified operating speed or maximum RPM allowed for the particular construction type. Maximum vibration shall be within the limits of ANSI/AMCA 204 Fan Application Category BV-3. Balance readings shall be taken by electronic type equipment in the axial, vertical, and horizontal directions on each of the bearings.



11. Blank off Panels: Each Multiple Fan section to be provided with one fan blank off panel to enable manual isolation of fan for servicing.
12. Fan Options: The following options shall be available for multiple fans:
  - a. Fan Inlet Screen: Fan inlet screen shall be factory installed as safety protection for limiting access to fan wheel inlet.
  - b. Piezometer Ring: Airflow station shall be factory installed in each fan inlet. The device shall have a measurement accuracy of  $\pm 5\%$ . Field-installed tubing shall be manifolded so that the measurement is representative of all fans in the array.
  - c. Backdraft Damper: Backdraft dampers shall be available for automatic isolation of individual fans.
13. Fans shall be electrically wired by the air handling manufacturer.
  - a. Each fan shall be wired to an MMP - manual motor protection - device which shall provide motor input current overload protection and a power disconnecting means for individual motor isolation.
  - b. All MMP's shall be located in a power distribution panel sharing a common power busbar.
  - c. Power distribution panel shall include a non-fused main disconnect which shall isolate power to the common power busbar.
14. Fan Array Motor Control: Common VFD Operation
  - a. All fan motors shall be factory-wired to individual manual motor protection (MMP) device which shall consist of a motor overload relay with adjustable current rating and an on-off disconnect switch for power isolation. Field wiring of MMP's to fan motors shall not be permitted.
  - b. MMP's shall be contained in a single control panel (MMP panel) and shall be mounted on the exterior wall panel of the fan array section.
  - c. MMP panel shall have a single point of connection for input power wiring and shall feed power individual MMP's through a common busbar. Independent wiring of input power to individual MMP's shall not be permitted.

## 2.8 ELECTRICAL MOTORS

- A. Fan motors shall be built in accordance and comply with the latest standards of the NEMA and IEEE.
- B. AHU and fan motors shall comply with ASHRAE 90.1.
- C. Fan motors shall be provided with the following characteristics:
  1. Voltage, Frequency and Phase, as scheduled.
  2. Motor RPM, as scheduled
  3. Minimum service factor of 1.15
  4. Premium efficiency, or as required to meet ASHRAE 90.1
  5. NEMA design ball bearing type
  6. Rated for continuous duty at full load in a  $104^{\circ}\text{F}$  [ $40^{\circ}\text{C}$ ] ambient

7. Open drip proof (ODP) or totally enclosed, fan cooled (TEFC) as scheduled.
8. Suitable for use in variable frequency application, per NEMA MG-1 Part 30
9. Premium Efficiency Inverter ready per NEMA STD MG1 PART 31.4.4.2

## 2.9 FAN-MOTOR DISCONNECTS

- A. Manufacturer shall provide UL or ETL listed fan-motor disconnects and associated components, as scheduled and shown on drawings. Disconnects shall comply with applicable provisions of the National Electric Code.
- B. Fused or non-fused fan-motor disconnects shall be provided in NEMA 1, NEMA 3R, NEMA 4, NEMA 12 enclosures, as scheduled or as shown on drawings.
- C. Unit main disconnect shall be mounted on the primary access side of supply fan section.
- D. Disconnect shall be suitable for use as an OSHA lockout/tagout disconnect when applied in accordance with part IV, Department of Labor OSHA 29 CFR Part 1910, Control of Hazardous Energy Source (lockout/tagout): final rule.
- E. Disconnect handles shall be lockable in the "off" position with up to three padlocks. Switch mechanism shall be directly lockable in the "off" position via padlock when door is open.
- F. Disconnects shall be provided with integral ground lug.
  1. Provide two (2) #14 ground wires on 16A to 100A disconnects.
  2. Provide one (1) #6-250 ground wire on 200A to 400A disconnects.
- G. Auxiliary contacts shall be provided as scheduled.

## 2.10 FAN-MOTOR VARIABLE FREQUENCY DRIVES

- A. Manufacturer shall provide UL or ETL listed VFDs and associated components, as scheduled and shown on drawings. VFDs shall comply with applicable provisions of the National Electric Code.
- B. VFDs shall be mounted in a dedicated NEMA 1 compartment located on the primary access side of its associated fan section and wire VFD to motor, unless otherwise indicated on drawings.
- C. Outdoor VFDs shall be enclosed in a NEMA 3R enclosure.
- D. VFDs on outdoor units shall be suitable for use in ambient temperatures from 5°F to 104°F.
  1. Provide low ambient temperature kit suitable for use down to -20°F.
  2. Provide high ambient temperature kit suitable for use up to 135°F.
- E. After unit installation, VFD shall be started and programmed by a factory trained and employed service technician. Refer to Section 3.05.

- F. Unit(s) shall be provided with following VFD disconnect and bypass optional:
  - 1. Non-Fused or Fused main disconnect
- G. Unit(s) shall be provided with harmonic distortion feedback protection.
- H. Unit(s) shall be provided with a user interface consisting of following features:
  - 1. 30 Character multi-lingual alphanumeric display
  - 2. Parameter set-up and operating data
  - 3. Display data shall include:
    - a. output frequency (Hz)
    - b. speed (RPM)
    - c. motor current
    - d. calculated % motor torque
    - e. calculated motor power (kW)
    - f. DC bus voltage
    - g. output voltage
    - h. heat sink temperature
    - i. elapsed time meter (re-settable)
    - j. kWh (re-settable)
    - k. input / output terminal monitor
    - l. PID actual value (feedback) & error
    - m. fault text
    - n. warning text
    - o. scalable process variable display
- I. VFD shall be provided with the following protection circuits:
  - 1. over current
  - 2. ground fault
  - 3. over voltage
  - 4. under voltage
  - 5. over temperature
  - 6. input power loss of phase
  - 7. loss of reference/feedback
  - 8. adjustable current limit regulator
- J. VFD shall be UL 508C approved for electronic motor overload (12t).
- K. VFD shall be provided with features for high input transient protection and surge suppression, such as:
  - 1. 4 MOVs ahead of diode bridge

2. 120 Joule rated 1600V diode module
3. Compliant with UL 1449 / ANSI 61.4

L. VFD shall be provided with the following communication features:

1. Two programmable analog inputs
2. Six programmable digital inputs
3. Two programmable analog output
4. Three programmable digital relay outputs
5. Modbus RTU Communications protocol
6. Adjustable filters on analog inputs and outputs
7. Input speed signals, including 4-20 mA and 0-10 VDC
8. Accel/Decel contacts [floating point control]
9. Auto restart [customer selectable and adjustable]
10. Start/Stop options shall include 2 wire dry contact closure, application of input power, and application of reference signal (PID sleep/wake-up).
11. Integrated control interface for BACnet MS/TP or LONWorks over RS-485.

M. VFD shall consist of the following functions:

1. Pre-magnetization on start
2. DC braking/hold at stop
3. Ramp or coast to stop
4. Seven preset speeds
5. Three critical frequency lockout bands
6. Start function shall include ramp, flying start, automatic torque boost, and automatic torque boost with flying start

## 2.11 FACTORY INSTALLED ELECTRICAL ACCESSORIES

- A. In addition to motor power terminals, unit(s) shall be provided with an independent power terminal for convenience receptacles and lights.
- B. All switches shall be provided as shown on drawings.
- C. Unit[s] shall be provided with LED (light emitting diode) lights in segments as scheduled or shown on drawings.

## 2.12 FILTERS

- A. Unit[s] shall be provided with filter segments consisting of filters and frames as scheduled.
- B. Side or front loading filters for filter segments located upstream of coil segment(s) shall be provided with an access door on the drive side through which filters can be easily loaded.
- C. Segments located downstream of coil segment(s) shall be provided with face loading filters. Access plenum and access door of 18" [minimum] shall be provided on the drive side through which face loading filters can be easily loaded.
- D. Class 2 or Class 1 filter media shall be provided per U.L. 900 and as required by local codes.
- E. Filter types, efficiencies, and nominal depths shall be as follows:
  - 1. Flat filters – 2" throwaway, 2" permanent cleanable, 2" 30% pleated, or 4" 30% pleated filters, as scheduled.
  - 2. Angled filters – 2" throwaway, 2" permanent cleanable, or 2" 30% pleated filters, as scheduled.
  - 3. Rigid filters – 4" mini pleated, 12" rigid, or 22" bag filters with efficiencies of 60-65%, MERV 11.
- F. A pre-filter rack shall be provided in rigid filter segments. Pre-filters shall have 2" throwaway, 2" permanent cleanable, 2" 30% pleated, or 4" 30% pleated filters as scheduled.
- G. Provide post-filter and/or pre-filter rack in carbon filter segments with 2" throwaway, 2" permanent cleanable, 2" 30% pleated, or 4" 30% pleated filters, as scheduled.
- H. Performance of installed filtration system shall be certified via a DOP test and classified as UL Class 1 when tested in accordance with UL Standard 586.
- I. Filter frame shall be specifically developed for HEPA filters, with appropriate quantities of filter clamps.
- J. Flush mounted, factory installed differential pressure gage on the drive side of unit shall be provided to measure pressure drop across filters. Manufacturer shall provide fully functional gauges, complete with tubing.

## 2.13 DAMPERS

- A. Dampers provided shall be tested in accordance with AMCA 500.
- B. Factory-installed dampers shall be provided, as shown on drawings.
- C. Dampers shall have airfoil blades, extruded vinyl edge seals, and flexible metal compressible jamb seals.
- D. Dampers shall have a maximum leakage rate of 4 CFM/square foot at 1" w.g., and shall comply with ASHRAE 90.1.
- E. Damper blades shall be parallel acting unless otherwise indicated.

- F. Damper blades shall be galvanized steel or aluminum, as scheduled.

#### 2.14 AIRFLOW MONITORING STATIONS

- A. Optional airflow monitoring stations shall be provided on air inlets, as shown in performance specifications.
- B. Airflow monitoring stations shall bear the AMCA Certified Ratings Seal for Airflow Measurement Performance.
- C. Airflow monitoring station dampers shall comply with leakage rates per ASHRAE 90.1.
- D. Airflow monitoring stations shall be accurate within 5% of actual airflow between 300 FPM and 3000 FPM free area velocity.
- E. Factory installed transducer that sends a CFM-proportional, 4-20 mA or 0-10V signal shall be provided only when factory packaged controls option is selected.

#### 2.15 APPURTENANCES

- A. Steel, structural formed or welded base rails suitable for rigging and lifting shall be provided, as shown on product drawings.
- B. Safety grates over bottom openings shall be provided, as shown on drawings. Safety grates shall be capable of supporting a 300 lb. center load.
- C. Lifting lugs shall be provided where required.

#### 2.16 EXTERIOR FINISHES

- A. Manufacturer shall clean the exterior surfaces of units prior to application of exterior protective coating.
- B. Unpainted air-handling units constructed of galvanized steel shall show a breakdown of less than 1/8" on either side of a scribed line when subjected to ASTM B117 220 hour, 5% salt spray conditions. This is equivalent to an ASTM D1654 rating of '6.' Also, per ASTM D610, degree of rusting to meet #8-G and per ASTM D714 degree of blister to meet #6 medium.
- C. Manufacturer shall paint exterior surfaces of indoor units prior to shipment.
  - 1. Manufacturer shall apply a primer prior to application of finish coating.
  - 2. Exterior finish coating shall show a breakdown of less than 1/8" on either side of a scribed line when subjected to ASTM B117 2,000 hour, 5% salt spray conditions. This is equivalent to an ASTM D1654 rating of '6.' Also, per ASTM D610, degree of rusting to meet #8-G and per ASTM D714 degree of blister to meet #6 medium.

2.17 ROOF CURBS

- A. Where applicable, provide factory-fabricated galvanized steel roof curb. Roof curb shall support the full-perimeter of the air handling equipment, including pipe chases.
- B. Match roof curb to roof slope. Curb surface shall be level in both axes.
- C. Provide wood nailing strip to which roofer may nail roof flashing.
- D. Ship roof curb loose for field installation prior to unit placement.

2.18 FACTORY PERFORMANCE TESTING

- A. Factory run test unit after unit has been fully assembled. The factory run test shall be conducted to examine unit operation and verify minimum vibration levels as specified. Include test results in report.
  - 1. Provide a static pressure profile through each unit for each supply and exhaust air path at design airflows. Simulate dirty "loaded" filters.
  - 2. Modify internal unit construction, as required, to reduce unusually high airflow pressure losses due to construction, at no additional cost to the Owner.
- B. The AHU manufacturer shall conduct a factory casing air leak test (FAT) for each unit prior to shipment. Unit sections shall be subjected to negative pressure upstream of supply fans and positive pressure downstream of the supply fans. Maximum air leakage rate shall be 0.5 percent of design CFM at 150 percent of the design static pressure, or fan shutoff pressure, whichever is greater. Air leakage to be measured with a calibrated orifice plate or flow tube.
  - 1. If a unit fails to meet the test requirements, make corrections at no additional expense to Owner, including travel and accommodation expenses resulting from multiple witness tests.
    - a. Caulking of interior or exterior surfaces is not an acceptable solution to fixing an air leak.
  - 2. If a unit fails the FAT at any point or requires modification to pass the FAT, the manufacturer shall bear the cost of mandatory field testing after the unit has been installed to prove it conforms with requirements.
- C. Each fan shall be factory run tested in accordance with Section 233416 to ensure structural integrity.
  - 1. Measure fan vibration in accordance with ANSI Standard S2.19, Grade G6.3.
  - 2. Maximum fan vibration, measured on fan bearings, shall be 0.20-inches per second.
- D. All coils shall be factory pressure tested in accordance with Section 238216.
- E. Sign and submit test reports.
- F. The completed unit shall pass all test requirements and bear an ETL label.

G. Witnessed Factory Test:

1. The unit manufacturer shall notify the Owner twelve (14) calendar days prior to the scheduled testing date for each unit. The Owner, Engineer and Construction Manager may witness the test, at their discretion.
  - a. The unit manufacturer shall bear all costs of the factory testing, including travel and living expenses for the Owner (1 person) Engineer (1 person) and Construction Manager (1 person) to witness (1) ERV and (1) AHV being tested.

H. Manufacturer costs for witnessed tests shall be included in the air handling units base price.

**PART 3 - EXECUTION**

3.1 EXAMINATION

- A. Examine conditions to verify that work necessary prior to installation of air-handling units is complete and in accordance with Manufacturer's published instructions.
- B. Commencing with installation of air-handling units indicates Contractor's agreement that work necessary prior to installation of air-handling units is complete and in accordance with Manufacturer's published instructions.

3.2 INSTALLATION

- A. Install equipment in accordance with the manufacturer's published instructions and as indicated on Drawings.
- B. AHUs shall not be used for temporary heating, cooling or ventilation prior to complete inspection and startup performed per this specification.
- C. Install AHUs with manufacturer's recommended clearances for access, coil pull, and fan removal.
- D. One complete set of filters shall be provided for testing, balancing, and commissioning. Provide second complete set of filters at time of transfer to owner.
- E. Install AHU plumb and level. Connect piping and ductwork according to manufacturer's instructions.
- F. Insulate plumbing associated with drain pan drains and connections.
- G. Install insulation on all staggered coil piping connections, both internal and external to the unit.

3.3 SUPERVISION OF UNIT ASSEMBLY AND INSTALLATION

- A. Unit manufacturer shall furnish services of field engineer for twenty-four (24) normal working hours to supervise rigging, assembling and installing units.



3.4 FIELD TESTING

- A. Leak test each unit, after installation of all components and external ductwork, and piping connections are completed, using the criteria indicated in this Section, and the procedures and apparatus identified in Chapters 3 and 5 of the SMACNA HVAC Air Duct Leakage Test Manual.
  - 1. Repair units leaking in excess of indicated limit, and retest at no additional cost to the Owner.

3.5 START-UP SERVICE

- A. Unit manufacturer shall furnish services of field engineer for supervision of unit start-up, and instruction of Owner's personnel in unit operation and maintenance, for minimum of sixteen (16) normal working hours.

3.6 CLEANING

- A. Clean unit interior prior to operating. Remove tools, debris, dust and dirt.
- B. Clean exterior prior to transfer to owner.

3.7 DOCUMENTATION

- A. Provide Installation Instruction Manual, & Startup checklist for each unit.
- B. Provide six copies of Spare Parts Manual for owner's record.

**END OF SECTION 23 7323**

**BID PROPOSAL FORM (REVISED)  
MAJOR RENOVATION AND ADDITION  
RICHMOND ELEMENTARY SCHOOL**

**Contract No. B-111C of 2017/18 General Construction**

**TO:** The School District of Philadelphia  
Board of Education

**OWNER**

Office of Capital Programs  
The School District of Philadelphia  
440 North Broad Street  
Third Floor - Suite 371  
Philadelphia, PA 19130-4015

**ADDRESS**

**FROM:** \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**CONTRACTOR  
ADDRESS**

**CITY/STATE  
CONTACT NAME  
PHONE NO.**

**BASE CONTRACT PROPOSAL:**

1. Having become completely familiar with the local conditions affecting the cost of Work at the place where Work is to be executed, and having carefully examined the site conditions as they currently exist, and having carefully examined the Bidding and Contract Documents prepared for this project, together with any Addenda to such Bidding and Contract Documents as listed hereinafter, the Undersigned hereby proposes and agrees to provide all labor, materials, plant, equipment, transportation and other facilities as necessary and/or required to execute all of the Work described by the Contract Documents for: **Contract No. B-111C of 2017/18-General Construction**

for the lump sum consideration of: \_\_\_\_\_  
\_\_\_\_\_ Dollars (\$\_\_\_\_\_), said amount being hereinafter referred to as the Base Proposal Amount. Base proposal Amount includes Unit Price Items listed below, if applicable.

**BID ALTERNATES (Not applicable to this Contract – No Alternates)**

**UNIT PRICES: (Included Base Bid Amount)**

**UNIT PRICE NO. 1: EXCAVATION AND DISPOSAL OF UNSUITABLE SOILS ONLY.**

1. Excavation and Disposal of **unsuitable** material beyond the design lines, grades and elevations or other limits indicated in the Contract Documents, as directed by the Owner's designated representative in accordance with Section 31 000-EARTHWORK , as applicable. (This unit price does not apply to excavation and offsite disposal of **suitable** material rendered **excess** by the construction of the New Addition))

2. Unit of Measurement: Cubic yard (CY) of excavated material as measured by the volume of the excavated area.

3. Payment: Payment to be made for the actual quantities in accordance with Section 01 1600-UNIT PRICES.

4. Base Bid Quantity: 1,200 CY

5. Unit Price Calculation (to be included in Base Bid Amount):

1,200 CY @ \$ \_\_\_\_\_ per CY=  
\$ \_\_\_\_\_ Total\*

**\*This amount included in Base Bid Amount**

**UNIT PRICE NO. 2: IMPORTED STRUCTURAL FILL MATERIAL**

1. Import, Place and Compact Fill Material, determined by testing as suitable for structural fill to Replace Unsuitable Soils excavated under Unit Price No.1 with the requirements of Section 31 0000-EARTHWORK.

2. Unit of Measurement: Cubic Yard (CY) of material in place, as measured by the volume of the excavated area to be filled.

3. Payment: Payment to be made for the actual quantities in accordance with Section 0 1600-UNIT PRICES.

4. Base Bid Quantity: 1,200 CY

5. Unit Price Calculation (Total to be included in Base Bid Amount):

1,200 CY @ \$ \_\_\_\_\_ per CY =

\$ \_\_\_\_\_ Total\*

**\*This amount included in Base Bid Amount**

**ACKNOWLEDGEMENT OF RECEIPT OF ADDENDA:**

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2. The Undersigned acknowledges receipt of the following Addenda (list by number and date appearing on Addenda):

<u>Addendum No.</u>	<u>Date</u>	<u>Addendum No.</u>	<u>Date</u>
_____	_____	_____	_____
_____	_____	_____	_____

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**TIME OF COMPLETION:**

3. The Undersigned agrees to Substantially Complete all Work under this Contract within the time periods specified in Division 1, General Requirements, Section 00 1300 entitled "Time of Completion, Milestones and Phasing or Sequencing Requirements".

**INSURANCE:**

4. All Bidders are instructed to refer to Article GC-11 of the General Conditions. All Contractors or Subcontractors bidding Work on the Project shall include in their bids the costs of Workers Compensation and Employer's Liability Insurance, Commercial General Liability Insurance, Automobile Liability Insurance, Excess Umbrella Liability Insurance (Commercial Umbrella Liability Insurance) and any other types of insurance identified in Division 1- General Requirements, Section 01200 (or 01 1200) entitled "Special Insurance Requirements".

**LIQUIDATED DAMAGES:**

5. Upon failure by the Contractor to achieve Substantial Completion within the time specified in Article GC-8 of the General Conditions from the Date of Commencement as set forth in the Notice to Proceed, the Contractor shall pay to the School District, as liquidated damages and not as a penalty, the sum of One Thousand Dollars (\$1,000.00) per day for each consecutive calendar day of delay until such time as Substantial Completion of the Work is achieved.

6. In addition, the Contractor shall be responsible for and pay for the cost of completion of construction of the Work, as well as for any and all additional charges of the School District, Architect/Engineer, other Project Contractors, and any other Consultants to the School District relating to the Contractor's failure to achieve Substantial Completion on a timely basis, including, but not limited to, delay damages, disruption damages, acceleration costs or expenses, investigative expenses, consulting fees, experts' fees, and attorneys' fees.

7. The Contractor and the School District agree that the amounts so fixed herein as liquidated damages are reasonable forecasts of just compensation for the harm that will be caused to the School District by the Contractor's breach.

**GENERAL STATEMENT:**

8. The Undersigned declares that the person or persons signing this Proposal is/are fully authorized to sign on behalf of the firm listed and to fully bind the firm listed to all the Proposal's conditions and provisions thereof.

9. It is agreed that the Undersigned has complied or will comply with all requirements of local, state, and federal laws, and that no legal requirement has been or will be violated in making or accepting this Proposal, in awarding the Contract to it and/or in prosecution of the Work.

10. Bid Security in the amount of ten percent (10%) of the Base Bid, plus all additive Alternates Proposal amounts, is attached hereto and made a part hereof, without endorsement, in the sum of \_\_\_\_\_ Dollars (\$ \_\_\_\_\_), which shall become the property of the School District in the event the Contract and Performance Bond and Labor and Materialmen's Bond are not executed within the time set forth, as liquidated damages.

11. The Undersigned further agrees within five (5) calendar days from date of Notice of Acceptance of this Proposal or Contract award, to sign and deliver to the School District, all required copies of the School District/Contractor Agreement, the Performance Bond, the Labor and Materialmen's Bond, and the Maintenance Bond, in the forms included in the Bidding Documents, and the policies of insurance or insurance certificates as required by the General Conditions. In case the undersigned fails or neglects to deliver within the specified time the School District/Contractor Agreement, the Performance Bond, the Labor and Materialmen's Bond, and the Maintenance Bond, and the insurance policies or certificates, all as aforesaid, the undersigned shall be considered as having abandoned the Contract, and the Bid Bond accompanying this Proposal shall be forfeited to the School District by reason of such failure on the part of the undersigned, as liquidated damages and not as a penalty.

12. The Undersigned further agrees that the Bid Security may be retained by the School District and shall remain with the School District until the School District/Contractor Agreement has been signed and delivered to the School District and the Performance Bond, the Labor and Materialmen's Bond, and the Maintenance Bond, and insurance policies or certificates have been made and delivered to the School District.

Respectfully submitted this \_\_\_\_\_ day of \_\_\_\_\_, 201\_\_.

***Individual Proprietorship or Partnership***

If Contractor is an individual proprietorship or is a partnership, sign here:

\_\_\_\_\_  
(Trade Name of Firm)

By: \_\_\_\_\_ By: \_\_\_\_\_ (SEAL)  
(Witness) (Owner or Partner)

**Corporation**

If Contractor is a corporation, sign here:

\_\_\_\_\_  
(Name of Corporation)

ATTEST:

By: \_\_\_\_\_ By: \_\_\_\_\_ (SEAL)  
(Secretary or Treasurer) (President or Vice President)

(CORPORATE SEAL)

Signature by anyone other than the President or Vice President and the Secretary or Treasurer of the Corporation must be accompanied by a power of attorney, executed by the proper corporate officers under the corporate seal indicating authority to execute this Bi