

ADDENDUM #3

30 July 2012

RE: Eli Whitney CTHS
Additions & Renovations Project
71 Jones Road
Hamden, CT 06514
Job Nos.: Department of Construction Services – BI-RT-837 / Antinozzi Associates - 04210

FROM: ANTINOZZI ASSOCIATES, P.C.

TO: PROSPECTIVE BIDDERS

Page 1 of 15

This Addendum shall be part of the Contract Documents and modifies the original bidding documents. This Addendum is to be acknowledged by the bidders on the Bid Form. Failure to do so may subject the bidder to disqualification. **The bid date remains 08/07/2012.**

Changes to prior Addenda:

- 1) Various items throughout this Addendum.

General Items:

- 1) None.

Clarifications:

- 1) **Question:** *Will there be any exterior rain water leader connections and laterals to the storm drain system not currently shown in the drawings? If so, please show the locations and connection details.* **Answer:** All proposed roof drainage leaders are shown on the current drawings.
- 2) **Question:** *Sheet C-3 shows concrete stairs and a landing with rails outside of C-Wing with the rails detailed in 3/C-16. It is difficult to scale the length of these railings from this drawing. What is the length of these railings at the landing? Please clarify.* **Answer:** Railings are approximately 10' in length for each side of the steps.
- 3) **Question:** *Sheet C-2 indicates to remove a below ground oil separator tank on the project west side of C Wing. Does this tank contain waste oil from the existing automotive garage? What is the size of the below ground oil separator tank?* **Answer:** See specification section 003124. Tank is stated to be a 550 gal. waste oil tank. Refer to Environmental Site Assessment - Phase 1 and other supplemental information in the project documents for further information.
- 4) **Question:** *Sheet C-2 shows underground utility tunnels between B Wing and C Wing and between B Wing and D Wing to be removed. What are the dimensions and depths of the tunnels? Please provide additional sections, details or information about the tunnels.* **Answer:** Between Bldg. B and Bldg. C: Record drawings show 4 water lines (including steam lines) concrete encased along with a gas line and several electrical conduits. Between Bldg. B and Bldg. D: Record drawings show 2 - 2.5" water lines (concrete encased) and 1 electrical conduit. This information has not been confirmed by site investigations.

ADDENDUM #3 (continued)

30 July 2012

Eli Whitney CTHS
Additions and Renovations Project

Page 2 of 15

- 5) **Question:** 1. Please provide a detail for the proposed 20' long concrete ramp with railings noted on drawing C-3. 2. There is a concrete platform at the east side entrance to C Wing. Concrete stairs are shown due to the grading requirements (details 3, 4 on C16). Should there also be a retaining wall with railings? **Answer:** 1. Sketch SK-0.026 is attached detailing ramp. Also see Plan 1 Sheet A-105.1, and Elevation 6 on Sheet A-307. 2. A retaining wall will not be necessary. A 2:1 lawn slope is to be provided between the concrete platform and the bottom of steps.
- 6) **Question:** Specification section 051200, subsection 1.6, A, indicates the installer for the structural steel framing must be an AISC Certified Erector. This certification will limit bidders, may limit or prevent MBE participation, and may add cost. Can the AISC Certified Erector requirement be removed through eliminating specification section 015200, subsection 1.6, A? **Answer:** AISC Certification requirement to remain in order to ensure high standard of quality control for steel fabrication and erection.
- 7) **Question:** Specification section 051200, subsection 1.6, C, indicates the structural steel framing subcontractor must use a shop painting applicator that is qualified according to AISC's Sophisticated Paint Endorsement P1 or SSPC-QP 3, "Standard Procedure for Evaluating Qualifications of Shop Painting Applicators." Many structural steel subcontractors can perform this work in house for less money but do not have this qualification. Can specification section 015200, subsection 1.6, C be eliminated to remove this requirement? This may reduce costs. **Answer:** P1 and SSPC-QP3 qualification requirements shall remain to ensure high standard of quality control for shop painted steel.
- 8) **Question:** Sheet S-105.1 shows a footing at the intersection of grid lines E-14 and E-E labeled F-7.0 suggesting a 7' width and length; however, the footing scales to a larger size close to a 10' width and length. Should this footing be F-7.0 with a 7' width and length as labeled or a larger size as depicted? Please clarify. **Answer:** The footing at E-14/E-E should be F-7.0 (7'-0" x 7'-0" x 1'-8").
- 9) **Question:** Are the seismic clips/CMU top of wall clips described on sheet S-401 only required at new walls of the existing buildings? **Answer:** Masonry clips as shown on 3/S-401 and 5/S-401 are only required at new masonry walls at the existing buildings.
- 10) **Question:** Specification section 083116 Floor Access Door, subsection 2.02, A, appears to describe a vault access door and not the floor hatches. Floor hatches do not appear to be described in the Antinozzi Associates Project Manual. There does not appear to be a floor access door or hatch in the vault rooms C114D or C122B. There is a new floor hatch in the Carpentry Room B108 and Drafting #2 Room B139.
- What model should be used for the floor access hatches shown? Please provide a specification. **Answer:** The Bilco Company Type FR fire rated vault or floor access door specified is the correct specification for the two doors identified in the B-Wing, and the double door identified in the C-Wing.
- 11) **Question:** Geothermal Wells are included in the scope of sitework bid package #31.01. There are no plans that show the layout of the system. Please advise. **Answer:** Clarification - The Building (referred to as the E-House) where the horizontal connection to the well will terminate is shown on Drawing Sheet C-3. All the scope of work, including locating and installing the wells and the termination back to the E-House is outlined in the Section 48 16 14 of the specifications. See the attached revised specification section 48 16 14, issued as part of Addendum #3 for more information.
- 12) **Question:** The Exterior Elevations, sheet A-302 through A-308, use different types of hatching for the exterior wall panels; however, it appears that both hatching types are used for both panel types. Please confirm that panel type 1 should be used in all locations except for where type 2 is labeled and that the labels

ADDENDUM #3 (continued)

30 July 2012

Eli Whitney CTHS
Additions and Renovations Project

Page 3 of 15

- for the panel types are correct. Answer:* As indicated in a boxed note on each sheet, panel type 1 shall be used unless panel type 2 is called out. The label for the panel types are correct.
- 13) **Question:** *Sheet A-110.0 includes Roof Demolition Note 15 which indicates to "Remove Existing Cant Curb Enclosure." Please clarify what a cant curb enclosure is and this scope of work. Is the intent to remove the existing parapet framing? Answer:* The note simply indicates to remove the existing cant and curb construction around the existing steel beam shown in detail 35/A110.7. The existing metal studs on the high parapet are to remain.
- 14) **Question:** *Specification section 074213, subsection 2.5, describes metal liner panels; however it is not clear where these should be installed. Sheet A-303.1 calls for insulated panels at duct penetrations. Should metal liner panels be included at the duct penetrations or any other locations? Please clarify where the metal liner panels should be installed. Answer:* Metal liner panels shall be used at metal soffit systems similar to the one shown on Detail 2/A-541.
- 15) **Question:** *Sheet F-101.1, in the Floor Key Plan, references "D2 Wing Supplemental Bid #2". This is also noted on other sheets. Please confirm that there is no supplemental bid for this project and these references should be deleted. Answer:* Ignore ALL references to Supplemental Bids throughout the documents. There are no Supplemental Bids in this project.
- 16) **Question:** *Please confirm that there are no LEED or other sustainability program requirements for this project Answer:* This project is not a LEED project, therefore there are not LEED specific requirements.
- 17) **Question:** *Have all of the masonry removals and rebuilding scope items required per the Demolition / Renovation Notes on the PCB drawings, sheet PCB-1 through PCB-8, been incorporated into the architectural drawings? Please verify. Answer:* The masonry removals scope of work shown on the PCB drawings, have been in most cases duplicated as material to be removed on the demolition drawings. In addition all the new masonry scope of work, including work shown as replacement for masonry that was abated, is being shown on the new/renovation drawings
- 18) **Question:** *Specification section 085113 subsection 2.1, A, indicates the basis of design for the aluminum windows is Winco model 1450H. On sheet A-920 and A-921, some window types are depicted as the specified 1450H and some are depicted as just 2" x 4 - 1/2" storefront. For example, sheet E-920 depicts type A as 2" x 4 - 1/2" storefront and type A1 as 1450H.*
- a) *Should all aluminum windows be Winco 1450H or should they be as depicted, either 1450H or 2" x 4 - 1/2" storefront? Answer:* A. All Aluminum windows shall meet the requirements or specifications for the model specified.
- b) **Question:** *If we are to proceed with aluminum windows as they are depicted, with both 1450H and 2" x 4 - 1/2" storefront systems, what series vent should be used in the storefront system? Detail 1C/A-922 seems to show a 2 - 1/2" +/- deep vent. Answer:* Vent shall be as dictated by the specified unit.
- c) **Question:** *If we are to proceed with aluminum windows as they are depicted, with both 1450H and 2" x 4 - 1/2" storefront systems, what system should be used where no details are provided? For example, no details are provided at Jr/A-921. Answer:* Systems or components shall be dictated by the specified unit, and shall be similar to details identified on similar window types.

ADDENDUM #3 (continued)

30 July 2012

Eli Whitney CTHS
Additions and Renovations Project

Page 4 of 15

- d) **Question:** *Sheet A-920 shows three different curtain wall face dimensions including a 2" width at AD, 2 - 1/4" width at M and 2 - 1/2" width at O. Is this correct or should the face dimensions be the same? Please clarify.* **Answer:** The face dimension shall be as depicted on the window and curtain wall elevation details.
- 19) *The Roof Insulation Plans, sheet A-110.3 and A-110.4, show the roof slopes. The Graphic Legend shows an area with dots to represent "Tapered Insul." These drawings also show slopes of 1/4" per foot or 1/2" per foot for many roof planes. The structural drawings indicate sloped decks in some locations.*
- a) **Question:** *A. Is tapered insulation required at the areas on sheet A-110.3 and A-110.4 with labels of 1/4" per foot or 1/2" per foot?* **Answer:** Clarification - All new roof framing and new roof deck is shown at 1/2" per foot structural system slope. All existing roof framing and existing roof deck, or new roof deck infill over existing framing system, or new roof deck over new structural framing system within or adjacent to an existing roof system, either have no slope at all, or minimal slopes. In areas where there is a minimal roof deck slope, a 1/4" per foot tapered insulation system is used to obtain a final code compliant 1/2 slope. In areas where there is no roof deck slope, a 1/2" tapered insulation system is used to accomplish a final code compliant 1/2" slope.
- b) **Question:** *B. The "Tapered Insul." symbol is not shown in some areas where we think it may be required. For example, sheet A-110.4 does not show the symbol for tapered insulation at some of the crickets adjacent roof drains or at the D-5, D-6, E3 or E4 roofs. Should tapered insulation only be included where the symbol is used on the drawings? Please review and clarify the locations of tapered insulation.* **Answer:** See SKA-15 and revised drawing Sheet A-110.3 issued as part of Addendum #3 for clarification.
- c) **Question:** *C. The direction of slopes for some crickets is shown but this information is not shown for others. Please show direction of slopes at all crickets and roof areas.* **Answer:** All tapered insulation crickets slope in such a way that allows the arrow (identifying the direction of slope) to be perpendicular to the line indicating the edge of the slope.
- d) **Question:** *D. At roof area C-6 roof drains are shown away from the parapets without a cricket between the drain and the close parapet. Will water pool between these roof drains and the close parapet with the slopes shown? Please clarify.* **Answer:** The water will not pool in the area in question. The low point of the insulation is at the center line of the drains; therefore the elevation of the insulation along the parapet is higher than the elevation at the drain, creating positive slope to the drain from the parapet.
- e) **Question:** *E. Please confirm that tapered insulation should be over 2 layers of 2.5" insulation per General Note 1 as this may create some height issues depending on the responses to the questions above.* **Answer:** The minimum insulation thickness at the drain, and at the lowest point in the tapered insulation system, is 1-1/2" above the roof deck, per the L.P. note in the Graphic Legend.
- 20) **Question:** *The Room Finish Schedule, sheet FI-901 through FI-905, notes for the flooring in various locations to be "S-1", "SH-1" and "Sealer". Are all of these terms meant to note a single concrete floor sealer product or multiple sealer and hardener products? Please indicate the correct floor finishes in the Room Finish Schedule and specify the products* **Answer:** Clarification: Sealer (S-1), and Sealer/Hardener (SH-1) both identify the application of the same product specified in Spec Section 03 53 19.
- 21) **Question:** *Sheet INFO.1, Wall Types, notes impact resistant wallboard for most Type 2 and all Type 3 walls; however, specification section 092116, subsection 2.4, only lists abuse-resistant gypsum wallboard, not impact resistant. Should the abuse-resistant gypsum board described in the specification be used at all*

ADDENDUM #3 (continued)

30 July 2012

Eli Whitney CTHS
Additions and Renovations Project

Page 5 of 15

- locations specified as impact resistant wallboard in the drawings? Please clarify.* **Answer:** Clarification - Abuse Resistant Gypsum Board identified in the specifications is synonymous and interchangeable with the terminology Impact Resistant Wallboard" identified in the drawings.
- 22) **Question:** *Specification section 100000, subsection 2.3, does not specify a model for the flammable liquids storage cabinet. Please provide a model or basis of design for this item.* **Answer:** A. Refer to Drawing A-801.3 for model number and basis of specification for the Flammable Liquid Storage Cabinet.
- 23) **Question:** *Specification section 100000, subsection 2.4, does not specify a model for the corrosive material storage cabinet. Please provide a model or basis of design for this item.* **Answer:** B. Refer to Drawing A-801.3 for model number and basis of specification for the Acid or Corrosive Material Storage Cabinet.
- 24) **Question:** *Sheet A-105.2 indicates to see the specifications for the T.V. Studio curtains in room E209. Please indicate that the T.V. Studio curtains and track are the same as the stage curtains and track or provide a specification.* **Answer:** The curtains in the TV Studio Shall meet the same specification as Spec section Stage Curtains 11 61 43.
- 25) **Question:** *Sheet EQ-106, Shop Equipment Schedule - Cosmetology, shows item 4 as Styling Chair (3'-0" Deep) Belvedere PA12-19CF-LB12FC. The manufacturer has noted that the tops for these chairs have been discontinued and recommends the Hampton styling chairs HP12-19CF-LB12UFC which have the same arms and approximately the same cost and would match the Hampton shampoo chairs. What product should be used for item 4, Styling Chair, on sheet EQ-106, Shop Equipment Schedule - Cosmetology?* **Answer:** Furnish and install the chair specified. During a conversation with Helena Monego - the Belvedere representative, on Friday ((07/27) afternoon, she confirmed the manufacturer will manufacture the specified chair since the order quantity was high enough.
- 26) **Question:** *The existing fire protection system will be demolished and a new fire protection systems will be completed as indicated in the construction documents. Specification section 210000, subsection 1.01, 7, indicates that "Occupied areas shall be operational for the use by the owner at all times during the project..." and that the contractor shall provide all "temporary connections" to maintain the services. Specification section 210000, subsection 3.03, 8, indicates "...until fire-protection needs are supplied by permanent facilities, install and maintain temporary fire-protection facilities of the types needed to protect against reasonably predictable and controllable fire losses." A fire protection note on sheet F-001 also indicates to "ensure that any areas occupied at that time will remain active." The Phasing Plan in the Fusco Project Manual outlines the project phasing. Please confirm that it is required to provide all temporary connections, piping and other work to maintain existing fire sprinkler functions only in areas to be occupied by the school during construction prior to completion of the permanent systems and that temporary fire sprinklers are not required for any construction areas or school areas that don't currently have fire sprinkler systems. (ref. RFI 0.0141)* **Answer:** It is understood that the construction area shall be separated from the owner occupied area (i.e., portions of the school occupied by students and staff) by rated construction, and that existing suppression and detection within the owner occupied area, shall remain function at all times (ref. Building Phasing Dwg. PH-100). Further, it is understood that temporary suppression is not required in the owner occupied area, where such suppression does not currently exist. However, the Construction Manager shall confirm this understanding with the AHJ/Hamden Fire Marshal as part of their overall Phasing Plan. Consistent with the aforementioned understanding, the sprinkler contractor shall provide all temporary connections, piping and other work necessary to maintain those required portions of the sprinkler system within the owner occupied area, functional at all times.

ADDENDUM #3 (continued)

30 July 2012

Eli Whitney CTHS
Additions and Renovations Project

Page 6 of 15

Changes to Bidding Requirements:

- 1) None.

Changes to Specifications:

PROJECT MANUAL VOLUME 2 OF 3

- 1) Section **04 01 20** – Clay Masonry Restoration and Cleaning
 - a) **Question:** *Specifications section 040120, subsection 1.1, A, 3 indicates that all existing and exposed clay masonry surfaces are to be cleaned. Please confirm that all existing and exposed interior and exterior clay masonry surfaces are to be cleaned as indicated in the specification. Answer:* Specification Section 04 01 20, Paragraph 1.1.A.3. - Insert the word "Exterior" between the words "exposed" and "clay."
- 2) Section **04 20 00** – Unit Masonry Assemblies
 - a) **Question:** *Specification Section 042000 pa. 2.2.C describes ground face and split face CMU. Please advise where these units occur. Answer:* See revised specification section 04 20 00 issued as part of Addendum #3.
- 3) Section **05 12 00** – Structural Steel Framing
 - a) **Question:** *Specification Section 051200 pa. 3.4.B2 states that all backing bars or runoff tabs need to be removed. Structural steel note #6 on drawing S-100 states that backing bars and runoff tabs do not need to be removed. Which note is correct? Answer:* Structural Steel Note #6 on S-100 is correct; backing bars and runoff tabs do not need to be removed. In specification Section 051200 Paragraph 3.4.B: Delete item 2: "Remove backing bars or runoff tabs, back gouge, and grind steel smooth." entirely.
- 4) Section **07 62 00** – Sheet Metal Flashing and Trim
 - a) **Question:** *Detail 48/A-110.8 indicates to include "Stone Look Metal Coping" and "Stone Look Metal Brick Cap." Is there a custom color or any other requirements for these items? Please specify the exact products or requirements for these items. Answer:* Specification Section 07 62 00, Paragraph 2.2.B.1.a.5 - Delete the words "Architectural Precast Concrete Panels," after the word "Match," and insert the following in lieu thereof - Ground Face Concrete Masonry Unit Specified, and the manufacturer full spectrum of colors as selected by the Architect."
- 5) Section **08 41 13** – Aluminum-Framed Entrances and Storefronts
 - a) **Question:** *Specification section 084113, subsection 2.1, lists Kawneer as the manufacturer for the basis of design and EFCO Corporation as another manufacturer for the aluminum framed systems. Subsection 2.5, A, 1 indicates for the doors to have an overall thickness of 2 - 1/4"; however, EFCO Corporation's doors are 2" thick. Please confirm that it is acceptable to use EFCO D302 thermal doors that are 2" thick. Answer:* Specification Section 08 41 13, Paragraph 2.5.A.1. - Delete the following, "2-1/4-inch (50.8- to 57.2-mm) overall," and insert the following in lieu thereof: "2-Inch Minimum."
- 6) Section **08 62 00** – Unit Skylights
 - a) **Question:** *Specification section 086200 does not specify the skylight sizes. Answer:* Specification Section 08 62 00 - Paragraph 2.2.C., After the words "Unit Shape & Size", Insert the following "Approximately 4'-0" X 4'-0". Contractor shall verify existing opening in the field."
- 7) Section **08 51 13** – Aluminum Windows

ADDENDUM #3 (continued)

30 July 2012

Eli Whitney CTHS
Additions and Renovations Project

Page 7 of 15

- a) Delete in its entirety, paragraph 2.6.H., in specification section 08 51 13.
- 8) Section **09 30 13** – Ceramic Tile
- a) **Question:** *Specification section 093013, subsection 1.2, A, 5, references waterproof membrane for thin-set tile installations; however, there is no waterproof membrane product listed or installation instructions for this item included in this specification section. Please confirm that no waterproof membrane is required for thin-set tile installations or update the specification and indicate the locations in the drawings.* **Answer:** Specification Section 09 30 13, paragraph 1.2.A.5. - Delete line 5 in its entirety.
- 9) Section **09 66 16** – Terrazzo Tile
- a) **Question:** *Specification section 096616, subsection 2.03, A, 1, indicates for the terrazzo tile to be 3/4" thick and subsection 2.01, 1, 1 lists Wausau Tile as the first acceptable manufacturer; however, Wausau Tile only manufactures 12 x 12 tile that is 3/8" thick rather than the 3/4" specified. Please confirm that 3/8" thick terrazzo tile is acceptable.* **Answer:** In Terrazzo Tile specification section 096616, subsection 2.03-A.-1., remove "Size. 11-15/16" x 11-15/16" x 3/4", 9.5 lbs. (Actual)." and replace with "Size. 11-15/16" x 11-15/16" x 1/2", 6.5 lbs. (Actual)." Adjust all related subsections accordingly based on new tile size.
- On drawings FI-103.2 & FI-103.3, add the following note to all floor areas in Lobby C102B and Corridor C124 (ending at building expansion joint Finish Plan north and at double doors Finish Plan south): "Install 3/8" high cementitious leveler/flash patching over existing concrete floor throughout area as shown prior to installing new floor finish as specified. See floor plans for details associated with existing floor cuts where required to accommodate elevation tie-ins where required. See finish schedule."
- b) **Question:** *Specification section 096616, subsection 3.03, 2, describes a sealer for the terrazzo tile. Wausau Tile is factory finished and sealed with 3 coats of finish. Please confirm that if the terrazzo tile is factory sealed and protected additional field sealing is not required.* **Answer:** In Terrazzo Tile specification section 096616, subsection 3.03-2., add item 2. "Precast tile may be factory-sealed. Submit evidence of factory sealing as specified herein."
- c) **Question:** *Specification section 096616, subsection 3.02, 1, describes methods of setting the terrazzo tile. Subsection 3.02, 1 item 1 and 2 describe thick-set cement mortar bed methods while subsection 3.02, 1 item 3 describes a thin-set method. The terrazzo tile areas do not appear to have depressed slabs. Please confirm that only the thin-set terrazzo tile setting method described under subsection 3.02, 1 item 3 should be used.* **Answer:** In Terrazzo Tile specification section 096616, subsection 3.02-1., remove installation methods 1. and 2. entirely. Thinset setting method (3.) applies for this project.
- 10) Section **11 40 00** – Food Service Equipment
- a) **Question:** *Does the warranty period for this job exceed the typical foodservice warranty which is one year parts and labor and 5 years compressor warranty?* **Answer:** The warranty period identified in the specification section 11400 shall be provided for all Kitchen Equipment
- b) **Question:** *Can the specification for the Walk-In Cooler be expanded to three brands?* **Answer:** Alternate manufacturers for the walk-in coolers and freezers will be accepted with all accessories, options, etc... as noted within the general specifications, itemized specifications and contract drawings. The following manufacturers are acceptable alternates Bally, Kolpak, Norlake and American Panel.
- c) **Question:** *Can the specification for the Hoods be expanded to three brands?* **Answer:** Alternate manufacturers for the exhaust hoods will be accepted with all accessories, options, etc... as noted within the general specifications, itemized specifications and contract drawings. The following manufacturers are acceptable alternates Captive Aire, Caddy and Avtec

ADDENDUM #3 (continued)

30 July 2012

Eli Whitney CTHS
Additions and Renovations Project

Page 8 of 15

- d) **Question:** *Can the specification for the Custom Fabricator be expanded to three brands?* **Answer:** Alternate manufacturers for the custom fabrication will be accepted with all accessories, options, etc... as noted within the general specifications, itemized specifications and contract drawings. The following manufacturers are acceptable alternates All State Fabricators, South Jersey Metal and Low Temp Industries.
- e) **Question:** *Specification section 114000, part 2, item B54 and B55, are indicated to be proof boxes model RPB-1 manufactured by Anets which is no longer available. No alternate products or manufacturers are listed in the specifications. Please specify an available product for item B54 and B55.* **Answer:** Provide Piper Products model RIP-1 with all accessories and options as originally specified.
- f) **Question:** *Specification section 114000, part 2, item L76, L78, L79, and L80 are indicated to be condiment cart model 07360 manufactured by Server Products which is no longer available. No alternate products or manufacturers are listed in the specifications. Please specify an available product for item L76, L78, L79, and L80.* **Answer:** Provide custom fabricated counter with lockable storage below, laminated exterior (as selected by architect), s.s. interior finish with intermediate and bottom shelves and 14 gauge s.s. top. Additional accessories to include (3) pump dispensing unit similar to Server model SET-DI and (2) souffle cup dispensers model SAC. Unit mounted on heavy duty casters, front two with brakes. Shop drawing to be submitted.

11) Section 11 66 23 – Gymnasium Equipment

- a) **Question:** *Elevations C38 and C39/A-803.3 indicates to include wall-mounted safety pads that are 6'-5" high; however, specification section 116623, subsection 2.4, C, 3 indicates to include pads that are 6' high. Should the wall-mounted safety pads be 6'-5" high or 6' high?* **Answer:** Specification Section 11 66 23, Paragraph 2.4.C.3. - After the word "by" delete the following: "72" (1800mm) high," and insert the following in lieu thereof, "Height as indicated on Drawings."

PROJECT MANUAL VOLUME 3 OF 3

1) Section 23 60 00 - Refrigeration

- a) The entire section is to be replaced with revised section, to include the following:
- Added cooling tower filtration section to match flow and control diagram on M-001 where filtration system was already shown.

2) Section 48 16 14 – Geothermal Well Drilling and Horizontal Piping Installation

- a) **Question:** *The location of the E House is noted on Drawing C-3. There is no location noted for the two geothermal wells. Please provide a sketch showing the location. Geothermal well specification requires 50 year warranty. What exactly does the 50 year warranty apply to and what are the conditions?* **Answer:** All the scope of work, including locating and installing the wells and the termination back to the E-House is outlined in the Section 48 16 14 of the specifications. The specifications are clear on warranty requirements. See the attached revised specification section 48 16 14, issued as part of Addendum #3 for more information.

ADDENDUM #3 (continued)

30 July 2012

Eli Whitney CTHS
Additions and Renovations Project

Page 9 of 15

Changes to Drawings:

VOLUME 1 OF 3 – PHASE, CIVIL, ENVIRONMENTAL, HAZARDOUS MATERIAL, DEMOLITION, STRUCTURAL

1) C-1

- a) **Question:** *Sheet C-1, C-2, C-3, C-4, C-5, and C-6 include a graphic scale in the bottom right corner where the distance on the drawings between the labels 0' and 50' is approximately 1" on a full-sized sheet and the distance between 0' and 200' is approximately 3". Please confirm that sheet C-1, C-2, C-3, C-4, C-5, and C-6 should be 50 scale where 1" on a full sized drawing equals 50' for the project site and that the reference to 200' in the graphic scale should be changed to 150'. **Answer:** Plan sheets are 50 scale. The 200' notation should be 150'.*

2) C-2

- a) Revise per answer to Question "a)" from sheet C-1.

3) C-3

- a) Revise per answer to Question "a)" from sheet C-1.

- b) **Question:** *There is some ambiguity regarding the proposed pavement structure.*

1. *Dwg. C-2 Demolition Plan requires removal of all existing bituminous concrete pavement.*

2. *Dwg. C-3 Site Plan identifies "Full Depth Bituminous Concrete Pavement" as dark shaded areas and refers to detail 7/C-9 (full depth bituminous concrete). There are no references or details regarding those paved areas that are not shaded dark.*

3. *Dwg. C-9, paving detail 7/C-9 "Bit. Conc. Pavement for Roadways & Parking Lots" has a pavement structure as follows:*

a. *Gravel subbase for new pavement - 8" minimum*

b. *Processed aggregate base for F.D. pavement to meet proposed grade when using existing base material - 4" minimum.*

c. *Bit. Conc. Class 1 @ parking & roadways - 1 1/2", 2 1/2".*

d. *Bit. Conc. Class 2 @ all areas top course - 1 1/2"*

Please clarify the requirements.

Answer: Demo plan shows all areas where existing bituminous pavement is to be removed.

Areas that are dot-hatched on the amended site layout plan C-3 (attached) will not require new installation of subbase and base (existing base material in place will be used). New base material shall be added to existing base material to achieve proposed grades as needed after the bituminous concrete is removed.

2 1/2" class one shall only be used in areas indicated on the attached sketch 0.070 – Pavement Clarifications.

4) C-4

- a) Revise per answer to Question "a)" from sheet C-1.

5) C-5

- a) Revise per answer to Question "a)" from sheet C-1.

6) C-6

- a) Revise per answer to Question "a)" from sheet C-1.

7) C-16

- a) Revise per answer to Question "b)" from sheet C-3.

ADDENDUM #3 (continued)

30 July 2012

Eli Whitney CTHS
Additions and Renovations Project

Page 10 of 15

8) C-18

- a) **Question:** *Detail 3/C-18 indicates to include granite veneer at the exterior dango pedestal bases. Note 4 indicates to coordinate the type of granite veneer with the artist; however, the type, thickness and finish of granite veneer will affect costs. What type, thickness and finish of granite veneer should be included at the exterior dango pedestal bases?* **Answer:** Sheet C-18 - Delete Note 4 at Detail 3 in its entirety and insert the following in lieu thereof - "All Granite shall be furnished and installed by the Artist. Coordinate Granite Size and Type with Artist to ensure proper construction of concrete base."

9) S-104.2 - Foundation and Slab on Grade Plan – Area D2

- a) **Question:** *Sheet S-104.2 references detail 1/S-210 along column line D-9. Is this correct and if so what are the limits?* **Answer:** Section 3/S210 applies from D-A to D-M along line D-9. Section 1/S210 applies south of line D-M along line D-9. Delete section mark 1/S210 cut between D-A and D-B.

VOLUME 2 OF 3 – ARCHITECTURAL

1) A-101.1 – Area A1 Main Level floor Plan

- a) **Question:** *Sheet A-101.1 shows a 2K wall type for Room A115 and sheet A-101.3 shows a 2K wall type for Room A208 along grid line A-E. Section 1/A-542 is referenced at the 2K wall type in Room A208. INFO.1 defines wall type 2K as metal stud with gypsum board on one side; however, section 1/A-542 shows this wall to be CMU with plaster. Should this wall be type 2K or per section 1/A-542? Please clarify. If section 1/A-542 is correct is the wall in A212 similar?* **Answer:** A-101.1 - Delete the three "2K" partition type symbols at the exterior wall of Room A115, and insert partition type symbol "1A" in lieu thereof. Insert wall section symbol "1/A542" at the exterior wall of Room A115.

2) A101.2 – Area A2 Main Level Floor Plan

- a) **Question:** *Sheet A-101.1 shows a 2K wall type for Room A115 and sheet A-101.3 shows a 2K wall type for Room A208 along grid line A-E. Section 1/A-542 is referenced at the 2K wall type in Room A208. INFO.1 defines wall type 2K as metal stud with gypsum board on one side; however, section 1/A-542 shows this wall to be CMU with plaster. Should this wall be type 2K or per section 1/A-542? Please clarify. If section 1/A-542 is correct is the wall in A212 similar?* **Answer:** A-101.2 - Insert partition type symbol "2M" at the exterior wall of Room A124.

3) A101.3 – Area A1 Upper Level Floor Plan

- a) **Question:** *Sheet A-101.1 shows a 2K wall type for Room A115 and sheet A-101.3 shows a 2K wall type for Room A208 along grid line A-E. Section 1/A-542 is referenced at the 2K wall type in Room A208. INFO.1 defines wall type 2K as metal stud with gypsum board on one side; however, section 1/A-542 shows this wall to be CMU with plaster. Should this wall be type 2K or per section 1/A-542? Please clarify. If section 1/A-542 is correct is the wall in A212 similar?* **Answer:** A-101.3 - Delete the three "2K" partition type symbols at the exterior wall of Room A208, and insert partition type symbol "1A" in lieu thereof.

4) A-101.4 – Area A2 Upper Level Floor Plan

- a) **Question:** *Sheet A-101.1 shows a 2K wall type for Room A115 and sheet A-101.3 shows a 2K wall type for Room A208 along grid line A-E. Section 1/A-542 is referenced at the 2K wall type in Room A208. INFO.1 defines wall type 2K as metal stud with gypsum board on one side; however, section 1/A-542 shows this wall to be CMU with plaster. Should this wall be type 2K or per section 1/A-542? Please clarify. If section 1/A-542 is correct is the wall in A212 similar?* **Answer:** A-101.4 - Insert partition type symbol "2M" at the exterior wall of Room A212 and A213.

5) A-102.2 – Area B2 Main Level Floor Plan

ADDENDUM #3 (continued)

30 July 2012

Eli Whitney CTHS
Additions and Renovations Project

Page 11 of 15

- a) **Question:** *Sheet A-102.2 shows the symbol used for a floor hatch in Storage Room B177; however, no label is provided like at the other locations. Please confirm that there is a floor hatch in A-102.2 and clarify if an existing hatch should remain or if a new hatch should be installed.* **Answer:** Insert the following note: "The existing access hatch cover in B177 shall remain."
- 6) **A-103.3** – Area C3 Main Level Floor Plan
Question: *Detail B/A-103.3 shows a similar but different interior dango pedestal base detail and references detail 3/C-18. This detail indicates that granite veneer is to be completed by the artist.*
i. *Should detail 3/C-18 and detail B/A-103.3 be the same or match more closely?*
ii. *Should the granite veneer at the interior dango pedestal bases be included by the contractor?*
Answer: Sheet A-103.3 - Insert the following note at Detail B: "All Granite shall be furnished and installed by the Artist. Coordinate Granite Size and Type with Artist to ensure proper construction of concrete base."
- 7) **A-303** – Exterior Elevations B Building
a) **Question:** *Specification section 074213, subsection 2.2, A, 1, specifies for the metal wall panels to be zinc-coated (galvanized) 18 gauge steel; however, the exterior elevations, such as elevation 1a/A-303, indicates to provide corrugated aluminum panels. Are the exterior panels the metal wall panels described in specifications section 074213 or is this section for a different application? Please clarify the panel material and gauge for panel type 1 and 2?* **Answer:** Delete the word "Aluminum" anywhere it exist within notes identifying the corrugated metal siding panels, or fascia siding panels on Sheet A-303.
Clarification: Both panel types shall be the 18 gauge G90 Galvanized steel sheet product that is specified in 07 42 13. All roof edge fascias or gravel stops shall remain aluminum products.
b) **Question:** *Sheet A-302 indicates that the base bid should include repointing 11,500 sf of brick veneer including 1,500 sf of brick replacement; however, sheet A-303, A-303.1, A-304 and A-305 indicate to include repointing of only 11,300 sf of brick veneer including 1,000 sf of brick replacement. Are the quantities of brick repointing and replacement correct on sheet A-302 or on sheet A-303, A-303.1, A-304 and A-305?* **Answer:** Sheets A-303 - Delete the numbers "11,300" and "1,000" in the boxed note addressing Brick repointing in the Base Bid, and insert the following numbers in lieu thereof, "11,500" and "1,500."
c) **Question:** *Elevation 4/A304 identifies the exterior veneer as precast concrete and 8x8 brick. Elevation 1/A304 around the corner identifies it as ground face CMU. The same conflict occurs with elevations 3/A306 and 1/A308. Please clarify the construction of these walls.*
Answer: Sheets A-303 - Delete the following phrases in reference to the Art Wall on the south end of the building, "Architectural Concrete Panels" and "4"X16"X32" Pigmented Precast Concrete," and insert the following note in lieu thereof, "4"X16"X16" Ground Face Concrete Masonry Unit."
- 8) **A-303.1** – Exterior Elevations B Building
a) **Question:** *Specification section 074213, subsection 2.2, A, 1, specifies for the metal wall panels to be zinc-coated (galvanized) 18 gauge steel; however, the exterior elevations, such as elevation 1a/A-303, indicates to provide corrugated aluminum panels. Are the exterior panels the metal wall panels described in specifications section 074213 or is this section for a different application? Please clarify the panel material and gauge for panel type 1 and 2?* **Answer:** Delete the word "Aluminum" anywhere it exist within notes identifying the corrugated metal siding panels, or fascia siding panels on Sheet A-303.1.
Clarification: Both panel types shall be the 18 gauge G90 Galvanized steel sheet product that is specified in 07 42 13. All roof edge fascias or gravel stops shall remain aluminum products.
b) **Question:** *Sheet A-302 indicates that the base bid should include repointing 11,500 sf of brick veneer including 1,500 sf of brick replacement; however, sheet A-303, A-303.1, A-304 and A-305 indicate to*

ADDENDUM #3 (continued)

30 July 2012

Eli Whitney CTHS
Additions and Renovations Project

Page 12 of 15

include repointing of only 11,300 sf of brick veneer including 1,000 sf of brick replacement. Are the quantities of brick repointing and replacement correct on sheet A-302 or on sheet A-303, A-303.1, A-304 and A-305? **Answer:** Sheets A-303.1 - Delete the numbers "11,300" and "1,000" in the boxed note addressing Brick repointing in the Base Bid, and insert the following numbers in lieu thereof, "11,500" and "1,500."

- c) **Question:** *Elevation 4/A304 identifies the exterior veneer as precast concrete and 8x8 brick. Elevation 1/A304 around the corner identifies it as ground face CMU. The same conflict occurs with elevations 3/A306 and 1/A308. Please clarify the construction of these walls.*

Answer: Sheets 303.1, - Delete the following phrases in reference to the Art Wall on the south end of the building, "Architectural Concrete Panels" and "4"X16"X32" Pigmented Precast Concrete," and insert the following note in lieu thereof, "4"X16"X16" Ground Face Concrete Masonry Unit."

9) A-304 – Exterior Elevations C Wing

- a) **Question:** *Sheet A-302 indicates that the base bid should include repointing 11,500 sf of brick veneer including 1,500 sf of brick replacement; however, sheet A-303, A-303.1, A-304 and A-305 indicate to include repointing of only 11,300 sf of brick veneer including 1,000 sf of brick replacement. Are the quantities of brick repointing and replacement correct on sheet A-302 or on sheet A-303.1, A-304 and A-305?* **Answer:** Sheets, A-304 - Delete the numbers "11,300" and "1,000" in the boxed note addressing Brick repointing in the Base Bid, and insert the following numbers in lieu thereof, "11,500" and "1,500."

- b) **Question:** *Elevation 4/A304 identifies the exterior veneer as precast concrete and 8x8 brick. Elevation 1/A304 around the corner identifies it as ground face CMU. The same conflict occurs with elevations 3/A306 and 1/A308. Please clarify the construction of these walls.*

Answer: Sheets A-304, - Delete the following phrases in reference to the Art Wall on the south end of the building, "Architectural Concrete Panels" and "4"X16"X32" Pigmented Precast Concrete," and insert the following note in lieu thereof, "4"X16"X16" Ground Face Concrete Masonry Unit."

10) A-305 - Exterior Elevations C Wing

- a) **Question:** *Sheet A-302 indicates that the base bid should include repointing 11,500 sf of brick veneer including 1,500 sf of brick replacement; however, sheet A-303, A-303.1, A-304 and A-305 indicate to include repointing of only 11,300 sf of brick veneer including 1,000 sf of brick replacement. Are the quantities of brick repointing and replacement correct on sheet A-302 or on sheet A-303, A-303.1, A-304 and A-305?* **Answer:** Sheets A-305 - Delete the numbers "11,300" and "1,000" in the boxed note addressing Brick repointing in the Base Bid, and insert the following numbers in lieu thereof, "11,500" and "1,500."

11) A-306 – Exterior Elevation D Wing

- a) **Question:** *Elevation 4/A304 identifies the exterior veneer as precast concrete and 8x8 brick. Elevation 1/A304 around the corner identifies it as ground face CMU. The same conflict occurs with elevations 3/A306 and 1/A308. Please clarify the construction of these walls.*

Answer: Sheets A-306, - Delete the following phrases in reference to the Art Wall on the south end of the building, "Architectural Concrete Panels" and "4"X16"X32" Pigmented Precast Concrete," and insert the following note in lieu thereof, "4"X16"X16" Ground Face Concrete Masonry Unit."

12) A-308 – Exterior Elevations and Building Sections Area D3

- a) **Question:** *Elevation 4/A304 identifies the exterior veneer as precast concrete and 8x8 brick. Elevation 1/A304 around the corner identifies it as ground face CMU. The same conflict occurs with elevations 3/A306 and 1/A308. Please clarify the construction of these walls.*

ADDENDUM #3 (continued)

30 July 2012

Eli Whitney CTHS
Additions and Renovations Project

Page 13 of 15

Answer: Sheets A-308, - Delete the following phrases in reference to the Art Wall on the south end of the building, "Architectural Concrete Panels" and "4"X16"X32" Pigmented Precast Concrete," and insert the following note in lieu thereof, "4"X16"X16" Ground Face Concrete Masonry Unit."

13) A-502 – Wall Sections Wing – A & E

- a) **Question:** *Detail 4/A-502 shows a 2M partition sitting on an existing sill and indicates for existing plaster to remain at the interior and for the plaster to be patched. Should the new 2M wall also receive plaster to match the existing plaster and patch? Please clarify.* **Answer:** Delete the 5/8" Gyp. Bd. Notes at detail 4/A-502, and insert the following note in lieu thereof, "5/8" Thick Type X Fire Rated Gypsum Board Plaster Base with Veneer Plaster Finish (See specs)."

14) A-803.3 – Interior Elevations C Wing

- a) **Question:** *Sheet Elevation C39/A-803.3 shows wall pads only between the two doors at the north wall of the Gymnasium Room C150; however, sheet A-103.2 depicts additional wall pads on the opposite sides of both of these doors and a corner pad at the 4 door jams. Should the locations of the wall-mounted safety pads be per the elevations or plan drawings? Please clarify and coordinate the locations.* **Answer:** Drawing A-803.3 - Detail C39 - Insert the following note: "Install Wall Pads to the extent shown on Floor Plan Drawing A-103.2."

15) A-803.4 – Interior Elevations C Wing

- a) **Question:** *Sheet A-803.4 appears to depict acoustical panels on the walls of Dining Room C151B without labels. Are these acoustical panels and if so are they existing to remain or new? Please clarify.* **Answer:** See the attached revised A-803.4 with acoustical panels labeled.

16) A-904 – Door Types, Frames, Details, & H.M. Window Frames

- a) **Question:** *The Door Schedule, sheet A-901 through A-903, references door frame type "4a" for several door frames including door number A106 as an example. Sheet A-904 does not show an elevation of door frame type "4a" under the metal frame types. Please provide an elevation for door frame type "4a" or remove this type from the Door Schedule.* **Answer:** See Frame Type "4a" per SKA-13 - Revised Metal Frame Type - attached. Adjust various door frame types and head & jamb details in A-Wing per SKA-11 - Revised A-Wing Main Floor Door Schedule (Partial) - and per SKA-12 - Revised A-Wing Upper Floor Door Schedule (Partial) - attached.

17) A-922 – Window head, Jamb, & Sill Details

- a) **Question:** *Specification section 085113, subsection 2.6, item H indicates to provide subframes as shown for the aluminum windows; however, the details do not indicate to provide subframes. Please confirm that specification item H item can be deleted and there are no subframes or revise the details.* **Answer:** Insert the following general note on sheets A-922, A923, and A-924, "Install PVC Frame Fillers, or PVC Caulk Stops at ALL new window frames' at the heads, jambs and sills."
- b) **Question:** *Specification section 085113, subsection 2.1, item A indicates that the aluminum windows basis of design is the Winco model 1450H; however the aluminum window details on sheet A-922 and A-923 show a 4 - 1/2" deep storefront system which is different from the specified model. Please specify a different aluminum window model or update the window details to match the specification.* **Answer:** Insert the following general note on sheets A-922, A923, and A-924, "All Aluminum Window Details shall be 4" deep frames in lieu of the 4-1/2" frames shown."

ADDENDUM #3 (continued)

30 July 2012

Eli Whitney CTHS
Additions and Renovations Project

Page 14 of 15

18) A-923 – Window head, Jamb, & Sill Details

- a) **Question:** *Specification section 085113, subsection 2.6, item H indicates to provide subframes as shown for the aluminum windows; however, the details do not indicate to provide subframes. Please confirm that specification item H item can be deleted and there are no subframes or revise the details.* **Answer:** Insert the following general note on sheets A-922, A923, and A-924, “Install PVC Frame Fillers, or PVC Caulk Stops at ALL new window frames’ at the heads, jambs and sills.”
- b) **Question:** *Specification section 085113, subsection 2.1, item A indicates that the aluminum windows basis of design is the Winco model 1450H; however the aluminum window details on sheet A-922 and A-923 show a 4 - 1/2" deep storefront system which is different from the specified model. Please specify a different aluminum window model or update the window details to match the specification.* **Answer:** Insert the following general note on sheets A-922, A923, and A-924, “All Aluminum Window Details shall be 4” deep frames in lieu of the 4-1/2” frames shown.”
- c) **Question:** *There are numerous conflicting drawings for curved sections of the exterior wall adjacent to the E-H line. Drawing A-105.2 indicates that it is a 1'-3" wall with brick on both the interior and exterior sides. Section 1/A540 shows this to be a 1'-3" wall without brick on the interior side. Detail 7c/A923 shows this wall to be a 1'-4" wall with brick on both sides of a 6" CMU core. The structural drawings indicate that these are 8" CMU shear walls. Please Clarify the construction of these walls.* **Answer:** See revised Plan Detail 7c/A-923, issued as part of Addendum #3 on Sheet SKA-14. Section 1/A-540 is no longer applicable to this detail.

19) A-924 – Elevations Glass Block Panels / Curtainwall Details

- a) **Question:** *Specification section 085113, subsection 2.6, item H indicates to provide subframes as shown for the aluminum windows; however, the details do not indicate to provide subframes. Please confirm that specification item H item can be deleted and there are no subframes or revise the details.* **Answer:** Insert the following general note on sheets A-922, A923, and A-924, “Install PVC Frame Fillers, or PVC Caulk Stops at ALL new window frames’ at the heads, jambs and sills.”
- b) **Question:** *Specification section 085113, subsection 2.1, item A indicates that the aluminum windows basis of design is the Winco model 1450H; however the aluminum window details on sheet A-922 and A-923 show a 4 - 1/2" deep storefront system which is different from the specified model. Please specify a different aluminum window model or update the window details to match the specification.* **Answer:** Insert the following general note on sheets A-922, A923, and A-924, “All Aluminum Window Details shall be 4” deep frames in lieu of the 4-1/2” frames shown.”

VOLUME 3 OF 3 – MECHANICAL, ELECTRICAL, PLUMBING FIRE PROTECTION, SECURITY

1) M-102.2 (sketch SKM 073012-02);

- a) Reconfigured dust collection discharge within the building to prevent noise issues.

2) M-401 (sketch SKM 073012-01);

- a) Revised cooling tower schedule GPM and wet bulb temperature.

ADDENDUM #3 (continued)

30 July 2012

Eli Whitney CTHS
Additions and Renovations Project

Page 15 of 15

Attachments:

- 1) 04 20 00 – Unit Masonry Assemblies
- 2) 23 60 00 – Refrigeration_ADD-03
- 3) 48 16 14 - Geothermal Well Drilling and Horizontal Piping Installation_ADD 03
- 4) Drawing SK-0.026 – Concrete Ramp Detail
- 5) Drawing SK-0.070 – Pavement Clarifications
- 6) Drawing SKA-11 – Revised A-Wing Main Floor Door Schedule (Partial)
- 7) Drawing SKA-12 – Revised A-Wing Upper Floor Door Schedule (Partial)
- 8) Drawing SKA-13 – Revised Metal Frame Type
- 9) Drawing SKA-14 – Revised Curtainwall Jamb Detail
- 10) Drawing SKA-15 – Revised Wing "C3", "B1", "B2", "D1", "D2" And "D3" Roof Insulation Plan (Partial)
- 11) C-3 – Site Plan
- 12) A-110.3 – Wing "C1", "C2", "A1", "A2", And "E" Roof Insulation Plan
- 13) A-803.4 - Interior Elevations C Wing
- 14) Sketch SKM-073012-01 – Revised mechanical schedule sheet
- 15) Sketch SKM-073012-02 – Revised mechanical plan

END OF ADDENDUM #3

SECTION 04 20 00 - UNIT MASONRY ASSEMBLIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

This Section includes unit masonry assemblies consisting of the following:

1. Brick Masonry Units.
2. Concrete Masonry Units.
3. Mortar and grout.
4. Reinforcing steel.
5. Masonry joint reinforcement.
6. Ties and anchors.
7. Embedded flashing.
8. Miscellaneous masonry accessories.
9. Expansion / Control Joint Materials
10. Cavity-wall insulation.
11. Field Applied Water Repellant Coating

- B. Related Sections include the following:

1. Division 7 Section "Bituminous Dampproofing" for dampproofing applied to cavity face of backup wythes of cavity walls.
2. Division 7 Section "Sheet Metal Flashing and Trim" for exposed sheet metal flashing.
3. Division 7 Section "Through-Penetration Firestop Systems" for firestopping at openings in masonry walls.
4. Division 7 Section "Fire-Resistive Joint Systems" for firestopping at tops of masonry walls.
5. Division 8 Section "Louvers and Vents" for wall vents (brick vents).

- C. Products furnished, but not installed, under this Section include the following:

1. Anchor sections of adjustable masonry anchors for connecting to structural frame, installed under Division 5 Section "Structural Steel."

- D. Products installed, but not furnished, under this Section include the following:

1. Steel lintels and shelf angles for unit masonry, furnished under Division 5 Section "Metal Fabrications."

2. Manufactured reglets in masonry joints for metal flashing, furnished under Division 7 Section "Sheet Metal Flashing and Trim."
3. Hollow-metal frames in unit masonry openings, furnished under Division 8 Section "Steel Doors and Frames."

1.3 DEFINITIONS

- A. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.4 PERFORMANCE REQUIREMENTS

- A. Provide unit masonry that develops the following net-area compressive strengths (f_m) at 28 days.
- B. Determine compressive strength of masonry from net-area compressive strengths of masonry units and mortar types according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.
- C. Exterior Concrete Masonry Units: ASTM C-90, Type 1 Moisture Controlled.

1.5 SUBMITTALS

- A. Product Data: For each different masonry unit, accessory, and other manufactured product specified.
- B. Shop Drawings: Show fabrication and installation details for the following:
 1. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement." Show elevations of reinforced walls.
 2. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.
- C. Samples for Initial Selection: For the following:
 1. Unit masonry Samples in small-scale form showing the full range of colors and textures available for each different exposed masonry unit required.
 2. Colored mortar Samples showing the full range of colors available.
- D. Samples for Verification: For the following:
 1. Full-size units for each different exposed masonry unit required, showing the full range of exposed colors, textures, and dimensions to be expected in the completed construction.
 2. Colored mortar Samples for each color required, showing the full range of colors expected in the finished construction. Make samples using the same sand and mortar ingredients to be used on Project. Label Samples to indicate types and amounts of pigments used.
 3. Weep holes/vents in color to match mortar color.
 4. Accessories embedded in the masonry.

- E. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.
1. Submittal is for information only. Neither receipt of list nor approval of mockup constitutes approval of deviations from the Contract Documents, unless such deviations are specifically brought to the attention of the Architect and approved in writing.
- F. Qualification Data: For firms and persons specified in "Quality Assurance" Article.
- G. Material Test Reports: From a qualified testing agency indicating and interpreting test results of the following for compliance with requirements indicated:
1. Each type of masonry unit required.
 - a. Include size-variation data, verifying that actual range of sizes falls within specified tolerances.
 - b. Include test results, measurements, and calculations establishing net-area compressive strength of masonry units.
 2. Mortar complying with property requirements of ASTM C 270.
 3. Grout mixes complying with compressive strength requirements of ASTM C 476. Include description of type and proportions of grout ingredients.
- H. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:
1. Each type of masonry unit required.
 - a. Include size-variation data for brick, verifying that actual range of sizes falls within specified tolerances.
 - b. Include test data, measurements, and calculations establishing net-area compressive strength of masonry units.
 2. Each cement product required for mortar and grout, including name of manufacturer, brand, type, and weight slips at time of delivery.
 3. Each combination of masonry unit type and mortar type. Include statement of net-area compressive strength of masonry units, mortar type, and net-area compressive strength of masonry determined according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.
 4. Each material and grade indicated for reinforcing bars.
 5. Each type and size of joint reinforcement.
 6. Each type and size of anchor, tie, and metal accessory.
- I. Cold-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with cold-weather requirements.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1093 to conduct the testing indicated, as documented according to ASTM E 548.
- B. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, through one source from a single manufacturer for each product required.
- C. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source or producer for each aggregate.
- D. Fire-Resistance Ratings: Where indicated, provide materials and construction identical to those of assemblies with fire-resistance ratings determined per ASTM E 119 by a testing and inspecting agency, by equivalent concrete masonry thickness, or by another means, as acceptable to authorities having jurisdiction.
- E. Sample Panels: Before installing unit masonry, build sample panels, using materials indicated for the completed Work, to verify selections made under sample Submittals and to demonstrate aesthetic effects. Build sample panels for each type of exposed unit masonry assembly in sizes approximately 48 inches long by 48 inches high by full thickness.
 - 1. Locate panels in the locations indicated or, if not indicated, as directed by Architect.
 - 2. Clean exposed faces of panels with masonry cleaner indicated.
 - 3. Protect approved sample panels from the elements with weather-resistant membrane.
 - 4. Maintain sample panels during construction in an undisturbed condition as a standard for judging the completed Work.
 - 5. Approval of sample panels is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; aesthetic qualities of workmanship; and other material and construction qualities specifically approved by Architect in writing.
 - a. Approval of sample panels does not constitute approval of deviations from the Contract Documents contained in sample panels, unless such deviations are specifically approved by Architect in writing.
 - 6. Demolish and remove sample panels when directed.
- F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings."

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

1. Protect Type I concrete masonry units from moisture absorption so that, at the time of installation, the moisture content is not more than the maximum allowed at the time of delivery.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- D. Deliver preblended, dry mortar mix in moisture-resistant containers designed for lifting and emptying into dispensing silo. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.
- E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.8 PROJECT CONDITIONS

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
 1. Extend cover a minimum of **24 inches (600 mm)** down both sides and hold cover securely in place.
 2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of **24 inches (600 mm)** down face next to unconstructed wythe and hold cover in place.
- B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.
- C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
 1. Protect base of walls from rain-splashed mud and from mortar splatter by coverings spread on ground and over wall surface.
 2. Protect sills, ledges, and projections from mortar droppings.
 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
 4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
- D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

1. Do not lay masonry when atmospheric temperature is below 32 degrees F on a rising temperature, or below 40 degrees F. on a falling temperature, unless approved provisions are made for heating materials and protecting work.
 2. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is **40 deg F (4 deg C)** and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.
- E. Hot-Weather Requirements: Protect unit masonry work when temperature and humidity conditions produce excessive evaporation of water from mortar and grout. Provide artificial shade and wind breaks and use cooled materials as required.
1. When ambient temperature exceeds **100 deg F (38 deg C)**, or **90 deg F (32 deg C)** with a wind velocity greater than **8 mph (13 km/h)**, do not spread mortar beds more than **48 inches (1200 mm)** ahead of masonry. Set masonry units within one minute of spreading mortar.

PART 2 - PRODUCTS

2.1 BRICK MASONRY

- A. General: Provide shapes indicated and as follows for each form of brick required:
1. Provide units without cores or frogs and with exposed surfaces finished for ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces.
- B. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.
1. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.
 2. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.
 3. Provide special shapes for outside corners which are less than or more than 90 degrees.
 4. For brick installed within interior of building, provide bullnose units for outside corners.
- C. Face Brick: ASTM C 216, Grade SW, Type FBS, and as follows:
1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of **3000 psi (20.7 MPa)**.
 2. Initial Rate of Absorption: Less than **20 g/30 sq. in. (20 g/194 sq. cm)** per minute when tested per ASTM C 67.
 3. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
 4. Surface Coloring: Brick with surface coloring, other than flashed or sand-finished brick, shall withstand 50 cycles of freezing and thawing per ASTM C 67 with no observable difference in the applied finish when viewed from **10 feet (3 m)**.

5. Size: Manufactured to the following actual dimensions:
 - a. Modular: 3-5/8 inches wide by 2-1/4 inches high by 7-5/8 inches long.
 - b. Economy: 3-5/8 inches wide by 3-5/8 inches high by 7-5/8 inches long.
 6. Application: Use where brick is exposed, unless otherwise indicated.
 7. Color and Texture: Match Architect's samples.
 8. Basis-of-Design Product: Subject to compliance with requirements, provide the following products as distributed by Tri-State Brick of Connecticut, Inc:
 - a. Type A: Product of Endicott Clay Co. – Coppertone
 - b. Type B: Product of Mutual Materials Co. – Ebony
 - c. Type C: Product of Cloud Ceramics – Cloud Sahara LT Buff
 - d. Type D: Product of Taylor Clay Products, Inc. – Taylor 301 White
 - e. Type E: Product of Taylor Clay Products, Inc. – Pearl Gray
 - f. Type F: Product of Endicott Clay Products – Endicott Desert Iron Spot Smooth
 - g. Type G: Product of Watsontown Brick Co. – Watsontown Pennwine
 9. Additional acceptable Face Brick includes products comparable to those of Tri-State Brick of CT as distributed by the following:
 - a. Consolidated Brick Company
 - b. Mack Brick Company
- D. Common Brick: (for use in concealed areas only)
1. Manufacturer: Any of the above manufacturers meeting ASTM C62 or C216.
 2. Materials:
 - a. Finish & Color: Not important
 - b. Standards: ASTM C62 or C216 or above brick types, Grade SW
 3. Assembly:
 - a. Size: Match face brick size supplied or module
 - b. Core: Optional

- E. Salvage of Existing Brick: (where new openings or modifications are made to existing building)
Salvage existing brick where applicable to obtain a uniform appearance at connections.

2.2 CONCRETE MASONRY UNITS

- A. General: Provide shapes indicated and as follows:

1. Provide special shapes for lintels, corners, jambs, sash, control joints, headers, bonding, and other special conditions.
2. Provide bullnose units for outside corners, except where scheduled to receive ceramic tile or unless otherwise indicated.

- B. Concrete Masonry Units: (CMU) ASTM C 90 and as follows:

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of **1900 psi**.
2. Weight Classification: Lightweight, unless otherwise indicated.
3. Provide Type I, moisture-controlled units.
4. Size (Width): Manufactured to the following dimensions:
 - a. **4 inches (102 mm)** nominal; **3-5/8 inches (92 mm)** actual.
 - b. **6 inches (152 mm)** nominal; **5-5/8 inches (143 mm)** actual.
 - c. **8 inches (203 mm)** nominal; **7-5/8 inches (194 mm)** actual.
 - d. **10 inches (254 mm)** nominal; **9-5/8 inches (244 mm)** actual.
 - e. **12 inches (305 mm)** nominal; **11-5/8 inches (295 mm)** actual.
5. Exposed Faces: Manufacturer's standard color and texture, unless otherwise indicated.
 - a. Where units are to be left exposed, provide color and texture matching the range represented by Architect's sample.
6. Provide units bearing U.L. label for use in fire-resistance rated walls and partitions.

C. Ground Face Concrete Masonry Units:

1. **Basis of design product:** The design of the Ground Face Concrete Masonry Units is based the following product as manufactured by:
 - a. **Trendstone by Trenwyth Industries.**
 - b. **Other acceptable manufacturer:**
 - 1) **Westbrook Concrete Block Co. Inc.**
 - 2) **Clayton Block**
 - 3) **A. Jandris & Sons, Inc..**
2. **Provide outside corner, head and sill ground face blocks in special shapes and sizes indicated on drawings and as required for smooth transitions around corners.**

3. Provide colors and textures as selected from the manufacturers full spectrum of colors for that product type, and as selected by the Architect..
4. All colored CMU's shall be produced in one continuous production run as per ASTM C90-(latest revision), Grade N, Type 1 moisture controlled.
5. **Ground Face Block:** Smooth ground face finish, ASTM C-331, with ASTM C-150 Portland cement. Units to be manufactured with integral water repellent, Dry-Block or approved equal.
 - a. 3-5/8" x 15-5/8" x 15-5/8" Block

D. Insulated Concrete Masonry Units:

1. Provide insulation inserts at all single wythe exterior masonry walls. Insulation for concrete masonry units shall be:
 - a. KORFIL Block Insulation or ICON Universal Insulation Inserts as manufactured by Concrete Block Insulating Systems, Inc. The expanded polystyrene shall be individually molded to have a minimum density of 1.0 P.C.F., and shall conform to ASTM C578-02 Standard Type 1. Used for corner and construction joint concrete block were Hi-R insulation can not be used.
 - b. HI-R Universal Insulation Inserts as manufactured by Concrete Block Insulating Systems, Inc. The expanded polystyrene shall be individually molded to have a minimum density of 1.3. P.C.F., and shall conform to ASTM C 578-04a, Type X, replacing Federal Specifications HH-I-524C, Specification for Rigid Cellular Polystyrene Thermal Insulation.

2.3 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color as selected from manufacturer's standard colors.
- B. Hydrated Lime: ASTM C 207, Type S.
- C. Portland Cement-Lime Mix: Packaged blend of Portland cement complying with ASTM C 150, Type I or Type III, and hydrated lime complying with ASTM C 207.
 1. For pigmented mortar, use a colored cement formulation as required to produce the color as selected from manufacturer's standard formulations.
 - a. Pigments shall not exceed 10 percent of Portland cement by weight for mineral oxides nor 2 percent for carbon black.
- D. Aggregate for Mortar: ASTM C 144; except for joints less than 1/4 inch (6.5 mm) thick, use aggregate graded with 100 percent passing the No. 16 (1.18-mm) sieve.

- E. Aggregate for Grout: ASTM C 404.
- F. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes. Use only pigments with a record of satisfactory performance in masonry mortar.
- G. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494, Type C, and recommended by the manufacturer for use in masonry mortar of composition indicated.
- H. Water: Potable.
- I. Water-Repellent Admixture: Provide liquid water-repellent mortar admixture for use with all concrete masonry units with integral water-repellent.
- J. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
- K. Products: Subject to compliance with requirements, provide one of the following:
 - 1. Mortar Pigments:
 - a. True Tone Mortar Colors; Davis Colors.
 - b. Centurion Pigments; Lafarge Corporation.
 - c. SGS Mortar Colors; Solomon Grind-Chem Services, Inc.
 - 2. Cold-Weather Admixture:
 - a. Accelguard 80; Euclid Chemical Co.
 - b. Morseled; W. R. Grace & Co., Construction Products Division.
 - c. Trimix-NCA; Sonneborn, Div. of ChemRex, Inc.

2.4 REINFORCING STEEL

- A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M; ASTM A 616/A 616M, including Supplement 1; or ASTM A 617/A 617M, **Grade 60 (Grade 400)**.

2.5 MASONRY JOINT REINFORCEMENT

- A. General: ASTM A 951 and as follows:
 - 1. Hot-dip galvanized, carbon-steel wire for both interior and exterior walls.
 - 2. Wire Size for Side Rods: W2.8 or **0.188-inch (4.8-mm)** diameter.
 - 3. Wire Size for Cross Rods: W2.8 or **0.188-inch (4.8-mm)** diameter.
 - 4. Provide in lengths of not less than **10 feet (3 m)**, with prefabricated corner and tee units where indicated.
- B. For single-wythe masonry, provide either ladder or truss type with single pair of side rods and cross rods spaced not more than **16 inches (407 mm)** o.c.

- C. For multiwythe masonry, provide types as follows:
1. Adjustable (2-piece) type with single pair of side rods and cross ties spaced not more than **16 inches (407 mm)** o.c. and with separate adjustable veneer ties engaging the cross ties. Cross ties are either U-shaped with eyes or rectangular. Space side rods for embedment within each face shell of backup wythe and size adjustable ties to extend at least halfway through outer wythe but with at least **5/8-inch (16-mm)** cover on outside face.
 - a. Use where indicated and where horizontal joints of facing wythe do not align with those of backup wythe.
 - b. Use where facing wythe is of different material than backup wythe.

2.6 TIES AND ANCHORS, GENERAL

- A. General: Provide ties and anchors, specified in subsequent articles, made from materials that comply with this Article, unless otherwise indicated.
- B. Hot-Dip Galvanized Carbon-Steel Wire: ASTM A 82; with ASTM A 153, Class B-2 coating.
- C. Steel Sheet, Galvanized after Fabrication: ASTM A 366/A 366M cold-rolled, carbon-steel sheet hot-dip galvanized after fabrication to comply with ASTM A 153.
- D. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

2.7 ADJUSTABLE ANCHORS FOR CONNECTING TO STEEL FRAME

- A. General: Provide two-piece assemblies that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
 1. Anchor Section: Crimped **1/4-inch- (6.4-mm-)** diameter, hot-dip galvanized steel wire anchor section for welding to steel.
 2. Tie Section: Triangular-shaped wire tie, sized to extend within **1 inch (25 mm)** of masonry face, made from **0.25-inch- (6.4-mm-)** diameter, hot-dip galvanized steel wire.

2.8 ADJUSTABLE MASONRY-VENEER ANCHORS

- A. General: Provide two-piece assemblies that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall, for attachment over sheathing to wood or metal studs, and as follows:
 1. Structural Performance Characteristics: Capable of withstanding a **100-lbf (445-N)** load in both tension and compression without deforming or developing play in excess of **0.05 inch (1.3 mm)**.
- B. Screw-Attached, Masonry-Veneer Anchors: Units consisting of a wire tie section and a metal anchor section complying with the following requirements:
 1. Anchor Section: Sheet metal plate with screw holes top and bottom and with raised rib-stiffened strap stamped into center to provide a slot between strap and plate for connection of wire tie.

- a. Plate 1-1/4 inches (32 mm) wide by 6 inches (150 mm) long with strap 5/8 inch (16 mm) wide by 3-5/8 inches (92 mm) long; slot clearance formed between face of plate and back of strap shall not exceed diameter of wire tie by more than 1/32 inch (0.8 mm).
 2. Wire Tie Section: Triangular- shaped wire tie sized to extend at least halfway through veneer but with at least 5/8-inch (16-mm) cover on outside face.
 3. Fabricate sheet metal anchor sections and other sheet metal parts from 0.0966-inch- (2.5-mm-) thick, steel sheet, galvanized after fabrication.
 4. Fabricate wire tie sections from 0.1875-inch- (4.8-mm-) diameter, hot-dip galvanized steel wire.
- C. Steel Drill Screws for Steel Studs: ASTM C 954 except manufactured with hex washer head and neoprene washer, No. 10 (4.8-mm) diameter by length required to penetrate steel stud flange by not less than 3 exposed threads, and with the following corrosion protective coating:
1. Organic polymer coating with salt-spray resistance to red rust of more than 800 hours per ASTM B 117.
- D. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
- E. Products: Subject to compliance with requirements, provide one of the following:
1. Screw-Attached, Masonry-Veneer Anchors:
 - a. D/A 210 with D/A 700-708; Dur-O-Wal, Inc.
 - b. 315-D with 316; Heckman Building Products, Inc.
 - c. DW-10-X; Hohmann & Barnard, Inc.
 2. Organic-Polymer-Coated, Steel Drill Screws:
 - a. Dril-Flex; Elco Industries, Inc.
 - b. Traxx; ITW-Buildex.
- F. Z-tie Type Anchors: 9 gage Z-ties at each vertical joint of soap units covering steel lintels / beams. Weld Z-ties to web of steel beam.
- 2.9 EMBEDDED FLASHING MATERIALS
- A. Metal Flashing: Fabricate from the following metal complying with requirements specified in Division 7 Section "Sheet Metal Flashing and Trim" and below:
1. Stainless Steel: 0.0156 inch (0.4 mm) thick.
 2. Fabricate through-wall metal flashing embedded in masonry from sheet metal indicated above and with ribs at 3-inch (75-mm) intervals along length of flashing to provide an integral mortar bond.

3. Fabricate metal expansion-joint strips from sheet metal indicated above, formed to shape indicated.
 4. Fabricate metal drip edges from sheet metal indicated above. Extend at least **3 inches (75 mm)** into wall and **1/2 inch (13 mm)** out from wall, with a hemmed outer edge bent down 30 degrees.
 5. Fabricate metal flashing terminations from sheet metal indicated above. Extend at least **3 inches (75 mm)** into wall and out to exterior face of wall. At exterior face of wall, bend metal back on itself for **3/4 inch (19 mm)** and then down into joint **3/8 inch (10 mm)** to form a stop for retaining sealant backer rod.
- B. Contractor's Option for Concealed Flashing: For flashing partly exposed to the exterior, use metal flashing specified above. For flashing not exposed to the exterior, use the following, unless otherwise indicated:
1. Copper-Laminated Flashing: Manufacturer's standard laminated flashing consisting of **5-oz./sq. ft. (1.5-kg/sq. m)** sheet copper bonded with asphalt between 2 layers of glass-fiber cloth. Use only where flashing is fully concealed in masonry.
- C. Solder and Sealants for Sheet Metal Flashings: As specified in Division 7 Section "Sheet Metal Flashing and Trim."
- D. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by the flashing manufacturer for bonding flashing sheets to each other and to substrates.
- E. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
- F. Products: Subject to compliance with requirements, provide one of the following:
1. Copper-Laminated Flashing:
 - a. Copper Fabric Flashing; Advanced Building Products, Inc.
 - b. Copper Fabric; AFCO Products, Inc.
 - c. H & B C-Fab Flashing; Hohmann & Barnard, Inc.
 - d. Type FCC-Fabric Covered Copper; Phoenix Building Products.
 - e. Copper Fabric Flashing; Polytite Manufacturing Corp.
 - f. Copper Fabric Flashing; Sandell Manufacturing Co., Inc.
 - g. York Copper Fabric Flashing; York Manufacturing, Inc.
- G. Single wythe walls: Use end dam flashings at ends of all lintels and wall penetrations.
- 2.10 MISCELLANEOUS MASONRY ACCESSORIES
- A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene, urethane, or PVC.
 - B. Preformed Control-Joint Gaskets: Material as indicated below, designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

1. Styrene-Butadiene-Rubber Compound: ASTM D 2000, Designation M2AA-805.
 2. PVC: ASTM D 2287, Type PVC-65406.
- C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).
- D. Rectangular Plastic Weep/Vent
1. Tubing: color to match grout, **3/8 by 1-1/2 by 3-1/2 inches (9 by 38 by 89 mm)**.
 2. Mesh type: color to match grout, **3/8 by 1-1/2 by 3-1/2 inches (9 by 38 by 89 mm)**.
- E. Cavity Drainage Material: **2-inch** thick, free-draining mesh; made from polyethylene strands and dovetail shaped to avoid being clogged by mortar droppings.
- F. Available Products: Subject to compliance with requirements, cavity drainage materials that may be incorporated into the Work include, but are not limited to, the following:
- G. Products: Subject to compliance with requirements, provide one of the following:
1. Weep Hole/Vent:
 - a. #342 W/S; Hohmann & Barnard, Inc.
 - b. CavClear @ www.cavclear.com
 2. Cavity Drainage Material:
 - a. Mortar Net; Mortar Net USA, Ltd.
 - b. CavClear @ www.cavclear.com

2.11 CAVITY-WALL INSULATION

- A. Extruded-Polystyrene Board Insulation: Rigid, cellular, polystyrene thermal insulation with closed cells and integral high-density skin; formed by the expansion of polystyrene base resin in an extrusion process to comply with ASTM C 578, Type IV.
- B. Adhesive: Type recommended by insulation board manufacturer for application indicated.

2.12 MASONRY CLEANERS

- A. Job-Mixed Detergent Solution: Solution of **1/2-cup (0.14-L)** dry measure tetrasodium polyphosphate and **1/2-cup (0.14-L)** dry measure laundry detergent dissolved in **1 gal. (4 L)** of water.
- B. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.
1. Available Products: Subject to compliance with requirements, products that may be used to clean unit masonry surfaces include, but are not limited to, the following:
 2. Products: Subject to compliance with requirements, provide one of the following:

- a. Cleaners for Red and Light-Colored Brick Not Subject to Metallic Staining with Mortar Not Subject to Bleaching:
 - 1) 202 New Masonry Detergent; Diedrich Technologies, Inc.
 - 2) Sure Klean No. 600 Detergent; ProSoCo, Inc.

- b. Cleaners for Red and Dark-Colored Brick Not Subject to Metallic Staining:
 - 1) 200 Lime Solv; Diedrich Technologies, Inc.
 - 2) Sure Klean No. 101 Lime Solvent; ProSoCo., Inc.

- c. Cleaners for Brick Subject to Metallic Staining:
 - 1) 202V Vana-Stop; Diedrich Technologies, Inc.
 - 2) Sure Klean Vana Trol; ProSoCo, Inc.

2.13 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.
 - 1. Do not use calcium chloride in mortar or grout.
 - 2. Add cold-weather admixture (if used) at the same rate for all mortar, regardless of weather conditions, to ensure that mortar color is consistent.

- B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in the form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

- C. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification.
 - 1. Extended-Life Mortar for Unit Masonry: Mortar complying with ASTM C 1142 may be used instead of mortar specified above, at Contractor's option.
 - 2. Limit cementitious materials in mortar to portland cement and lime.
 - 3. For masonry below grade, in contact with earth, and where indicated, use Type M.
 - 4. For reinforced masonry and where indicated, use Type S.
 - 5. For interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type N.
 - 6. Water-Repellent Admixture: Provide liquid water-repellent mortar admixture for use with all concrete masonry units with integral water-repellent. Mortar admixture to match product used for concrete masonry units.

- D. Pigmented Mortar: Select and proportion pigments with other ingredients to produce color required. Limit pigments to the following percentages of cement content by weight:
 - 1. For mineral-oxide pigments and portland cement-lime mortar, not more than 10 percent.
 - 2. For carbon-black pigment and portland cement-lime mortar, not more than 2 percent.
 - 3. Color: as selected by Architect from manufacturer's complete line of colors.

- E. Grout for Unit Masonry: Comply with ASTM C 476.
 - 1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 5 of ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
 - 2. Provide grout with a slump of **8 to 11 inches (200 to 280 mm)** as measured according to ASTM C 143.

2.14 SOURCE QUALITY CONTROL

- A. Owner will engage a qualified independent testing agency to perform source quality-control testing indicated below:
 - 1. Payment for these services will be made by Owner.
 - 2. Retesting of materials failing to meet specified requirements shall be done at Contractor's expense.
- B. Concrete Masonry Unit Tests: For each type of concrete masonry unit indicated, units will be tested according to ASTM C 140.

2.15 EXPANSION / CONTROL JOINT MATERIALS

- A. Expansion/Control Joints for Concrete Masonry Walls: (intended primarily for use between backup walls and within other masonry walls where joints are required; space expansion joints maximum 50'-0" o.c. interior walls and 35'-0" o.c. in exterior walls.)
 - 1. Manufacturer shall be equal to:
 - a. Dur-O-Wal rapid control joint for block thickness used. D/A 2000 to D/A 2007 as needed
 - b. Hohmann & Barnard, Inc. – Standard to wide flange VS1118 as needed
 - c. AA Wire Products – AA-2000 or AA-2005 as needed
 - d. National Wire Products – Ty-Wal PVC 001 to PVC 012 as needed
 - e. Everlastic – Slot seal and slot seal wide flange as applicable
 - f. Wire Bond - #2901/2902/2903 PVC joints as needed
 - 2. Materials: Resilient control joint fillers shall be a regular or wide flange (full block width) factory molded product of rubber conforming to ASTM D-2000 (2AA-805) with a compressible neoprene compound edge conforming to ASTM 2BC-310 C12 with a durometer hardness of 30. Cross members shall maintain block wall alignment.
- B. Expansion/Control Joints for Brick Walls: Intended for use primarily in exterior exposed masonry walls and/or as shown on drawings. Space face brick control joints at maximum of 30'-0" o.c. or as shown.
 - 1. Manufacturer shall be equal to:
 - a. Williams Products Company – Neo-Seal IV neoprene control joint or closed cell sponge neoprene Type NNI, or Neo-Seal IV extruded control joints.

- b. Emseal USA Inc. – Polyurethane with oxidized asphalt. Provide back-up and caulk joint where exposed per Division 7.
- c. Will-Seal – Construction Foams (Div. Illbruck):
 - 1) 250 black – below grade
 - 2) 150 gray – above grade
 - 3) 50/50 membrane sealant system – large joints
- d. AA Wire Products – AA3400 Will Seal or AA3405 Joint Tite, AA3410 Joint Tite
- e. Wire Bond – Horizontal or vertical expansion joint
- f. Hohmann & Barnard – Closed cell in panels 3” wide x ¼”, ⅜” or ½” thick x length needed.
- g. Dur-O-Wal – D/A 2010 Rapid Soft Joint

2.16 FIELD APPLIED WATER REPELLANT COATING

- A. Penetrating Water Repellent: Clear, consisting of 1 or several different resins (silanes or siloxanes), polymers, stearates, or oils plus other compounds or products of components; and with 3.3 lb/gal. (400 g/L) or less of VOCs.
 - 1. Available Products:
 - a. Hydrozo, a division of ChemRex; Enviroseal Double 7 HD (Basis of Design)
 - b. L&M Construction Chemicals, Inc.; Aquapel Plus.
 - c. Textured Coatings of America, Inc.; Rainstopper 100.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
 - 1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance.
 - 2. Verify that foundations are within tolerances specified.
 - 3. Verify that reinforcing dowels are properly placed.
 - 4. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Before installation, examine rough-in and built-in construction to verify actual locations of piping connections.

3.2 INSTALLATION, GENERAL

- A. Thickness: Build cavity and composite walls and other masonry construction to the full thickness shown. Build single-wythe walls to the actual widths of masonry units, using units of widths indicated.

- B. Build chases and recesses to accommodate items specified in this Section and in other Sections of the Specifications.
- C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to the opening.
- D. Cut masonry units with motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide a continuous pattern and to fit adjoining construction. Where possible, use full-size units without cutting. Allow units cut with water-cooled saws to dry before placing, unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
- E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.
 - 1. Mix units from several pallets or cubes as they are placed.
- F. Field applied water repellent coating: Upon completion of all exterior concrete masonry unit walls, apply two coats of clear water repellent sealer as specified. Apply sealer per manufactures' recommendation.

3.3 CONSTRUCTION TOLERANCES

- A. Comply with tolerances in ACI 530.1/ASCE 6/TMS 602 and the following:
- B. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than **1/4 inch in 20 feet (6 mm in 6 m)**, nor **1/2 inch (12 mm)** maximum.
- C. For vertical alignment of exposed head joints, do not vary from plumb by more than **1/4 inch in 10 feet (6 mm in 3 m)**, nor **1/2 inch (12 mm)** maximum.
- D. For conspicuous horizontal lines, such as exposed lintels, sills, parapets, and reveals, do not vary from level by more than **1/4 inch in 20 feet (6 mm in 6 m)**, nor **1/2 inch (12 mm)** maximum.
- E. For exposed bed joints, do not vary from thickness indicated by more than plus or minus **1/8 inch (3 mm)**, with a maximum thickness limited to **1/2 inch (12 mm)**. Do not vary from bed-joint thickness of adjacent courses by more than **1/8 inch (3 mm)**.
- F. For exposed head joints, do not vary from thickness indicated by more than plus or minus **1/8 inch (3 mm)**. Do not vary from adjacent bed-joint and head-joint thicknesses by more than **1/8 inch (3 mm)**.

3.4 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

- B. Bond Pattern for Exposed Masonry: Lay exposed masonry in the following bond pattern; do not use units with less than nominal **4-inch (100-mm)** horizontal face dimensions at corners or jambs.
 - 1. One-half running bond with vertical joint in each course centered on units in courses above and below, unless otherwise indicated on Drawings.
- C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than **2 inches (50 mm)**. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal **4-inch (100-mm)** horizontal face dimensions at corners or jambs.
- D. Stopping and Resuming Work: In each course, rack back one-half-unit length for one-half running bond or one-third-unit length for one-third running bond; do not tooth. Clean exposed surfaces of set masonry, wet clay masonry units lightly if required, and remove loose masonry units and mortar before laying fresh masonry.
- E. Built-in Work: As construction progresses, build in items specified under this and other Sections of the Specifications. Fill in solidly with masonry around built-in items.
- F. Fill space between hollow-metal frames and masonry solidly with mortar, unless otherwise indicated.
- G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath in the joint below and rod mortar or grout into core.
- H. Fill cores in hollow concrete masonry units with grout **24 inches (600 mm)** under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.
- I. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above, unless otherwise indicated.
 - 1. Install compressible filler in joint between top of partition and underside of structure above.
 - 2. At fire-rated partitions, install firestopping in joint between top of partition and underside of structure above to comply with Division 7 Section "Fire-Resistive Joint Systems."

3.5 MORTAR BEDDING AND JOINTING

- A. Lay hollow masonry units as follows:
 - 1. With full mortar coverage on horizontal and vertical face shells.
 - 2. Bed webs in mortar in starting course on footings and in all courses of piers, columns, and pilasters, and where adjacent to cells or cavities to be filled with grout.
 - 3. For starting course on footings where cells are not grouted, spread out full mortar bed, including areas under cells.
- B. Lay solid brick-size masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

1. At cavity walls, bevel beds away from cavity, to minimize mortar protrusions into cavity. As work progresses, trowel mortar fins protruding into cavity flat against the cavity face of the brick.
- C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than the joint thickness, unless otherwise indicated.
- D. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint), unless otherwise indicated.

3.6 BONDING OF MULTI-WYTHE MASONRY

- A. Use individual metal ties installed in horizontal joints to bond wythes together. Provide ties as shown, but not less than one metal tie for 1.77 sq. ft. (0.16 sq. m) of wall area spaced not to exceed 16 inches (406 mm) o.c. horizontally and 16 inches (406 mm) o.c. vertically. Stagger ties in alternate courses. Provide additional ties within 12 inches (305 mm) of openings and space not more than 36 inches (915 mm) apart around perimeter of openings. At intersecting and abutting walls, provide ties at no more than 24 inches (610 mm) o.c. vertically.
- B. Corners: Provide interlocking masonry unit bond in each wythe and course at corners, unless otherwise indicated.
 1. Provide continuity with masonry joint reinforcement at corners by using prefabricated "L" units as well as masonry bonding.
- C. Intersecting and Abutting Walls: Unless vertical expansion or control joints are shown at juncture, bond walls together as follows:
 1. Provide continuity with masonry joint reinforcement by using prefabricated "T" units.

3.7 CAVITIES

- A. Keep cavities clean of mortar droppings and other materials during construction.
 1. Use wood strips temporarily placed in cavity to collect mortar droppings. As work progresses, remove strips, clean off mortar droppings, and replace in cavity.
 2. Provide temporary opening by omitting 1 brick every 48 inches (1200 mm) at bottom of cavity and in first course above flashing. After wall has been built to top of cavity and mortar has set, clean out cavity and then close temporary opening.
- B. Coat cavity face of backup wythe to comply with Division 7 Section "Bituminous Dampproofing."
- C. Installing Cavity-Wall Insulation: Place small dabs of adhesive, spaced approximately 12 inches (300 mm) o.c. both ways, on inside face of insulation boards, or attach with plastic fasteners designed for this purpose. Fit courses of insulation between wall ties and other confining obstructions in cavity, with edges butted tightly both ways. Press units firmly against inside wythe of masonry or other construction as shown.

1. Fill cracks and open gaps in insulation with crack sealer compatible with insulation and masonry.

3.8 MASONRY JOINT REINFORCEMENT

- A. General: Provide continuous masonry joint reinforcement as indicated. Install entire length of longitudinal side rods in mortar with a minimum cover of **5/8 inch (16 mm)** on exterior side of walls, **1/2 inch (13 mm)** elsewhere. Lap reinforcement a minimum of **6 inches (150 mm)**.
 1. Space reinforcement not more than **16 inches (406 mm)** o.c.
 2. Space reinforcement not more than **8 inches (203 mm)** o.c. in foundation walls and parapet walls.
 3. Provide reinforcement not more than **8 inches (203 mm)** above and below wall openings and extending **12 inches (305 mm)** beyond openings.
 - a. Reinforcement above is in addition to continuous reinforcement.
- B. Cut or interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.
- C. Provide continuity at corners and wall intersections by using prefabricated "L" and "T" sections. Cut and bend reinforcing units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.9 ANCHORING MASONRY TO STRUCTURAL MEMBERS

- A. Anchor masonry to structural members where masonry abuts or faces structural members to comply with the following:
 1. Provide an open space not less than **1 inch (25 mm)** in width between masonry and structural member, unless otherwise indicated. Keep open space free of mortar or other rigid materials.
 2. Anchor masonry to structural members with flexible anchors embedded in masonry joints and attached to structure.
 3. Space anchors as indicated, but not more than **24 inches (610 mm)** o.c. vertically and **36 inches (915 mm)** o.c. horizontally.

3.10 ANCHORING MASONRY VENEERS

- A. Anchor masonry veneers to wall framing and to concrete and masonry backup with masonry-veneer anchors to comply with the following requirements:
 1. Fasten each anchor section through sheathing to wall framing with two metal fasteners of type indicated.
 2. Embed pintel portion of veneer anchors into horizontal courses of concrete masonry backup.
 3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
 4. Space anchors as indicated, but not more than **16 inches (407 mm)** o.c. vertically and **16 inches (407 mm)** o.c. horizontally, with not less than 1 anchor for each **1.77 sq. ft. (0.16**

sq. m) of wall area. Install additional anchors within **12 inches (305 mm)** of openings and at intervals, not exceeding **8 inches (203 mm)**, around the perimeter.

3.11 CONTROL AND EXPANSION JOINTS

- A. General: Install control and expansion joints in unit masonry where indicated. Build-in related items as masonry progresses. Do not form a continuous span through movement joints unless provisions are made to prevent in-plane restraint of wall or partition movement.
- B. Form control joints in concrete masonry as follows:
 - 1. Install preformed control-joint gaskets designed to fit standard sash block.
- C. Form expansion joints in brick made from clay or shale as follows:
 - 1. Form open joint of width indicated, but not less than **3/8 inch (10 mm)** for installation of sealant and backer rod specified in Division 7 Section "Joint Sealants." Keep joint free and clear of mortar.
- D. Build in horizontal, pressure-relieving joints where indicated; construct joints by either leaving an air space or inserting a compressible filler of width required for installing sealant and backer rod specified in Division 7 Section "Joint Sealants."
 - 1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry veneer and attached to structure behind masonry veneer.

3.12 LINTELS

- A. Install steel lintels where indicated.
- B. Provide masonry lintels where shown and where openings of more than **12 inches (305 mm)** for brick-size units and **24 inches (610 mm)** for block-size units are shown without structural steel or other supporting lintels.
 - 1. Provide precast lintels made from concrete matching concrete masonry units in color, texture, and compressive strength and with reinforcing bars indicated or required to support loads indicated. Cure precast lintels by the same method used for concrete masonry units.
- C. Provide minimum bearing of **8 inches (200 mm)** at each jamb, unless otherwise indicated.
- D. Provide 9 gage Z-ties at each vertical joint of soap units covering steel lintels. Weld Z-ties to web of steel lintel.

3.13 FLASHING, WEEP HOLES, AND VENTS

- A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.

- B. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Unless otherwise indicated, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
- C. Install flashing as follows:
1. At multiwythe masonry walls, including cavity walls, extend flashing from exterior face of outer wythe of masonry, through outer wythe, turned up a minimum of **8 inches (200 mm)**, and through inner wythe to within **1/2 inch (13 mm)** of the interior face of the wall in exposed masonry. Where interior surface of inner wythe is concealed by furring, carry flashing completely through inner wythe and turn flashing up approximately **2 inches (50 mm)**, unless otherwise indicated.
 2. At masonry-veneer walls, extend flashing from exterior face of veneer, through veneer, up face of sheathing at least **8 inches (200 mm)**, and behind air-infiltration barrier or building paper.
 3. At lintels and shelf angles, extend flashing a minimum of **4 inches (100 mm)** into masonry at each end. At heads and sills, extend flashing **4 inches (100 mm)** at ends and turn flashing up not less than **2 inches (50 mm)** to form a pan.
 4. Extend sheet metal flashing **1/2 inch (13 mm)** beyond face of masonry at exterior and turn flashing down to form a drip.
 5. Cut flashing off flush with face of wall after masonry wall construction is completed.
- D. Install weep holes in the head joints in exterior wythes of the first course of masonry immediately above embedded flashing and as follows:
1. Use weep hole/vents to form weep holes.
 2. Space weep holes **16 inches (406 mm)** o.c.
 3. Place cavity drainage material immediately above flashing in cavities.
- E. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.

3.14 REINFORCED UNIT MASONRY INSTALLATION

- A. Temporary Formwork and Shores: Construct formwork and shores to support reinforced masonry elements during construction.
1. Construct formwork to conform to shape, line, and dimensions shown. Make it sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
 2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.
- B. Placing Reinforcement: Comply with requirements of ACI 530.1/ASCE 6/TMS 602.
- C. Grouting: Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist grout pressure.

1. Comply with requirements of ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
2. Limit height of vertical grout pours to not more than 60 inches (1520mm).

3.15 FIELD QUALITY CONTROL

- A. Owner will engage a qualified independent testing agency to perform field quality-control testing indicated below.
 1. Payment for these services will be made by Owner.
 2. Retesting of materials failing to meet specified requirements shall be done at Contractor's expense.
- B. Testing Frequency: Will be specified by the Engineer-of-Record in the Statement of Special Inspections filed with the Building Official at the time of application for building permit.
- C. Concrete Masonry Unit Tests: For each type of concrete masonry unit indicated, units will be tested according to ASTM C 140.

3.16 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application.
- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
 3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.
 4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing the surfaces thoroughly with clear water.
 5. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2 applicable to type of stain on exposed surfaces.

3.17 MASONRY WASTE DISPOSAL

- A. Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

END OF SECTION 04 20 00

SECTION 23 60 00 - REFRIGERATION

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

1. Drawings and applicable provisions of the Contract, including General and Supplementary Conditions, Division 1 - General Requirements, and the General Provisions, Section 230000, govern the work of this Division.
2. Refer to specification 230000 2.1 A, B, C, D, E, F, and G for Video recording of material, equipment, operation and training.
3. Requirements given herein may be affected by other related requirements of the project specification. Correlation of the contract requirements is the responsibility of the contractor.

1.02 REFERENCES

1. Perform the work in accordance with the requirements of section 230000, General Provisions, and with the provisions of all applicable codes and laws.
2. The installation and equipment is to conform to ANSI B 9.1 Safety Code for Mechanical Refrigeration.

1.03 SUBMITTALS

1. Procedure
 - a. Prepare and make the submissions listed below and in Section 230000 in accordance with the procedure specified in Section 230000.
2. Shop Drawings
 - a. Chillers
 - b. Cooling Towers
 - c. Air Cooled Condensers
 - d. Refrigeration Accessories
 - e. Field Performance Tests
3. System maintenance requirements not covered by equipment manufacturers' instructions.

1.04 SYSTEM TESTING

1. Perform operating tests and instruct Owner's personnel as specified in Section 230000. Produce and maintain refrigeration effect under operating criteria determined in advance by agreement with the Architect and the Building Official.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS

1. Construct all apparatus of materials suitable for the conditions encountered during operation.
2. Construct all equipment in accordance with the requirements of the local and state codes. Construct all pressure vessels in accordance with the ASME Code for unfired pressure vessels. Pressure vessels shall bear the code stamp.
3. All factory applied acoustical and thermal insulation, including facing and adhesive, to be fire-resistant or non-combustible, and shall conform to the requirements of NFPA and local codes.
4. Mount grease fittings directly on bearings unless the bearings are not visible or inaccessible. Then provide easily accessible extensions to bearing lubrication fittings.
5. Balance all fan wheels and other moving components statically and dynamically. Drill all fan shafts on the center line to receive a tachometer point.
6. Match and balance all system components to achieve compatibility of equipment for satisfactory operation and performance throughout the entire operating temperature and control range.
7. Provide all controls, wiring, piping, valves, tubing, accessories and other components necessary to make a complete operating system.
8. All refrigeration equipment shall comply with the applicable provisions of the ASME Code and American Standard Safety Code for Mechanical Refrigeration ASA-B 9.1, the requirements of all regulating bodies having jurisdiction and the recommendations of the equipment manufacturer.
9. Electrical operating and safety controls shall be 120 volt or less. The control circuit shall have a grounded neutral with all safety controls in the ungrounded leg.
10. All items of refrigeration equipment shall be shipped complete with a holding charge or refrigerant and oil.
11. Chillers shall be shipped with a factory charge of refrigerant HCFC-123 or R-134a. Chillers using R-11 or R-12 shall not be acceptable.

2.02 CHILLER: HIGH EFFICIENCY CENTRIFUGAL

1. Performance Tolerance And Verification Of Chiller Capacity And Efficiency

a. Factory Performance Test

- 1) The chiller test points shall be an ARI 4 Point test as follows: 100% @ 85F ECWT and design condenser water flow, 75% at 75 ECWT, 50% and 25% @ 65F ECWT.

* Adjustments to be made per paragraph C6.3 of ARI Std 550/590-2003

- 2) A certified test report of all data shall be submitted to the Contracting Officer prior to completion of the project. The factory certified test report shall be signed by an officer of the manufacturer's company.
- 3) The equipment will be accepted if the test is conducted in conformance with ARI Standard 550/590-2003 procedures and the proposed tolerances are met.
- 4) If the equipment fails to perform within proposed tolerances, the manufacturer will be allowed to make necessary revisions to his equipment and retest as required.
- 5) In the event that these revisions do not achieve submitted performance, the following penalties will be imposed:
- a) **CAPACITY TEST:** For each ton below the allowable capacity, one thousand dollars per ton will be deducted from the contract price.
- b) Allowable capacity = $[(1 - \text{tolerance}) \times \text{design capacity}]$
- c) **POWER CONSUMPTION PENALTY:** All load points and the Power Consumption Penalty (P.C.P.) shall be based upon the tolerances specified above. The P.C.P shall be calculated based upon the following formula: $\text{P.C.P.} = [\text{Measured KW} - (\text{Measured Tons} \times \text{ALLOWABLE KW/Ton}^*)] \times \$2000/\text{KW}$ *Allowable KW/Ton = $[(1 + \text{tolerance}) \times \text{design KW/Ton}]$
- d) **TOTAL PERFORMANCE PENALTY:** The total performance penalty will be the sum of CAPACITY PENALTY AND POWER CONSUMPTION PENALTY, times the number of typical chillers, regardless if tested.
- e) Equipment manufacturer shall not invoice for the centrifugal chillers(s) until successful completion of the performance test or acceptance of penalty deduction from the contract.

- b. All Chillers shall be factory performance tested with the proposed refrigerant

under full load and part load conditions in an ARI certified test facility. The manufacturer shall supply a certified test report to confirm performance as specified. Proper ARI certification documents for the test loop shall be made available upon request from the manufacturer for inspection.

- c. The factory test instrumentation shall be per ARI Standard 550/590-2003, and the calibration of all instrumentation shall be traceable to the National Institute of Standards and Technology (formerly NBS).
- d. The performance test shall be run with clean tubes in accordance with ARI 550/590-2003 to include the following:
 - 1) A downward temperature adjustment per ARI 550/590-2003 Section C6.3 shall be made to the design leaving evaporator water temperature to adjust from the design fouling to the clean tube condition.
 - 2) An upward temperature adjustment per ARI 550/590-2003 Section C6.3 shall be made to the design entering condenser water temperature to adjust from the design fouling to the clean tube condition.
 - 3) There shall be no exceptions to conducting the performance test with clean tubes and with temperature adjustments in (1) and (2). The manufacturer shall clean tubes, if necessary, prior to test to obtain a test fouling factor of .0000 hr. sq. ft. F/BTU.

2. Regulatory Requirements

- a. Conform to ARI Standard 550/590-2003 code for rating and testing of water chillers.
- b. Conform to UL 1995 for Safety for Heating and Cooling Equipment.
- c. Conform to ANSI/ASME SECTION VIII Boiler and Pressure Vessel Code for construction and testing of centrifugal chillers as applicable.
- d. Conform to ANSI/ASHRAE STANDARD 15-2001 code for construction and operation of centrifugal chillers.
- e. Unit shall bear the ARI Certification Label for the specific type of water chiller as applicable.

3. Handling And Equipment Room Requirements

- a. Comply with manufacturer's installation instructions for rigging, chiller loading, local transportation requirements, unloading, storage, rigging and final setting.

- b. Protect chiller and controls from physical damage. Leave factory shipping covers in place until installation.
- c. Equipment Room Requirements
 - 1) Follow minimum standards for refrigeration systems as required by ANSI/ASHRAE Standard 15-2001 paying special attention to requirements for air monitoring, ventilation, self-contained breathing apparatus and leak detection to assure the safety of chiller plant operating personnel.
 - 2) Install proper outside exhaust of chiller refrigerant relief device(s), discharge header(s), and purge unit(s). Route exhaust to the outside of the building and away from all air intakes in compliance with ANSI/ASHRAE Standard 15-2001.
 - 3) Install a refrigerant monitor that can be calibrated for appropriate refrigerant(s), capable of detecting concentrations of minimum ppm for low level leak detection to assure the safety of chiller plant operating personnel.
 - 4) Install suitable audible and visual alarms that activate well below the Acceptable Exposure Level (AEL) of the specific refrigerant(s) to alert persons inside and outside of the equipment room that a refrigerant leak condition exists.

4. Summary

- a. Description: Factory-assembled and tested water chiller complete with compressor, evaporator, condenser, controls, starter or variable speed drive, interconnecting unit piping and wiring, indicating accessories, and mounting frame. Performance shall be per specification section 3 schedule.
- b. The contractor shall furnish and install centrifugal water chillers as shown and scheduled in the plans and specifications. The units shall produce the specified tonnage per the scheduled data in accordance with ARI 550/590-2003. The unit shall bear the ARI certification label as applicable.
- c. Unit shall be painted in accordance with the manufacturers standard procedures and practices.

5. Compressor And Motor

- a. The compressor shall be centrifugal.
- b. Low pressure refrigerant machines shall be provided when available.

- c. Chiller should be able to unload to 20 percent of design tonnage with constant 85F entering water temperature. The minimum unloading point shall be demonstrated at the time of the factory performance test. The machine shall be modified to include hot gas bypass if the minimum load cannot be met.
 - d. Compressor assembly shall be vibration tested at the factory. Vibration shall not exceed 0.15 inches per second. The test data shall be recorded and provided to the customer for approval.
 - e. The motor shall be hermetic and either suction or liquid refrigerant cooled. Hot gas motor cooling is not acceptable. If an open drive motor is provided, a motor-compressor shaft seal leakage containment system shall be provided.
 - 1) An oil reservoir shall collect any oil and refrigerant that leaks past the seal.
 - 2) A float device shall be provided to open when the reservoir is full, directing the refrigerant/oil mixture back into the compressor housing.
 - 3) Manufacturer shall warrant the shaft seal, reservoir, and float valve system against leakage of oil and refrigerant to the outside of the chiller for a period of 5 years from initial start-up, including parts and labor to replace a defective seal and any refrigerant required to trim the charge to original specifications. Inspections shall be performed a minimum of once a year.
 - 4) Motors shall have winding RTD's for temperature sensing on each phase. These temperatures shall be furnished to the unit control panel for monitoring and alarm.
 - f. Manufacturers with speed increasing transmissions shall not exceed 10,000 RPM compressor speeds and shall annually inspect the gears and all bearings. A report shall be forwarded to the owner each year over the first five years to confirm completion.
 - g. The impellers shall be fully shrouded and made of a high strength aluminum alloy. Impellers shall be dynamically balanced and over-speed tested at 1.25 times impeller shaft speed.
6. Evaporator (Chiller Barrel)
- a. The evaporator and condenser shall be built in accordance with ANSI/ASHRAE 15-2001 Safety Code for Mechanical Refrigeration.
 - b. Evaporator tubes shall be internally enhanced. The minimum tube wall thickness shall be 0.025 inch.
 - c. The evaporator water piping connections shall be victalic.

- d. The evaporator water boxes shall be standard non-marine type with connections per schedule.
- e. Supply and return head water boxes shall be designed for a working pressure of 150 psig and shall be factory hydrostatic pressure tested at 150 percent of the design pressure. Provide drain and vent connections in water boxes.
- f. Insulation will be 3/4" insulation and cover all low temperature surfaces to include the evaporator, water boxes, and suction elbow. Economizer, if applicable, is insulated with 3/8" insulation.
- g. Units with multi-stage compressors shall incorporate an interstage flash vessel "economizer". All units with single stage compressors shall have the condensers circuited for liquid subcooling and be provided with a thermometer well to monitor the amount of subcooling.
- h. Adjustable or float type refrigerant metering devices and thermal expansion valves shall be inspected and adjusted by the manufacturer at the end of each year for the first five years of operation to assure equivalent reliability and maintenance to a fixed orifice system. A written report shall be forwarded to the owner each year to confirm completion.

7. Condenser

- a. The condenser shall be built in accordance with ANSI/ASHRAE 15-2001 Safety Code for Mechanical Refrigeration.
- b. Condenser tubes shall be internally enhanced. The minimum tube wall thickness shall be 0.028 inch.
- c. The condenser water piping connections shall be victallic.
- d. The condenser water boxes shall be standard non-marine type with connections per schedule.
- e. Supply and return head water boxes shall be designed for a working pressure of 150 psig and shall be factory hydrostatic pressure tested at 150 percent of the design pressure. Provide drain and vent connections in water boxes.

8. Purge System

- a. The manufacturers of low pressure machines, must provide a purge system.
- b. The purge efficiency must meet ASHRAE Standard 147-2002 paragraph 4.7.
- c. The purge shall be capable of operating when the chiller is idle in accordance with ASHRAE Standard 147-2002, paragraph 4.7.2 (a). If the purge unit cannot operate when the chiller and pump are off, a positive pressure device (such as a

belly heater) shall be provided to prevent non-condensables from entering the machine per ASHRAE Standard 147-2002, paragraph 4.7.2 (b). This will raise the pressure in the evaporator bundle above atmospheric pressure when the machine is off.

9. Controls

- a. The chiller shall be controlled by a unit mounted, stand-alone Direct Digital Control (DDC) system. A dedicated chiller microprocessor control panel is to be supplied with each chiller by the chiller manufacturer.
- b. Enclosure shall be unit mounted NEMA 250 Type 1 using wire duct. Zip ties are not acceptable.
- c. A color, touch sensitive liquid crystal display (LCD) shall be unit mounted and a minimum of 12.1" diagonal. The display shall be fully adjustable in height and viewing angle. Animated graphical representations of chiller subsystem operation shall be used to enhance the user interface.
- d. Display shall consist of a menu driven interface with easy touch screen navigation to organized subsystem reports for compressor, evaporator, condenser, purge and motor information as well as associated diagnostics. The controller shall display all active diagnostics and a minimum of 20 historical diagnostics.
- e. The controller shall have the ability to display all primary sub-system operational parameters on dedicated trending graphs. The operator must be able to create up to 6 additional custom trend graphs, choosing up to 10 unique parameters for each graph to trend log data parameters simultaneously over an adjustable period and frequency polling.
- f. The chiller control panel shall provide control of chiller operation and monitoring of chiller modules, sensors, actuators, relays and switches. The chiller control panel shall include controls to safely and efficiently operate the chiller.
- g. Safeties - the chiller control panel shall provide the following safeties:
 - 1) Low chilled water temperature
 - 2) Low evaporator refrigerant temperature or pressure
 - 3) High condenser refrigerant pressure
 - 4) Evaporator and condenser water flow status
 - 5) Low oil pressure
 - 6) Low oil temperature

- 7) High oil temperature
- 8) High motor winding temperatures
- 9) High motor current
- 10) Starter/AFD function faults
- 11) Sensor faults
- 12) Unit controls operation
- 13) The chiller control panel or starter shall incorporate advanced motor protection to safeguard the motor throughout the starting and running cycles from the adverse effects of:
 - a) Current phase loss
 - b) Current phase unbalance
 - c) Current phase reversal
 - d) Under/Over voltage
 - e) Motor current overload
 - f) Distribution fault protection with auto restart consisting of three-phase current sensing devices that monitor the status of the current
 - g) Starter contactor fault protection
 - h) Starter transition failure
- h. The chiller control panel shall be capable of displaying system data in I-P or SI units.
- i. The front of the chiller control panel shall display the following in clear language, without the use of codes, look-up tables, or gauges:
 - 1) Run time
 - 2) Number of starts
 - 3) Current chiller operating mode
 - 4) Chilled water set point and set point source
 - 5) Electrical current limit set point and set point source

- 6) Entering and leaving evaporator water temperatures
 - 7) Entering and leaving condenser water temperatures
 - 8) Saturated evaporator and condenser refrigerant temperatures
 - 9) Evaporator and condenser refrigerant pressure
 - 10) Oil tank temperature
 - 11) Oil tank pressure
 - 12) Oil pump discharge pressure
 - 13) Differential oil pressure
 - 14) Compressor motor current per phase
 - 15) Compressor motor percent RLA
 - 16) Compressor motor voltage per phase
 - 17) kW energy consumption and power factor
 - 18) Compressor motor winding temperatures per phase
 - 19) Purge operating mode
 - 20) Purge operating status
 - 21) Time until next purge run
 - 22) Daily pumpout - 24 hours
 - 23) Avg daily pumpout - 7 Days
 - 24) Purge refrigerant compressor suction temp
 - 25) Purge liquid temp (chiller condenser saturated refrigerant temperature)
 - 26) Daily pumpout limit/alarm
- j. The chiller control panel shall provide password protection of all setpoints.

- k. Control authority must be capable of handling at least four conditions: Off, local manual at the chiller, local automatic at the chiller and automatic control through a remote source.
- l. The chiller control panel shall provide evaporator freeze protection and low limit control to avoid low evaporator refrigerant temperature trip-outs during critical periods of chiller operation. Whenever this control is in effect, the controller shall indicate that the chiller is in adaptive mode. If the condition exists for more than 30 seconds, a limit warning alarm relay shall energize.
- m. The chiller control panel shall provide individual relay outputs to start/stop the evaporator and condenser water pumps. The condenser water pump relay output can be used to enable the cooling tower temperature controls.
- n. The chiller control panel shall provide leaving chilled water temperature reset based upon return water temperature.
- o. The chiller control panel shall be capable of providing short cycling protection.
- p. The chiller control panel shall provide a relay output that shall energize whenever the compressor is running.
- q. The chiller control panel shall provide an alarm relay output that shall energize whenever a fault requiring manual reset is detected by the panel.
- r. The chiller control panel shall provide a relay output that shall energize whenever the chiller is operating at maximum capacity.
- s. The chiller control panel shall provide a head relief request relay output to indicate that the chiller is in condenser limit mode and thereby requesting condenser water temperature relief.
- t. The chiller control panel shall provide an analog output signal that shall indicate the Compressor Motor Percent RLA.
- u. The chiller control panel shall provide an analog output signal that shall indicate the condenser refrigerant pressure or condenser/evaporator differential refrigerant pressure.
- v. The chiller control panel shall provide condenser limit control including a pressure transducer and interconnecting piping and wiring. This control shall be used to avoid high condenser refrigerant pressure tripouts. The control shall take action in response to the condenser refrigerant pressure. Whenever this control is in effect, the panel will automatically indicate that the chiller is in adaptive mode and if the condition exists for more than 30 seconds, a limit warning alarm shall energize.

10. Starters

a. Variable Speed Drive (VSD), Unit Mounted

- 1) The centrifugal water chiller shall be furnished with a liquid cooled variable speed drive (VSD) as shown on the drawings. The VSD shall be factory mounted on the chiller and shipped completely factory assembled, wired and tested.
- 2) The VSD will be specifically designed to interface with the centrifugal water chiller controls and allow for the operating ranges and specific characteristics of the chiller. The VSD control logic shall optimize chiller efficiency by coordinating compressor motor speed and compressor inlet guide vane position to maintain the chilled water setpoint while avoiding surge. If a surge is detected, VSD surge avoidance logic will make adjustments to move away from and avoid surge at similar conditions in the future.
- 3) The VSD efficiency shall be 97% or better at full speed and full load. Fundamental displacement power factor shall be a minimum of 0.96.
- 4) The VSD shall be solid state, microprocessor based pulse width modulated (PWM) design. The VSD shall be voltage and current regulated. Output power devices shall be IGBT transistors.
- 5) Power semi-conductor and capacitor cooling shall be from a liquid cooled heatsink.
- 6) The VSDs shall each be furnished in a NEMA 1 metal enclosure having as minimum a short circuit withstand rating of 65,000 amps per UL 508. It will include three phase input lugs plus a grounding lug for electrical connections, output motor connection via factory installed bus bars and all components properly segregated and completely enclosed in a single metal enclosure.
 - a) Enclosure shall include a padlockable, door-mounted circuit breaker with shunt trip and AIC rating of 65,000 amps.
 - b) The entire chiller package shall be U.L./C.U.L. listed.
- 7) The VSD shall be tested to ANSI/UL Standard 508 and shall be listed by a Nationally Recognized Testing Laboratory (NRTL) as designated by OSHA.
- 8) Compliance to recommendations stated in IEEE 519-1992.
 - a) The VSD design shall include as standard integrated active rectification control system to limit total demand distortion (TDD) in current at the VSD to less than or equal to 5-percent. If active filters are used to meet less than or equal to 5% TDD, then the losses associated with the filter shall be included in the chiller performance on the selection.

- 9) Input shall be nominal 480 volts, three phase, 60 Hertz AC power, +/- 10 percent of nominal voltage.
- 10) Line frequency 38-60 hertz.
- 11) The VSD shall include the following features:
 - a) All control circuit voltages are physically and electrically isolated from power circuit voltage.
 - b) One hundred fifty percent instantaneous torque available for improved surge control.
 - c) Minimum and maximum speed adjustments.
 - d) Soft start, adjustable linear acceleration, coast to stop.
 - e) Adjustable current limiting and UL approved electronic motor overload protection.
 - f) Insensitivity to incoming power phase sequence.
 - g) VSD and motor protection from the following faults: - Output line-to-line short circuit protection - Line-to-ground short circuit protection - Phase loss at AFD input - Phase reversal / Imbalance - Over-voltage - Under-voltage - Over temperature
 - h) Carrier frequency shall be fixed at 4 Khz for maximum efficiency.
- 12) The following VSD status indicators shall be available to facilitate startup and maintenance: - Output speed in hertz and rpm - Input line voltage - Input line kW - Output/load amps - Average current in percent RLA - Load power factor - Fault - VSD transistor temperature
- 13) Service Conditions - at full output power. No external venting or heat exchangers shall be required.
 - a) Operating ambient temperature 32-104 F (0-40 C).
 - b) Room ambient 0-95% relative humidity.
 - c) Elevation to 3300-feet (1000-meters). For every 300-feet above 3300-feet, the rated output current shall be decreased by one percent.

11. Manufacturer: Model:
 Trane CVHE
 Carrier
 York

2.06 COOLING TOWER: CENTRIFUGAL - BLOW THROUGH - CORROSION PROTECTED

1. A complete factory assembled unit of matched components including belt driven centrifugal fan and drives, wet deck, pan, casing, eliminators, all necessary piping, wiring, controls and accessories. All tower materials of construction shall be hot dipped galvanized steel unless otherwise noted.
2. Pan shall be V-shaped heavy gauge, type 304 stainless steel with type 304 steel reinforcing angles. Circular gasketed access doors located at both ends of the pan section. Type 304 steel anticavitation plate.
3. Galvanized steel forwardly curved centrifugal belt driven fans with four sided discharge cowls. Heavy duty pillow block type bearings with eccentric locking collars and extended lube lines, and grease fittings. Multiple, adjustable, vee belt type for drives designed for not less than 150% of nameplate horsepower. Galvanized steel protective fan inlet screens. Fan motors shall be totally enclosed, fan cooled (TEFC), squirrel cage, ball bearing type suitable for outdoor service. Fan motors shall be suitable for variable frequency drives.
4. Wet deck - wave formed, self-extinguishing, polyvinyl chloride, minimum 15 mils thick, with a maximum flame spread rating of 5.
5. Eliminators - Hot dipped PVC eliminator plates with a minimum of three directional changes. Individually removable. Eliminator sections shall not exceed 100 pounds in weight per section.
6. Water circulation system - multiple steel distribution headers with removable PVC spray nozzles running the entire length of the heat exchanger section.
7. Wiring diagrams - provide one set of complete reproducible power and control wiring diagrams, clearly indicating factory and field wiring. Submit one set of marked up shop-drawings to the division 17 contractor upon receipt of Engineer's approval.
8. Accessories.
 - a. Factory installed submersible electric immersion heater(s), sump thermostat with sensing bulb, float switch, power contactors and heater fused disconnect switch, each in NEMA 3R waterproof enclosures.
 - b. Solid brass float-type make up water valve with foam filled ball.

9. Sound absorbers.
 - a. Factory constructed inlet and outlet attenuators, outer casing of 22 gauge galvanized steel, lock formed seams, mastic filled. 26 gauge perforated galvanized steel interior partitions.
 - b. Filler material of inorganic glass fiber, packed under not less than 5% compression to eliminate voids due to vibration and settling. Material shall be insect and vermin, and moisture proof. Fill shall conform to ASTM and NFPA regulations governing flamespread, smoke development, and fuel contribution.
 - c. Seal joints airtight in the field.
 - d. Mating flanges for connection to equipment.
 - e. Submit certification of acoustical performance from an independent testing laboratory.

10. Manufacturer: Model/Series:
 Baltimore Aircoil VTL (low profile)
 Evapco LRT
 Recold JT

2.15 AIR CONDITIONING UNIT – SPLIT-SYSTEM COOLING ONLY INDOOR UNITS

1. Complete assembly including cooling coil, fan, fan motor, all necessary accessories and controls, interconnecting piping, valves and wiring assembled within a finished cabinet.
2. General: Indoor, direct-expansion, ceiling-suspended fan coil. Fan coil shall be hipped complete with cooling coil, fan, an motor, piping connectors and ceiling mounting brackets.
3. Unit Cabinet: Indoor cabinet shall be zinc-coated bonderized steel finished with a baked enamel paint. Inlet grilles shall be attractively styled, high-impact polystyrene. Matching mounting brackets shall be provided.
4. Fans: Indoor fan shall be 3-speed centrifugal blower type with air intake in the bottom rear of the unit and discharge in the front. Automatic, motor-driven vertical air sweep shall be provided standard.
5. Coils: Indoor coils shall be copper tube with aluminum fins and galvanized steel tube sheets. Fins shall be bonded to the tubes by mechanical expansion. A drip pan under the coil shall have a drain connection for hose attachment to remove condensate.
6. Motors: Motors shall be permanently lubricated ball bearing with inherent overload protection.
7. Controls: Controls shall consist of a solid state thermostat control system which shall control space temperature and determine optimum fan speed. The unit shall have the following functions as a minimum.

- a. An automatic restart after power failure at the same operating conditions as at failure.
 - b. Thermostat control to enter set points and operating conditions.
 - c. Filter status indication after 250 hours of indoor fan operation.
 - d. Cooling mode to provide modulating fan speed based on difference between temperature based on difference between temperature setpoint and space temperature.
 - e. Fan only operation to provide room air circulation when no cooling is required.
 - f. Fan speed control shall be user-selectable: high, medium, low or automatic operation during all operating modes.
 - g. A time delay shall prevent compressor restart in less than 2 or 4 minutes (adjustable).
8. Filters: Unit shall have filter track with factory-supplied cleanable filters.
9. Electrical Requirements: Unit shall operate on 208/230 v 60 Hz power supply as specified on the equipment schedule. Power and control connections shall have terminal block connections.
10. Unit shall be matched with condensing unit by the same manufacturer.
11. Units to be provided with an auxiliary drip pan underneath the unit with an overflow shut-off switch.
12. Carrier Corporation Model 40QAB or the approved equal of Trane, York.

2.16 CONDENSING UNIT – SPLIT SYSTEM OUTDOOR

1. General: Factory assembled, single piece, air-cooled outdoor unit. Contained within the unit enclosure shall be all factory wiring, piping, controls, compressor, full charge of R-22 refrigerant and special features required prior to field start-up.
2. Unit Cabinet: Unit cabinet shall be constructed of galvanized steel, bonderized and coated with a baked-enamel finish. Removable access panels for full access to the compressor, fan and control components.
3. Fans:
 - a. Direct-drive propeller type fans. Fan motors totally enclosed; single-phase; permanently lubricated sleeve bearings, with internal thermal overload protection.
 - b. Shaft shall have inherent corrosion resistance. Fan blades shall be corrosion resistant and shall be statically and dynamically balanced. Provide PVC coated protection grille over fan and coil.

4. Compressor:
 - a. Compressor shall be fully scroll type, equipped with oil system, operating oil charge and motor. Internal overloads shall protect the compressor from overtemperature, overcurrent. Discharge gas temperature protection if required.
 - b. Motor shall be NEMA rated class F, suitable for operation in a refrigerant atmosphere.
 - c. Compressor assembly shall be installed on rubber vibration isolators and shall have internal spring isolation.
5. Outdoor coil: Coil shall be constructed of aluminum fins mechanically bonded to internally enhanced, seamless copper tubes which are cleaned, dehydrated and sealed.
6. Refrigeration Components: Refrigerant circuit components shall include brass external liquid line service valve with service gauge port connections, suction line service valve with service gauge connection port, service gauge connections on compressor suction and discharge lines with Schrader type fittings with brass caps, accumulator, pressure relief and a full charge of refrigerant.
7. Controls and Safeties: Operating controls and safeties shall be factory selected, assembled and tested. The minimum control functions shall include the following:
 - a. Controls:
 - 1) Time delay restart to prevent compressor reverse rotation on single-phase scroll compressors.
 - 2) Automatic restart on power failure.
 - 3) Safety lockout if any outdoor unit safety is open.
 - 4) A time delay control sequence provided through the fan coil board, thermostat, or controller.
 - 5) High-pressure and liquid line low-pressure switches.
 - 6) Automatic outdoor-fan motor protection.
 - 7) Start capacitor and relay (single-phase units without scroll compressors).
 - b. Safeties:
 - 1) System diagnostics.
 - 2) Compressor motor current and temperature overload protection.
 - 3) High-pressure relief.
 - 4) Outdoor fan failure protection.
8. Casing: Aluminum or galvanized steel with baked enamel finish, galvanized steel angle legs.

2.18 REFRIGERANT GAS DETECTION SYSTEM

1. General

- a. Refrigerant gas detection system supplier/installer shall be familiar with standard practices of safety and installation of refrigerant gas vapor detection systems and shall provide these systems as a normal course of business. Acceptable gas detection supplier shall supply a list of 12 similar projects. Acceptable suppliers:
- b. Manufacturers: OI Analytical Corporation, Honeywell Sensing, Kunding, ATC, Inc or approved equal.
- c. System shall be "Packaged Equipment."
- d. System shall meet or exceed the latest ASHRAE 15-2001 requirement and EPA standard 608 CFR. System shall incorporate all latest revisions to bring up to current standards.
- e. Refrigerant gas detection system shall comply with IMC 2003 and/or all local codes.

2. Gas Detection System

- a. System shall be capable of detecting presence of any CFC, HCFC, or HFC refrigerant regardless of which chiller is selected (i.e. R-22, R-123, R-134a, R-410, etc. or other). System shall be capable of indicating, alarming, and shutting down equipment as specified below and in governing regulations. Oxygen deficiency monitoring shall not be acceptable in lieu of LTV-TWA monitoring for human safety exposure. Where combustion equipment is employed, refrigerant vapor monitoring system shall automatically shut down the combustion process in event of refrigerant leakage if other alternative acceptable conditions are not applied. Sequential sampling and multi-point monitoring shall be employed where air flow currents and room size prohibit a representative sample from one sensing point. Diluted samples due to ventilation air flow currents shall employ multi-point monitoring techniques strategically located according to regulation guidelines. Multiple chiller applications shall carefully consider whether mechanical room size and layout can adequately be monitored to comply with regulations with a single point or a multi-point system. System design considerations shall also be incorporated in leak detection monitoring sensing location(s), for early warning indication to prevent a major loss of refrigerant without alarm, should a leak occur.

3. Control Panel and Control Panel Equipment

- a. Analyzer: Analyzer shall be microprocessor-based and employed infrared (IR) sensor technology. It will accurately provide sensing down to one part per million (ppm) and shall be compound specific and/or monitor multiple compounds as specified, and be calibrated for either refrigerant R-22, R-123, R-134a, R-410, or other as required by approved chiller system. Any installed unit can be switched to monitor, at a future date, to another refrigerant type of changing one part and

recalibrating (i.e. CFC-11 to HCFC-123, etc.). Adjustable three level alarm for each point shall be supplied with common alarm output contacts. Provide local digital indication of ppm level for four sample points. Alarms shall be identified by an alarm message indicating the point in alarm and the alarm level. Unit shall have self diagnostics, and supply a common malfunction output for alarm horn or beacon. Loss of sample flow at either sample or ZERO line will indicate system malfunction.

- b. Sequential Sampling System: Four point sequential sampling system shall be integrated into one analyzer enclosure. Microprocessor shall sequentially control required flow valves and communicated output signals to allow monitoring from multiple remote sampling locations. Unit shall read and hold output value of infrared sensor and control of corresponding four point sequential sampling assembly. Each sampling point shall have adjustable sampling tie and adjustable levels of alarm. Sample line capability up to 500 ft. The system shall have add-on sample point expansion modules available for present configuration and future expansion.
- c. The system shall monitor and display accurately with the range of 0 to 25 ppm for refrigerant system and chiller diagnostics, detecting low level refrigerant leads and deterioration of system efficiency.
- d. NEMA-4 wall mount enclosure. Auto zero calibration shall be initiated at one hour interval (adjustable) or manually at the monitor and shall automatically zero by drawing air from an uncontaminated air source. Include built-in sample pump and differential pressure flow switch for low flow indication. Provide four separate 4-20 mA dc analog outputs and one RS-485 output of refrigerant level(s) for input into Direct Digital Control (DDC) or Building Management System (BMS). Unit shall be insensitive to vibration and shall provide for a continuous sample. Intermittent dump and purge, batch type samples with long response times shall not be acceptable. Response time shall be twenty (20) seconds or less to ninety-nine (99%) percent of reading. Malfunction relay is energized due to flow loss or electrical malfunction. Electrochemical sensing technology employing depletion sensors and short term life sensors, which deplete as a normal part of their operation or storage shelf life, shall not be acceptable.
- e. The system shall be configured to provide for an optional relay board, with dry contacts for each channel, to initiate output signal for three level alarms at local panel, interface with both the DDC or BMS and the building ventilation system. An early leak warning alarm shall be set at 10 ppm, regardless of refrigerant type, to prevent large refrigerant loss and provide chiller diagnostics. Other alarm level shall be set at or below the TLV-TWA level of ppm (e.g. 30 ppm for R-123). At the TLV-TWA level the system shall activate the purge ventilation system and sound a refrigerant leak alarm. Malfunction alarm indication and horn shall be provided (by contractor). Provide dry alarm contacts for each alarm level for interface to the DDC or BMS.
- f. Installation: Unit must be factory calibrated. No field calibration is acceptable at time of installation.

- g. Maintenance & Calibration: No calibration shall be required for a period of one (1) year from date of shipment. Zero filter and end of line filters should be replaced every three to six months or sooner, based on usage.

2.19 COOLING TOWER FILTRATION SYSTEM

1. General

- a. *Provide a high efficiency media filtration system. The filtration system shall operate continuously to remove suspended particulate from the condenser water. The filtration system shall backwash automatically upon reaching a 16 psig differential pressure set-point across the media bed or after 2 days, whichever occurs first. A manual pushbutton switch shall also activate the automatic backwash cycle.*
- b. *Filtration flux rate shall not exceed 20 gpm/ft². To assure that all filtered solids are removed during backwash, backwash flux rate shall not be less than 15 gpm/ft² for two minutes.*
- c. *Filtration system shall be as manufactured by Process Efficiency Products (PEP Filters) or approved equal.*

2. Equipment

- a. *The filtration system shall consist of a filter vessel, high efficiency filtration media, system matched pump with close coupled motor, pump pre-strainer with removable stainless steel strainer basket, UL control panel, face piping, pressure gauges, control valves and actuators. All filtration system components shall be mounted on a C4 channel 304 stainless steel base.*
- b. *Filtration system shall be assembled and tested at the factory prior to shipment.*
- c. *Filter Vessel and Vessel Components*
 - 1) *The filter vessel shall be fabricated of epoxy coated carbon steel. The vessel shall be rated for 100 psig maximum operating pressure. Filter vessel shall have suitably sized inlet and outlet connections, drain connection, access ports and vent fittings. Internal over and under-drain shall be of PVC construction.*
 - 2) *The filter vessel shall include both automatic and manual air vents.*
- d. *Face Piping*
 - 1) *Filter vessel face piping shall be schedule 80 PVC.*
 - 2) *Face piping shall be configured for system water backwash.*

e. Valves

- 1) *Valves shall be ball type with bronze body and corrosion resistant steel alloy ball with Teflon seat.*
- 2) *To eliminate water hammer potential and “out of sequence” operation, the control valves shall be mechanically linked.*

f. Actuator

- 1) *Motorized type electric actuator shall be utilized to cycle 3-way ball valves between filter and backwash mode.*
- 2) *Actuators shall be oversized for 150% over torque requirement for long life and dependability.*

g. Pump/Motor

- 1) *Filtration system shall include a filter-matched close-coupled bronze fitted pump/TEFC motor. The pump shall be sized for 35 gpm @ 50 ft. TDH to accommodate filter pressure drop. Pump shall include a cast iron body suction strainer.*

h. Control Panel

- 1) *The control panel shall be UL listed.*
- 2) *All electrical components shall be housed in a lockable NEMA 4X enclosure.*
- 3) *A lockable main disconnect switch shall be mounted on the enclosure door.*
- 4) *The control panel shall include a differential pressure switch to automatically cycle the backwash.*
- 5) *Panel shall have pump motor overload protection.*
- 6) *Panel shall include step-down transformer.*
- 7) *Panel and pump motor shall be factory pre-wired for single point connection to power source.*

i. Filter Media:

- 1) *Media shall be permanent type, rechargeable by backwashing at a flow rate no less than 15 gpm/ft² for two minutes. Filter manufacturer shall supply all required media. Media shall meet AWWA or NFS standards.*
- 2) *The standard media pack shall be rated to remove suspended*

particulate down to 5 microns.

PART 3 - EXECUTION

3.01 GENERAL

1. Install equipment in conformance with manufacturer's recommendations.

3.02 FIELD TESTS - PERFORMANCE

1. The manufacturer of the equipment shall perform all field testing and final adjustment of the refrigeration apparatus in accordance with provisions of the applicable ASHRAE Standards and 2003 IMC Section 1108.

2. Compile and certify the following data as applicable to the equipment being tested.

Outdoor air temperature

Temperature of chilled water - in and out

Temperature of condenser water (or glycol) - in and out

Chilled water flow - GPM

Condenser water (or glycol) flow - GPM

Pressure drop through chillers

Pressure drop through condensers

Condensing temperature

Operating kilowatts from measured voltage, amperes, power factor.

3. Should any part of the apparatus or system fail to meet the contract requirements, adjust, repair or replace any and all defective or inoperative parts and, on completion, again conduct the complete performance tests.

3.03 INSTALLATION, SUPERVISION AND INSTRUCTION

1. The manufacturer shall provide a competent engineer for a total of three eight-hour days, (straight time basis) for the phase of completion for the equipment and two eight-hour days per phase of the project not necessarily consecutive, for the instruction of the Owner's personnel. The instruction period shall start after the test period. Refer to the phasing documents for phasing and time durations.

2. Provide three charts of equipment lubrication and maintenance schedules mounted on 1/4" masonite and covered with heat bonded clear plastic laminate.

3. Provide a set of start and stop instruction mounted on 1/4" masonite and covered with heat bonded clear plastic laminate at each machine.

3.04 WARRANTY

1. The contractor shall provide to the owner an equipment warranty of no less than 18 months. The warranty period shall begin at the time of substantial compliance of a given phase as provided by the commissioning agent. The contractor shall refer to the phasing documents for installation and start of equipment.
2. The contractor shall furnish and install parts and labor as required for maintenance during the warranty period.

3.05 MAINTENANCE

1. The contractor shall maintain the refrigeration equipment during the warranty period. The maintenance shall be in accordance with manufacturers recommendations. The contractor shall furnish and install parts and labor during the warranty period at no additional cost to the owner.
2. The contractor shall maintain the refrigeration equipment until the project completes the last phase of construction. Refer to the phasing documents for time durations. The maintenance shall be in accordance with manufacturers recommendations. The contractor shall furnish and install the required maintenance of the equipment at no additional cost to the owner.
3. The maintenance shall include but not be limited to monthly greasing, equipment checks, phasing test for the addition of new equipment and piping, seasonal drain down, and seasonal filling and restart, and equipment cleaning. Refer to phasing documents.

END OF SECTION

SECTION 48 16 14 – GEOTHERMAL WELL DRILLING AND HORIZONTAL PIPING
INSTALLATION

PART 1 - GENERAL

1.1 PURPOSE OF SPECIFICATION

- A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 RELATED DOCUMENTS AND PROJECT COORDINATION

- A. During the execution of the Work, other contractors and trade personnel associated with project construction may be on-site during the installation, testing, and commissioning of the geothermal system. Contractor shall provide and pay for all temporary construction utilities and services not available but required to complete the Work.
- B. For the Geothermal installation, the Contractor shall coordinate with the Owner's Representative regarding all Work including but not limited to permitting, drilling, well installations, excavating, trenching, piping, flushing, flow testing, hydrostatic testing, and backfilling.
- C. The Contractor shall provide written requests for all clarifications pertaining to the Contract documents.

1.3 DESCRIPTION OF WORK

- A. The closed-loop ground source heat exchanger (CLGSHX) system consisting of two (2) 150-ft deep geothermal wells configured into a well circuits. The CLGSHX will serve as the heating and cooling source or sink circulation loops connected to the load side of a building HVAC system utilizing ground source heat pump units. The wells are connected by polyethylene heat fusion joined piping formed into vertical loops connected by horizontal headers installed to the geothermal wells.
- B. The Work includes furnishing all equipment, materials and labor for the installation and testing for the CLGSHX system as indicated in the contract drawings and specifications.
- C. The Work in this Section includes but may not be limited to:
 - 1. Drilling and installation of the geothermal wells including advancement through all subsurface materials including obstructions, at the locations and to the depths required. Pre-drilling, pre-excavation, or other methods, if required to overcome obstructions, shall be performed using techniques proposed by the Contractor and accepted through the submittal process defined herein.
 - 2. Installation of high density polyethylene (HDPE) U-bend assemblies and grouting into geothermal wells.

3. Flushing, flow testing, and pressure testing of the geothermal U-bend assembly before installation and after grouting.
4. Capping the installed U-bend assembly.
5. Trench excavation and backfilling for all exterior geothermal piping headers and circuits.
6. Installation of HDPE horizontal piping and connection to the geothermal wells, pipe bedding, and backfilling.
7. Installation of pipe bedding surrounding the horizontal pipe headers prior to backfilling.
8. Flushing, flow testing, and pressure testing of the circuits and pressure testing of each of the circuits.

1.4 RELATED DIVISIONS OR SECTIONS

NOT USED

1.5 DEFINITIONS AND REFERENCE STANDARDS

A. Definitions:

1. Contractor: Entity responsible for performing the Work of this Section.
2. Owner's Representative: Authorized representatives of the Owner.
3. Exchanger Grout: Thermally Enhanced grout installed around U-Tube exchanger.

B. Reference Standards

1. American National Standards Institute (ANSI)
2. American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE)
3. American Society of Mechanical Engineers (ASME)
4. American Society for Testing Materials (ASTM)
5. American Welding Society (AWS)
6. American Water Works Association (AWWA)
7. International Ground Source Heat Pump Association (IGSHPA)
8. National Ground Water Association (NGWA)
9. National Sanitation Foundation (NSF)
10. U.S. Occupational Safety and Health Administration (OSHA)
11. Plastics Pipe Institute (PPI)
12. Underground Facilities Protection Organization (UFPO)
13. Underwriters Laboratories (UL) or Factory Mutual (FM) Engineering Division

C. Should any conflict arise between the contract specifications and the above identified codes and standards the more stringent shall apply without effect to the Owner or Owner's Representative.

1.6 REGISTRATIONS, CERTIFICATIONS, AND LICENSES

- A. All drilling shall be conducted by a Connecticut registered well drilling contractor whether employed directly by the Contractor or by hire as a subcontractor.
- B. All loop installation shall be conducted by personnel certified as a System Fabricator and Installer by IGSHPA or an approved manufacturers' certification program whether employed directly by the Contractor or by hire as a subcontractor.

- C. All heat fusion shall be conducted by personnel as a Certified Heat Fusion Technician by IGSPHA whether employed directly by the Contractor or by hire as a subcontractor.

1.7 PROJECT CONDITIONS

NOT USED.

1.8 QUALITY CONTROL

- A. The Contractor shall adhere to the applicable requirements of ASHRAE, IGSHPA, and OSHA Standards, Connecticut Department of Energy and Environmental Protection (DEEP) and to all other applicable ordinances, codes, statutory rules, and regulations of federal, state, and local authorities having jurisdiction over the Work of this Section and other applicable specification Sections.
- B. The Contractor shall conduct field testing and measurements to confirm compliance with the requirements of this Section. Contractor shall notify the Owner's Representative 48 hours in advance of each test. The Owner's Representative may also conduct field testing during and/ or after completion of the wells to confirm compliance with the requirements of this Section. The Contractor shall cooperate with the Owner's Representative in all respects to facilitate any testing or observations. After testing is complete, Contractor shall certify system is installed in accordance with Contract Documents and is operating properly.
- C. Contractor supplied testing equipment shall be capable of operating in a satisfactory manner and of meeting performance criteria without defects or operational difficulties. If necessary, tests shall be repeated until satisfactory results are consistently obtained at no cost.
- D. Work not in conformance with the requirements of this Section shall be improved, or replaced with additional wells that conform to the requirements of this Section, as judged by the Owner's Representative and at no additional cost to the Owner. All costs related to testing of nonconforming Work or materials shall be paid for by the Contractor at no additional cost to the Owner.
- E. The presence of the Owner's Representative shall not relieve the Contractor of its responsibility to perform the Work in accordance with the Contract Documents, nor shall it be construed to relieve the Contractor from full responsibility for the means and methods of construction, protection of site improvements against damage, and for safety on the construction site.
- F. Tolerances:
 - 1. As-installed plan location of the well center shall be within 2 in. of the location shown on the Drawings.

1.9 SUBMITTALS

- A. Submittal Procedures
 - 1. Apply Contractor's stamp to submittal documents and sign or initial to certify that review and verification of the Products required, field dimensions, adjacent construction Work,

- and coordination of information is in accordance with the requirements of the Work and Contract Documents.
2. Schedule submittals to expedite the Project, and deliver to the Owner's Representative. For review of each submittal, allow a minimum of 5 days excluding delivery time to and from the Contractor, for Owner's Representative review. Provide for additional review time where specified.
 3. If Contractor identifies variations from Contract Documents or Products which may be detrimental to successful performance of the completed Work, Contractor shall identify such variations for the referenced Submittal.
- B. Review and Action on Submittals. Each submittal review sheet will be returned to the contractor stamped or marked as follows:
1. REVIEWED: The Contractor is advised that this means that fabrication, manufacture and/or construction may proceed providing the Work is in compliance with the Contract Documents.
 2. REVIEWED AS NOTED: The Contractor is advised that this means that fabrication, manufacture and/or construction may proceed providing the Work is in compliance with the marked notations and the Contract Documents.
 3. REVIEWED AS NOTED – RESUBMISSION REQUESTED: The Contractor is advised that this means that fabrication, manufacture and/or construction may proceed providing the Work is in compliance with the marked notations and the Contract Documents. The submittal should be corrected and resubmitted for final distribution.
 4. REJECTED: The Contractor is advised that this means no Work shall be fabricated, manufactured and/or constructed and that the Contractor shall make a new submittal for the project. Product submissions marked with this ACTION or NOTATION will not be permitted on the site.
 5. In the case of Shop Drawings, returned in the form of manufacturer's descriptive literature, catalog cuts and brochures stamped "REVIEWED" or "REVIEWED AS NOTED", the Contractor shall be responsible for distributing them in the field and to its subcontractors. If the returned Shop Drawings are stamped "REVIEWED AS NOTED RESUBMISSION REQUESTED" or "REJECTED", the Contractor shall submit new copies of Shop Drawings revised to show compliance with the Contract Documents.
 6. Owner's Representative review and action on the submittals are expressly limited as provided in the Contract Documents and are only to determine compliance with information given in the Contract Documents and conformance with the design concept of the completed project as a whole. Contractor is solely responsible for all matters relating to fabrication, shipping, handling, storage, assembly, installation, and construction, all safety aspects of performing the Work, system integrity and performance, and coordination of the Work.
- C. Submittal Packages
1. Submittals shall be prepared, and will be reviewed, in Pre- and Post- Construction Submittal Packages as described herein. Submittals contained in each package will be reviewed as a group. Packages containing missing or incomplete submittals will be returned NOT REVIEWED.
 2. In addition to Pre- and Post- Construction Submittal Packages, the Contractor shall also submit Construction Records throughout the construction period, as described herein.

- D. Pre-Construction Submittal Package. A Pre-Construction Submittal Package shall contain all of the following listed below, or will be return in its entirety and coded NOT REVIEWED. No work shall commence prior to complete review of the Pre-Construction Submittal Package.
1. Licenses and certifications as follows:
 - a. For all drilling contractors, whether employed directly by the Contractor or by hire as a subcontractor, provide proof of current, annual registration as a Connecticut registered well drilling contractor.
 - b. For all personnel involved in system installation, whether employed directly by the Contractor or by hire as a subcontractor or subcontracted employee, provide proof of System Fabricators and Installers Certified Installer accreditation from IGSHPA or approved manufacturers' certification program.
 - c. For all personnel involved in heat fusion, whether employed directly by the Contractor or by hire as a subcontractor or subcontracted employee, Proof of IGSHPA Certified Heat Fusion Technician.
 2. Identify all means and methods of fabrication and installation including the following:
 - a. Description of method to control and containerize water and drill cutting spoils.
 - b. Schedule for mobilization, set-up, and well drilling, including sequence.
 - c. Methods, equipment and devices to be used to advance the wells.
 - d. Methods of U-bend pipe installation.
 - e. Methods of tremie grouting around U-bend pipe.
 - f. Proposed mix designs of Exchanger Grout.
 - g. Methods to measure the flow of water being introduced to the well (due to Contractor's installation methods) to the nearest 10 gpm.
 - h. Methods to measure the flow of water being taken out of the well to the nearest 10 gpm.
 - i. Pipe bedding and backfill
 - j. Pipe and fittings including joining methods and pipe fusion equipment
 - k. Pipe manufacturer shall supply a Certificate confirming compliance with the specifications of this Section and governing agencies
 - l. Inside and outside diameter of surface casing and tremie tube
 - m. Methods and materials to join surface casings
 - n. Diameter of all bits to be used.
 - o. Detail of cap to be used.
 - p. Proposed material to be used for Sand Bedding including documentation demonstrating that these materials meet specified requirements.
 3. All permits and approvals required to perform the Work.
 4. Submit manufacturer's product data and cut sheets for all equipment, materials and products to be supplied to complete the Work.
 5. Submit Shop Drawings that consist of detailed layout drawings of the Work Area Layout and System including but not limited to:
 - a. location and description of equipment, vehicles, laydown areas, water collection systems, storage areas, and other relevant features,
 - b. system piping including pipe lengths and U-bend assemblies,
 - c. dimensioned locations of each bore hole,
 - d. locations of site utilities,
 - e. alignment and grade of horizontal header geothermal loop heat exchanger piping,
 - f. Erosion control plan.
 - g. Location for on-site stockpile area,
 - h. Water treatment and water discharge plan.

6. Provide warranty documentation showing that the Contractor and pipe manufacturer will meet the warranty requirements indicated herein.
 7. Written Flushing and Testing Plan detailing the means and equipment to be used for system purging, flushing, and hydrostatic testing as required herein, including:
 - a. Shop drawings showing flush, flow testing, and hydrostatic testing set up and methods.
 - b. Cut sheets of flow meters and pressure gages to be used, including range and smallest dial readings and recent calibration logs.
 - c. Cut sheet of pumps to be used for hydrostatic testing and hydrostatic testing methods.
 - d. Proposed forms to be used to collect and maintain purge, flow, and hydrostatic pressure test data both for testing at individual wells and for circuits.
- E. Construction Records. During Construction, the following records shall be submitted via email to pormond@haleyaldrich.com on the day the activity is undertaken:
1. Photo-documentation of installed piping system and separator clips, using the attached form.
 2. Flushing, flow, and hydrostatic tests with separate records for each of these tests conducted at:
 - a. Each individual well.
 - b. Each circuit.
 3. Completed well drilling logs indicating conditions encountered, depth of installed casing, water encountered, drilling time, down-time, methods used, top of geologic rock, date of U-bend installation, date of grouting, and other relevant information to record conditions encountered and as-built conditions.
 4. Logs of recorded water flow measurements encountered during drilling according to methods described herein.
 5. Results of Exchanger Grout sample testing for hydraulic conductivity and thermal conductivity.
- F. Post-Construction Submittal Package. A Post-Construction Submittal Package shall contain the all of the following listed below, or will be returned in its entirety and coded NOT REVIEWED. The Post-Construction Submittal Package shall be submitted within 10 days of project completion.
1. Record drawings showing all final dimensions, elevations, and locations of all work performed under this contract including locations of the geothermal wells, and all underground utilities within.
 2. All paperwork and registrations as required by the Connecticut DEEP, including submission of well completion reports to the respective agencies.
 3. All inspections and approvals from the governing authorities and submit to the Owner's Representative.
- 1.10 DELIVERY, STORAGE, AND HANDLING
- A. Coordinate all deliveries and storage locations with Owner's Representative and other site contractors.
 - B. All equipment delivered and placed in storage shall be stored with protection from the weather, humidity, temperature variations, dirt, dust, and other contaminants.

- C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- D. Protect piping systems from entry of foreign materials and water by temporary covers, completing sections of work, and isolating parts of completed system.

1.11 FIELD MEASUREMENTS

- A. It is the contractor's responsibility to call "Call Before You Dig" to determine if any existing underground utilities are located in the vicinity of the Work, per State regulations. Contractor shall coordinate with the Owner's Representative to verify any Site underground utilities not covered by "Call Before You Dig." If any "marked" or located underground utilities are damaged during the Work, it will be the Contractor's responsibility to properly repair and return the utility to service and restore the site to existing conditions prior to recommencing the Work at no cost to the Owner.
- B. Coordinate with Owner's Representative to verify set-backs and easements (if applicable); confirm drawing dimensions and elevations prior to commencing the Work.
- C. Establish adequate site protection measures for moving, setting up, operating and removal of drill rigs and other support vehicles or equipment, including protection of curbs and sidewalks, protection of existing trees, shrubs and lawn and any potential overhead interferences. Contractor shall inform the Owner's Representative of any obstructions to the drilling operation before actions are taken to remove obstructions. If any "identified" site features are damaged during the Work, it will be the Contractor's responsibility to properly repair and return the site feature to existing conditions prior to recommencing the Work at the expense of the Contractor.

PART 2 - PRODUCTS

2.1 WELL MATERIALS

- A. Drilling Equipment: Truck-mounted (rubber tire) vehicles capable of advancing wells as specified herein under site conditions at the planned time of installation
- B. Casing shall be flush threaded steel casing with no external couplings. Casing shall conform to AWWA Standards and shall have a minimum wall thickness of 0.25 in. or sufficient wall thickness to allow installation into soil and bedrock without having to drill an oversized hole through the soil and bedrock.

2.2 EXCHANGER GROUT

- A. Exchanger gout shall be CETCO High TC Geothermal Grout or an approved equal high solids cement-bentonite grout having a thermal conductivity equal to or greater than 0.76 BTU/hr-ft-°F and having a hydraulic conductivity less than 1×10^{-7} cm/sec.
- B. Sand used for the geothermal grout mixture shall be provided by the contractor and shall be as specified by the grout manufacturer.

- C. Exchanger grout shall be mixed and installed according to the manufacturer's specifications.

2.3 PIPE SEPARATORS

- A. Omega EZ-Snaps manufactured by Geo-Air Industries, or approved equal.
- B. GeoClip™ manufactured by GBT, Inc, or approved equal.

2.4 HDPE U-TUBE/ PIPE ASSEMBLY AND MATERIALS

- A. All horizontal and vertical piping shall be of high density polyethylene (HDPE) material and shall be manufactured by Performance Pipe – Charter Plastics, DriscoPlex, Lamson Vylon, NuMex Plastics, or approved equal. HDPE pipe must meet the specifications as follows:
1. Pipe shall be Schedule 40
 2. Vertical U-tubes shall have an inside diameter of 1.38-in.
 3. Horizontal piping connecting the wells to the building shall have inside diameter of 3-in.
 4. All HDPE Pipe Dimensions shall be manufactured in accordance with ASTM D-3035.
 5. All pipe and heat-fused material shall be manufactured from virgin polyethylene extrusion compound material in accordance with ASTM D 3035. Pipe shall be manufactured to outside diameters, wall thickness and respective tolerances as specified in ASTM D-3039 or D-2447.
 6. Material shall maintain a 1,600 psi Hydrostatic Design Basis at 73.4 degrees Fahrenheit per ASTM D-2837, and shall be listed in PPI TR4 as a PE3408 piping formulation. The material shall be a high-density extrusion compound having a minimum cell classification of PE345434C or higher with a UV stabilizer of C, D, or E as specified in ASTM D-3350 with the exception that this material shall exhibit zero failure (F0) when tested for 192 hours or more under ASTM D-1693, condition C, as required in ASTM D-3350.
 7. Sufficient information shall be permanently marked on the length of the pipe. The appropriate ASTM pipe standard defines this information. All fittings shall also be similarly marked. Marked information shall include:
 - a. Manufacturer's name.
 - b. Nominal size.
 - c. Pressure rating.
 - d. Relevant ASTM standards.
 - e. Cell classification number.
 - f. Date of manufacture.
 8. All piping used for the u-bend heat exchanger (pipe located in the borehole) will have factory hot-stamped lengths impressed on the side of the piping indicating the length of the heat exchanger to that point. The length shall read zero on the u-bend end and the actual heat exchanger total length on the other end.
 9. HDPE fittings shall meet the requirements of ASTM D-2683 (for socket fusion fittings) or ASTM D-3261 (for butt/saddle fusion fittings), and 780 CMR 71.00 Section 7104.2. For connections to equipment and valves with threaded connections, furnish fused transition with reinforced threads. Barbed type fittings shall not be used.
 10. Eccentric fittings and/or eccentric reducing couplings shall be provided in all cases where air or water pockets would otherwise occur in the system horizontal piping due to the reduction in pipe size. Unless otherwise indicated, eccentric fittings shall be installed to keep the piping flush on the top.

2.5 UNDERGROUND PIPE MARKERS

- A. Manufacturers: Seton, Reef Industries, Inc. or approved equal
- B. Detectable Warning Tape: Magnetic detectable conductor, brightly colored plastic covering, imprinted with "Caution Geothermal Piping Buried Below" in large letters.

PART 3 - EXECUTION

3.1 GENERAL

- A. Contractor shall coordinate with the Owner's Representative regarding trenching, excavation and backfilling and directed by Owner's Representative for placement of geothermal piping systems.
- B. Install all piping, fittings, and appurtenances in accordance with Contract Drawings and Specifications as well as manufacturer's written instructions after inspection and approval by the Contractor.

3.2 WELL DRILLING

- A. Advance wells in accordance with approved submittals.
- B. Contractor shall anticipate that down-the-hole hammers, roller bits/cones, core barrels, or other similar equipment will be necessary to overcome boulders and cobbles, soil overburden, and bedrock. Telescoping casing may be required to be able to overcome boulders and cobbles to construct the well as specified.
- C. Drilling shall be advanced such that no voids remain around the exterior of the casing and that the annular space between the outside of the casing and the surround soil and rock is less than 1/8 in.
- D. Casing shall be advanced to a minimum of 10 ft below competent rock, as determined by the Owner's Representative.
- E. Casing shall be left-in-place and shall not be extracted.
- F. Rock bore diameter shall be 6-in.

3.3 REAL TIME WELL DRILLING FLOW MONITORING; PURGING/CLEANING; QUALITY CONTROL

- A. During drilling, measure the flow rate of water being introduced into the well at the ground surface to support the drilling operations. Measure the flow rate of water being extracted from the well, at a minimum, once per hour during drilling and each time significant changes in flow are encountered. Log the data and maintain measurements on site.

- B. Upon completion of each drill, purge and clean each well to remove sediment and other materials from well. Refer to Drawings for testing requirements.

3.4 WATER MANAGEMENT, TREATMENT, AND DISCHARGE

- A. Construct and provide containers, sheeting, bins, hoses, pumps, and other equipment necessary to collect water from the wellhead such that the water does not leave the rig area or cause erosion.

3.5 U-BEND INSERTION AND GROUTING; CIRCUIT AND SYSTEM TESTING

- A. Conduct flushing, flow testing, and hydrostatic testing at each well, circuit, and whole system as indicated herein.
- B. Record pressures, flow rates, and other data as indicated herein.
- C. Contractor shall place Pipe Separators at a minimum of 10-ft intervals to position the U-bend pipes against the borehole wall while inserting into each well.
- D. Conduct photo-documentation as require herein, including a prominent display of well number in the photograph and Pipe Separator installation. Photographs shall be date and time stamped and submitted via email on the day the photograph is taken.
- E. Insert U-bend assembly with Pipe Separators into drilled bore.
- F. Add additional Exchanger Grout as necessary if top of grout level drops below the ground surface after initial grouting.
- G. Collect Exchanger Grout specimens and conduct testing as required on the Drawings.

3.6 FLUSHING AND INTEGRITY TESTING OF INDIVIDUAL U-BENDS

- A. After tremie grouting of U-bend in well, conduct flushing of the well to purge air and debris from the U-bend by maintaining a minimum of 9 gpm for the greater of 15 minutes or until air bubbles are observed to be absent from the effluent. Flow rate shall be confirmed with a flow meter capable of measuring flow rate to the nearest 1 gpm, having graduations no larger than 20 gpm on the flow meter dial.
- B. After flushing has been completed, apply a target flowrate of 9 gpm and measure the pressure drop across the inlet and outlet of the U-bend for a minimum of 15 minutes. Record pressure drop every 1 minute. Pressure drop shall be measured to the nearest 1 psi using a dial gage containing graduations no larger than 5 psi on the pressure gage dial. Flow rate shall be maintained to with 0.25 gpm of the target flowrate throughout the test. Flow rate shall be measured as stated above. Confirm pressure drop is no greater than 2.5 psi.
- C. After the pressure drop test, conduct a hydrostatic pressure test in accordance with ASTM F2164-02 as follows:

1. Hold a target test pressure of 90 psi for a minimum of 4 hours. During the four hour period, take readings of hydrostatic test pressure every 5 minutes. Pressure shall be measured with pressure gage capable of reading pressure to the nearest 1 psi using dial gage containing graduations no larger than 100 psi. If measured pressure reduces more than 1 psi, re-apply test pressure to match (not exceed) test pressure.
 2. Repeat test pressure re-application as necessary for 4 hours.
 3. If no leaks are detected after maintaining pressure, reduce target test pressure by 10 psi and hold for a duration of 1 hour. Do not add pressure during this period.
 4. Confirm that target test pressure does not vary more than 5% of test pressure over 1 hour period.
- D. Reduce pressure to atmospheric while maintaining water in the U-bend.

3.7 WELL LOCATIONS AND HORIZONTAL CIRCUIT CONSTRUCTION

- A. Wells shall be located on the project site at locations to be determined.
- B. Well locations shall conform to state and local regulations, including utility setback requirements.
- C. The two wells shall be joined in a reverse-return circuit configuration.
- D. Horizontal piping shall be placed such that the top of the pipe shall be a minimum of 4-ft below finished grades.
- E. All horizontal piping shall be surrounded by a sand bedding, extending 1-ft above and below the top and sides of the piping.
- F. A pair of 3-in pipes shall extend from the building to the wells, connecting the wells and the building. The pipes in this pair shall be minimum of 1-ft distant from each other.
- G. Horizontal piping shall come into building as follows:
 1. Both pipes shall remain 4-ft below grade, up to building wall at a location to be determined.
 2. Foundation footings shall be locally lowered to accommodate the horizontal piping going over the top of the footings by at least 6-in.
 3. The horizontal piping shall sweep up through the lowest level slab and extend a minimum of 12-in vertically above the top of the lowest level slab at a location to be determined.
 4. Cap the pair of pipes with an heat-fused HDPE cap.

3.8 FLUSHING AND INTEGRITY TESTING OF CIRCUIT

- A. After completion of circuits connecting the two wells to the building, conduct flushing of the circuit to purge air and debris from the circuit by maintaining a minimum flow rate to be determined for the greater of 15 minutes or until air bubbles are observed to be absent from the

effluent. Flow rate shall be confirmed with a flow meter capable of measuring flow rate to the nearest 1 gpm, having graduations no larger than 20 gpm on the flow meter dial.

- B. After flushing has been completed, apply a target flowrate to be determined and measure the pressure drop across the inlet and outlet of the circuit for a minimum time to be determined. Record pressure drop every 1 minute. Pressure drop shall be measured to the nearest 1 psi using a dial gage containing graduations no larger than 5 psi on the pressure gage dial. Flow rate shall be maintained to within 0.25 gpm of the target flowrate throughout the test. Flow rate shall be measured as stated above. Confirm pressure drop is no greater than the target to be determined.
- C. After the pressure drop test, conduct a hydrostatic pressure test in accordance with ASTM F2164-02 as follows:
1. Hold a target test pressure of 90 psi for a minimum of 4 hours. During the four hour period, take readings of hydrostatic test pressure every 5 minutes. Pressure shall be measured with pressure gage capable of reading pressure to the nearest 1 psi using dial gage containing graduations no larger than 100 psi. If measured pressure reduces more than 1 psi, re-apply test pressure to match (not exceed) test pressure.
 2. Repeat test pressure re-application as necessary for 4 hours.
 3. If no leaks are detected after maintaining pressure, reduce target test pressure by 10 psi and hold for a duration of 1 hour. Do not add pressure during this period.
 4. Confirm that target test pressure does not vary more than 5% of test pressure over 1 hour period.
- D. Reduce pressure to atmospheric while maintaining water in the circuit.

3.9 CAPPING

- A. ~~Cap the well ends using closed HDPE cap.~~

3.10 UNDERGROUND HORIZONTAL HDPE PIPING AND JOINING METHODS

- A. Contractor shall field verify well u-bend/pipe assembly to header piping connections and document the u-bend length prior to completing the connection of the u-bend assembly to the horizontal piping.
- B. Joining of the HDPE pipe system shall be by the heat fusion process. Joining shall be of the socket, butt, saddle fusion, or electro-fusion methods in accordance with the pipe manufacturer's procedures.
- C. Butt fusion equipment used in the joining procedure shall be capable of meeting all conditions recommended by the pipe manufacturer, including, but not limited to, temperature requirements, alignment, and interfacial fusion pressure.
- D. Butt fusion joining shall be 100 percent efficient offering a joint weld strength equal to or greater than the tensile strength of the pipe. Flanges, unions, grooved couplers, transition fittings and some mechanical couplers may be used to mechanically connect HDPE pipe without butt fusion provided one end of these fittings is fusion welded to the HDPE pipe.

- E. Contractor shall provide coiled pipe for all vertical and horizontal runs to the extent possible to minimize the number of underground joints required while avoiding sharp bends in piping runs. Minimum bend radius shall be determined by manufacturer's written data. Contractor shall submit length of coiled piping used, in lieu of fittings, to ensure reverse return and well circuit piping lengths are equivalent as indicated in Contract Drawings.
- F. Contractor shall connect piping to all wells shown on Drawings including connections to any existing test wells. Contractor shall cut down or extend any existing wells for tie in to piping system.
- G. Prepare dimensioned drawings of the complete ground heat exchanger piping system indicating locations and depth before backfilling including identifying sizes and quantities of piping length for determination of installed system fluid volumes.

3.11 HDPE PIPE BEDDING

- A. Prior to laying pipe in excavation, place sand bedding. Bedding fill shall be placed in layers not to exceed 9 in. in thickness as measured before compaction. Each layer shall be compacted by a minimum of four coverages with hand-guided vibratory equipment or mechanical tampers as approved by the Owner Representative.
- B. After piping has been installed in trench bed and all hydrostatic testing and purging is completed, trenches shall be backfilled between and over the crown of the HDPE piping as shown on the Contract Drawings.

3.12 UNDERGROUND PIPE MARKERS

- A. Geothermal detectable warning tape shall be installed above all horizontal geothermal piping 12 in. below finished grade and shall be centered over each trench.

3.13 WARRANTY

- A. Contractor shall provide a minimum 50-year warranty to Eli Whitney Regional Vocational Technical School for the HDPE piping materials. Warranty shall name Eli Whitney Regional Vocational Technical School as the beneficiary and the Contractor and pipe manufacturer as the warranty providers.

PART 4 - MEASUREMENT AND PAYMENT

4.1 GENERAL

- A. Except as provided below, all Work of this Section, including obtaining permits, mobilization/demobilization, equipment procurement or rental, labor, incidentals, and materials shall not be measured, but rather paid as a Base Bid in accordance with item number 48 16 14-1 identified in the table below. The Base Bid shall assume the following:

SECTION 48 16 14

GEOTHERMAL WELL DRILLING AND HORIZONTAL PIPING INSTALLATION

1. 75-ft of casing is required at each well location to meet the requirements of 3.02 Part 4 of Section 3 Part D. If more or less well casing than this Base Bid quantity is required, the Contractor shall be compensated or shall provide a credit for the actual casing footage installed in aggregate between the two wells which is more or less than the total quantity provided in the Base Bid. Add/ deduct accepted by the Owner's Representative shall be paid or credited in accordance with item number 48 16 14-2 identified in the table below.
2. Between 0 and 50 gallons per minute (gpm) per well is required to be removed from the bedrock to advance the well boreholes to their design depth. Additional equipment, materials, and labor required to drill well boreholes and manage the effluent for conditions where greater than 50 gpm of water per well is encountered in the bedrock requiring continuous removal from the well column to enable drill equipment to be advanced shall not be measured but shall be paid Lump Sum per Well basis in accordance with item 48 16 14-3 identified in the table below.

Item Number	Description	Unit	Quantity	Price
48 16 14-1	Base Bid	Lump Sum	1	\$_____
48 16 14-2	Add/ Deduct Measured Casing	Linear foot	As Necessary	\$___/ft Add/ Deduct from Base Bid of 75-ft at each well
48 16 14-3	Additional Water Discharge (>50 gpm)	Lump Sum per Well	2	\$___/well

Attachment: Separator Installation Record

END OF SECTION

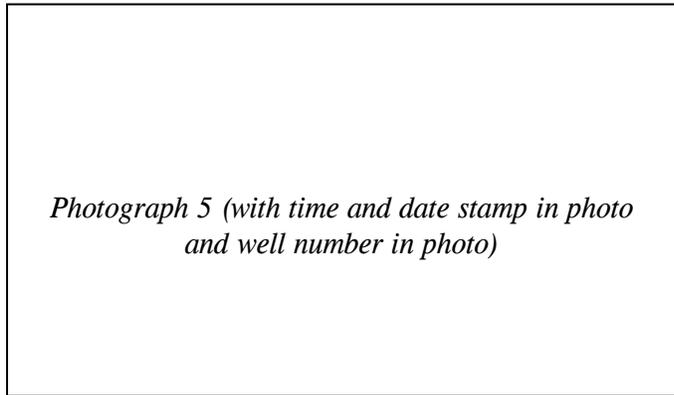
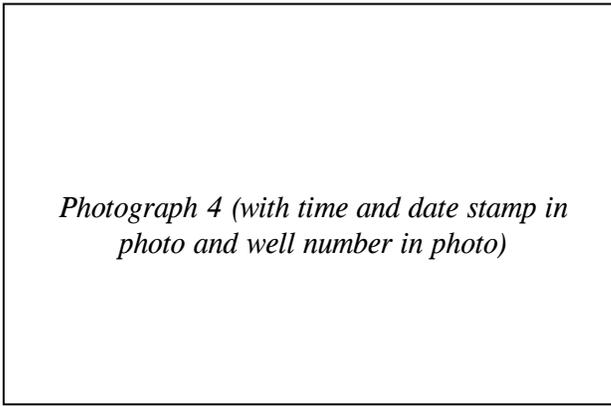
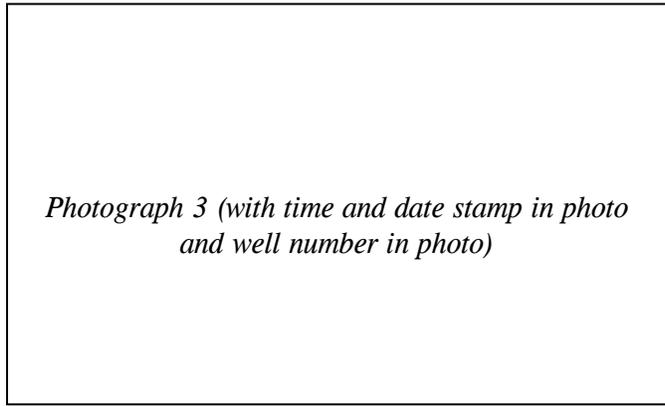
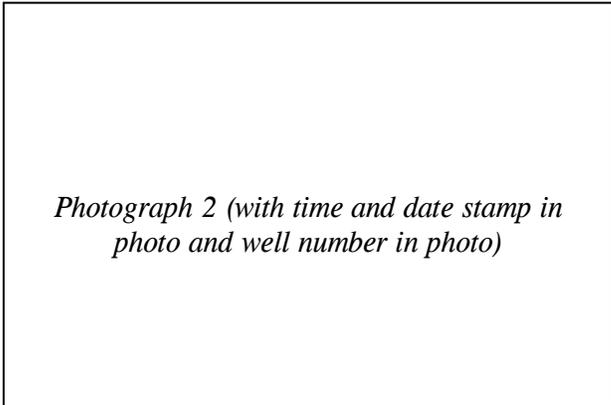
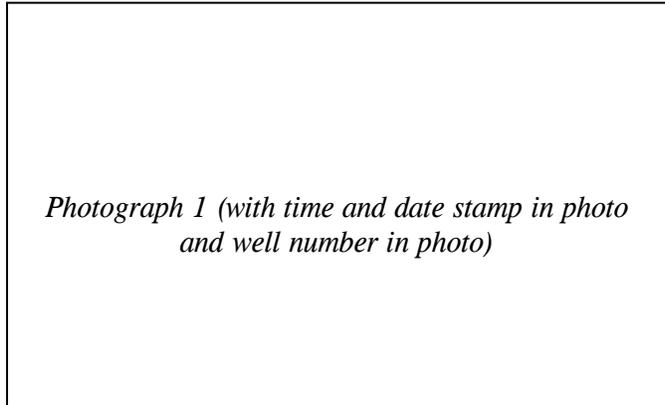
Z:\31771\700\Deliverables\Specs\Addendum 3~\$12-0730 48 16 14 GeothermalWell Spec-F2 Addendum 3.docx

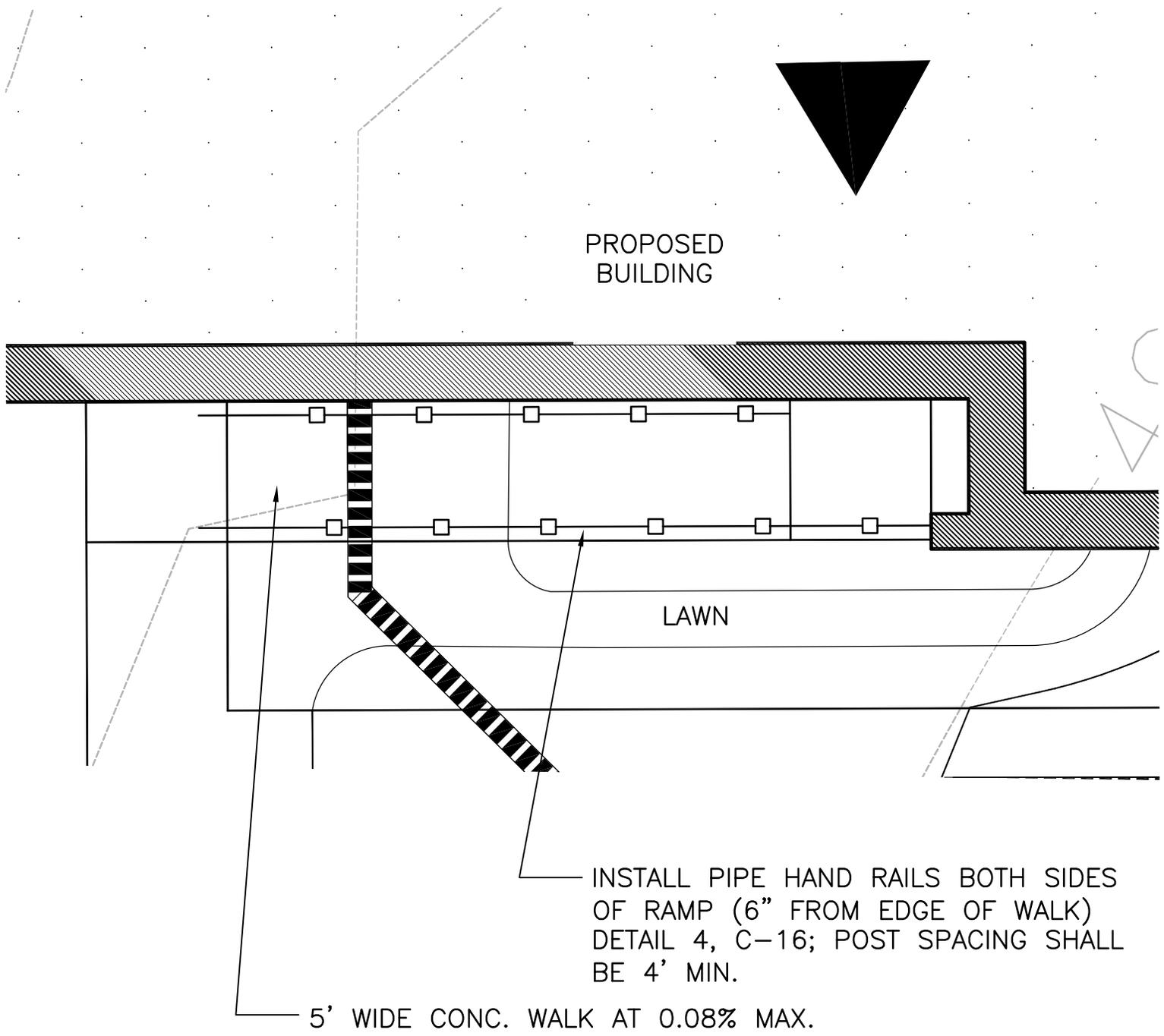
SEPERATOR INSTALLATION RECORD

E-House
Geothermal System Installation
Hamden, Connecticut

Well Number _____
Well and Separator Installation Date _____

**COMPLETED RECORD SHALL BE SENT VIA EMAIL TO
PORMOND@HALEYALDRICH.COM ON SAME DAY OF SEPERATOR INSTALLATION**





SCALE: 1" = 5'

Addendum No. 3

JULY 30, 2012
210610049



Stantec

Stantec Consulting Services Inc.

2321 Whitney Avenue
Hamden, CT 06518

Tel. 203.281.1350
Fax. 203.281.1470
www.stantec.com

Client/Project

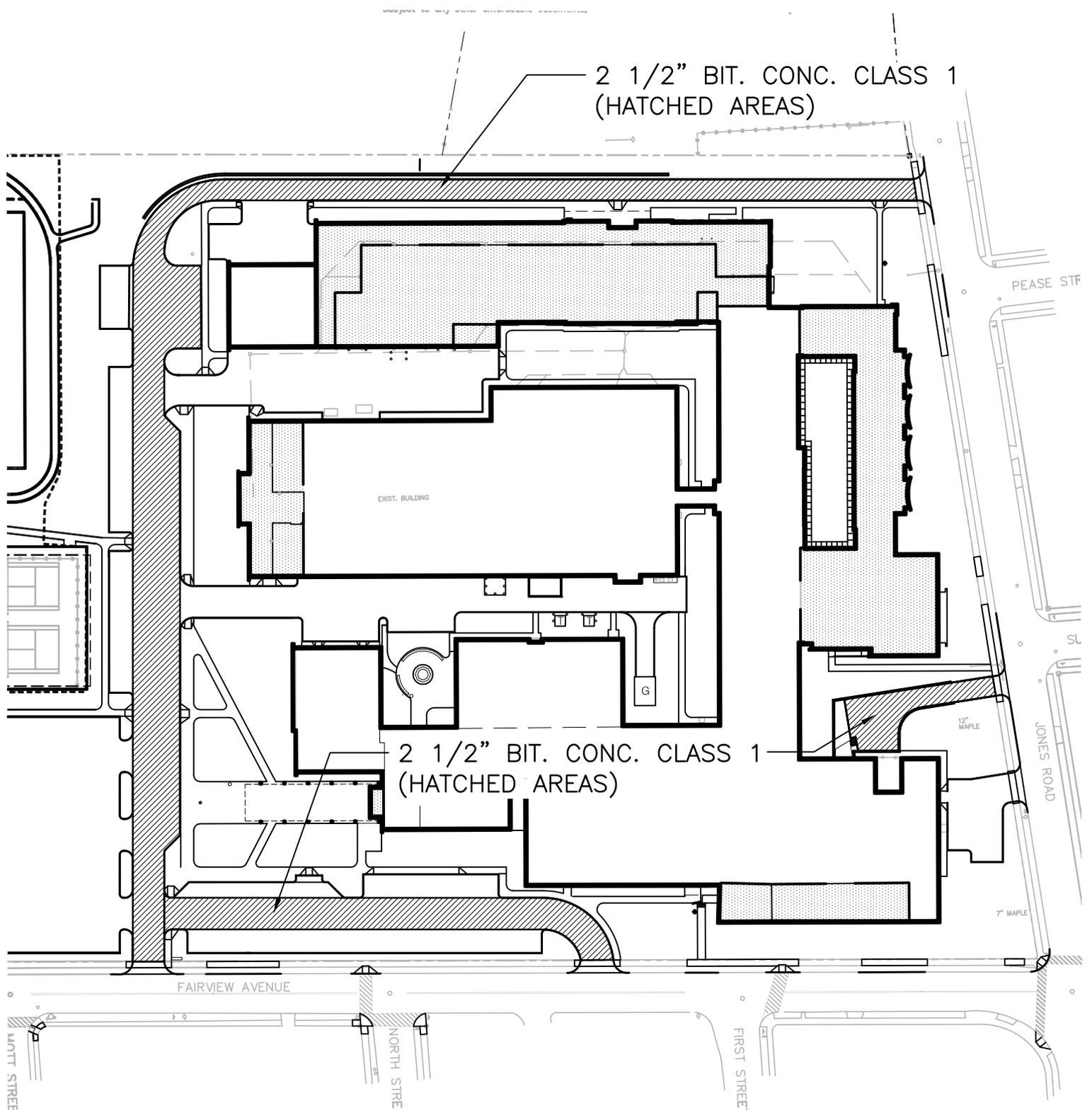
Eli Whitney CTHS

Figure No.

SK-0.026

Title

**CONCRETE RAMP DETAIL
RFI 0.026**



2 1/2" BIT. CONC. CLASS 1
(HATCHED AREAS)

2 1/2" BIT. CONC. CLASS 1
(HATCHED AREAS)

SCALE: 1" = 100'

Addendum No. 3
JULY 30, 2012
210610049



Stantec

Stantec Consulting Services Inc.
2321 Whitney Avenue
Hamden, CT 06518

Tel. 203.281.1350
Fax. 203.281.1470
www.stantec.com

Client/Project
Eli Whitney CTHS

Figure No.
SK-0.070

Title
**PAVEMENT CLARIFICATIONS
RFI 0.070**

A-WING MAIN FLOOR DOOR SCHEDULE

DOOR		FRAME																								
DOOR NUMBER	SHEET NUMBER	SIZE (EACH LEAF)											TYPE/MATERIAL	TYPE/MATERIAL	DETAILS-SEE DWG. A-905			HARDWARE SET NO. - SEE SPEC. - 08710	LABEL (IN MINUTES)	REMARKS						
		DOUBLE LEAF DOOR	2'-0" x 7'-0" x 1-3/4"	2'-6" x 7'-0" x 1-3/4"	3'-0" x 7'-0" x 1-3/4"	4'-0" x 7'-0" x 1-3/4"	3'-4" x 7'-0" x 1-3/4"	3'-6" x 7'-0" x 1-3/4"	3'-8" x 7'-0" x 1-3/4"	3'-0" x 8'-0" x 1-3/4"	6'-0" x 8'-6" MLT. ROLL-UP	10'-0" x 8'-6" MLT. ROLL-UP	ROLLING GRILLE CURTAIN	3'-0" x 7'-0" (MESH)	FINISH	(SEE DOOR ELEVATIONS)	(SEE FRAME ELEVATIONS)				FINISH	HEAD DETAIL	JAMB DETAIL	SILL/THRESHOLD/DETAIL		
A100a	A-101.1	*			*											S	C-WD	EX-HM	P	H13	J25b	-	24	45	21	
A101a	A-101.1	*			*											S	C-WD	EX-HM	P	H12	J24	-	24	45	21	
A101b	A-101				*											P	A-HM	EX-HM	P	H12	J24	-	41	45	21	
A102	A-101.1				*											S	A-WD	EX-HM	P	H12	J24	-	42	45	21, 28	
A103	A-101.1	*										*				P	C-HM	EX-HM	P	H12	J24	-	27	-	21	
A104	A-101.1				*											S	C-WD	4A-HM	P	H17, H17b	J18, J20	-	44	-		
A105	A-101.1				*											S	C-WD	5-HM	P	H17, H17b	J18, J20	-	44	-		
A106	A-101.1				*											S	C-WD	4A-HM	P	H17, H17b	J18, J20	-	44	-		
A107a	A-101.1				*											S	C-WD	4-HM	P	Sim H18, Sim H18a	Sim J28b	-	34	45	9	
A107b	A-101.1				*											S	C-WD	4-HM	P	Sim H18, Sim H18a	Sim J28b	-	34	45	9	
A107c	A-101.1				*											S	C-WD	4-HM	P	Sim H18, Sim H18a	Sim J28a, Sim J28b	-	33	45	9	
A108	A-101.1			*												S	A-WD	1D-HM	P	H6	J18	-	43	-		
A109	A-101.1				*											S	C-WD	4-HM	P	H18, H18a	J28b	-	33	45		
A111a	A-101.1				*											S	A-WD	1B-HM	P	H6	J18	-	44	-	28	
A111b	A-101.1				*											S	A-WD	1B-HM	P	H6	J18	-	43	-	28	
A113	A-101.1				*											S	A-WD	1B-HM	P	H6	J18	T2	37	-	8	
A114	A-101.1			*												S	A-WD	1D-HM	P	H6	J18	-	43	-	28	
A115	A-101.1				*											S	C-WD	4-HM	P	H18, H18a	J28b	-	33	45		
A116a	A-101.1				*											S	C-WD	4-HM	P	Sim H18, Sim H18a	Sim J28b	-	34	45		
A116b	A-101.1				*											S	C-WD	1-HM	P	Sim H18	Sim J28b	-	34	45		
A116c			N	O	T	U	S	E	D																	
A117a	A-101.2	*			*											S	B-WD	2-HM	P	H12	J25	-	25	45		
A119	A-101.1				*											S	A-WD	1B-HM	P	H6	J18	-	44	-		
A120	A-101.1				*											S	A-WD	1B-HM	P	H6	J18	-	44	-	28	
A121a	A-101.1				*											S	A-WD	1-HM	P	H14	J26, J27	-	41	45	28	
A121b	A-101.1				*											S	A-WD	1-HM	P	H14	J26, J27	-	44	45	28	
A122	A-101.1				*											S	C-WD	4-HM	P	H18, H18a	J28a, J28b	-	33	45		
A123	A-101.2				*											S	C-WD	1B-HM	P	H6	J18	-	43	-	28	
A123a			N	O	T	U	S	E	D																	



ELI WHITNEY CTHSS
 ADDITIONS AND RENOVATIONS
 STATE PROJECT NUMBER: BI-RT-837
 71 JONES ROAD
 HAMDEN, CONNECTICUT

DRAWING TITLE:
 REVISED A-WING MAIN FLOOR
 DOOR SCHEDULE (PARTIAL)
 REF. DWG.: A-901 (PART OF ADDENDUM - 03)

DRAWING NO.
SKA-11

SCALE:	DRAWN BY: JDS	REVIEWED BY: DCF	DATE: 30 JULY 2012
			JOB NUMBER: 11025

A-WING UPPER FLOOR DOOR SCHEDULE

		DOOR										FRAME							
DOOR NUMBER	SHEET NUMBER	SIZE										TYPE/ MATERIAL	TYPE/ MATERIAL	DETAILS-SEE DWG. A-905			HARDWARE SET NO. - SEE SPEC. - 08710	LABEL (IN MINUTES)	REMARKS
		DOUBLE LEAF DOOR	2'-0" x 7'-0" x 1-3/4"	2'-6" x 7'-0" x 1-3/4"	3'-0" x 7'-0" x 1-3/4"	4'-0" x 7'-0" x 1-3/4"	3'-4" x 7'-0" x 1-3/4"	3'-6" x 7'-0" x 1-3/4"	3'-8" x 7'-0" x 1-3/4"	3'-0" x 8'-0" x 1-3/4"	6'-0" x 8'-6" MLT. ROLL-UP	10'-0" x 8'-6" MLT. ROLL-UP	ROLLING GRILLE CURTAIN	3'-0" x 7'-0" (MESH)	FINISH	(SEE DOOR ELEVATIONS)			

A213	A-101.4			*										S	A-WD	1B-HM	P	H17	J20	-	43	-	
A214	A-101.4			*										S	C-WD	4A-HM	P	H17, H17b	J18, J20	-	44	-	11
A215	A-101.4			*										S	A-WD	1-HM	P	H14	J26	T2	36	45	8, Undercut door 3/4"
A216	A-101.4			*										S	A-WD	1-HM	P	H14	J26	T2	36	45	8, Undercut door 3/4"
A217	A-101.4			*										S	A-WD	1-HM	P	Sim H18	Sim J28b	-	41	45	28
A218	A-101.4			*										S	A-WD	1B-HM	P	H17	J18	-	44	-	8
A219	A-101.4		*											S	A-WD	1D-HM	P	H17	J18	-	43	45	
A220	A-101.4			*										S	C-WD	4-HM	P	H18, H18a	J28b	-	35	45	
A221	A-101.4			*										S	C-WD	8-HM	P	H17	J18	-	44	-	10
A222	A-101.4			*										S	C-WD	4A-HM	P	H17	J18, J20	-	44	-	10
A223	A-101.4			*										S	C-WD	4A-HM	P	H17	J18, J20	-	43	-	10
A224	A-101.4			*										S	A-WD	1B-HM	P	H17	J18	-	44	-	
A225a	A-101.4			*										S	C-WD	1-HM	P	H18	J28b	-	34	45	
A225b	A-101.4			*										S	C-WD	1B-HM	P	H17	J18	-	34	-	11
A225c	A-101.4			*										S	C-WD	4-HM	P				34	45	11
A226	A-101.4			*										S	C-WD	4-HM	P	H18, H18a	J28b	-	34	45	11
A227a	A-101.3	*		*										S	B-WD	3A-HM	P	H14	J26	-	24	45	
A227b	A-101.4	*		*										S	B-WD	3A-HM	P	H14	J26	-	24	45	
A229	A-101.4			*										S	C-WD	1-HM	P	Sim H18	Sim J28a, Sim J28b	-	34	45	9
A230	A-101.4			*										S	C-WD	1-HM	P	Sim H18	Sim J28b	-	34	45	11
A231	A-101.4			*										S	C-WD	4-HM	P	Sim H18, Sim H18a	Sim J28b	-	34	45	11
A232	A-101.4			*										S	C-WD	4-HM	P	H18, H18a	J28b	-	34	45	11
A233	A-101.4			*										S	C-WD	4-HM	P	H18, H18a	J28b	-	34	45	11
A234	A-101.4			*										S	A-WD	1-HM	P	H13	J25	T2	39	45	8, Undercut door 3/4"
A235	A-101.4			*										S	A-WD	1-HM	P	H13	J25	T2	39	45	8, Undercut door 3/4"

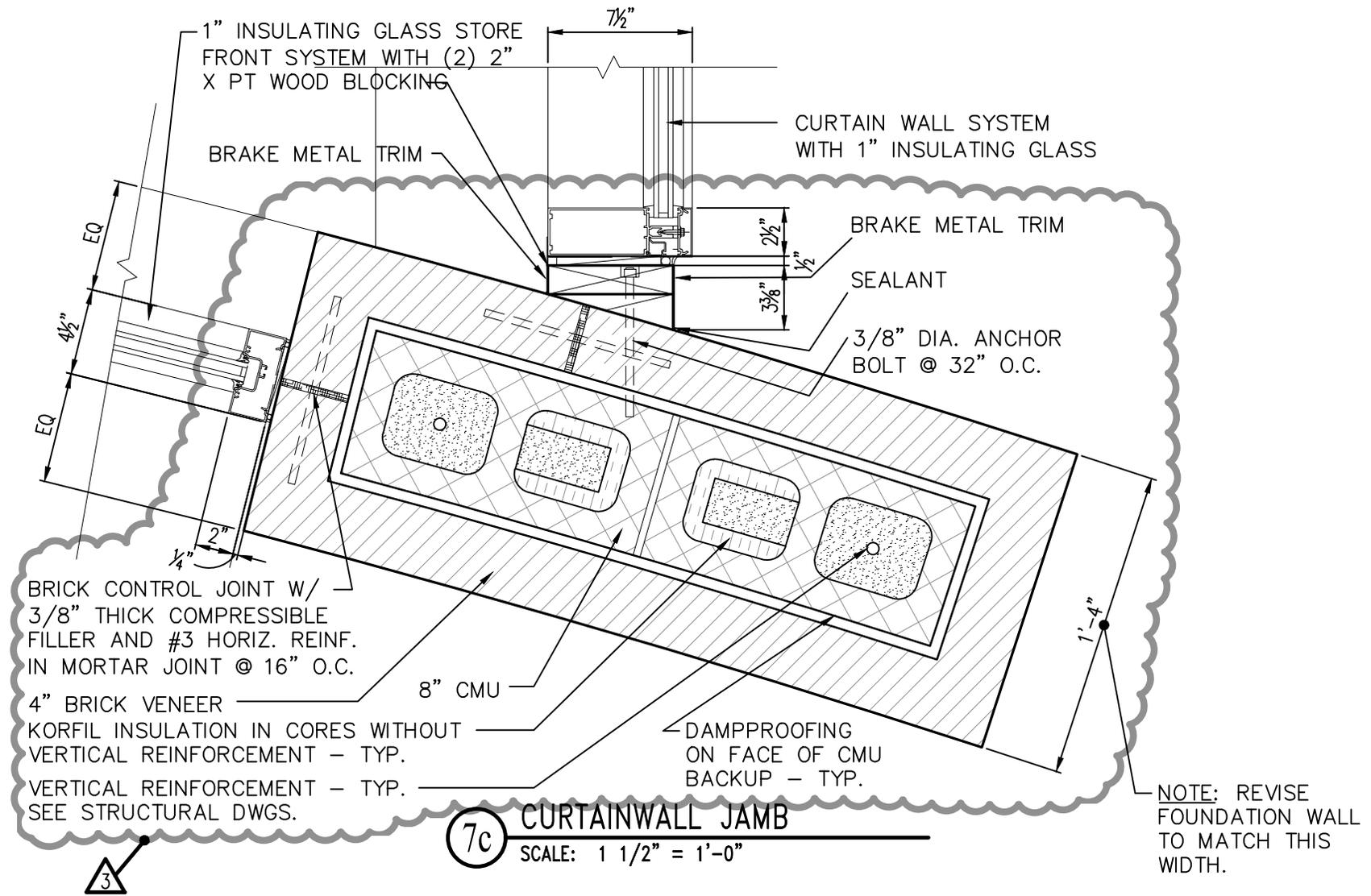


ELI WHITNEY CTHSS
 ADDITIONS AND RENOVATIONS
 STATE PROJECT NUMBER: BI-RT-837
 71 JONES ROAD
 HAMDEN, CONNECTICUT

DRAWING TITLE:
 REVISED A-WING UPPER FLOOR
 DOOR SCHEDULE (PARTIAL)
 REF. DWG.: A-901 (PART OF ADDENDUM - 03)

DRAWING NO.
SKA-12

SCALE:	DRAWN BY: JDS	REVIEWED BY: DCF	DATE: 30 JULY 2012	JOB NUMBER: 11025
--------	------------------	---------------------	-----------------------	----------------------



ANTINOZZI ASSOCIATES
ARCHITECTURE & INTERIORS

ELI WHITNEY CTHSS
ADDITIONS AND RENOVATIONS
STATE PROJECT NUMBER: BI-RT-837
71 JONES ROAD
HAMDEN, CONNECTICUT

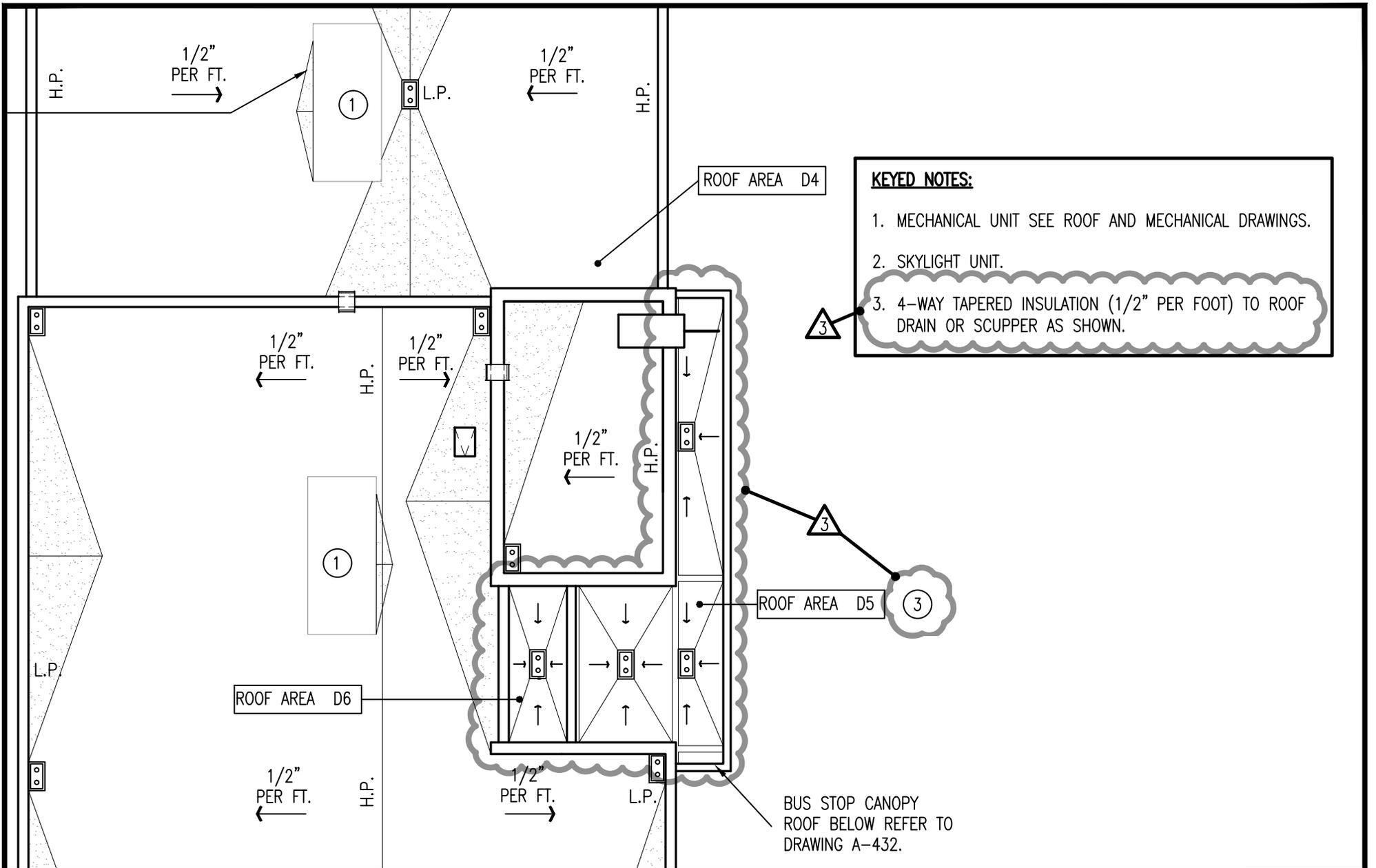
DRAWING TITLE:
REVISED CURTAINWALL JAMB DETAIL

DRAWING NO.

SKA-14

REF. DWG: A-923 (PART OF ADDENDUM - 03)

SCALE: AS NOTED	DRAWN BY: JDS	REVIEWED BY: DCF	DATE: 30 JULY 2012	JOB NUMBER: 11025
--------------------	------------------	---------------------	-----------------------	----------------------



ANTINOZZI ASSOCIATES
ARCHITECTURE & INTERIORS

ELI WHITNEY CTHSS
ADDITIONS AND RENOVATIONS
STATE PROJECT NUMBER: BI-RT-837
71 JONES ROAD
HAMDEN, CONNECTICUT

DRAWING TITLE:
REVISED WING "C3", "B1", "B2", "D1", "D2" AND "D3"
ROOF INSULATION PLAN (PARTIAL)

DRAWING NO.

SKA-15

REF. DWG.: A-110.4 (PART OF ADDENDUM - 03)

SCALE:	DRAWN BY:	REVIEWED BY:	DATE:	JOB NUMBER:
1/16" = 1'-0"	JDS	DCF	30 JULY 2012	11025

	ROOF	PROD. SHOPS	1,735	5,480	1.5"/2.9"	AF	1,140	3.92	7.5	480
HV-2	ROOF	PLUMBING/ MANUFACTURING	1,735	5,480	1.5"/2.9"	AF	1,140	3.92	7.5	480
HV-3	ROOF	MANUFACTURING/ CARPENTRY	1,300	3,455	1.5"/2.88"	AF	1,691	2.7	5	480
HV-4	ROOF	KITCHEN	2,665	2,665	0.75"/2.4"	AF	1,506	1.79	3	480

NOTES:

1. ALL SUPPLY AND RETURN FANS TO BE PROVIDED WITH VARIABLE FREQUENCY DRIVES.

COOLING TOWERS

UNIT NO	LOCATION	WATER DATA				AIR DATA		FAN DATA		ELECTRICAL			
		GPM	EWT	LWT	HEAD	WB	CFM	SP	TYPE	HP	VOLTS	PH	RF
CT-1	B2 ROOF	675	95° F	85° F	9'	77° F	46,550	-	TEFC	30	480	3	1.7
CT-2	B2 ROOF	675	95° F	85° F	9'	77° F	46,550	-	TEFC	30	480	3	1.7

3

3

CHILLERS

UNIT NO	LOCATION	TYPE	CAP TONS	EVAPORATOR				CONDENSER				PART LOAD POINTS			KW TO
				GPM	EWT	LWT	PD	GPM	EWT	LWT	PD	75% @ 75°F	50% @ 65°F	25% @ 65°F	
CH-1	B1 CHILLER ROOM	HI EFFIC. CENTRIF.	225	538	55° F	45° F	12.9'	675	85° F	95° F	14.0'	75% @ 75°F	50% @ 65°F	25% @ 65°F	0.53
CH-2	B1 CHILLER ROOM	HI EFFIC. CENTRIF.	225	538	55° F	45° F	12.9'	675	85° F	95° F	14.0'	75% @ 75°F	50% @ 65°F	25% @ 65°F	0.53

NOTE: MANUFACTURERS SHALL MEET BOTH FULL LOAD AND PART LOAD VALUES.

PLUMBING

AltieriSeborWieber LLC

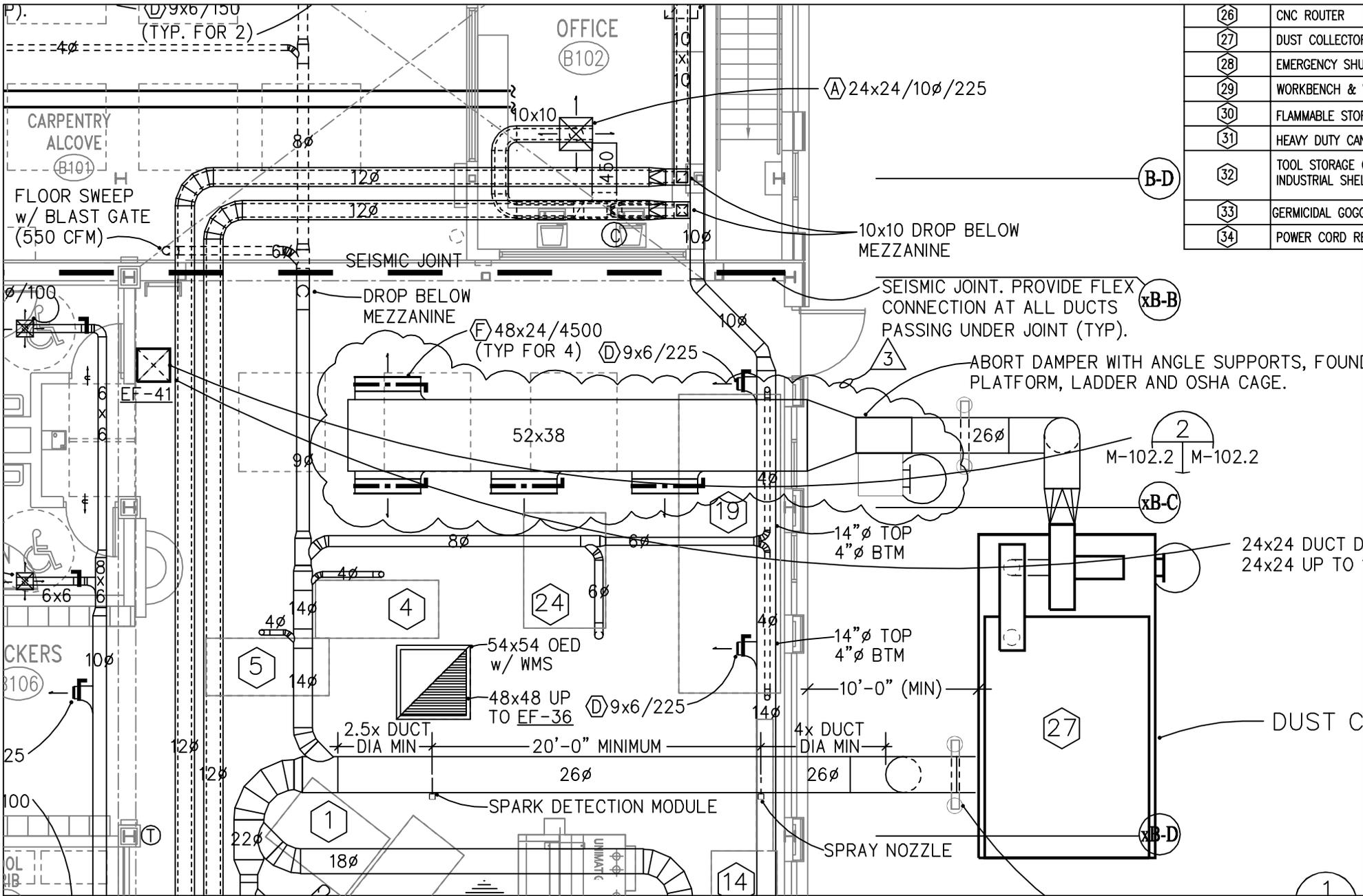
Consulting Engineers

31 Knight Street Norwalk, CT 06851

DATE 07/30/12 DRAWING NUMBER MSK073012-01

PROJECT NUMBER 04-51 PROJECT Eli Whitney REVISION TO SHEET NUMBER M-401

Addendum #3



AltieriSeborWieber LLC

Consulting Engineers

31 Knight Street Norwalk, CT 06851

DATE 07/30/12

DRAWING NUMBER MSK073012-02

PROJECT NUMBER 04-51 PROJECT

Eli Whitney

REVISION TO SHEET NUMBER M-102.2

Addendum #3