



## ADDENDUM NO.3

**PROJECT:** Cumru Fire Department  
**ADDRESS:** 1775 Welsh Road  
Mohnton, PA 19540

**MWS PROJECT NO:** 18-036  
**DATE:** 1/19/2024

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The following changes shall be incorporated into the work in accordance with all general requirements as if incorporated in the original documents.

### INFORMATION:

#### CHANGES TO DRAWINGS:

1. Replace drawing A103 with revised drawing A103 CONSTRUCTION TYPES dated 01/19/2024 Addendum #3.
2. Replace drawing A111 with revised drawing A111 ENTRY PLAN, ELEVATIONS & DETAILS dated 01/19/2024 Addendum #3.

#### CHANGES TO SPECIFICATIONS:

1. Replace specification section 00 4323 – ALTERNATES FORM and replace with **00 4323 - ALTERNATES FORM –**, dated 1/19/2024 Addendum #3.
2. Replace specification section 01 2300 – ALTERNATES and replace with **01 2300- ALTERNATES–**, dated 1/19/2024 Addendum #3.
3. Add specification section **04 2613 – MASONRY VENEER (FULL-BED STONE VENEER) ALTERNATE–** dated 1/19/2024 Addendum #3.
4. Add specification section **04 7200 – CAST STONE MASONRY–**dated 1/19/2024 Addendum #3.
5. Remove specification section **08 3613 - SECTIONAL DOORS.**
6. Replace specification section 237310 - INDOOR AIR HANDLING UNITS and replace with **237310 - INDOOR AIR HANDLING UNITS –**, dated 1/19/2024 Addendum #3.

#### BIDDER QUESTIONS & RESPONSES:

1.) **QUESTION:** Can you provide a specification or part number for the cord reels shown in room 140?

**RESPONSE:** Legrand 1400 series or equal.

2.) **QUESTION:** Drawing A108 call for a blackout shades at a double door in room #134 Dayroom. Is that correct?

**RESPONSE:** Correct.

**3.) QUESTION:** Would the Honeywell Optimizer Building Management System which is based upon Tridium Niagara N4 architecture system be acceptable in lieu of the specified system. I believe a Honeywell system will meet the intent of the specification but will also provide the Owner a more cost-effective solution for a truly open system that will provide them flexibility with regard to any future expansion, modification, or service of the system should they wish to seek services from another qualified contractor.

**RESPONSE: Contractor to submit formal substitution request per substitution specification section requirements.**

**4.) QUESTION:** if a Graphic Fire Alarm Annunciator is required as per spec or would a 2 line LCD text annunciator only be acceptable?

**RESPONSE: Provide graphic fire alarm annunciator as indicated in specification.**

**5.) QUESTION:** Can Sch.40 DWV PVC be used for underground sanitary and storm water in lieu of service weight cast iron pipe and fittings.

**RESPONSE: See addendum 2 for response regarding underground sanitary pipe work. Sch.40 PVC can be used for stormwater, minus downspout boots.**

**6.) QUESTION:** The Ceiling drawing is calling the Ceiling "CLG-1" to be Ultima 1940 and the specs are calling for Ultima 1910. The 1940 tile is more expensive, which tile should we price?

**RESPONSE: Ultima 1910.**

**7.) QUESTION:** For CLG-3, the ceiling schedule is calling for 5/8" GWB ceiling but has USG Ensemble listed also. Is this ceiling supposed to be just regular GWB? Ensemble ceilings get very costly so please clarify so we are pricing accordingly.

**RESPONSE: Ceiling to be standard suspended or light gauge framed GWB ceiling. 5/8" thickness can be reduced to 1/2" thickness at ceiling locations.**

**8.) QUESTION:** 6. All the SP-2's call for printed PET panels, which we would need to test before quoting to make sure we can do it correctly. a. Do you have the graphics available yet? If so, please provide. b. If not, can we try Acoustigraphix over 1" HardSide as an alternative?

**RESPONSE: Submit specification or cutsheet information Acoustigraphix and Hardside material for design team review.**

**9.) QUESTION:** The toilet room accessory labeled SDS1 ASI 7380-518 is not available or has the wrong model number listed. ASI makes a soap dispenser shelf model 0318. Can you please approve this model or supply another model number?

**RESPONSE: Substitutions should be submitted via the requirements found within the substitution specification section.**

10.) **QUESTION:** The finish schedule on A106 listed for there to be BT-3 & BT-4 for the base in that room. BT-3 is 4" base & BT-4 is a 6" Base. I do not see it indicating anywhere on the plans which walls get which base in that room. Are we to just use BT-3 in this room (this is used everywhere else)? Or do they have information stating which walls get what?

**RESPONSE: Confirm the room number or name to properly respond to the above question. In the event the bidder is referring to the use of BT-3/4 in Dayroom 134, BT-4 is used per detail 3/A106 for the platform riser. BT-3 to be used around room perimeter wall conditions.**

11.) **QUESTION:** The sectional door spec matches the four fold door spec. Please provide the proper sectional door specification.

**RESPONSE: Delete section 08 3613 - SECTIONAL DOORS. Sectional doors are not part of the base-bid. Use basis of design for bidding of sectional door alternate requirements as described in the alternate specification section.**

12.) **QUESTION:** The solid surface spec references integral sinks but it appears all the sinks are by the plumber. Please confirm there are no integral sinks.

**RESPONSE: The plumbing fixture spec 224000 indicates sinks S-1, S-2, S-3 and S-4 as sinks provided by plumbing contractor.**

13.) **QUESTION:** Addendum 2 issued a new spec for information to be furnished by the bidder which requires a subcontractor list that cannot be modified after the fact without approval from the owner. We cannot fully commit to any subcontractor prior to a full scope review which we will not have time for on bid day, especially with the bid being due at 10AM on a Monday. This would cause prime bidders to possibly lock into a subcontractor who has a mistake and the prime bidder would be stuck for the cost difference. On public projects that require us to be the low bidder in order to win the project, the risk of this possibility is immense when we are trying to get as low as possible. These requirements will not aide the owner in getting the best price and in the event of a problem will get the project off to a poor start.

**RESPONSE: Provide subcontractor list, per specification requirements. Bid opening date and time will remain as indicated in the project specifications.**

14.) **QUESTION:** Addendum 2 issued a new spec for information to be furnished by the bidder which requires a manufacturer list that cannot be modified after the fact without approval from the owner but it does not list what materials are to be included on this list. Is every manufacturer of every item required to be on this list? This would be absolutely impossible to get from every subcontractor because the manufacturer of the materials they included are rarely on their bid day quotes and simply read 'per specs.' Public projects that include specs already require that we use

the manufacturers listed so this list seems unnecessary. Does the owner intend deny certain manufacturers even if they are listed in the specifications? Is this permitted per the prevailing wage guideline for public work in Pennsylvania? Manufacturers generally get submitted to the owner through the submittal process by the awarded contractor rather than requiring every bidder to submit all of this information for a project that only 1 bidder will be awarded.

**RESPONSE: Bidders are not required to furnish a list of product manufacturers as part of bid submission.**

**15.) QUESTION:** The RCP calls for CLG-3 to be a drywall ceiling with the ensemble acoustical drywall. I can't seem to find anything on this ceiling in the specs. They are calling to have this ceiling assembly put at all interior drywall locations including the shower room 115. This is a perforated drywall ceiling for acoustical qualities and is much more expensive. Can you please clarify this.

**RESPONSE: See above response previously answered in this addendum.**

**16.) QUESTION:** Section 3 page A706 shows FRT plywood at the back of the display cases. Please indicate how this should be finished or if another material is required to cover FRT plywood.

**RESPONSE: See revised detail included within this Addendum.**

**17.) QUESTION:** General partition note 1 on page A103 says to install impact resistant gyp at entry's, lobby's and corridors. In corridor 131 does impact gyp need to go all the way to top of clerestory? Typically this would only go up to 8' then change to standard drywall. Please advise.

**RESPONSE: Impact resistant GWB to provided up 8' A.F.F within indicated areas.**

**18.) QUESTION:** There are some differences in the depiction of the retaining walls at the steps and along and around the parking lots. First the civils show a stone veneer and stone cap(148.3, 148.4), and the Architectural (A100, A111) shows a split face to match the building with a Precast cap. Please clarify.

**RESPONSE: Base bid retaining walls shall receive a split face CMU veneer to match building split face CMU veneer. Alternate 11: Replace split face CMU veneer with Full-bed stone veneer, per requirements of Alternate 11, included within this addendum. Both base-bid and alternate shall implement retaining walls with a cast stone cap.**

**19.) QUESTION:** Light control note #7 indicates wall mounted OC Sensors in rooms 123,124,125,126,127,128. Drawing E201 shows a normal wall switch. In these rooms. Which is correct a normal wall switch or a wall mounted OC Sensor?

**RESPONSE: Provide wall mounted occupancy sensor switch in the rooms listed.**

- 20.) **QUESTION:** Appendix B Scope of Work 01 1320B.1.2 sheet 4 of 11 Indicates screening of topsoil, please confirm that rockhounding the respread of existing topsoil is acceptable in place of screening.
- RESPONSE: Mechanical rockhounding is acceptable in lieu of topsoil screening.**
- 21.) **QUESTION:** In the Tech Spec section 33 2603 Precast Structures: 2.2 C. states “Steel Reinforcement Shall Be Epoxy Coated.” Is this correct? It also states that all precast must be from a Pre-approved PennDOT supplier ... PennDot does not require Epoxy Coated rebar.
- RESPONSE: Steel reinforcement need not be epoxy coated in pre-cast structures. Pre-cast structures shall come from a PennDot approved supplier.**
- 22.) **QUESTION:** Please confirm fire department connection and oil separator are by pc.
- RESPONSE: Confirmed.**
- 23.) **QUESTION:** For ceiling CLG-1 drawings call for tile 1940 but specs call for tile 1910. Please Clarify.
- RESPONSE: See previous response provided in this addendum.**
- 24.) **QUESTION:** Specification for the Electrical contract section 011320, 1.1, I states the EC shall preform all trenching and backfilling required for his work. Notes 23 and 24 states the Civil contractor shall provide trenching and backfill for the telephone conduits. Which is correct?
- RESPONSE: EC shall preform all trenching and backfilling required for their work.**
- 25.) **QUESTION:** The plumbing drawings show a new Fire department connection line. Does the plumber own this line complete including excavation? It is not shown on any site or architectural plan.
- RESPONSE: The Plumbing Prime Contractor owns this scope.**
- 26.) **QUESTION:** Please provide a stamp pattern for the stamped entrance patio.
- RESPONSE: Stamp pattern to match or be similar to that shown on drawings.**
- 27.) **QUESTION:** There is a spec for alternates. The pricing sheet does not list any alternates. Please clarify.
- RESPONSE: See alternates form 00 4323 to be included with bid form.**
- 28.) **QUESTION:** Given that the Plumbing prime own all water water supply distribution including outside the building, is the plumb also responsible for Testing and Disinfecting Water Main of the water main per spec section 332675?
- RESPONSE: 1A prime responsible for testing and disinfecting water main, per contract package specification.**
- 29.) **QUESTION:** Please provided specification on these lockers. GC is required to install and we need to know what we are installing.

**RESPONSE:** Clarify the term “these lockers.” There a multiple locker types within the project that have, see specification section 10 5113 Welded Metal Lockers for more information.

**30.) QUESTION:** Regarding the type “G2” and G3” door panel elevations on drawing A600. Please confirm if the material below the 8” intermediate rail is to be glass or a flush panel. The elevations do not show what is to be used in the bottom of these doors.

**RESPONSE:** Flush panel. Material to match surrounding stiles.

**31.) QUESTION:** Please confirm that any and all equipment marked as E-# is not in the general contract and on others. This includes kitchen equipment etc..

**RESPONSE:** See equipment schedule of what material is owner vs. contractor provided on page A108.

**32.) QUESTION:** Are the E8 lockers the only one to received a concrete base? All the rest get the metal stud base with bc plywood? per a700

**RESPONSE:** Correct, minus E9. E9 are wall mount only, with no base.

**33.) QUESTION:** Please provide spec for stone veneer on site walls.

**RESPONSE:** See addendum 3 materials.

**34.) QUESTION:** Can a spec be provided for the stone veneer and stone cap for the retaining wall?

**RESPONSE:** See addendum 3 materials.

**35.) QUESTION:** Is there dampproofing on the site walls?

**RESPONSE:** Yes.

**36.) QUESTION:** Please clarify which spec is for the four fold doors- 083516 or 083613

**RESPONSE:** Use 08 3516 - FOUR-FOLD DOOR SYSTEMS specification.

**37.) QUESTION:** Sheet a705 has sf-5 with a SS sill, A603 has it as wood. Please clarify.

**RESPONSE:** Provide solid surface sills.

**38.) QUESTION:** can all testing (quality control) be handled with the allowances?

**RESPONSE:** No.

**39.) QUESTION:** Page S102 of the east mezzanine deck requires shoring for the concrete pour. Says shoring as required by deck manufacturer. The manufacturer is trying to figure out if a 2x6, 16” OC wood framed wall to carry the load. Can the engineer confirm this will suffice?

**RESPONSE:** Shoring to be designed by 1A General Prime Contractor.

**40.) QUESTION:** For the alternates with garage doors- the description door numbers don't match the numbers on the plans.

**RESPONSE:** Revise the alternate to say the following:

1. **Base Bid: Provide Four-Fold Doors FF1-5 and FF6-10 as indicated in the Drawings and as specified 08 3516 - FOUR-FOLD DOOR SYSTEMS ".**
2. **Alternate: In lieu of Four-Fold Doors, provide for openings FF1-5 and FF6-10 fully-glazed sectional doors and controls; basis-of-design: Raynor; AlumaView AV300, as follows:**

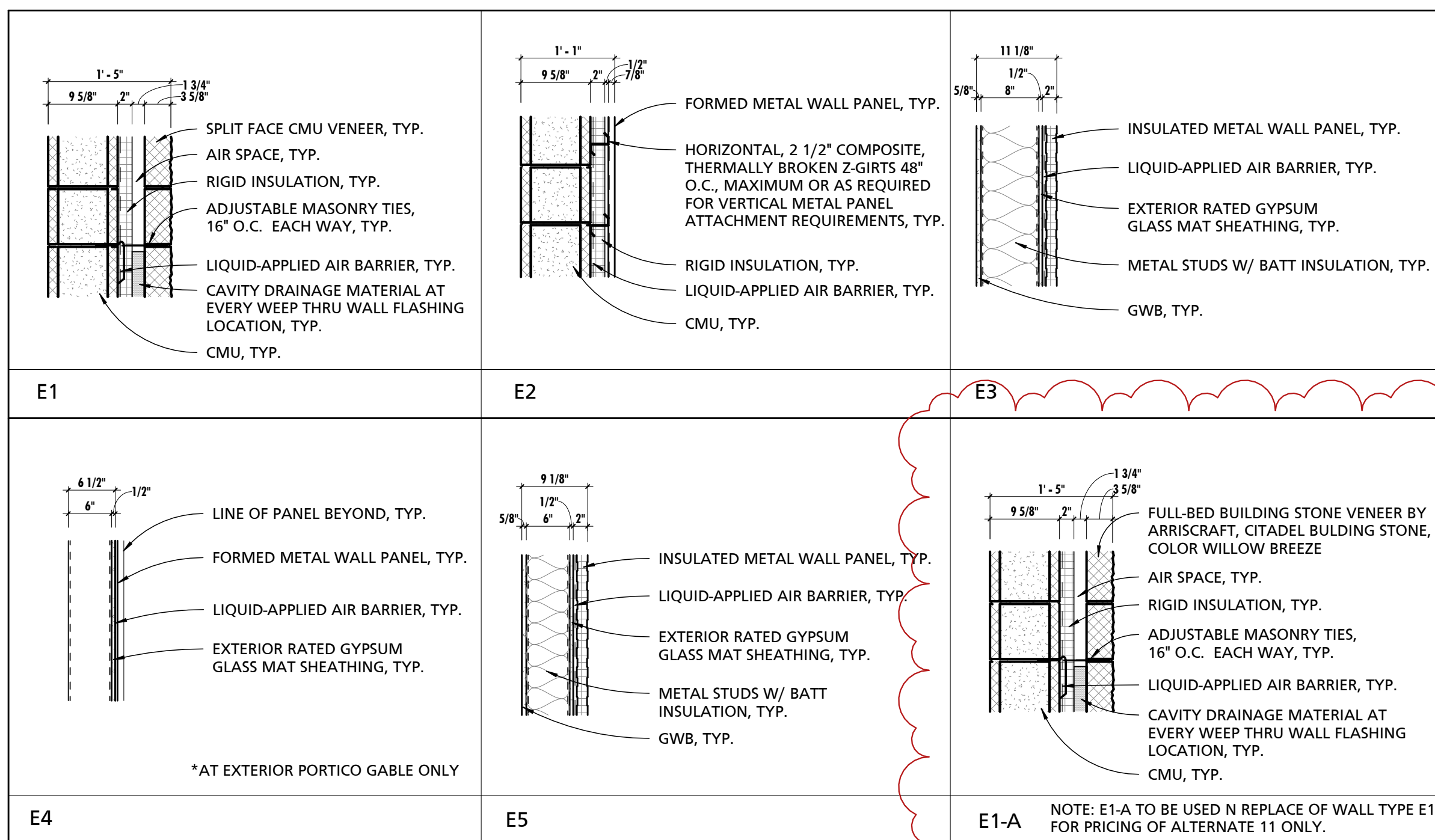
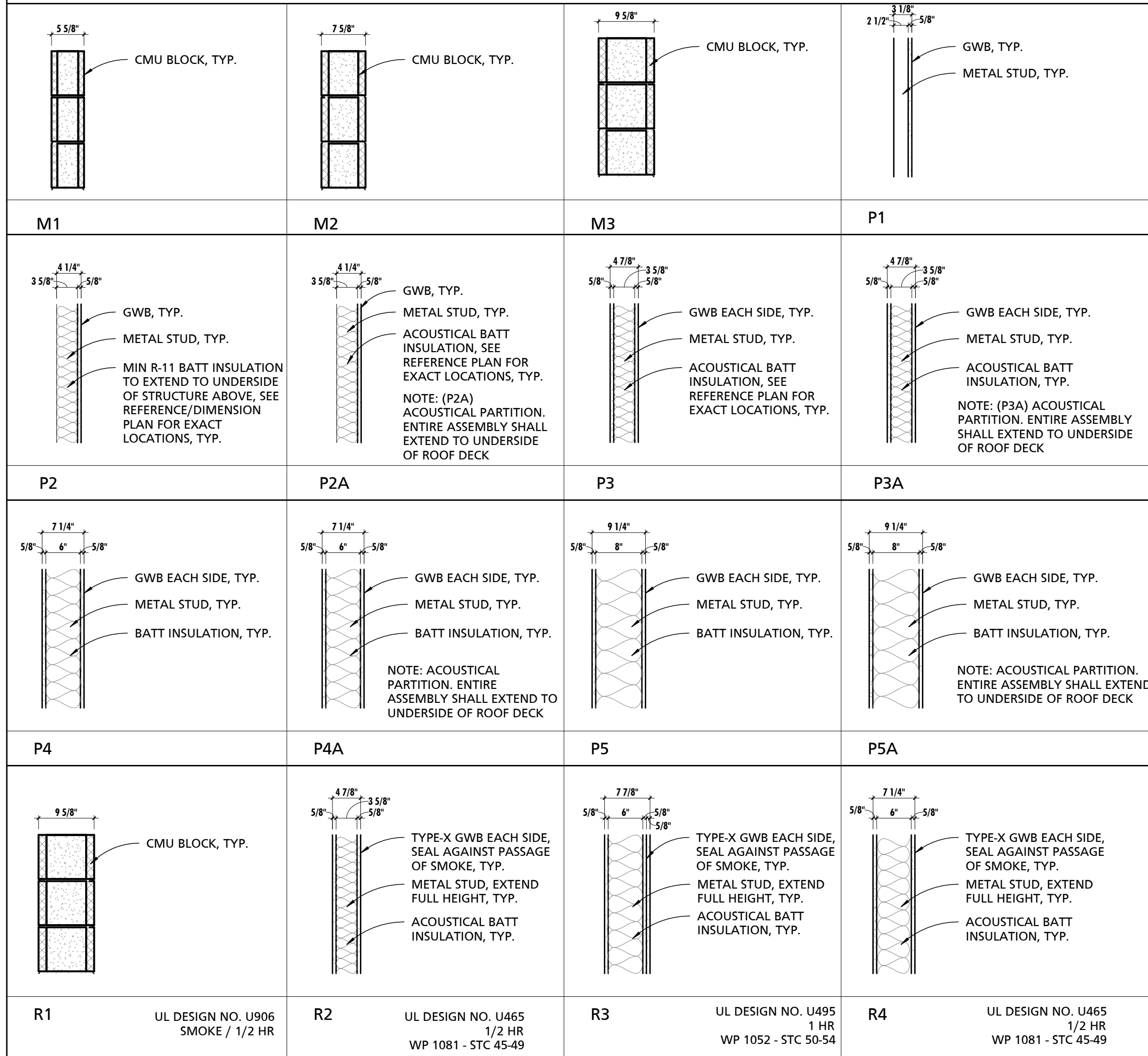
**ATTACHMENTS:**

- 1.) Addendum No. 3 Drawings & Specifications

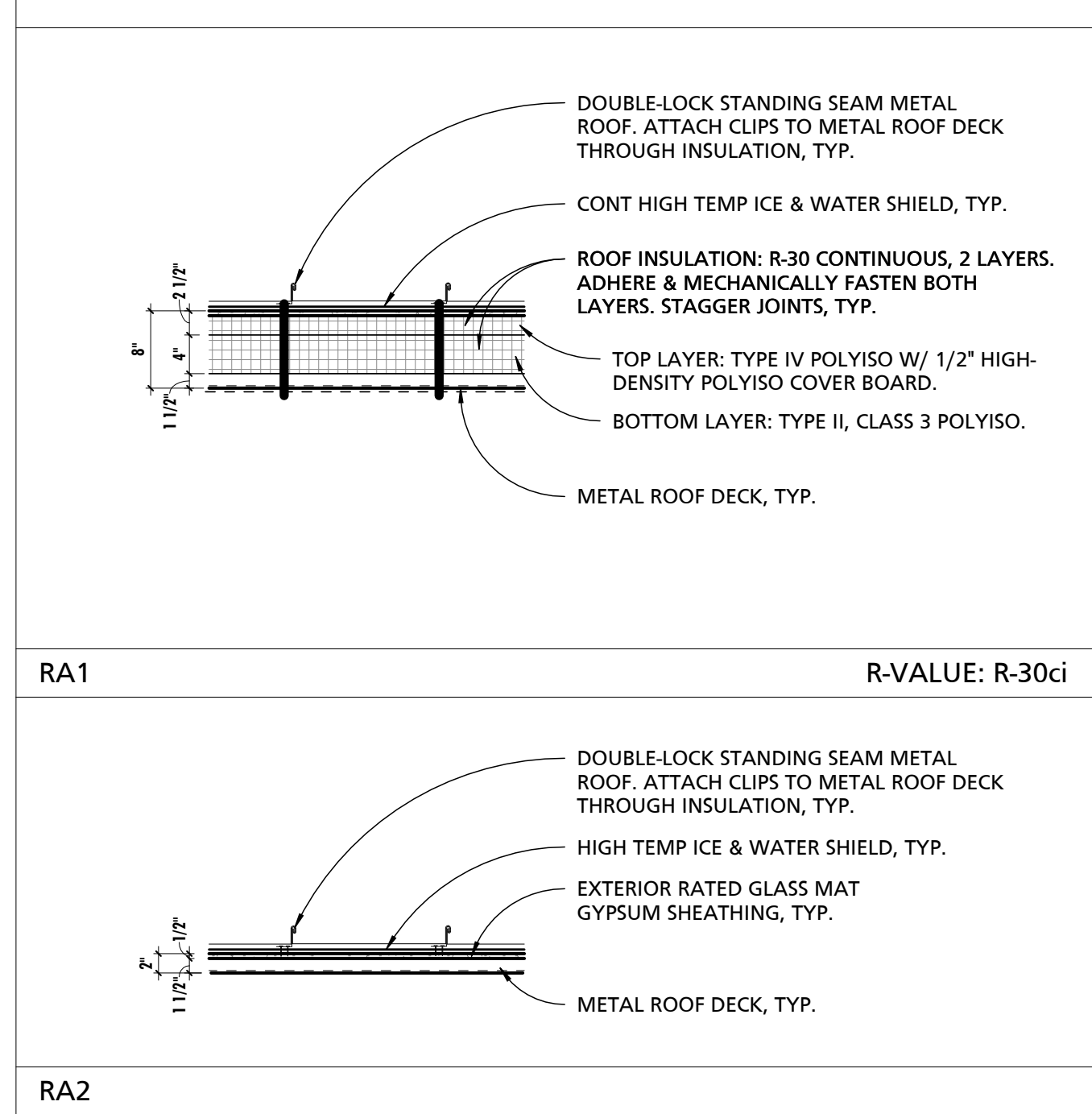
**END OF ADDENDUM**



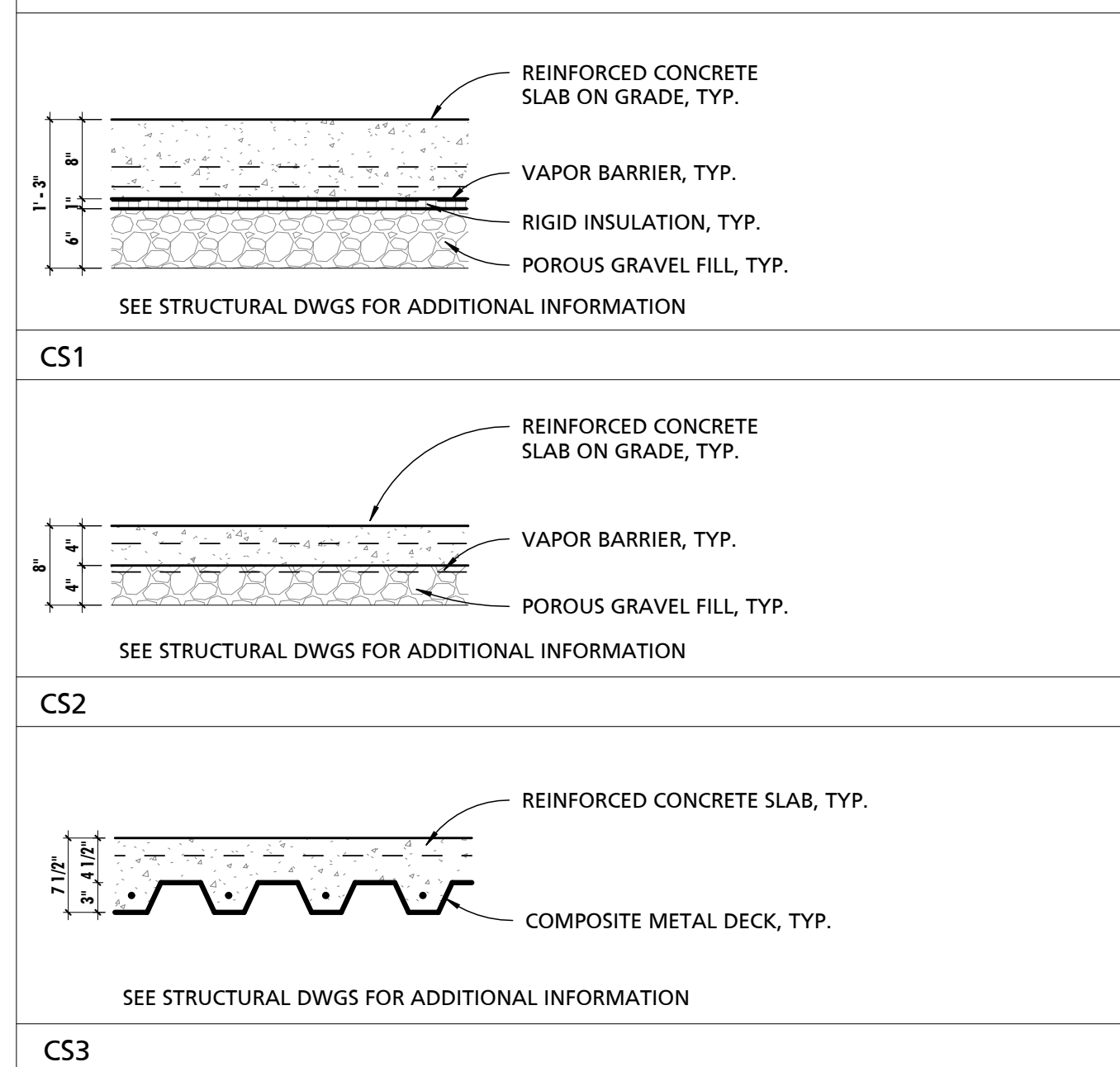
**WALL ASSEMBLIES**



**ROOF ASSEMBLIES**



**SLAB ASSEMBLIES**



**GENERAL PARTITION NOTES**

- ENTRY SPACES, LOBBIES, AND CORRIDORS TO RECEIVE IMPACT RESISTANT GYPSUM WALL BOARD, U.N.O.
- PROVIDE FIBERGLASS REINFORCED MOISTURE RESISTANT GYPSUM WALL BOARD IN ALL EQUIPMENT ROOMS, JANITOR'S CLOSETS, RESTROOMS, KITCHENS AND OTHER WET AREAS. PROVIDE FIBERGLASS REINFORCED MOISTURE RESISTANT WALL BOARD IN ALL OTHER AREAS WITHIN 8'-0" OF WATER SOURCE.
- CONTRACTOR SHALL PROVIDE BLOCKING AND BRACING AS REQUIRED TO SUPPORT ALL NEW WORK, INCLUDING ITEMS TO BE PROVIDED AND/OR INSTALLED BY OWNER.
- ALL CORRIDOR AND FIRE-RATED PARTITIONS SHALL BE EXTENDED TO THE UNDERSIDE OF THE STRUCTURE ABOVE, U.N.O. THE PERIMETER WALLS OF ANY SPACE NOT PROVIDED WITH A CEILING SHALL EXTEND TO THE UNDERSIDE OF DECK ABOVE.
- PROVIDE DEFLECTION TRACKS AT TOP OF ALL NON-LOAD BEARING STUD WALLS EXTENDING TO THE UNDERSIDE OF STRUCTURE ABOVE, U.N.O.
- PROVIDE CONCRETE BACKER BOARD IN LIEU OF GYPSUM WALL BOARD WHERE TILE FINISH IS INDICATED.
- ALL FIRE WALLS SHALL BE PLACED OR STENCILED ON BOTH SIDES WITH THE PHRASE "FIRE WALL" PER IBC SECTION 703.1. THE LETTERS SHALL BE RED IN COLOR, 6" INCHES HIGH AND A MIN. OF 3/4" WIDE. THE PHRASE SHALL BE WRITTEN ONCE FOR EACH 15 FEET OF HORIZONTAL WALL LENGTH. THIS SIGNAGE MAY BE LOCATED IN THE CONCEALED SPACE ABOVE A CEILING.
- MOISTURE RESISTANT GYPSUM WALL BOARD SHALL BE UTILIZED IN ALL AREAS WHERE GYPSUM WALL BOARD IS TO BE DIRECTLY ADHERED TO CONCRETE OR MASONRY SURFACES IN INTERIOR APPLICATIONS. SUBSTRATE SHALL BE CLEANED AS REQUIRED AND FREE OF DUST, DEBRIS, AND MOISTURE PRIOR TO ADHESION AND FINISHING.
- CONSTRUCTION OF RATED WALL ASSEMBLIES SHALL BE IN ACCORDANCE WITH UL AND GYPSUM ASSEMBLY SPECIFICATIONS. REFER TO CODE PLANS FOR ADDITIONAL INFORMATION.
- PROVIDE A BULLNOSE CMU AT ALL OUTSIDE CORNERS OF INTERIOR MASONRY WALLS & SILLS.
- ALL PARTITIONS LABELED P1A ARE ACoustICALLY RATED AND SHALL EXTEND TO UNDERSIDE OF ROOF/MEZZANINE DECK ABOVE. PROVIDE REQUIRED DEFLECTION TRACK AT TOP PLATE CONNECTION POINT.

**SCHEDULE - INTERIOR PARTITION & WALL TYPE**

| MARK | WIDTH       | DESCRIPTION   | FIRE RATING |               | STC RATING    |          |
|------|-------------|---|-------------|---------------|---------------|----------|
|      |             |   | RATING      | ASSEMBLY REF. | ASSEMBLY REF. | RATING   |
| M1   | 0' - 5 5/8" | 6" CONCRETE MASONRY UNIT                                  |             |               |               |          |
| M2   | 0' - 7 5/8" | 8" CONCRETE MASONRY UNIT                                  |             |               |               |          |
| M3   | 0' - 9 5/8" | 10" CONCRETE MASONRY UNIT                                 |             |               |               |          |
| P1   | 0' - 3 1/8" | 2-1/2" METAL STUD WITH 5/8" GYPSUM WALL BOARD ON ONE SIDE |             |               |               |          |
| P2   | 0' - 4 1/4" | 3-5/8" METAL STUD WITH 5/8" GYPSUM WALL BOARD ON ONE SIDE |             |               |               |          |
| P3   | 0' - 4 7/8" | 3-5/8" METAL STUD W/ 5/8" GYPSUM WALL BOARD EACH SIDE     |             |               | <varies>      | <varies> |
| P3A  | 0' - 4 7/8" | 3-5/8" METAL STUD W/ 5/8" GYPSUM WALL BOARD EACH SIDE     |             |               | NGC 2018004   | 50       |
| P4   | 0' - 7 1/4" | 6" METAL STUD W/ 5/8" GYPSUM WALL BOARD EACH SIDE         |             |               |               |          |
| P4A  | 0' - 7 1/4" | 6" METAL STUD W/ 5/8" GYPSUM WALL BOARD EACH SIDE         |             |               |               | <varies> |
| P5   | 0' - 9 1/4" | 8" METAL STUD W/ 5/8" GYPSUM WALL BOARD EACH SIDE         |             |               |               | 50       |
| P5A  | 0' - 9 1/4" | 8" METAL STUD W/ 5/8" GYPSUM WALL BOARD EACH SIDE         |             |               |               | 45-49    |
| R1   | 0' - 9 5/8" | SEE CODE PLANS  | SMOKE       | U 906         |               | 45-49    |
| R2   | 0' - 4 7/8" | SEE CODE PLANS  | 1           | U465          |               | 45-49    |
| R3   | 0' - 7 7/8" | SEE CODE PLANS  |             |               |               | 50-54    |
| R4   | 0' - 7 1/4" | SEE CODE PLANS  | 1/2         | U465          |               | 45-49    |

**SCHEDULE - EXTERIOR WALL TYPE**

| MARK | WIDTH   | DESCRIPTION   | MIN. R-VALUE |        |
|------|---------|---|--------------|--------|
|      |         |   | R            | R-CI   |
| E1   | 17"     | 9-5/8" CMU W/ LIQUID APPLIED AIRBARRIER W/ 2" RIGID INSULATION W/ ADJUSTABLE MASONRY TIE 16" O.C. VERTICALLY & HORIZONTALLY 32" O.C. STAGGERED EACH ROW W/ 1-3/4" AIR SPACE W/ 3-5/8" SPLIT FACE CMU VENEER | N/A          | R-11.4 |
| E2   | 13-3/8" | 9-5/8" CMU W/ LIQUID APPLIED AIR BARRIER W/ 2" RIGID INSULATION & HORIZONTAL 2 1/2" COMPOSITE, THERMALLY BROKEN Z-GIRTS 48" O.C. W/ PRE-FINISHED VERTICAL METAL PANEL                                       | N/A          | R-11.4 |
| E3   | 11-1/8" | 5/8" GWB W/ 8" METAL STUD W/ BATT INSULATION W/ 1/2" EXTERIOR RATED GYPSUM GLASS MAT SHEATHING W/ LIQUID APPLIED AIR BARRIER W/ PRE-FINISHED HORIZONTAL INSULATED METAL WALL PANEL                          | R-13         | R-7.5  |
| E4   | 6-1/2"  | 6" METAL STUD W/ 1/2" EXTERIOR RATED GYPSUM GLASS MAT SHEATHING W/ LIQUID APPLIED AIR BARRIER W/ VERTICAL METAL PANEL   | N/A          | N/A    |
| E5   | 9-1/8"  | 8" GWB W/ 6" METAL STUD W/ R-19 BATT INSULATION W/ 1/2" EXTERIOR RATED GYPSUM GLASS MAT SHEATHING W/ LIQUID APPLIED AIR BARRIER W/ 2" INSULATED HORIZONTAL CORRUGATED METAL PANEL                           | R-13         | R-7.5  |

**SCHEDULE - ROOF TYPES**

| MARK | DESCRIPTION   | MIN. R-VALUE |      |
|------|---|--------------|------|
|      |   | R            | R-CI |
| RA1  | STANDING SEAM METAL ROOF PANEL OVER ICE & WATER SHIELD, 2 1/2" POLYISO COMPOSITE PANEL W/ 1/2" HIGH-DENSITY POLYISO COVER BOARD, 4" POLYISO RIGID INSULATION AND 1-1/2" METAL ROOF DECK |              | R-30 |
| RA2  | STANDING SEAM METAL ROOF PANEL OVER ICE & WATER SHIELD, 1/2" EXTERIOR RATED GYPSUM GLASS MAT SHEATHING AND 1-1/2" METAL ROOF DECK   |              |      |

**SCHEDULE - SLAB ASSEMBLY TYPES**

| MARK | THICKNESS   | DESCRIPTION   | MIN. R-VALUE |      |
|------|-------------|---|--------------|------|
|      |             |   | R            | R-CI |
| CS1  | 1' - 3"     | 8" REINFORCED CONCRETE SLAB ON GRADE W/ VAPOR BARRIER W/ 1" RIGID INSULATION W/ 6" POROUS GRAVEL FILL |              | R-5  |
| CS2  | <varies>    | 4" REINFORCED CONCRETE SLAB ON GRADE W/ VAPOR BARRIER W/ 4" POROUS GRAVEL FILL                        |              |      |
| CS3  | 0' - 7 1/2" | 4 1/2" REINFORCED CONCRETE SLAB W/ 3" COMPOSITE METAL DECK  |              |      |



SEAL: I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ARCHITECT UNDER THE LAWS OF THE STATE OF PENNSYLVANIA. LICENSE NUMBER: #6405311 EXPIRATION DATE: 6-30-2023

CONSULTANT:

CUMRU FIRE DEPARTMENT  
1775 WELSH ROAD  
MOHNTON, PA 19540

| NO. | DESCRIPTION | DATE     |
|-----|-------------|----------|
| 3   | Addendum 3  | 01/19/24 |

PROJECT NUMBER:  
18-036  
PROJECT SET:  
BID SET  
DATE ISSUED:  
11/30/2023

DRAWING TITLE:  
CONSTRUCTION TYPES

SHEET NUMBER:  
**A103**







## **SECTION 00 4323 - ALTERNATES FORM**

### 1.1 BID INFORMATION

- A. Bidder: \_\_\_\_\_.
- B. Bid Package (Prime Contract Package): \_\_\_\_\_.
- C. Project Name: Cumru Township, Cumru Fire Department, Station 42.
- D. Project Location: 1775 Welsh Road, Mohnton PA 19540.
- E. Owner: The Cumru Township.
- F. Architect: Manns Woodward Studios, Inc..
- G. Architect Project Number: 18-036.

### 1.2 BID FORM SUPPLEMENT

- A. This form is required to be attached to the Bid Form.

### 1.3 DESCRIPTION

- A. The undersigned Bidder proposes the amount below be added to or deducted from the Base Bid if particular alternates are accepted by Owner. Amounts listed for each alternate include costs of related coordination, modification, or adjustment.
- B. If the alternate does not affect the Contract Sum, the Bidder shall indicate "NO CHANGE."
- C. If the alternate does not affect the Work of this Contract, the Bidder shall indicate "NOT APPLICABLE."
- D. Owner reserves the right to accept or reject any alternate, in any order, and to award or amend the Contract accordingly within 60 days of the Notice of Award unless otherwise indicated in the Contract Documents.
- E. Acceptance or non-acceptance of any alternates by the Owner shall have no affect on the Contract Time unless the "Schedule of Alternates" Article below provides a formatted space for the adjustment of the Contract Time.

1.4 SCHEDULE OF ALTERNATES

A. Alternate No. 1: Omit Lobby and Meeting Room Casework:

- 1. ADD \_\_\_ DEDUCT \_\_\_ NO CHANGE \_\_\_ NOT APPLICABLE \_\_\_.
- 2. \_\_\_\_\_ Dollars (\$\_\_\_\_\_).

B. Alternate No. 2: Omit Resinous Flooring Integral Base:

- 1. ADD \_\_\_ DEDUCT \_\_\_ NO CHANGE \_\_\_ NOT APPLICABLE \_\_\_.
- 2. \_\_\_\_\_ Dollars (\$\_\_\_\_\_).

C. Alternate No. 3: Sealed Concrete In Lieu of Resinous Flooring:

- 1. ADD \_\_\_ DEDUCT \_\_\_ NO CHANGE \_\_\_ NOT APPLICABLE \_\_\_.
- 2. \_\_\_\_\_ Dollars (\$\_\_\_\_\_).

D. Alternate No. 4: Sectional Doors In Lieu of Four-Fold Doors:

- 1. ADD \_\_\_ DEDUCT \_\_\_ NO CHANGE \_\_\_ NOT APPLICABLE \_\_\_.
- 2. \_\_\_\_\_ Dollars (\$\_\_\_\_\_).

E. Alternate No. 5: Omit Steel Beam for Future Operable Partition:

- 1. ADD \_\_\_ DEDUCT \_\_\_ NO CHANGE \_\_\_ NOT APPLICABLE \_\_\_.
- 2. \_\_\_\_\_ Dollars (\$\_\_\_\_\_).

F. Alternate No. 6: Painted Gypsum Wall Board In Lieu of Wall Tile, Restrooms:

- 1. ADD \_\_\_ DEDUCT \_\_\_ NO CHANGE \_\_\_ NOT APPLICABLE \_\_\_.
- 2. \_\_\_\_\_ Dollars (\$\_\_\_\_\_).

G. Alternate No. 7: Add MVE-Control System to Interior Concrete Slabs On Grade to Mitigate High Slab Moisture Problems:

- 1. ADD \_\_\_ DEDUCT \_\_\_ NO CHANGE \_\_\_ NOT APPLICABLE \_\_\_.
- 2. \_\_\_\_\_ Dollars (\$\_\_\_\_\_).

H. Alternate No. 8: Solid Exterior Wall In Lieu of Rear Apparatus Bay Door FFB1-5R:

- 1. ADD \_\_\_ DEDUCT \_\_\_ NO CHANGE \_\_\_ NOT APPLICABLE \_\_\_.
- 2. \_\_\_\_\_ Dollars (\$\_\_\_\_\_).

I. Alternate No. 9: Lawn in Lieu of Rear Apron:

- 1. ADD \_\_\_ DEDUCT \_\_\_ NO CHANGE \_\_\_ NOT APPLICABLE \_\_\_.
- 2. \_\_\_\_\_ Dollars (\$\_\_\_\_\_).

J. Alternate No. 10: Reduce Standing Seam Roof Thickness:

- 1. ADD \_\_\_ DEDUCT \_\_\_ NO CHANGE \_\_\_ NOT APPLICABLE \_\_\_.
- 2. \_\_\_\_\_ Dollars (\$\_\_\_\_\_).

K. Alternate No. 11: Replace split face CMU veneer with full-bed masonry veneer:

- 1. ADD \_\_\_ DEDUCT \_\_\_ NO CHANGE \_\_\_ NOT APPLICABLE \_\_\_.
- 2. \_\_\_\_\_ Dollars (\$\_\_\_\_\_).

1.5 SUBMISSION OF BID SUPPLEMENT

- A. Respectfully submitted this \_\_\_ day of \_\_\_\_\_, 2021.
- B. Submitted By: \_\_\_\_\_ (Insert name of bidding firm or corporation).
- C. Authorized Signature: \_\_\_\_\_ (Handwritten signature).
- D. Signed By: \_\_\_\_\_ (Type or print name).
- E. Title: \_\_\_\_\_ (Owner/Partner/President/Vice President).

**END OF DOCUMENT 004323**

## **SECTION 01 2300 - ALTERNATES**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. Section includes administrative and procedural requirements for alternates.

#### **1.3 DEFINITIONS**

- A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if the Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
  - 1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
  - 2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternates into the Work. No other adjustments are made to the Contract Sum.

#### **1.4 PROCEDURES**

- A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
  - 1. Include, as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation, whether or not indicated as part of alternate.
- B. Execute accepted alternates under the same conditions as other Work of the Contract.
- C. Schedule: A Part 3 "Schedule of Alternates" Article is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.



PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

- A. Alternate No. 01: Omit Lobby and Meeting Room Casework.
1. Base Bid: In Lobby 101 and Meeting Room 104, provide all casework as indicated in the Drawings.
  2. Alternate: In Lobby 101 omit two (2) wall-recessed casework units, and in Meeting Room 104 omit one (1) wall-recessed casework unit; in lieu, finish gypsum wall board alcoves to Level 4 and prime and paint; install wall base as scheduled for each room; and extend floor coverings into alcove as scheduled for each room.
- B. Alternate No. 02: Omit Resinous Flooring Integral Base.
1. Base Bid: Provide Resinous Flooring integral cove base at all resinous flooring areas indicated in the Finish Schedule.
  2. Alternate: Remove resinous flooring integral cove base; in lieu, provide wall surface finished to floor, primed and painted.
- C. Alternate No. 03: Sealed Concrete In Lieu of Resinous Flooring.
1. Base Bid: Provide Resinous Flooring and integral base, including reflective striping, as indicated in the Finish Schedule.
  2. Alternate: Remove Resinous Flooring and associated integral base in its entirety from all areas indicated in the Finish Schedule; in lieu, provide sealed concrete floor finish.
- D. Alternate No. 04: Sectional Doors In Lieu of Four-Fold Doors.
1. Base Bid: Provide Four-Fold Doors FFB1-5F and FFB1-5R as indicated in the Drawings and as specified in Section 08 3513, "Bifold Doors".
  2. Alternate: In lieu of Four-Fold Doors, provide for openings FFB1-5F and FFB1-5R fully-glazed sectional doors and controls; basis-of-design: Raynor; AlumaView AV300, as follows:
    - a. ½-inch thickness clear, fully tempered insulating glazing units.
    - b. 3 inch heavy duty tracks and rollers
    - c. Heavy duty springs, minimum lift cycle of 90,000 operations.
    - d. Jack-shaft-mounted motor.
    - e. Two (2) push-button remote operators for each door.
    - f. Safety door edge and photoelectric eye sensor safety system.
    - g. 1 manual pushbutton station at interior jamb of each door.
    - h. Include General Contractor coordination of re-design for door weight, attachment locations, and motor power requirements.

- E. Alternate No. 05: Omit Steel Beam for Future Operable Partition.
1. Base Bid: In Meeting Room 104, provide and install structural steel beam and supporting steel columns for future operable partition, located between Column Lines (E) and (F), as indicated in the Drawings.
  2. Alternate: In Meeting Room 104, remove from the Scope of Work the structural steel beam and two (2) supporting steel columns for future operable partition, located between Column Lines (E) and (F). Column footings and baseplate shall remain in the Contract, and shall not be omitted.
- F. Alternate No. 06: Painted Gypsum Wall Board In Lieu of Wall Tile, Restrooms.
1. Base Bid: In Rooms 102, 103, 115, 116, 120, and 121, provide wall tile on backer board and associated setting materials and accessories as indicated in the Finish Schedule and as specified in Specifications Section 09 3013, "Ceramic Tiling".
  2. Alternate: In Rooms 102, 103, 115, 116, 120, and 121, omit wall tile on all walls EXCEPT for walls against which toilets and urinals are installed; in lieu, provide level-4-finish gypsum wall board, primed and two-coat painted with satin latex paint system indicated in Section 09 9123, "Interior Painting". Do not omit wall tile for walls in those rooms against which urinals and toilets are indicated to be installed.
- G. Alternate No. 07: Add MVE-Control System to Interior Concrete Slabs On Grade to Mitigate High Slab Moisture Problems.
1. Base Bid: Omit Moisture-Vapor-Emission Control system as specified in Section 09 0561.13, "Moisture Vapor Emission Control" in its entirety from the Scope of Work.
  2. Alternate: Furnish and install the Moisture-Vapor-Emission Control system, including all components, labor, and accessories, as specified in Section 09 0561.13, "Moisture Vapor Emission Control" to all interior concrete slabs-on-grade, except in locations and under specific types of floor coverings specifically indicated in Section 09 0561.13.
- H. Alternate No. 08: Solid Exterior Wall In Lieu of Rear Apparatus Bay Door FFB1-5R.
1. Base Bid: Provide four-fold door FFB1-5R in the rear wall of the Apparatus Bay, as indicated in the Drawings.
  2. Alternate: Delete four-fold door FFB1-5R and associated controls and accessories from the Scope of Work; and in lieu of door and opening, provide an equal square-foot area of exterior wall construction (Wall Types E1 and E2) in place of door, for a seamless, uninterrupted expanse of exterior wall. The structural steel and lintel associated with the omitted Door FFB1-5R shall remain in the Scope of Work.
- I. Alternate No. 09: Lawn in Lieu of Rear Apron.
1. Base Bid: Provide the concrete slab-on-grade apron to the plan-north side of the Apparatus Bay from the face of the building to the existing roadway, and associated subgrade and site grading as indicated in the Drawings.

2. Alternate: Remove from the Work the rear concrete apron and associated subgrade and site grading, from plan-north face of the Apparatus Bay to the connection to the existing roadway; and remove bollards along plan-north exterior face of the building. In lieu, extend sidewalk along plan-north exterior wall of Apparatus Bay, from the plan-northeast-corner of the building to the concrete utility pad location in the middle of the plan-north exterior wall; and lawn consisting of suitable fill and 4 inches of topsoil finish-graded to contour of adjoining lawn and roadway, grass seed, and straw thatch.
- J. Alternate No. 10: Reduce Standing Seam Roof Thickness.
1. Base Bid: For Roof Types R-1 and R-2, provide standing seam metal roof of gage as indicated in Specifications Section 07 4113.16, "Standing Seam Metal Roof Panels".
  2. Alternate: For Roof Types R-1 and R-2, in lieu of specified thickness, reduce metal thickness of standing seam metal roof panels to 0.025 inch (24 gage).
- K. Alternate No. 11: Replace Splitface CMU Veneer with Full-bed Masonry Veneer.
1. Base Bid: Provide splitface CMU veneer as illustrated on exterior wall type "E1" as indicated in the Drawings.
  2. Alternate: Replace splitface CMU veneer as indicated on wall type "E1" with full-bed masonry veneer as illustrated in wall type "E1-A." See specification section 04 2613 Masonry Veneer (Full-Bed Masonry Veneer), ALTERNATE for additional information.

**END OF SECTION 01 2300**

**SECTION 04 2613 - MASONRY VENEER**  
**(FULL-BED STONE VENEER) - ALTERNATE**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Calcium Silicate Building Stone Units
2. Mortar.
3. Ties and anchors.
4. Embedded flashing.
5. Miscellaneous masonry accessories.

B. Products Installed but not Furnished under This Section:

1. Cast-stone trim in masonry veneer.
2. Steel lintels in masonry veneer.
3. Steel shelf angles for supporting masonry veneer.

C. Related Requirements:

1. Section 07 6200 "Sheet Metal Flashing and Trim" for exposed sheet metal flashing and for furnishing manufactured reglets installed in masonry joints.

1.3 DEFINITIONS

- A. CMU(s): Concrete masonry unit(s).

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

**1.5 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Shop Drawings: For the following:
  - 1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
  - 2. Stone Trim Units: Show sizes, profiles, and locations of each stone trim unit required.
  - 3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.
- C. Samples for Initial Selection:
  - 1. Calcium Silicate Building Stone Units
  - 2. Colored mortar.
  - 3. Weep holes/vents.

**1.6 INFORMATIONAL SUBMITTALS**

- A. 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. Receipt of list does not constitute approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Architect and approved in writing.
- B. Material Certificates: For each type and size of the following:
  - 1. Masonry units.
    - a. Include data on material properties material test reports substantiating compliance with requirements.
  - 2. Cementitious materials. Include name of manufacturer, brand name, and type.
  - 3. Mortar admixtures.
  - 4. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
  - 5. Anchors, ties, and metal accessories.
- C. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

**1.7 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: For manufactured products, manufacturer having sufficient plant facilities to produce the shapes, quantities, and size of Products required in accordance with the Project schedule.



- B. Sample Panels: Build sample panels to verify selections made under Sample submittals and to demonstrate aesthetic effects. Comply with requirements in Section 01 4000 "Quality Requirements" for mockups.
  - 1. Build sample panels for typical exterior and interior walls in sizes approximately 60 inches long by 48 inches high by full thickness.
  - 2. Build sample panels facing south.
  - 3. Clean one-half of exposed faces of panels with masonry cleaner indicated.
  - 4. Protect approved sample panels from the elements with weather-resistant membrane.
  - 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.

#### 1.8 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. Platform shall be elevated a minimum of 3 inches above grade.
- B. Lift masonry units with proper and sufficiently long slings or forks with protection to prevent damage to units. Protect edges and corners.
- C. Place polyethylene or other plastic sheet between wood and other finished surfaces of units when stored for extended periods of time.
- D. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- E. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- F. Deliver preblended, dry mortar mix in moisture-resistant containers. Store preblended, dry mortar mix in delivery containers on elevated platforms in a dry location or in covered weatherproof dispensing silos.
- G. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.
- H. Do not use salt or calcium chloride to remove ice from masonry surfaces.

1.9 FIELD CONDITIONS

- A. Protection of Masonry: During construction, cover tops of veneer, 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 down face of veneer, and hold cover securely in place.
- B. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry. Immediately remove grout, mortar, and soil that come in contact with masonry.
  - 1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings 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.
- C. 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 TMS 602/ACI 530.1/ASCE 6.
  - 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.
- D. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. 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, from single source from single manufacturer for each product required.
- B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

**2.2 UNIT MASONRY, GENERAL**

- A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects will be exposed in the completed Work.

**2.3 CALCIUM SILICATE BUILDING STONE (FULL BED STONE VENEER)**

- A. Basis of Design Product: Subject to compliance with requirements, provide Citadel Building Stone, 3-Unit (25:50:25) as manufactured by Arriscraft.
1. General: ASTM C73, Grade SW; solid units that have been pressure formed and autoclaved; special shapes as indicated; three size configuration.
  2. Modular Sizes:
    - a. CIT23: 2-3/8 inch high, 3-5/8 inch bed, various lengths up to 23-5/8 inches; 25%
    - b. CIT52: 5-1/4 inch high, 3-1/2 inch bed, various lengths up to 23-5/8 inches; 50%
    - c. CIT81: 8-1/8 inch high, 3-1/2 inch bed, various lengths up to 23-5/8 inches; 25%
  3. Texture: Tumbled finish on exposed faces and ends.
  4. Color: As selected by Architect from manufacturers full range.

**2.4 MORTAR MATERIALS**

- A. Portland Cement: ASTM C150/C150M, 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 indicated.
1. Alkali content shall not be more than 0.1 percent when tested according to ASTM C114.
- B. Hydrated Lime: ASTM C207, Type S.
- C. Mortar Ratio: 1:1:6 portland cement-hydrated lime-sand mix.
- D. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C979/C979M. Use only pigments with a record of satisfactory performance in masonry mortar.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Davis Colors.
    - b. Euclid Chemical Company (The); an RPM company.
    - c. Lanxess Corporation.
    - d. Solomon Colors, Inc.

- E. Colored Cement Products: Packaged blend made from portland cement and hydrated lime and mortar pigments, all complying with specified requirements, and containing no other ingredients.
1. Colored Portland Cement-Lime Mix:
    - a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      - 1) Essroc.
      - 2) Holcim (US) Inc.
      - 3) Lafarge North America Inc.
      - 4) Lehigh Hanson; HeidelbergCement Group.
    2. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's standard colors.
    3. Pigments shall not exceed 10 percent of portland cement by weight.
- F. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C494/C494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. BASF Corp. - Construction Chemicals.
    - b. Euclid Chemical Company (The); an RPM company.
    - c. GCP Applied Technologies Inc.
- G. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMUs containing integral water repellent from same manufacturer.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. ACM Chemistries.
    - b. BASF Corp. - Construction Chemicals.
    - c. Euclid Chemical Company (The); an RPM company.
    - d. GCP Applied Technologies Inc.
- H. Water: Potable.
- 2.5 TIES AND ANCHORS
- A. Ties and anchors shall be as specified in SECTION 04 2200 "Concrete Unit Masonry."

2.6 EMBEDDED FLASHING MATERIALS

- A. Embedded flashing materials shall be as specified in SECTION 04 2200 "Concrete Unit Masonry."

2.7 MISCELLANEOUS MASONRY ACCESSORIES

- A. Unless indicated below, miscellaneous masonry accessories shall be as specified in SECTION 04 2200 "Concrete Unit Masonry."
- B. Weep/Vent Products: Use the following unless otherwise indicated:
  - 1. Stone Cavity Weep: High impact polystyrene sheets, 0.024 inch thick, formed with corrugations. Continuous roll with pre-spaced weep legs; 2-1/4 inch wide by length needed to span veneer thickness; spaced 6-3/4 inches apart.
    - a. Basis of design product, subject to compliance with requirements, provide Stone Cavity Weep SCV 5012 as manufactured by MTI, Masonry Technology Incorporated or approved equivalent.

2.8 MASONRY CLEANERS

- A. Masonry cleaners shall be as specified in SECTION 04 2200 "Concrete Unit Masonry."

2.9 MORTAR 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. Use portland cement-lime mortar unless otherwise indicated.
  - 3. For exterior masonry, use portland cement-lime mortar.
  - 4. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.
- B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.
- C. Pigmented Mortar: Use colored cement product or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products.
  - 1. Pigments shall not exceed 10 percent of portland cement by weight.
  - 2. Application: Use pigmented mortar for exposed mortar joints.



### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
  - 1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 INSTALLATION, GENERAL

- A. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.
- B. Use full-size units without cutting if possible. If cutting is required to provide continuous pattern or to fit adjoining construction, cut units with masonry splitter and dress split ends to match face when exposed in wall.
- C. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.
- D. Wetting of Calcium Silicate Building Stone: Where the ambient temperature exceeds 100 degrees F with a wind velocity greater than \* mph, pre-wet building stone units. Lay wetted units when surface is dry.
- E. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested according to ASTM C67. Allow units to absorb water so they are damp but not wet at time of laying.

#### 3.3 TOLERANCES

- A. Dimensions and Locations of Elements:
  - 1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch or minus 1/4 inch.
  - 2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch.
  - 3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.
- B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.

### 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. Coursing; Calcium Silicate Building Stone
  1. Place masonry to lines and levels indicated.
  2. Maintain masonry courses to uniform width. Make vertical and horizontal joints equal and of uniform thickness.
  3. Lay building stone units random bond pattern, to the following percentage ratio, described from smallest to largest sized units: 25:50:25.
  4. Maintain mortar joint thickness of 1/2 inch.
  5. Tool mortar joints by compacting the surface when thumbprint hard, to concave finish.
- C. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.
- D. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

### 3.5 MORTAR BEDDING AND JOINTING

- A. Lay masonry in full bed of mortar, properly jointed with other work. Buttering corners or joints, and deep or excessive furrowing of mortar joints as well as slushing head joints is not permitted.

- B. Fully bond intersections and external corners.
- C. Do not adjust units after laying. Where resetting of masonry is required, remove, clean, and reset units in new mortar.
- D. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

### 3.6 ANCHORED MASONRY VENEERS

- A. Anchor masonry veneers as indicated in SECTION 04 2200 "Concrete Unit Masonry."

### 3.7 EXPANSION JOINTS

- A. General: Install expansion-joint materials in unit masonry as masonry progresses. Do not allow materials to span expansion joints without provision to allow for in-plane wall or partition movement.

### 3.8 LINTELS

- A. Install steel lintels where indicated.
- B. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

### 3.9 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. Install vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities, and where indicated.
- B. Install flashing as indicated in SECTION 04 2200 "Concrete Unit Masonry."
- C. Install weep holes in veneers in head joints of first course of masonry immediately above embedded flashing.
  - 1. Use specified weep/vent products to form weep holes.
  - 2. Trim weep material flush with outside face of wall after mortar has set.
- D. Place cavity drainage material in airspace behind veneers to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.

3.10 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, where indicated.
- 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 or polyethylene film and waterproof masking tape.
  - 4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
  - 5. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.
  - 6. Clean stone trim to comply with stone supplier's written instructions.
  - 7. Clean limestone units to comply with recommendations in ILI's "Indiana Limestone Handbook."

3.11 MASONRY WASTE DISPOSAL

- A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.
- B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
  - 1. Crush masonry waste to less than 4 inches in each dimension.
  - 2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Section 31 2000 "Earth Moving."
  - 3. Do not dispose of masonry waste as fill within 18 inches of finished grade.

- C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

**END OF SECTION 04 2613**

## **SECTION 04 7200 - CAST STONE MASONRY**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Cast-stone trim.
- B. Related Sections:
  - 1. Section 04 2200 "Concrete Unit Masonry" for installing cast-stone units in unit masonry.

#### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. For cast-stone units, include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: Show fabrication and installation details for cast-stone units. Include dimensions, details of reinforcement and anchorages if any, and indication of finished faces.
  - 1. Include building elevations showing layout of units and locations of joints and anchors.
- C. Samples for Initial Selection: For colored mortar.
- D. Samples for Verification:
  - 1. For each color and texture of cast stone required, 10 inches square in size.
  - 2. For each trim shape required, 10 inches in length.

#### **1.4 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For manufacturer.

- B. Material Test Reports: For each mix required to produce cast stone, based on testing according to ASTM C 1364, including test for resistance to freezing and thawing.
  - 1. Provide test reports based on testing within previous two years.

#### 1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer of cast-stone units similar to those indicated for this Project, that has sufficient production capacity to manufacture required units, and is a plant certified by the Cast Stone Institute the Architectural Precast Association or the Precast/Prestressed Concrete Institute for Group A, Category AT.
- B. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
- C. Mockups or Sample Panels: Furnish cast stone for installation in mockups or sample panels specified in Section 04 2000 "Unit Masonry."
- D. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects[ and set quality standards for materials and execution].

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Coordinate delivery of cast stone with unit masonry work to avoid delaying the Work and to minimize the need for on-site storage.
- B. Pack, handle, and ship cast-stone units in suitable packs or pallets.
  - 1. Lift with wide-belt slings; do not use wire rope or ropes that might cause staining. Move cast-stone units if required, using dollies with wood supports.
  - 2. Store cast-stone units on wood skids or pallets with nonstaining, waterproof covers, securely tied. Arrange to distribute weight evenly and to prevent damage to units. Ventilate under covers to prevent condensation.
- C. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- D. Store mortar aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

#### 1.7 PROJECT CONDITIONS

- A. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Comply with cold-weather construction requirements in TMS 602/ACI 530.1/ASCE 6.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until cast stone has dried, but no fewer than seven days after completing cleaning.
- B. Hot-Weather Requirements: Comply with hot-weather construction requirements in TMS 602/ACI 530.1/ASCE 6.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Source Limitations for Cast Stone: Obtain cast-stone units from single source from single manufacturer.

### 2.2 CAST-STONE MATERIALS

- A. General: Comply with ASTM C 1364.
- B. Portland Cement: ASTM C 150/C 150M, Type I or Type III, containing not more than 0.60 percent total alkali when tested according to ASTM C 114. Provide natural color or white cement as required to produce cast-stone color indicated.
- C. Coarse Aggregates: Granite, quartz, or limestone complying with ASTM C 33/C 33M; gradation and colors as needed to produce required cast-stone textures and colors.
- D. Fine Aggregates: Natural sand or crushed stone complying with ASTM C 33/C 33M, gradation and colors as needed to produce required cast-stone textures and colors.
- E. Color Pigment: ASTM C 979/C 979M, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, free of carbon black, nonfading, and resistant to lime and other alkalis.
- F. Admixtures: Use only admixtures specified or approved in writing by Architect.
  1. Do not use admixtures that contain more than 0.1 percent water-soluble chloride ions by mass of cementitious materials. Do not use admixtures containing calcium chloride.
  2. Use only admixtures that are certified by manufacturer to be compatible with cement and other admixtures used.
  3. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
  4. Water-Reducing, Accelerating Admixture: ASTM C 494/C 494M, Type E.
  5. Other Admixtures: Integral water repellents and other chemicals, for which no ASTM standard exists, shall be previously established as suitable for use in concrete by proven field performance and through laboratory testing.
- G. Embedded Anchors and Other Inserts: Fabricated from steel complying with ASTM A 36/A 36M and hot-dip galvanized to comply with ASTM A 123/A 123M.



## 2.3 CAST-STONE UNITS

- A. Cast-Stone Units: Comply with ASTM C 1364.
  - 1. Units shall be manufactured using the vibrant dry tamp method.
  - 2. Units shall be resistant to freezing and thawing as determined by laboratory testing according to ASTM C 666/C 666M, Procedure A, as modified by ASTM C 1364.
- B. Fabricate units with sharp arris and accurately reproduced details, with indicated texture on all exposed surfaces unless otherwise indicated.
  - 1. Slope exposed horizontal surfaces 1:12 to drain unless otherwise indicated.
  - 2. Provide raised fillets at backs of sills and at ends indicated to be built into jambs.
  - 3. Provide drips on projecting elements unless otherwise indicated.
- C. Fabrication Tolerances:
  - 1. Variation in Cross Section: Do not vary from indicated dimensions by more than 1/8 inch.
  - 2. Variation in Length: Do not vary from indicated dimensions by more than 1/360 of the length of unit or 1/8 inch, whichever is greater, but in no case by more than 1/4 inch.
  - 3. Warp, Bow, and Twist: Not to exceed 1/360 of the length of unit or 1/8 inch, whichever is greater.
  - 4. Location of Grooves, False Joints, Holes, Anchorages, and Similar Features: Do not vary from indicated position by more than 1/8 inch on formed surfaces of units and 3/8 inch on unformed surfaces.
- D. Cure Units as Follows:
  - 1. Cure units in enclosed, moist curing room at 95 to 100 percent relative humidity and temperature of 100 deg F for 12 hours or 70 deg F for 16 hours.
  - 2. Keep units damp and continue curing to comply with one of the following:
    - a. No fewer than five days at mean daily temperature of 70 deg F or above.
- E. Acid etch units after curing to remove cement film from surfaces to be exposed to view.
- F. Colors and Textures: As selected by Architect from manufacturer's full range.

## 2.4 MORTAR MATERIALS

- A. Provide mortar materials that comply with Section 04 2200 "Concrete Unit Masonry"

## 2.5 ACCESSORIES

- A. Anchors: Type and size indicated, fabricated from Type 304 stainless steel complying with ASTM A 240/A 240M, ASTM A 276, or ASTM A 666 steel complying with ASTM A 36/A 36M and hot-dip galvanized to comply with ASTM A 123/A 123M.

- B. Dowels: 1/2-inch- diameter round bars, fabricated from Type 304 stainless steel complying with ASTM A 240/A 240M, ASTM A 276, or ASTM A 666 steel complying with ASTM A 36/A 36M and hot-dip galvanized to comply with ASTM A 123/A 123M.
- C. 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 cast-stone manufacturer and expressly approved by cleaner manufacturer for use on cast stone and adjacent masonry materials.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Diedrich Technologies, Inc.
    - b. EaCo Chem, Inc.
    - c. ProSoCo, Inc.

## 2.6 MORTAR MIXES

- A. Comply with requirements in Section 04 2200 "Concrete Unit Masonry" for mortar mixes.

## 2.7 SOURCE QUALITY CONTROL

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 SETTING CAST STONE IN MORTAR

- A. Install cast-stone units to comply with requirements in Section 04 2200 "Concrete Unit Masonry".
- B. Rake out joints for pointing with sealant to depths of not less than 3/4 inch. Scrub faces of units to remove excess mortar as joints are raked.
- C. Point joints with sealant to comply with applicable requirements in Section 07 9200 "Joint Sealants."

1. Prime cast-stone surfaces to receive sealant and install compressible backer rod in joints before applying sealant unless otherwise indicated.
- D. Provide sealant joints at head joints of copings and other horizontal surfaces; at expansion, control, and pressure-relieving joints; and at locations indicated.
1. Keep joints free of mortar and other rigid materials.
  2. Build in compressible foam-plastic joint fillers where indicated.
  3. Form joint of width indicated, but not less than 3/8 inch.
  4. Prime cast-stone surfaces to receive sealant and install compressible backer rod in joints before applying sealant unless otherwise indicated.
  5. Prepare and apply sealant of type and at locations indicated to comply with applicable requirements in Section 07 9200 "Joint Sealants."

3.3 ADJUSTING AND CLEANING

- A. In-Progress Cleaning: Clean cast stone as work progresses.
1. Remove mortar fins and smears before tooling joints.

**END OF SECTION 04 7200**

## **SECTION 23 7310 - INDOOR AIR HANDLING UNITS**

### PART 1 - GENERAL

#### 1.1 DESCRIPTION OF WORK

- A. Extent of indoor air handling unit work required by this section is indicated on drawings and schedules, and by requirements of this section and all other Division-23 sections.
- B. Types of indoor air handling units specified in this section include the following:
  - 1. Indoor air handling units
- C. Refer to requirements of Division-26.

#### 1.2 QUALITY ASSURANCE

- A. Regulatory Requirements:
  - 1. ARI Compliance: Provide capacity ratings for indoor air handling units in accordance with ARI Standard 360 "Standard for Commercial and Industrial Unitary Air-Conditioning Equipment".
  - 2. ASHRAE Compliance: Construct refrigerating system of indoor air handling units in accordance with ASHRAE Standard 15 "Safety Code for Mechanical Refrigeration".
  - 3. UL Compliance: Provide indoor air handling units which are designed, manufactured, and tested in accordance with UL requirements.

#### 1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data, including rated capacities of selected model clearly indicated, weights, furnished specialties and accessories; and installation and start-up instructions.
- B. Shop Drawings: Submit manufacturer's assembly-type shop drawings indicating dimensions, weight loadings, required clearances, and methods of assembly of components.

- C. Wiring Diagrams: Submit manufacturer's electrical requirements for power supply wiring for indoor air handling units. Submit manufacturer's ladder-type wiring diagrams for interlock and control wiring. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed.
  - D. Maintenance Data: Submit maintenance data and parts list for each heating and cooling unit, control, and accessory; including "troubleshooting" maintenance guide. Include this data and product data in maintenance manual; in accordance with requirements of Division-01.
  - A. Manufacturer Seismic Qualification Certification: Submit certification that the dedicated outdoor air system (DOAS), accessories, and components will withstand seismic forces as defined in ASCE 7. Refer to Division 23 Section "Seismic and Wind Controls." Provide one of the following:
    - 1. Analysis: Calculation by a Professional Engineer demonstrating compliance with ASCE 7 Chapter 13.
    - 2. Equipment Certificate: Certificate must show equipment has been tested based on a nationally recognized testing standard procedure. Indicate whether withstand certification is based on actual test of assembled components or on calculation.
      - a. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
      - b. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
    - 3. Experience Data: Provide experience data acceptable to the local Authority Having Jurisdiction which demonstrates the seismic capacity of components and their supports in accordance with ASCE 7 Chapter 13.
    - 4. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
- 1.4 PRODUCT DELIVERY, STORAGE AND HANDLING
- A. Handle indoor air handling units and components carefully to prevent damage, breaking, denting and scoring. Do not install damaged indoor

air handling units or components; replace with new.

- B. Store indoor air handling units and components in clean dry place. Protect from weather, dirt, fumes, water, construction debris, and physical damage.
- C. Comply with Manufacturer's rigging and installation instructions for unloading indoor air handling units, and moving them to final location.

## PART 2 - PRODUCTS

### 2.1 INDOOR AIR HANDLING UNITS (DOAS-1)

- A. **Manufacturer's local representative shall employ or contract with local factory trained and certified service technicians with capability to support the equipment for factory authorized start-up, warranty and service, including manufacturer's start-up forms and requirements, control interface, wiring and wiring schematics, packaged refrigeration systems, gas heat, and energy recovery devices.**
- B. **Unit Arrangement**
  - 1. **Duct connections shall be located as shown on the drawings. Duct connection sizes shall not have a higher face velocity or different aspect ratio than the specified unit.**
  - 2. **Air tunnels shall be arranged as shown on the drawings. Unit height and width shall not be less than the specified unit height and width.**
  - 3. **Filters shall be located within the unit cabinet (not in an external sleeve or in the hood).**
  - 4. **Maintenance access space and airflow transition space between components shall be provided as shown on the drawings. Unit length shall not be less than the specified unit length.**
  - 5. **Fans and/or filters shall not be face mounted on coils or heat transfer components.**
- C. **Construction**
  - 1. **General. Construct unit with materials and features as specified herein. Provide structural base and tube frame to house inset wall, ceiling and floor panels. Unit construction shall meet Cabinet Performance specified in this section. Structural tube frame and panel construction shall be provided with no individual panel**

exceeding 36" width. All panels on the unit shall be fully removable without the use of cutting tools. All internal components shall be removable without compromising the structural integrity of the unit. Unit shall be suitable for indoor installation as detailed on the plan drawings.

**2. Cabinet Performance. Unit construction shall meet the following minimum performance criteria.**

- a. **Base Deflection. Design structural base to limit deflection to 1/4" in length and width when rigging the unit according to manufacturer recommendations. Provide engineering calculations demonstrating compliance with this requirement.**
- b. **Cabinet Deflection. Construct cabinet to limit deflection of the walls and roof to L/250 at 8" w.c. static pressure, or 1.5 times the maximum static pressure within the unit at design conditions, whichever is lower. Deflection ratings for panels only shall not be accepted.**
- c. **Floor Deflection: Maximum floor deflection shall be L/500 (L=span in inches) when subjected to an 800 lb/sq ft. point load. Provide test data demonstrating compliance with this requirement.**
- d. **Casing Air Leakage. Maximum casing leakage shall meet SMACNA duct leakage class (DLC) rating of 5.0. Provide calculations demonstrating compliance with this requirement.**
- e. **Casing Insertion Loss (Acoustic rating). The panel insertion loss, per octave band, shall not be less than the following:**

|                      |     |     |     |     |      |      |      |      |
|----------------------|-----|-----|-----|-----|------|------|------|------|
| Frequency (Hz):      | 100 | 125 | 250 | 500 | 1000 | 2000 | 4000 | 8000 |
| Insertion Loss (dB): | 24  | 16  | 30  | 32  | 33   | 34   | 63   | 60   |

- f. **Thermal Performance. All interior walls, floor, and ceiling shall be double wall and insulated with polyurethane injected foam insulation having a minimum R- value of 6.3 - 7.1/inch. Fiberglass or non-injected foam insulation is not acceptable and will be rejected.**

**3. Base. Base shall be constructed of welded 10 ga. structural steel G channel perimeter and C channel cross members with integral lifting lugs. Units without a welded structural steel base that utilize lifting**

provisions near the top of the cabinet shall be unacceptable. Bolted bases shall not be acceptable. Coat base exterior with 2 part epoxy primer and urethane modified enamel topcoat. Welded lifting lugs shall be provided. Weep holes shall be provided in base channels. Base height shall be a minimum of 8" to facilitate proper trapping of drains.

4. **Frame.** Frame shall be constructed of structural tube members designed to support flush-mounted double-wall panels. Vertical frame members shall be easily removable without the use of specialty tools or torches for replacement of large internal components. Welded frame shall not be accepted unless all internal components can be easily removed without cutting any welds. A closed-cell polyvinyl foam gasket with a thickness of 3/16" or greater shall be applied between all frame members and panels, providing a thermal break between the panels and the structural frame. Units without a structural tube frame shall be unacceptable.
  - a. **Frame Material:** Extruded 6063 Aluminum Tube
5. **Floor.** Floor shall be 2" thick double-wall, foam injected panel construction for optimal support strength. Floor shall be a fastener free design, bonded to the unit base with a structural adhesive. All seams shall be finished with an adhesive sealant providing a watertight floor system. Use of tack welding, caulk or screws penetrating the entire floor panel anywhere in the floor shall not be accepted. The floor shall have a smooth and flat walk-on surface. A minimum 1" lip shall be provided around all floor penetrations. Walk-on grating shall be provided over all accessible floor mounted duct connections. Paneled floor shall be constructed of a minimum of 18 gauge galvanized G90 steel walk on surface, and 22 gauge galvanized steel underside surface.
6. **Wall and Ceiling Panels.** Unit shall have non-load bearing, fully removable, heavy gauge 2" double-wall panels which fully encapsulate the injected foam insulation. No individual panel shall exceed 36" width. Panel edges utilizing PVC edge wrappers to cover the insulation shall not be accepted. Panels shall be manufactured with an integral thermal break.
  - a. **Exterior Materials:** Exterior skin shall be galvanized G90 steel. Unpainted galvanized exterior shall be unacceptable if unit casing or framework is welded.
  - b. **Interior Materials:** Interior skin shall be galvanized G90 steel.
7. **Thermal Break Construction.** The casing (panels and frame)



excluding doors, shall meet AHRI 1350 CB-1 requirements.

8. **Insulation.** Insulation shall be a product of a manufacturer specializing in insulating materials. All walls, floor, and ceiling shall be double wall and insulated with polyurethane injected foam insulation. Provide a data sheet from the insulation manufacturer confirming an R-value of 6.3 - 7.1 per inch. No insulation shall be exposed to the airstream. Non-injected foam board insulation or air handler manufacturer produced insulating material shall not be accepted. Fiberglass, mineral wool, and non-injected foam board insulation shall not be accepted.
9. **Access Doors.** Provide double wall doors with the same insulation and inner/outer wall material as the wall panels. Doors shall have an integral aluminum frame and shall be mounted into the structural frame of the unit. Door openings cut into casing panels shall not be accepted. Doors shall be full height (up to 72") with industrial continuous stainless steel hinges. Bi-directional compression latches with integral roller cam and hex-screw locking assembly shall be provided. An EPDM type door gasket shall be provided in accordance with ASTM D 2000. Supply and exhaust airstreams shall not be covered by a single door. Access panels in lieu of access doors shall not be accepted. Rain gutters shall be provided over all access doors that are not the full height of the unit casing. All doors that open with pressure shall be provided with a pressure relief safety latch. Access doors shall be provided for sections requiring routine maintenance.

**D. Enthalpy Wheel**

1. Provide AHRI Certified enthalpy wheel with ratings, performance, wheel material, desiccant type, seal, drive, purge sector, housing and warranty as scheduled and specified herein.
2. **Construction.** The enthalpy wheel shall be constructed with the following features:
  - a. **Substrate material.** Construct wheel of 50 micron hardened aluminum alloy or synthetic substrate. Wheel shall be a minimum of 4" deep as scheduled.
  - b. **Desiccant.** Provide permanently bonded 3 angstrom molecular sieve, non-migrating, water selective desiccant. Silica Gel desiccant shall not be acceptable.
  - c. **Dedicated Purge Sector.** Provide purge sector to minimize cross-over of return air to supply air during rotation. Purge sector

- shall limit the Exhaust Air Transfer Ratio (EATR) to the AHRI Certified value at 3" w.c. pressure differential between the airstreams.
- d. **Seals.** Provide circumferential and radial seals to limit the Outside Air Correction Factor (OACF) to the AHRI Certified value at 3" w.c. pressure differential between the airstreams. Seals shall be minimum 4 pass or 8 pass polypropylene.
  - e. **Bearing.** Provide permanently lubricated bearings with 100,000 hour non-maintenance spherical ball bearings protected by a galvanized steel dust shield.
  - f. **Drive System.** Provide a VFD factory wired to the wheel motor for defrost and economizer provisions. Provide gear motor with V-belt drive. Sheaves shall be cast iron. Belts shall be fabric reinforced urethane coated perforated V-belts
  - g. **Cleaning Provisions.** Wheel substrate shall be able to be cleaned with mild detergent, water, compressed air, or low pressure steam (<15 psi). Wheel 96" diameter and larger shall be provided in a frame housing with removable pie- shaped segments.
3. **Ratings.** The enthalpy wheel shall be AHRI Certified at a minimum of 3" w.c. pressure differential (Test 3). Ratings submitted at zero pressure differential (Test 1) or 0.5" pressure differential (Test 2) do not meet this requirement and shall not be accepted.
- a. **Exhaust Air Transfer Ratio (EATR).** EATR shall be no greater than 1.5% at 3" w.c. pressure differential. Provide AHRI Certified Rating verifying this rating. Wheels that are not AHRI certified at a minimum of 3" w.c. pressure differential (Test 3).
  - b. **Outside Air Correction Factor (OACF).** OACF shall be no greater than 1.20 at 3" w.c. pressure differential. Provide AHRI Certified Rating verifying this rating.
4. **Performance.** Provide enthalpy wheel with the following performance:
- a. **Effectiveness.** Minimum total, sensible, and latent effectiveness as scheduled.
  - b. **Pressure Drop.** Maximum air pressure drop as scheduled for outside air and exhaust air.

5. **Mounting in the Air Handler.** The heat exchanger shall be applied in the air handler as follows:
  - a. A minimum of 18" open transition space shall be provided between the enthalpy wheel and the nearest component both upstream and downstream of the enthalpy wheel in both OA/SA and RA/EA airstreams through full plenum height access doors.
  - b. Hinged doors shall be provided for belt tensioning and drive motor access and servicing.
  
- E. **Blow/Motor**
  1. **Supply Blower; Exhaust Blower;**
  2. **Wheel.** The fan wheel shall be non-overloading centrifugal type. Wheel shall be statically and dynamically balanced to balance grade G6.3 per ANSI S2.19.
    - a. The supply fan wheel shall be manufactured with a minimum of seven, stitch welded steel backward curved blades.
    - b. The exhaust fan wheel shall be manufactured with a minimum of seven, stitch welded steel backward curved blades.
    - c. Fan wheel shall be finished with a protective coating to inhibit corrosion.
    - d. The wheel and fan inlet shall be carefully matched and shall have precise running tolerances for maximum performance and operating efficiency.
  3. **Construction.** Plenum fans shall be of the unboxed direct drive centrifugal type.
    - a. Fan plate shall be aerodynamically designed with high-efficiency inlet, engineered to reduce incoming air turbulence.
    - b. Panels and framework shall be constructed of precision laser cut and die formed galvanized steel to provide a rigid structure to support the drive motor, shaft, bearings and wheel and reduce low frequency vibration.
    - c. Each fan shall be given an electronic vibration analysis in accordance with ANSI/AMCA Standard 204, while operating at the specified fan RPM. The vibration signatures shall be taken at

motor mounting pedestal in the horizontal, vertical and axial direction. The maximum allowable fan vibration shall be 0.10 in./sec peak velocity, filter-in as measured at the fan RPM.

4. **Motor.** Motors shall meet or exceed EISA (Energy Independence and Security Act) efficiencies. Motors shall be 3-phase NEMA T-frame, 60 Hz, with RPM as scheduled.
  - a. Enclosure shall be Totally Enclosed Fan Cooled (TEFC).
  - b. Supply motors housing shall be rolled steel.
  - c. Exhaust motors housing shall be rolled steel.
  - d. Service factor shall be 1.15.
  - e. Insulation shall be Class F.
  - f. Supply fan motors shall have an integrated ABB VFD.
  - g. Exhaust fan motors shall have an integrated ABB VFD.
  - h. Supply motors shall have internal brush shaft grounding.
  - i. Exhaust motors shall have internal brush shaft grounding.
5. **Performance.** Conform to ANSI/AMCA Standards 210 and 300. Fans shall be tested in accordance with AMCA Publications 211 and 311 in an AMCA accredited laboratory and certified for air and sound performance. Fans shall be licensed to bear the AMCA ratings seal for air performance (AMCA 210) and sound performance (AMCA 300).
  - a. Fan brake horsepower shall not exceed the scheduled brake horsepower at the total static pressure and airflow scheduled.
  - b. Provide the number of fans scheduled, no exceptions.
  - c. Fan motors shall be selected to run at no more than 90 Hz at design conditions.
6. **Mounting.** Blower and motor shall be mounted on a unitary isolation base.
  - a. Structural steel fan/motor base shall be designed by the manufacturer to properly support the fan/motor assembly to mitigate vibration.

- b. **1" deflection housed seismic rated spring isolators shall be provided.**
  - c. **Fan inlets shall be connected to a double wall foam injected plenum wall.**
  - d. **Fans shall be connected to the plenum wall with canvas flex connectors with galvanized steel edge caps.**
- 7. Variable Frequency Drives: Provide variable speed drive for all plenum fans. VFDs shall be factory provided and factory installed. See Electrical section of this unit specification for more VFD requirements.**
- F. Dampers**
- 1. Dampers shall meet or exceed the following construction and ratings.**
    - a. **Outside Air Damper;**
      - 1) Steel Frame and Blade Dampers, Formed Blade**
        - a) **Construction**
        - b) **Frame Material: 16 ga. galvanized steel, 5" x 1" hat channel**
        - c) **Blade Material: Galvanized steel**
        - d) **Blade Type: Formed 3V**
        - e) **Linkage: Plated steel concealed in the jamb (out of airstream). Plastic and/or gear driven linkages shall not be allowed**
        - f) **Axle Material: Plated steel**
        - g) **Axle Bearings: Acetal (synthetic) sleeve**
        - h) **Blade Seals: TPE**
        - i) **Jamb seals: Stainless steel**
      - b. **Ratings. AMCA Class 1A rated at 1" w.c. and Class 1 up to 5" w.c. with AMCA certified performance for pressure drop and leakage per AMCA 500-1D, Test Figures 5.2, 5.3, and 5.5.**
        - a) **Velocity Limit: Suitable for use to 3000 feet per minute**

- b) **Leakage: 3 cfm/sq. ft (AMCA Class 1A)**
  - c) **Temperature Range: -40 deg F to 250 deg F**
  - d) **Pressure Limit: Suitable for use to 5" w.c.**
2. **The following dampers shall be provided at a minimum (additional dampers may be required, please consult the sequence of operation to determine what is needed):**
- a. **Outside Air Shut-off Damper, 2-position actuator required**
  - b. **Exhaust Air Shut-off Damper, 2-position actuator required**
- G. **Filters**
1. **General Requirements. Provide filters as specified in this section. Filter racks shall be blanked off to the unit casing to inhibit air bypass. Filters shall be located within the air handling unit cabinet and shall not be in a hood or duct sleeve outside of the air handler cabinet.**
2. **Outside Air Pleated Filter: Provide a flat bank or V-bank filter section as shown on the unit drawing and as follows:**
- a. **Depth and Rating: 2" MERV-8**
  - b. **Location: Mount filters immediately downstream of the outside air inlet.**
  - c. **Rack: Mount in shared rack with cartridge filters**
  - d. **Face Velocity: Provide filters sized for 500 fpm maximum face velocity, but no higher than the scheduled value.**
  - e. **Filters shall be rated per U.L. standard 900.**
3. **High Efficiency Cartridge Filter: Provide a flat bank or V-bank cartridge filter section as shown on the unit drawing and as follows:**
- a. **Depth and Rating. Provide 4" MERV-14 cartridge filters**
  - b. **Location: Mount in a shared rack with the pre-filter, immediately downstream of the OA inlet, or in the supply airstream if shown on the unit drawing.**
  - c. **Rack: Provide a galvanized steel front access rack. Front access racks shall include filter clips and be gasketed.**

- d. **Face Velocity:** Provide filters sized for 500 fpm maximum face velocity, but no higher than the scheduled value.
  - e. **Filters shall be rated per U.L. standard 900.**
4. **Return Air Pleated Filter:** Provide a flat bank or V-bank filter section as shown on the unit drawing and as follows:
- a. **Depth and Rating:** 2" MERV-8
  - b. **Location:** Mount filters immediately downstream of the return air inlet.
  - c. **Rack:** Provide a galvanized steel side access slide rack. Rack shall include vertical formed U-channels attached to the frame at intervals across the rack to protect against filter media getting pulled through the rack.
  - d. **Face Velocity:** Provide filters sized for 500 fpm maximum face velocity, but no higher than the scheduled value.
  - e. **Filters shall be rated per U.L. standard 900.**
- H. **Indirect Fired Duct Furnace**
- 1. **Standard of Quality.** Provide in-shot gas heat sections as manufactured by Heatco, LLC. Alternate manufacturers shall be considered only if ALL of the requirements in this section are met. Comply with all mounting and access provisions specified in this section. Drum type gas heaters shall not be allowed.
  - 2. **Agency Listings:** Provide gas heaters with the following Agency listings:
    - a. **Listed by Intertek Testing Services (ITS / ETL), a Nationally Recognized Testing Laboratory (NRTL) as a Recognized Component, to the current edition of ANSI Z83.8 / CSA 2.6 Standard for Gas-Fired Duct Furnaces for installation on the positive pressure side of the circulating air blower only.**
    - b. **Listed for application downstream of refrigeration and cooling systems**
    - c. **Listed for outdoor installation, or for indoor installation in accordance with Category I and Category III venting systems without need for additional power venting**

- d. **Duct Furnace shall incorporate a Direct Spark Ignition control module that is design certified by a NRTL to ANSI Z21.20 and CAN/CSA-C22.2**
3. **Construction. Provide heat exchanger tubes with the following features, material types and thicknesses:**
  - a. **Tubes: 0.047" thick 304 stainless steel**
  - b. **Features: Module design shall provide means for removal of condensate that can occur in the heat exchanger tubes during cooling season. Heat exchanger tubes shall have integral formed dimpled restrictors or formed turbulators to provide for an unobstructed drainage path and tubes shall be formed to provide a positive pitch to promote condensate drainage. Drainage shall be configured so that in-shot burners are not exposed to condensate.**
4. **Performance. Provide heat section meeting the following performance parameters:**
  - a. **System parameters:**
    - 1) **Fuel: Natural gas**
    - 2) **Maximum Inlet Gas Pressure: 13.5 " w.c., Natural Gas or Propane. Pressure reducing valves, if required, shall be by others.**
    - 3) **Minimum Inlet Gas Pressure: 5.0" w.c. for input ratings 400 MBH or less, 6.0" w.c. for input ratings greater than 400 MBH**
  - b. **Capacity: Input and output capacities shall be as scheduled. Scheduled capacity shall include a de-rate if the project altitude is greater than 2000 feet above sea level.**
  - c. **Turndown: Provide heater section with minimum turndown no less than the turndown scheduled.**
  - d. **Air Pressure Drop: Maximum 0.50" w.c. per bank, but shall not exceed the scheduled value.**
5. **Venting requirements. An induced-draft fan shall be provided for positive venting of combustion gases. Venting provisions shall be provided as follows:**



- a. **Venting shall be provided and installed per heater module by the installing contractor:**
  - 1) **For vertical venting, provide a Category 1 B Vent sized per ANSI Z223.1/NFPA 54**
  - 2) **For horizontal venting, provide a Category III vent with maximum equivalent length of 50 feet. Use approved Category III materials, and size the pipe per the heater IOM.**
  - 3) **Combustion air shall be provided to the heater per module. The source of the combustion air shall be designated by the Engineer of Record, either from the mechanical room or directly from outdoors (separated combustion), sized per the heater manufacturer's recommendations for airflow and pressure drop.**
  - 4) **The air handler manufacturer shall provide standard collars for connecting the vent pipe and combustion air duct (when required). Transitions to the collars shall be provided by the installing contractor.**
6. **Mounting in the Air Handler: The following requirements shall be met at a minimum and demonstrated in the submittal:**
  - a. **A removable, fastener free and self- retaining access panel shall be provided for full access to all serviceable components. The panel shall be removable without requiring the use of tools.**
  - b. **A combustion air intake shall be provided and sized appropriately for the heater capacity per the heater manufacturer's recommendation.**
  - c. **Heater section shall be configured to provide adequate temperature rise across the heaters to limit condensation of flue gases.**
  - d. **The air tunnel shall be configured such that airflow through the heater shall not change direction within the heater to prevent uneven heat transfer and hot spots. Heaters shall not be mounted over supply duct connections.**
  - e. **Hinged access doors shall be provided for access both upstream and downstream of heater section.**
7. **Warranty: The heat exchanger shall be provided with a 20 year non-prorated parts warranty. Burners and all other components shall be**

provided with the standard manufacturer's parts warranty.

**I. DX Coil**

- 1. Standard of Quality. Provide coils rated in accordance with AHRI 410-2001 as manufactured by Precision Coils, Modine, or Direct Coil meeting all construction features and performance parameters as specified in this section and the project schedule.**
- 2. Construction. Provide coils with the following material types and thicknesses:**
  - a. Fins: 0.006" thick aluminum**
  - b. Tubes: 0.016" thick seamless copper**
  - c. Tube Diameter: 3/8", 1/2", or 5/8" as required**
  - d. Casing: 16 ga. galvanized steel**
  - e. Circuiting Type: Interlaced, or as scheduled**
- 3. Performance. Provide coils meeting the following performance parameters:**
  - a. System parameters:**
    - 1) Fluid: R-410a**
    - 2) Outdoor ambient temperature: deg F, or as scheduled**
  - b. Face Velocity: Minimum 250 fpm, maximum 500 fpm, but not to exceed the scheduled value**
  - c. Air Pressure Drop: Not to exceed the scheduled value**
  - d. Refrigerant Pressure Drop: Maximum 13 psi**
  - e. Heat Transfer Surface:**
    - 1) Rows: Provide the number of rows scheduled**
    - 2) Fin Density: Maximum 12 fins/inch, but not to exceed the number of fins/inch scheduled**
- 4. Cooling Coil Drain Pan. All cooling coils shall be provided with Stainless Steel IAQ drain pans that begin at the entering airside of the coil face and extend a minimum of 12" past the leaving air side of**

the coil face. Entire underside of the drain pan, including the piping run to the casing exterior, shall be coated with no less than 2" of spray foam insulation to ensure no sweating occurs below. Coil shall be installed on "walk-on" supports spaced a maximum of 6" apart to allow full access to the coil face without damage to the drain pan. Pans without the feature shall not be accepted. The drain pan shall be sloped in a minimum of 2 directions to ensure proper drainage. The drain shall be located on the bottom of the drain pan and the connection countersunk below the surface of the drain pan to eliminate the potential for standing water at the connection. No side connections in the pan shall be allowed. An integral intermediate drain pan shall be provided for coils over 44" finned height in applications where condensate is expected. The intermediate pan shall be factory piped to the main drain pan.

5. **Piping Connections.** All refrigerant connections shall remain inside the unit cabinet.

J. **Split System DX with Remote Condenser**

1. **General Requirements.**

- a. Condenser shall be matched to the refrigerant system per the requirements of this section.
- b. Condenser shall ship with a nitrogen charge.
- c. Condenser coils and appurtenant condenser fans shall be factory assembled as a single remote unit and require field installation separate from the main unit. Condenser fans shall feature swept blade design resulting in reduced sound levels. Condenser fan motors shall be three phase, external rotor, type 56 frame, open air over and shaft up. Each condenser fan motor shall have a vented frame, rated for continuous duty and be equipped with an automatic reset thermal protector. Lead condenser fan will have an electronically commutated (EC) motor that will modulate to maintain a head pressure set point. Motors shall be UL Recognized and CSA Certified.
- d. **Low Ambient Operating Temperature.** Remote condensing unit shall be designed to operate at a minimum outdoor air temperature of 35°F
- e. **Compressors:** The lead refrigerant compressor(s) shall be digital hermetic scroll-type. Compressors shall be equipped with liquid line filter drier, expansion valve, manual reset high pressure and low pressure cutouts and all appurtenant sensors,

service ports and safety devices. Remote condenser and associated main unit shall ship with a nitrogen holding charge. Each compressor shall be factory-equipped with an electric crankcase heater to boil off liquid refrigerant from the oil. Each compressor shall be factory-equipped with an electric crankcase heater to boil off liquid refrigerant from the oil.

- f. Main unit shall have an integral compressor(s) and evaporator coil located within the weather-tight unit housing
- g. The installing contractor shall:
- h. Provide, size, and install all refrigeration specialities for a serviceable complete system.
- i. Provide and install all required control wiring between the condensing unit, refrigeration piping valves and the unit control panel.
- j. Provide and install power wiring to the remote condenser.
- k. Size, provide and install refrigerant piping from the remote condensing unit to the refrigerant coil(s) in the unit.
- l. Charge the system with the required amounts of refrigerant and oil.

2. System Requirements:

- a. R-410a refrigerant

3. Refrigeration Circuit(s). Provide independent circuits

K. Electrical

1. General Requirements.

- a. Units shall be provided fully factory wired per the requirements of this section.
- b. Units shall be ETL listed to the Standard for Safety for Heating and Cooling Equipment, ANSI/UL Standard 1995 and CAN/CSA C22.2 No. 236-05. Factory wiring practices, safety provisions, components, and labeling shall be per the requirements of the ETL listing.
- c. All major electrical components shall be UL listed.

2. **Wiring Requirements.**
  - a. Power wiring shall be enclosed in conduit.
  - b. Ladder wiring diagrams shall be provided. Lines on the diagram shall be numbered, and the associated wires shall be numbered at both terminations for help in troubleshooting.
  - c. Wires shall be color coded per voltage (line voltage/120V/24V) in the Electrical Panel, and per function from the terminal blocks in the Electrical/Control panel to end devices. Color coding shall be called out on the ladder diagram.
  - d. Provide units with an SCCR rating of 5kA.
  - e. Provide dedicated wires to end devices (transducers, analog sensors, etc.) to limit potential electrical interference.
  - f. Wiring and conduit penetrations through panels or block-offs shall be provided with a grommet per metal surface to protect against electrical short circuiting and abrasion, and sealed with sealant to prevent leakage.
3. **Major Components.**
  - a. Non-Fused disconnect shall be provided by the unit manufacturer and mounted by the unit manufacturer.
  - b. Electrical/Control Panels(s). Provide NEMA 3R panel or panels as required
    - 1) Provide exterior panels or flush mounted enclosures as shown on the unit drawings.
    - 2) Provide a backplate within the panel for mounting of electrical components, DDC controllers and expansion boards, control transformers, required fusing, service switch, VFDs (where applicable) and terminal blocks.
    - 3) For rooftops units, exterior panels housing VFDs shall be mechanically ventilated and provided with electric strip heaters. Flush mounted panels shall be ventilated by the unit airstream.
4. Variable Frequency Drives shall be factory provided, wired and programmed.

- a. **VFDs for enthalpy wheel shall be ABB**
  - b. **Individual branch fusing per VFD shall be provided by the unit manufacturer.**
  - c. **VFD Mounting. For indoor units, mount VFDs on the unit exterior. For outdoor units provide exterior NEMA 3R enclosure or flush mounted enclosure as shown on the unit drawings. Provide a backplate within the enclosure for mounting of VFDs.**
5. **Motor protection. Motors (including compressors) not controlled using VFDs shall have motor starter protectors and contactors rated for the duty.**
- L. **DDC System**
1. **Manufacturer shall provide a programmable digital control system for each custom unit. A user terminal with LCD display shall provide capability of monitoring operation and changing setpoints through an integral keypad. The user terminal shall be capable of being either unit mounted (UUT) or remote mounted (RUT) using straight through six wire flat cable. The manufacturer shall program the sequence of operation as specified in this section. The program shall include the following:**
    - a. **Unit start-up and shut-down requirements including fan/airflow proving indication and damper actuator end switch indication.**
    - b. **Temperature control for all heating and cooling devices.**
    - c. **Humidity control for all dehumidification devices and processes.**
    - d. **Economizers (dry-bulb, enthalpy, dewpoint, energy recovery) where applicable.**
    - e. **Fan controls for each mode of operation.**
    - f. **Defrost control for all energy recovery devices (where applicable).**
    - g. **Requirements for modes of operation other than Normal Occupied mode.**
    - h. **Integration of all optional devices (firestats, smoke detectors, pressure transducers, airflow stations, etc) specified in this section.**

- i. Alarms:**
  - 1) Informational auto-reset alarms shall be provided and stored for all sensors, end devices, and components, and shall be accessible through the controller user interface.**
  - 2) Manual reset alarms shall be provided as specified for some optional devices (e.g. firestats, freezestats, smoke detectors, fan duct static pressure limits) and where required to protect the space served or the equipment.**
  - 3) A list of standard alarms available to the BAS shall be included in the points list as specified in this section.**
- 2. The controller shall communicate with the Building Automation System (BAS) through a factory provided BACnet MS/TP interface card. A points list necessary to control the equipment, perform the sequence of operation, and informational points required by the BAS shall be provided as specified in this section.**
- 3. The controller shall have the capability through a web-based User Interface to remotely monitor all inputs/outputs, control the user terminal, view status of all alarms including both alarm and cleared time stamps, remotely upload a new program, and view historical and live log data for the past 24 hours. The controller shall save the log data for a rolling 7 days in a csv file that can be downloaded, with the additional capability of storing 31 days of logged data to an external thumb drive.**
- 4. Alarm Indication. DDC controller shall have one digital output for remote indication of an alarm condition. (i.e. Blower current switch, differential pressure switch, damper end switch, supply discharge low limit, freeze stat, fire stat, smoke, dirty filters...). Alarm Indication shall be configurable to indicate only shut down alarms if desired. The type of alarm shall be distinguishable through the BMS.**
- 5. Miscellaneous Controls:**
  - a. Condensate drain pan switch shall be provided for all drain pans**
- 6. Sequence of Operation. Manufacturer shall provide the sensors required for the Sequence of Operation, including additional points listed in the BMS Points listed when included in this section. The sequence of operation shall incorporate devices such as smoke detectors, filter switches or transducers, and kill switches specified in the Electrical section of this equipment specification.**

- M. ~~Unit shall be fully assembled at the factory and consist of an insulated metal cabinet, downturn outdoor air intake hood with 2" aluminum mesh filter assembly, evaporator coil, condensate drain pan, Energy wheel, hot gas reheat coil, indirect gas furnace, split DX system with remote air-cooled condenser, phase and brownout protection, motorized dampers, sensors, filter assembly for intake air, supply air blower assembly, exhaust/relief blower assembly and an electrical control center. All specified components and internal accessories factory installed are tested and prepared for single point high voltage connection except with electric post heat and exhaust fan only power if dual point power is selected.~~
- N. ~~Cabinet~~
- ~~1. Materials: Formed, double wall insulated metal cabinet, fabricated to permit access to internal components for maintenance.~~
    - ~~a. Internal assemblies: 24 gauge, galvanized (G90) steel except for motor supports which shall be minimum 14 gauge galvanized (G90) steel.~~
  - ~~2. Cabinet Insulation: Comply with NFPA 90A and NFPA 90B and erosion requirements of UL 181.~~
    - ~~a. Materials: Rigid urethane foam~~
      - ~~1) Thickness: 2 inch (50 mm)~~
      - ~~2) Meets UL94HF-1 flame requirements~~
      - ~~3) Location and application: Full coverage of entire exterior to include walls, roof of unit, unit base and doors~~
  - ~~3. Access panels / doors: Unit shall be equipped with insulated, hinged doors or removable access panels to provide easy access to all major components. Doors and access panels shall be fabricated of 18 gauge galvanized G90 steel or painted galvanized steel.~~
  - ~~4. Supply Air blower assemblies: Blower assembly shall consist of an electric motor and direct-drive fans. Assembly shall be mounted on heavy gauge galvanized steel rails and further mounted on 1.125 inch thick neoprene vibration isolators. Blower motors shall be capable of continuous speed modulation and controlled by a VFD.~~
  - ~~5. Exhaust Air blower assemblies: Blower assembly shall consist of an electric motor and a direct-drive fan. Assembly shall be mounted on~~



~~heavy gauge galvanized steel rails and further mounted on 1.125 inch thick neoprene vibration isolators. Blower motor shall be capable of continuous speed modulation and controlled by a VFD.~~

- ~~6. Evaporator Coil: Evaporator coil shall be AHRI Certified and shall be (silver) soldered or brazed into the compressed refrigerant system. Coil shall be constructed of copper tubing, permanently bonded to aluminum fins and enclosed in a galvanized steel frame. If two compressors are used as components of the unit, then the evaporator coil shall be of "interlaced" configuration, permitting independent operation of either compressor without conflict with the other compressor.~~
- ~~7. Control panel / connections: Units shall have an electrical control center where all high and low voltage connections are made. Control center shall be constructed to permit single point high voltage power supply connections. The DOAS shall be equipped with a Unit Disconnect Switch.~~
- ~~8. Condensate drain pan: Drain Pan shall be an integral part of the unit whenever a cooling option is included. Pan shall be formed of welded austenitic stainless steel sheet material and provided with a welded stainless steel drain connection at the front for connection to a P trap. Drain pan shall be sloped in two directions to provide positive draining and drain connector shall be sealed at penetration through cabinet wall.~~
- ~~9. P trap: If the unit is equipped with a condensate drain pan, contractor shall provide, or fabricate, and install an appropriate P trap, in accordance with all local and area codes and Best Practices.~~
- ~~10. Energy wheel: Energy wheel shall be of total enthalpy, rotary air to air type and shall be an element of a removable energy wheel cassette. The cassette shall consist of a galvanized steel framework (designed to produce laminar air flow through the wheel), an energy wheel as specified and a motor and drive assembly. The cassette shall incorporate a pre-tensioned urethane drive belt with a five year warranty. The wheel media shall be a polymer film matrix in a stainless steel framework and be comprised of individual segments that are removable for servicing. Non-segmented energy wheels are not acceptable. Silica gel desiccant shall be permanently bonded to the polymer film and is designed and constructed to permit cleaning and servicing. The energy wheel is to have a five year warranty. Performance criteria are to be as specified in AHRI Standard 1060, complying with the Combined~~

Efficiency data in the submittal.

- ~~11. Modulating frost control. Control system shall include an outdoor air thermostat and pressure sensor on the wheel assembly to initiate frost control sequence.~~
- ~~12. Reheat Coil with factory installed modulating hot gas reheat valve
  - ~~a. Shall be ETL Certified as a component of the unit.~~
  - ~~b. Shall have an integral combustion gas blower.~~
  - ~~c. Shall be ETL Certified for installation downstream of a cooling coil.~~
  - ~~d. Shall have fault sensors to provide fault conditions to optional digital controller or building controls.~~
  - ~~e. Shall have 4 pass tubular heat exchangers, constructed of type 409 stainless steel. Heat exchanger tubes shall be installed on the vest plate by means of swaged assembly, welded connections are not acceptable. Heat exchanger tubes shall be supported by a minimum of two fabricated assemblies that support the tubes and also permit expansion and contraction of the tubes.~~
  - ~~f. Heat exchanger shall have a 10 year extended warranty.~~
  - ~~g. Furnace control shall be High Turndown 16:1 Modulating.~~
  - ~~h. Shall be encased in a weather tight metal housing with intake air vents. Large, metal lift off door shall provide easy access to the enclosed vest plate, control circuitry, gas train, burner assembly and exhaust blower.~~
  - ~~i. Shall have solid state controls permitting stand alone operation or control by building controllers.~~~~
- ~~13. Split System DX with Remote Condenser: Main unit shall have an integral compressor(s) and evaporator coil located within the weather tight unit housing. Condenser coils and appurtenant condenser fans shall be factory assembled as a single remote unit and require field installation separate from the main unit. Condenser fans shall feature swept blade design resulting in reduced sound levels. Condenser fan motors shall be three phase, external rotor, type 56 frame, open air over and shaft up. Each condenser fan motor shall have a vented frame, rated for continuous duty and be~~

~~equipped with an automatic reset thermal protector. Lead condenser fan will have an electronically commutated (EC) motor that will modulate to maintain a head pressure set point. Motors shall be UL Recognized and CSA Certified. The lead refrigerant compressor(s) shall be digital hermetic scroll type. Compressors shall be equipped with liquid line filter drier, expansion valve, manual reset high pressure and low pressure cutouts and all appurtenant sensors, service ports and safety devices. Remote condenser and associated main unit shall ship with a nitrogen holding charge. Each compressor shall be factory equipped with an electric crankcase heater to boil off liquid refrigerant from the oil. Each compressor shall be factory equipped with an electric crankcase heater to boil off liquid refrigerant from the oil.~~

- ~~14. Packaged DX Control and Diagnostics: The Packaged DX system shall be controlled by an onboard digital controller (DDC) that indicates both owner-supplied settings and fault conditions that may occur. The DDC shall be programmed to indicate the following faults:
  - ~~a. Global alarm condition (active when there is at least one alarm)~~
  - ~~b. Supply Air Proving alarm~~
  - ~~c. Dirty Filter Alarm~~
  - ~~d. Compressor Trip alarm~~
  - ~~e. Compressor Locked Out alarm~~
  - ~~f. Supply Air Temperature Low Limit alarm~~
    - ~~1) Sensor #1 Out of Range (outside air temperature)~~
    - ~~2) Sensor #2 Out of Range (supply air temperature)~~
    - ~~3) Sensor #3 Out of Range (cold coil leaving air temperature)~~~~
- ~~15. Phase and brownout protection: Unit shall have a factory installed phase monitor to detect electric supply phase loss and voltage brown-out conditions. Upon detection of a fault, the monitor shall disconnect supply voltage to all motors.~~
- ~~16. Motorized dampers / Intake Air, Motorized dampers of low leakage type shall be factory installed.~~

O. Blower

- ~~1. Blower section construction Supply Air: direct drive motor(s) and blower(s) shall be assembled on a 14 gauge galvanized steel platform and shall be equipped with 1.125 inch thick neoprene vibration isolation devices.~~
- ~~2. Blower assemblies: Shall be statically and dynamically balanced and designed for continuous operation at maximum rated fan speed and horsepower.~~
- ~~3. Fan: Direct drive, airfoil plenum fan with painted steel wheels statically and dynamically balanced and AMCA certified for air and sound performance.~~
- ~~4. Blower section motor source quality control: Blower performance shall be factory tested for flow rate, pressure, power, air density, rotation speed and efficiency. Ratings are to be established in accordance with AMCA 210, "Laboratory Methods of Testing Fans for Rating."~~

P. Motors

- ~~1. General: Blower motors greater than  $\frac{3}{4}$  horsepower shall be "NEMA Premium™" unless otherwise indicated. Compliance with EPA Act minimum energy efficiency standards for single speed ODP and TE enclosures is not acceptable. Motors shall be heavy duty, permanently lubricated type to match the fan load and furnished at the specified voltage, phase and enclosure.~~

Q. Unit Controls

- ~~1. The unit shall be constructed so that it can function as a stand alone heating and cooling system controlled by factory supplied controllers, thermostats and sensors, or it can be operated as a heating and cooling system controlled by a Building Management System (BMS). This unit shall be controlled by a factory installed microprocessor programmable controller (DDC) that is connected to various optional sensors.~~
- ~~2. Unit shall incorporate a DDC controller with integral LCD screen that provides text readouts of status. DDC controller shall have a built in keypad to permit operator to access read-out screens without the use of ancillary equipment, devices or software. DDC controllers that require the use of equipment or software that is not factory installed in the unit are not acceptable. Alarm readouts consisting of flashing light codes are not acceptable. Owner specified ventilating~~

~~conditions can be input by means of pushbuttons.~~

- ~~3. Unit supply fan shall be configured for Constant Volume (ON/OFF).~~
- ~~4. Unit exhaust fan shall be configured for Constant Volume (ON/OFF).~~
- ~~5. Outside Air / Return Air damper control shall be~~
- ~~6. Operating protocol: The DDC shall be factory programmed for BACNetMSTP.~~
- ~~7. Variable Frequency Drive (VFD): unit shall have factory installed variable frequency drive for modulation of the supply and exhaust air blower assemblies. The VFD shall be factory programmed for unit specific requirements and shall not require additional field programming to operate.~~

R. ~~Filters~~

- ~~1. Unit shall have permanent metal filters located in the outdoor air intake and shall be accessible from the exterior of the unit. MERV 8 disposable pleated filters shall be provided in the supply air stream. MERV 8 and MERV 13 disposable pleated filters shall be provided in the supply final air stream and MERV 8 filters in the exhaust air stream.~~

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine areas and conditions under which indoor air handling units are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION OF INDOOR AIR HANDLING UNITS

- A. General: Install indoor air handling units in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.
- B. Support: Install units on 4" high concrete pad, 4" larger on each side than equipment base. Cast anchor bolt inserts into pad.
- C. Electrical Wiring: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's

wiring diagram submittal to Electrical Installer.

1. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division-26 sections. Do not proceed with equipment start-up until wiring installation is acceptable to equipment Installer.
- D. Ductwork: Refer to Division-23 ductwork sections. Connect supply and return ducts to unit with flexible duct connections. Provide transitions to exactly match unit duct connection size.
1. Connect outside air duct to unit with flexible connection, provide manual damper, quadrant and lock.
  2. Connect condenser supply and exhaust ducts to unit with flexible connections.
- E. Condenser Piping: Refer to Division-23 section "Refrigerant Piping". Connect liquid and suction piping to unit as indicated.
- F. Drain Piping: Connect unit drain to nearest indirect waste connection. Provide trap at drain pan; construct at least 1" deeper than fan pressure in inches of water.
- G. Start-up indoor air handling units, in accordance with manufacturer's start-up instructions. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.

### 3.3 TRAINING OF OWNER'S PERSONNEL

- A. Provide services of manufacturer's technical representative for one (1) half day to instruct Owner's personnel in operation and maintenance of indoor air handling units.
1. Schedule training with Owner, provide at least seven (7) day notice to Contractor and Engineer of training date.

### 3.4 SPARE PARTS

- A. General: Furnish to Owner, with receipt, the following spare parts for each heating and cooling unit:
1. One set of matched fan belts for each belt driven fan.

2. One set of filters for each unit.

**END OF SECTION**