Liberty School District – Storm Shelter Additions  
Addendum No: 004  
Description Narrative  
September 29, 2023  

This Addendum is issued to all registered plan holders pursuant to the Instructions to Bidders and Conditions of the Contract. This Addendum serves to clarify, revise, and supersede information in the Project Manual, Drawings, and previously issued Addenda. Portions of the Addendum affecting the Contract Documents will be incorporated into the Contract by enumeration of the Addendum in the Owner/Contractor Agreement.

The Bidder shall acknowledge receipt of this Addendum in the appropriate space on the Bid Form.

A. CONSTRUCTION MANAGER’S FRONT END MANUAL

   Bid date has changed to October 10th. 3pm.
   Answers to bidder questions.

B. OTHER

   NA

C. SPECIFICATIONS

   1. Please reference the attached Addendum No. 004 issued by Hollis + Miller dated September 29, 2023, for updates to Specifications

D. DRAWINGS

   1. Please reference the attached Addendum No. 004 issued by Hollis + Miller dated September 29, 2023, for updates to Drawings

Please direct any questions regarding the information in this addenda and the project to Newkirk Novak Construction Partners.
<table>
<thead>
<tr>
<th>Question Issued By</th>
<th>Discipline</th>
<th>Scope of Work</th>
<th>Date</th>
<th>Drawing / Detail</th>
<th>Building Question</th>
<th>Response</th>
<th>Answered By</th>
<th>Date Answered</th>
</tr>
</thead>
<tbody>
<tr>
<td>Image Flooring 1</td>
<td>Arch</td>
<td>Flooring</td>
<td>9/21/2023</td>
<td>112</td>
<td>Request for Athletic Flooring - Omnisport Active</td>
<td>Yes</td>
<td>HMA</td>
<td>9/22/2023</td>
</tr>
<tr>
<td>Progressive Electronics 2</td>
<td>MEP</td>
<td>Evac.</td>
<td>9/21/2023</td>
<td>1 &amp; 1N/A212A</td>
<td>There is no AV drawings. Please confirm no scope exists at Evac.</td>
<td>For Evac the AV scope is shown in the electrical plans (B1012A and B1018B. [AV design by S&amp;B for EPIC, AV design by Avant for DMS and SVMS.)</td>
<td>S&amp;B</td>
<td>9/24/2023</td>
</tr>
<tr>
<td>Royal Construction 3</td>
<td>Arch</td>
<td>Wall Panels</td>
<td>9/21/2023</td>
<td>A1 &amp; A1/L/A321, A1 &amp; A1/L/A622</td>
<td>Request to change details on any Plam or Wood panels that are on Z-clips to have a plywood backer for sheetrock.</td>
<td>Please clarify.</td>
<td>HMA</td>
<td>9/25/2023</td>
</tr>
<tr>
<td>Royal Construction 4</td>
<td>Arch</td>
<td>Wall Panels</td>
<td>9/21/2023</td>
<td>B1 &amp; B1/L/A321</td>
<td>A complete section through the Plam and AP3 wall panels would be helpful. We need to see how the WP1 panels will attach and how they will align with the AP3 panels.</td>
<td>Will be updated in upcoming addendum.</td>
<td>HMA</td>
<td>9/25/2023</td>
</tr>
<tr>
<td>Royal Construction 5</td>
<td>Arch</td>
<td>Wall Panels</td>
<td>9/21/2023</td>
<td>A1/L/A321A</td>
<td>The room number is min-labeled (should be &quot;A161&quot;).</td>
<td>Exact.</td>
<td>HMA</td>
<td>9/25/2023</td>
</tr>
<tr>
<td>Royal Construction 6</td>
<td>Arch</td>
<td>Wall Panels</td>
<td>9/21/2023</td>
<td>A1, A12, D12/A621, E12, E7 &amp; E7/A622</td>
<td>The room number is min-labeled (should be &quot;A111&quot;).</td>
<td>Will be updated in upcoming addendum.</td>
<td>HMA</td>
<td>9/25/2023</td>
</tr>
<tr>
<td>Royal Construction 7</td>
<td>Arch</td>
<td>Wall Panels</td>
<td>9/21/2023</td>
<td>J4/A121A</td>
<td>Epic Assuming that the PL21 panels return on the back side and extend to the ceiling (see below).</td>
<td>Correct.</td>
<td>HMA</td>
<td>9/25/2023</td>
</tr>
<tr>
<td>Royal Construction 8</td>
<td>Arch</td>
<td>Wall Panels</td>
<td>9/21/2023</td>
<td>J4/A121A, D10 &amp; J13/A661</td>
<td>Epic Correct.</td>
<td>HMA</td>
<td>9/25/2023</td>
<td></td>
</tr>
<tr>
<td>Royal Construction 9</td>
<td>Arch</td>
<td>Wall Panels</td>
<td>9/21/2023</td>
<td>J4/A121A</td>
<td>Epic The room number is mis-labeled (should be &quot;A103&quot;). Will be updated in upcoming addendum.</td>
<td>Correct.</td>
<td>HMA</td>
<td>9/25/2023</td>
</tr>
<tr>
<td>Royal Construction 10</td>
<td>Arch</td>
<td>Wall Panels</td>
<td>9/21/2023</td>
<td>J4/A121A, D10 &amp; J13/A661</td>
<td>Epic A plywood backer would be preferred behind Plam panels. Also, there are no references to Fry-Reglet channels on the corners, which is different than the other schools. Please clarify.</td>
<td>Correct.</td>
<td>HMA</td>
<td>9/25/2023</td>
</tr>
<tr>
<td>Byers Glass 11</td>
<td>Arch</td>
<td>Glazing</td>
<td>9/21/2023</td>
<td>A1</td>
<td>Please clarify if Door D-A101a should be labeled as part of Frame 3 instead of Frame 2.</td>
<td>Correct. Doors D-A101a are part of Frame Type 3. Will be updated in upcoming addendum.</td>
<td>S&amp;B</td>
<td>9/25/2023</td>
</tr>
<tr>
<td>Mid America Precast 12</td>
<td>Arch / Structural</td>
<td>Structure</td>
<td>9/22/2023</td>
<td>DMS / SVMS</td>
<td>Due to the size of the panels, the weights have become an issue with transportation. Is there anyway we could change the dimensions of the double t’s and load bearing walls (north and south side) walls? This would allow the weight of the panels to reduce which should eliminate the transportation issue. We suggest a 8’4” size instead of the 10’ shown on the plans.</td>
<td>Precast double T size and locations need to remain as is to the original design due to multiple penetrations and structural coordination during design to support the athletic and fine arts functions in the space. Precast wall panels can be reduced in size per manufacture recommendation as long as, double T size remains as is per the original design and accommodate design intent, provide cost assessment for additional joint and steel connections to precast vs. keeping panels as is, all open sizes and locations need to remain as is per the construction drawings. It is highly advisable for precast wall panels to remain 10’ to the original design.</td>
<td>BDC/HMA</td>
<td>9/25/2023</td>
</tr>
<tr>
<td>Byers Glass 13</td>
<td>Arch</td>
<td>Glazing</td>
<td>9/21/2023</td>
<td>SRPS</td>
<td>Please clarify if Door D-A100 should be labeled as part of Frame 17?</td>
<td>Correct.</td>
<td>HMA</td>
<td>9/25/2023</td>
</tr>
<tr>
<td>Byers Glass 14</td>
<td>Arch</td>
<td>Glazing</td>
<td>9/21/2023</td>
<td>SRPS</td>
<td>Please clarify if Door D-A100 should be labeled as part of Frame 17?</td>
<td>Correct.</td>
<td>HMA</td>
<td>9/25/2023</td>
</tr>
<tr>
<td>Mid America Precast 15</td>
<td>Arch / Structural</td>
<td>Structure</td>
<td>9/22/2023</td>
<td>DMS / SVMS</td>
<td>Due to the size of the panels, the weights have become an issue with transportation. Is there anyway we could change the dimensions of the double t’s and load bearing walls (north and south side) walls? This would allow the weight of the panels to reduce which should eliminate the transportation issue. We suggest a 8’4” size instead of the 10’ shown on the plans.</td>
<td>Precast double T size and locations need to remain as is to the original design due to multiple penetrations and structural coordination during design to support the athletic and fine arts functions in the space. Precast wall panels can be reduced in size per manufacture recommendation as long as, double T size remains as is per the original design and accommodate design intent, provide cost assessment for additional joint and steel connections to precast vs. keeping panels as is, all open sizes and locations need to remain as is per the construction drawings. It is highly advisable for precast wall panels to remain 10’ to the original design.</td>
<td>BDC/HMA</td>
<td>9/25/2023</td>
</tr>
<tr>
<td>Buildology 16</td>
<td>Arch / Structural</td>
<td>Structure</td>
<td>9/22/2023</td>
<td>All</td>
<td>In the precast spc (D19100, 2.1, 8, 4) it states that &quot;at no point shall the thickness of the precast panel w/thick be less than 4 inches thick.&quot; The precast plans show an exterior 3” w/thick. Please clarify.</td>
<td>3” is acceptable</td>
<td>BDC</td>
<td>9/25/2023</td>
</tr>
<tr>
<td>Cardinal Structures 18</td>
<td>Arch / Structural</td>
<td>Structure</td>
<td>9/25/2023</td>
<td>All</td>
<td>Please confirm Bearing Wall width can match TI Width aspect per Precast Manufacturer.</td>
<td>See response for Questions 16</td>
<td>BDC/HMA</td>
<td>9/26/2023</td>
</tr>
<tr>
<td>Progression Electronics 20</td>
<td>Arch</td>
<td>Fire-Alarm</td>
<td>9/25/2023</td>
<td>All</td>
<td>Could you please provide the model number of the main fire alarm control panel at each school?</td>
<td>Yes</td>
<td>HMA</td>
<td>9/28/2023</td>
</tr>
<tr>
<td>SC Mechanical 21</td>
<td>MEP</td>
<td>Plumbing</td>
<td>9/25/2023</td>
<td>Epic</td>
<td>Please confirm the water closets (WC-1 &amp; WC-2) on EPIC Elementary are intended to be hung fixtures per the schedule. The riser diagram and plan view piping schematic show these being plumbed like floor mounted fixtures.</td>
<td>Water closets shall be wall hung per the plumbing fixture schedule. The plans and riser diagram will be updated accordingly.</td>
<td>S&amp;B</td>
<td>9/27/2023</td>
</tr>
<tr>
<td>Contractor</td>
<td>Project</td>
<td>Issue</td>
<td>Details</td>
<td></td>
<td></td>
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<tr>
<td>Newkirk Novak Construction</td>
<td>26</td>
<td>Arch Skin</td>
<td>9/25/2023</td>
<td>Epic: Please confirm removal of brick at Epic Classroom around CIP Walls is acceptable. Provide revised details if accepted.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>New America Precast</td>
<td>27</td>
<td>Structural</td>
<td>9/25/2023</td>
<td>SMA5: On page S100 in the South Valley Middle School plans, on the east side of the foundation plan, it appears the wall changes and had a step in the foundation. It shows T/Slab (St. 9F) directly to the north of the S202/5 note. Can you verify this is supposed to read T/4lab or is it supposed to read T/ftg like the wall is up until that point on the north?</td>
<td></td>
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</tr>
<tr>
<td>DH Pace</td>
<td>30</td>
<td>Arch Doors, Frames, Hardware</td>
<td>9/26/2023</td>
<td>Epic: E-A114a is listed as Door Type A2. A2 is not specified. Please advise what type of door should be provided for this opening.</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>DH Pace</td>
<td>31</td>
<td>Arch Doors, Frames, Hardware</td>
<td>9/26/2023</td>
<td>Epic: S-A115 Door Type on Epic is missing. It is just listed as A. Please advise what door type this should be.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cornell Roofing</td>
<td>38</td>
<td>Arch Roofing</td>
<td>9/26/2023</td>
<td>All: Is TPO to be an alternate at all buildings? If so what alternate.</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>BCI Structural Steel</td>
<td>40</td>
<td>Arch Roofing</td>
<td>9/26/2023</td>
<td>All: See SO0002 2 SAM&amp;B point to a prefabricated aluminum ships ladder and a shop fabricated steel ladder. Can you confirm if this is the intent? Or if both are desired to be aluminum.</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Questec</td>
<td>41</td>
<td>Structural / MEP</td>
<td>9/26/2023</td>
<td>ICES: By going through the architectural drawing I noticed that in both middle school drawing sets on sheet S100 &quot;General notes&quot; section 10 &quot;Precast Concrete Members&quot; note Q states information regarding ICC500. However, epic elementary has no mention of ICC500. To properly meet ICC500 we would need to use wall shrouds and offset vents when going through the storm shelter structure. I want to confirm that these storm shelters on all buildings (elementary school included) are ICC500 and will require proper shrouding materials on plumbing penetrations throughout the shelter.</td>
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</tr>
</tbody>
</table>
**ADDENDUM NO. 04**

Issued: 09/29/2023

Project: 23018 - Discovery Middle School, 800 Midjay Drive, Liberty, Missouri 64068  
23019 - South Valley Middle School, 1000 Midjay Drive, Liberty, Missouri 64068  
23020 - EPiC Elementary School, 650 Conister Street, Liberty, Missouri 64068

Owner: Liberty Public Schools  
8 Victory Lane  
Liberty, MO 64068

Bidding Documents Issued: 08.31.2023

This Addendum includes these 6 pages and the following attachments:

Supplemental Information:
  - Refer to Newkirk Novak Construction Partners Description Narrative.

Project Manual:
  - Reissued Section 000105 “Certifications Page” consisting of 2 pages.  
  - Reissued Section 000110 “Table of Contents” consisting of 6 pages.  
  - Reissued Section 075216 “Modified Bituminous Membrane Roofing” consisting of 14 pages.  
  - Reissued Section 075423 “Thermoplastic Polyolefin (TPO) Roofing” consisting of 14 pages.  
  - Reissued Section 116143 “Stage Curtains” consisting of 4 pages.  
  - Refer to Bob D. Campbel & Co., Structure Addendum No. 4 narrative.  
  - Refer to Smith & Boucher, MEP Addendum No. 4 narrative.  
  - Refer to Peerbolte Theatrical Addendum 4 narrative.

Drawings:

**23018 – Discovery Middle School**

  - Refer to Bob D. Campbell, Structure Addendum No. 4  
  - Refer to Smith & Boucher, MEP Addendum No. 4  
  - Refer to Peerbolte Creative, Theater Addendum No. 4

**23019 – South Valley Middle School**
Revised architectural sheets A101A, A121A, A141, A363, A621, A661, A662

  - Refer to Bob D. Campbell, Structure Addendum No. 4  
  - Refer to Smith & Boucher, MEP Addendum No. 4  
  - Refer to Peerbolte Creative, Theater Addendum No. 4

**23020 – EPiC Elementary School**

  - Refer to Bob D. Campbell, Structure Addendum No. 4  
  - Refer to Smith & Boucher, MEP Addendum No. 4  
  - Refer to Peerbolte Creative, Theater Addendum No. 4
PROJECT MANUAL REVISIONS

A1  SECTION 000005 – CERTIFICATIONS PAGE
    A1.1 REPLACE existing Section 000005 “Certifications Page” with the attached revised Section 000005 “Certifications Page”, dated September 29, 2023.

A2  SECTION 000110 - TABLE OF CONTENTS
    A2.1 REPLACE existing Section 000110 “Table of Contents” with the attached revised Section 000110 “Table of Contents”, dated September 29, 2023.

A3  SECTION 075216 - MODIFIED BITUMINOUS MEMBRANE ROOFING
    A3.1 REPLACE existing Section 075216 “Modified Bituminous Membrane Roofing” with the attached revised Section 075216 dated September 29, 2023.

A4  SECTION 075423 - THERMOPLASTIC POLYOLEFIN (TPO) ROOFING
    A4.1 REPLACE existing Section 075423 “Thermoplastic Polyolefin (TPO) Roofing” with the attached revised Section 075423 dated September 29, 2023.

A5  SECTION 116143 – STAGE CURTAINS
    A5.1 REPLACE existing Section 116143 “Stage Curtains” dated September 2023 with the attached revised Section 116143 “Stage Curtains,” dated September 29, 2023.

M1  REFERENCE ATTACHED MEP ADDENDUM NO. 4
E1  REFERENCE ATTACHED MEP ADDENDUM NO. 4
P1  REFERENCE ATTACHED MEP ADDENDUM NO. 4
S1  REFERENCE ATTACHED STRUCTURAL ADDENDUM NO. 4
TH1 REFERENCE ATTACHED THEATER ADDENDUM NO. 4
DRAWINGS REVISIONS – 23018 Discovery Middle School

A6  GENERAL – ARCHITECTURAL SHEETS
    A6.1  REMOVED room name and verbiage throughout the Architectural Sheets as occurs, as follows: STAGE. REPLACED room name with PLATFORM.

A7  SHEET A101A – REFLECTED CEILING PLAN - LEVEL 1 - AREA A
    A7.1  REVISE plan note at bleachers, per sheet A101A.

A8  SHEET A121A – REFLECTED CEILING PLAN - LEVEL 1 - AREA A
    A8.1  REMOVE plan note referencing roof vents. REVISED and ADDED AP2 (098436.A01 – SOUND-ABSORBING CEILING PANELS) at Platform A108, per sheet A121A.

A9  SHEET A141 – ROOF PLAN
    A9.1  REMOVE keynote 077200.A04, Smoke Vents, and a portion of the walkway pads (075216.A16) in PLAN A1/A141.
    A9.2  REMOVED keynote 035216.A02 SUBRATE BOARD. REPLACED keynote with 075216.25 COVERBOARD in ROOF TYPES.
    A9.3  REMOVED keynote 035216.A04 INSULATION. REPLACED keynote with 075216.20 ROOF INSULATION in ROOF TYPES.

A10 SHEET A501 – DOOR SCHEDULE, DOOR TYPES, FRAME TYPES & DETAILS
    A10.1  REVISE Frame Types for doors D-A100a,D-A100b, and D-A101a in DOOR SCHEDULE.

A11 SHEET A622 – INTERIOR ELEVATIONS
    A11.1  ADDED section L5 in ELEVATION A1, per sheet A622. Section at plastic laminate and AP3 panel.

A12 SHEET A661– INTERIOR DETAIL
    A12.1  REVISED detail N12, per sheet A661.

A13 SHEET A662 – INTERIOR DETAIL
    A13.1  REVISED drawing note in TYPE A, B, & C SECTION in panel detail in detail A10, per sheet A662.
    A13.2  ADDED detail L5, per sheet A662.

S1  REFERENCE ATTACHED STRUCTURAL ADDENDUM NO. 4

M2  REFERENCE ATTACHED MEP ADDENDUM NO. 4

E2  REFERENCE ATTACHED MEP ADDENDUM NO. 4

P2  REFERENCE ATTACHED MEP ADDENDUM NO. 4

AV1  GENERAL – AV SHEETS
    AV1.1  REMOVED room name and verbiage throughout the AV Sheets as occurs, as follows: STAGE. REPLACED room name and verbiage with PLATFORM.

TH2  REFERENCE ATTACHED THEATER ADDENDUM NO. 4
DRAWINGS REVISIONS – 23019 South Valley Middle School

A14   GENERAL – ARCHITECTURAL SHEETS

A14.1   REMOVED room name and verbiage throughout the Architectural Sheets as occurs, as follows: STAGE. REPLACED room name with PLATFORM.

A15   SHEET A101A – REFLECTED CEILING PLAN - LEVEL 1 - AREA A

A15.1   REVISE plan note at bleachers, per sheet A101A.

A16   SHEET A121A – REFLECTED CEILING PLAN - LEVEL 1 - AREA A

A16.1   REMOVE plan note referencing roof vents. REVISED and ADDED AP2 (098436.A01 – SOUND-ABSORBING CEILING PANELS) at Platform A108, per sheet A121A.

A17   SHEET A141 – ROOF PLAN

A17.1   REMOVE keynote 077200.A04, Smoke Vents, and a portion of the walkway pads (075216.A16) in PLAN A1/A141.

A17.2   REMOVED keynote 035216.A02 SUBRATE BOARD. REPLACED keynote with 075216.25 COVERBOARD in ROOF TYPES.

A17.3   REMOVED keynote 035216.A04 INSULATION. REPLACED keynote with 075216.20 ROOF INSULATION in ROOF TYPES.

A18   SHEET A363 – EXTERIOR DETAILS

A18.1   REVISED detail L1, per sheet A363.

A19   SHEET A622 – INTERIOR ELEVATIONS

A19.1   ADDED section L5/A662 in ELEVATION A1/A622 at plastic laminate and AP3 panel.

A20   SHEET A662 – INTERIOR DETAIL

A20.1   REVISED drawing note in TYPE A, B, & C SECTION in panel detail in detail A10, per sheet A662.

A20.2   ADDED section N7, per sheet A662.

S1   REFERENCE ATTACHED STRUCTURAL ADDENDUM NO. 4

M3   REFERENCE ATTACHED MEP ADDENDUM NO. 4

E3   REFERENCE ATTACHED MEP ADDENDUM NO. 4

P3   REFERENCE ATTACHED MEP ADDENDUM NO. 4

AV2   GENERAL – AV SHEETS

AV2.1   REMOVED room name and verbiage throughout the AV Sheets as occurs, as follows: STAGE. REPLACED room name and verbiage with PLATFORM.

TH3   REFERENCE ATTACHED THEATER ADDENDUM NO. 4
DRAWINGS REVISIONS – 23020 EPIC Elementary School

A13 SHEET G000 – COVER SHEET
   A13.2 ADDED sheet TH100 to drawing index.

A14 SHEET AS101 – ARCHITECTURAL SITE PLAN
   A14.2 REMOVED subdrainage connection at NW corner of storm shelter.

A15 SHEET A101A – FLOOR PLAN – LEVEL 1 – AREA A
   A15.2 REVISED wall types and dimensions at A103 Art.

A16 SHEET A121A – REFLECTED CEILING PLAN – LEVEL 1 – AREA A
   A16.2 ADDED TR2 to detail J4.
   A16.3 ADDED enlarged plan callout E1/A121B to A114 Music.

A17 SHEET A201 – EXTERIOR ELEVATIONS
   A17.2 REVISED elevations A1, F1, and F9.

A18 SHEET A331 – WALL SECTIONS
   A18.2 ADDED section A14/A331.
   A18.3 REVISED sections A8 and A11 to remove face brick and replace with metal panel and cast in place concrete with form liner.

A19 SHEET A332 – WALL SECTIONS
   A19.2 REMOVED subdrainage and ADDED geofoam on sections A4, A9, and A13.

A20 SHEET A361 – EXTERIOR DETAILS
   A20.2 REVISED detail J1.

A21 SHEET A363 – EXTERIOR DETAILS
   A21.2 REVISED detail K1 and K7.
A22  SHEET A422 – ENLARGED PLANS & DETAILS
   A22.2  ADDED wall types to A7.

A23  SHEET A501 – DOOR TYPES & FRAME TYPES
   A23.2  REVISED openings E-A108, E-A114a and EA115.

A24  SHEET A621 – INTERIOR ELEVATIONS
   A24.2  REVISED room numbers on elevation A7, A12, D7, D12, L1, and L9.

A25  SHEET A622 – INTERIOR ELEVATIONS
   A25.2  REVISED room numbers on elevation A1, A7, A12, E1, E7, and L7.

A26  SHEET A661 – INTERIOR DETAILS
   A26.2  ADDED TR2 to details A9 and J13.
   A26.3  REVISED PL1 to PL21 on detail A9.

A27  SHEET A681 – MATERIAL FINISH LEGEND
   A27.2  REVISED material F21.

S1   REFERENCE ATTACHED STRUCTURAL ADDENDUM NO. 4
M4   REFERENCE ATTACHED MEP ADDENDUM NO. 4
E4   REFERENCE ATTACHED MEP ADDENDUM NO. 4
P4   REFERENCE ATTACHED MEP ADDENDUM NO. 4
TH4  REFERENCE ATTACHED THEATER ADDENDUM NO. 4

END OF ADDENDUM NO. 04
ARCHITECT

I HEREBY, PURSUANT TO RSMO 327.411, STATE THAT THE SPECIFICATIONS INTENDED TO BE AUTHENTICATED BY MY SEAL ARE LIMITED TO SPECIFICATIONS LISTED BELOW:

DIVISION 1 SECTIONS: 011000, 012100, 012200, 012300, 012500, 013100, 013200, 013233, 014000, 014200, 014529, 016000, 017419, 017700, 017823, 017839, 017900.
DIVISION 2 SECTION: 024119.
DIVISION 4 SECTION: 042000.
DIVISION 5 SECTIONS: 055000, 055100, 055213.
DIVISION 6 SECTIONS: 061000, 061600, 064023.
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DIVISION 11 SECTIONS: 116143, 446623, 116653.
DIVISION 12 SECTIONS: 122413, 123200, 123666, 126600.
DIVISION 34 SECTION: 334600.

I HEREBY DISCLAIM ANY RESPONSIBILITY FOR ALL OTHER SPECIFICATIONS, DRAWINGS, ESTIMATES, REPORTS, OR OTHER DOCUMENTS OR INSTRUMENTS RELATING TO OR INTENDED TO BE USED FOR ANY PART OR PARTS OF THE ARCHITECTURAL OR ENGINEERING PROJECT OR SURVEY.

______________________________  _____________________________
KEVIN E. NELSON              SEPTEMBER 29, 2023
ARCHITECT                      DATE

STATE OF MISSOURI

KEVIN E. NELSON

A-2019015618

ARCHITECT

SEPTEMBER 29, 2023
SECTION 000105 - CERTIFICATIONS PAGE

STRUCTURAL ENGINEER

I HEREBY, PURSUANT TO RSMO 327.411, STATE THAT THE SPECIFICATIONS INTENDED TO BE AUTHENTICATED BY MY SEAL ARE LIMITED TO SPECIFICATIONS LISTED BELOW:

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RYAN M. HAGEDORN  __________           9/29/2023___ ___________________________
ENGINEER                                                          DATE
MEP ENGINEER

I HEREBY, PURSUANT TO RSMO 327.411, STATE THAT THE SPECIFICATIONS INTENDED TO BE AUTHENTICATED BY MY SEAL ARE LIMITED TO SPECIFICATIONS LISTED BELOW:

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RYAN J. DIEDIKER, PE, RCDD, LEED AP  
DATE 09.28.2023
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800 Midjay Drive, Liberty, Missouri 64068  
23019- South Valley Middle School  
1000 Midjay Drive, Liberty, Missouri 64068  
23020- EPiC Elementary School  
650 Conistor Street, Liberty, Missouri 64068 |
| Latest Revision | 09.29.2023 |
| Original Issue | 08.31.2023 |

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### BIDDING REQUIREMENTS

(Refer to Construction Manager's Front End Manual for additional Bidding Requirements)

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(Refer to Construction Manager's Front End Manual for additional Contracting Requirements)

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SPECIFICATIONS:

000105 – Certifications Page
1. Add section 034100

033000 – Cast-In-Place Concrete
1. Add section 0.1-1-B: inclusion of foam void fill (geofoam)
2. Add section 1.03-A-2-m: Foam void fill (geofoam) installation
3. Add section 2.18: Foam Void Fill (Geofoam)
4. Add section 2.19: Fabricating Foam Void Fill (Geofoam)
5. Add section 3.21: Foam Void Fill (Geofoam) Installation

034100 – Precast Structural Concrete
1. Revise section 2.1-4-a: 4” minimum thickness changed to 3” minimum thickness

EPIC ELEMENTARY SCHOOL DRAWINGS:

S001 – GENERAL NOTES
1. Add noted 10.G

S100 – FOUNDATION PLAN
1. Revised footing size, layout, and step locations on west side of addition at art room

S201 – FOUNDATION SECTIONS
1. Revised section 1 to reflect geofoam backfill in place of soil backfill, eliminating below grade temporary bracing requirements.
2. Revised section 2 to include retaining wall design
3. Revised section 9 to include retaining wall design

S202 – FOUNDATION SECTIONS
1. Revised sections 1, 2, 3, and 5 to reflect geofoam backfill in place of soil backfill, eliminating below grade temporary bracing requirements.

S203 – FOUNDATION SECTIONS
1. Revised sections 1 and 2 to reflect geofoam backfill in place of soil backfill, eliminating below grade temporary bracing requirements.

SOUTH VALLEY MIDDLE SCHOOL DRAWINGS:

S102 – ROOF FRAMING PLAN
1. Removed roof vents openings in the precast double-tees

DISCOVERY MIDDLE SCHOOL DRAWINGS:

S102 – ROOF FRAMING PLAN
1. Removed roof vent openings in the precast double tees
ADDENUM No. 4

Liberty Discovery Middle School Storm Shelter Addition
Smith & Boucher Project No. 2314702

Liberty South Valley Middle School Storm Shelter Addition
Smith & Boucher Project No. 2314703

Liberty Epic Elementary School Lighting Storm Shelter Addition
Smith & Boucher Project No. 2314704

09/29/2023

To Documents Titled: See titles above.
Architect-of-Record: Hollis and Miller
08/31/2023
1828 Walnut Street Suite 922
Kansas City, MO 64108

The Contract Documents for the above referenced project and the Work covered thereby are modified as described herein.

SPECIFICATIONS

1. 221316 – Sanitary Waste and Vent Piping
   a. Add 1.2 Definitions.
   c. Add 1.5.C and 1.5.D Quality Assurance
   d. Revise and add Part 2 – Products
   g. Add 3.2.J, 3.2.K, and 3.2.L.
   h. Revise and add 3.3 Joint Construction.

2. 221413 – Storm Drainage Piping
   a. Revise 3.2.B to heavy-duty.

DISCOVERY MIDDLE SCHOOL DRAWINGS

1. Sheet M101A – HVAC Plan – Level 1 & Mezzanine – Area A
   a. Remove plan note 15.
   b. Remove the room name “Stage” and replace with “Platform”.

SOUTH VALLEY MIDDLE SCHOOL DRAWINGS

1. Sheet M101A – HVAC Plan – Level 1 & Mezzanine – Area A
   a. Remove plan note 15.
   b. Remove the room name “Stage” and replace with “Platform”.
EPIC ELEMENTARY SCHOOL DRAWINGS

2. Sheet P100A – Underslab Plumbing Plan – Level 1 – Area A
   a. Water closets are wall-hung. Removed pipe through slab at water closet bowl and revised plan note 1 leader lines.

3. Sheet P301- Plumbing Riser Diagrams
   a. Revised water closets WC-1 and WC-2 to be wall-hung on Waste & Vent Riser Diagram – Area A and Waste & Vent Riser Diagram – Area B.

4. Sheet E302- Electrical Schedules and Details
   a. Revised lighting controls narrative for Stage lighting to be networked and available for control via app or browser control.

Attachments

• See specification and drawing list above.

END OF MEP ITEMS FOR ADDENDUM NO. 4
Make the following changes to Specification 116133

Item 1 - 116133, 2.3 DELETE paragraphs C and D in their entirety and REPLACE with the following:

C. Flame Retardant: All synthetic fabrics utilized for the curtains hereafter specified shall be inherently flame retardant to conform to all applicable building and safety codes. The specified synthetic velours shall be inherently flame retardant to the extent that the curtain will withstand cleanings without being affected. Prior to final approval, the Rigging Contractor shall provide two original signed and notarized, flameproofing certificates stating the process used, the method of Flame Retardant utilized, the fabric, the color and the yardage. All certificates shall be originated by the firm having done the flameproofing and not by the Theatrical Rigging Contractor.

D. Materials provided:
1. Forestage (Grand Drapery, Grand Valance), Color to be selected by Architect shall be manufactured using one of the following fabrics, or approved equal.
   a. 62” Da Vinci Velvet Plus synthetic velour, 21 ounces per linear yard as manufactured by Dazian.
   c. Rose Brand: Encore synthetic velour, 22 ounces per linear yard, 64” wide.
   a. 62” Milano Velvet Plus synthetic velour, 16 ounces per linear yard as manufactured by Dazian.
   b. Fred Krieger Fabric: Prism synthetic velour, 14 ounces per linear yard, 62” wide.
   c. Rose Brand: Encore synthetic velour, 15 ounces per linear yard, 64” wide.
3. Stage Curtain Bags
   a. 68” canvas, 15 ounce per linear yard as manufactured by Rose Brand.
   b. 64” Ranger, 16 ounces per linear yard as manufactured by KM Fabric, Inc.
4. Curtain tracks and hardware,
   a. Automatic Devices Company, Model 280 Silent Steel
   b. H&H Specialties, 400 Series Heavy-Duty Straight Track
   c. Hall Stage, T70 Curtain track

Item 2 - 116133 2.3 paragraph M, 1. DELETE reference to Prestige velour and REPLACE with Encore velour. DELETE Reference to 50% and REPLACE with 75%.

Item 3 - 116133 2.3 paragraph M, 2. DELETE reference to Prestige velour and REPLACE with Encore velour. DELETE Reference to 50% and REPLACE with 75%.

Item 4 - 116133 2.3 paragraph M, 3. DELETE reference to Plateau velour and REPLACE with Encore velour. DELETE reference to track lengths of 33'5" and 34'8" with a total track span of 66'3". And REPLACE with 30'2" and 30'4" with a total track span of 58'2".

Item 5 - 116133 2.3 paragraph M, 4. DELETE reference to Plateau velour and REPLACE with Encore velour.
Item 6 - 116133 2.3 paragraph M, 5. DELETE in its entirety and REPLACE with the following:

5. Provide Five (5) pair, Ten (10) sections total, masking legs. Finish each section 10'0" wide x 23'0" high, 50% fullness, Encore velour, color black.
   a. With each pair of legs, Provide Two (2) ADC 280 Tracks, ten sections total.
      1) Five (5) sections shall be 12’4” in length.
      2) Five (5) sections shall be 12’6” in length.
      3) The tracks shall be provided with all necessary hardware for endless line one way operation and an adjustable 5” floor pulley. Install at locations 3, 6, 9, 14 and 17 on the drawings.

Item 7 - 116133 2.3 paragraph M, 6. DELETE in its entirety and REPLACE with the following;

6. Provide One (1) masking borders, One (1) section total. Finish with 50% fullness, Encore velour, color black. Finish 47”4" wide x 5'0" high, tied to batten. Install at location 4 on the drawings.

Item 8 - 116133 2.3 paragraph M, 7. DELETE reference to Plateau velour and REPLACE with Encore velour.

Make the following changing to the drawings:

Item 9 - Delete Discovery TH100 and TH101 and replace with attached Discovery TH100 and TH101

Item 10 - Delete South Valley TH100 and TH101 and replace with attached South Valley TH100 and TH101.

Item 11 - In all theatrical drawings and specification; TH002, TH003, TH100, TH101, TH102, TH110, TH111, TH112, TH130 and 116100, 116133, 265500. DELETE reference to Stage and REPLACE with Platform.
The addendum contains the following changes to the theatrical documents

1. Sheet TH100 for EPiC Elementary **ADDED**.
2. Specification 116143 is **DELETED** and **REPLACED** in its entirety.
SECTION 033000 – CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SUMMARY

A. Section includes cast-in-place concrete (033000.A01), including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
   1. Footings and trench footings (grade beams).
   2. Foundation walls and stem walls.
   3. Slabs-on-grade.
   4. Concrete toppings.
   5. Light pole bases.

B. This section also includes the following:
   1. Providing foam void fill (geofoam) blocks to form and support concrete stairs, risers, ramps, and platforms, and provide lightweight backfill.

C. Related Requirements:
   1. Section 012200 “Unit Prices” for unit prices relating to work of this Section.
   2. Section 012300 “Alternates” for alternates effecting work of this Section.
   3. Section 099123 “Interior Painting” for colored (painted) concrete finish.
   4. Section 316329 “Drilled Concrete Piers and Shafts” for drilled concrete piers and shafts.
   5. Section 321313 “Concrete Paving” for concrete pavement and walks.

1.02 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, other pozzolans, and silica fume; materials subject to compliance with requirements.

B. W/CM Ratio: The ratio by weight of water to cementitious materials.

1.03 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
   1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
      a. Architect and Engineer.
      b. Contractor’s superintendent.
      c. Independent testing agency responsible for concrete design mixtures.
      d. Owner’s testing agency.
      e. Ready-mix concrete manufacturer.
      f. Concrete Subcontractor.
      g. Flatwork technicians.
      h. Manufacturer’s representative for waterproofing admixture.
      i. Flooring manufacturers.
   2. Review special inspection and testing and inspecting agency procedures for the following:
      a. Field quality control.
      b. Concrete finishes and finishing.
      c. Cold- and hot-weather concreting procedures.
      d. Curing procedures.
      e. Construction contraction and isolation joints, and joint-filler strips, semirigid joint fillers.
      f. Forms and form removal limitations.
      g. Vapor-retarder installation.
      h. Anchor rod and anchorage device installation tolerances.
      i. Steel reinforcement installation.
      j. Perimeter insulation installation.
      k. Concrete repair procedures.
      l. Concrete protection.
      m. Foam void fill (geofoam) installation.
1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.
1. Indicate amounts of mixing water to be withheld for later addition at Project site.
   a. Batch delivery tickets shall indicate batch weights as well as amount of available water to add on each delivery ticket.

C. Steel Reinforcement Shop Drawings: Placing Drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

D. Jointing Layout: Submit floor plans indicating proposed layout and locations for joints required to construct the structure, including but not limited to the following:
1. Location of expansion joints.
2. Location of construction and control joints. Locations are subject to approval of the Architect.

E. Samples: For each of the following materials:
1. Form-facing panels.
2. Form ties.
3. Chamfers and rustications.
4. Vapor retarder.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, manufacturer and testing agency.

B. Welding certificates.

C. Material Certificates: For each of the following, signed by manufacturers:
1. Cementitious materials.
2. Admixtures.
3. Steel reinforcement and accessories.

D. Material Test Reports: For the following, from a qualified testing agency indicating compliance with requirements:
1. Aggregates: Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.

E. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer, detailing fabrication, assembly, and support of formwork.
1. Include details of decorative formwork matching design shown on drawings.

F. Research/Evaluation Reports: For foam-plastic insulation, from ICC-ES.

G. Field quality-control reports.

H. Minutes of preinstallation conference.

1.06 QUALITY ASSURANCE

A. General:
1. The following contractors will not be considered by Blue Valley School District projects due to past performance issues: Midland Concrete of Topeka Kansas, Freeman Concrete and Heartland Contractors.
2. The following material suppliers will not be considered on Blue Valley School District projects due to past performance issues: Kincaid.
3. Contractor shall be responsible for providing exposed finishes completely free of graffiti, scratches and other man-made marks made after wet cement has been placed. Marked surfaces shall be removed and replaced at no additional cost to the Owner.

B. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

C. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
   1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

D. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
   1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
   2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Grade I. Testing agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician, Grade II.

E. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

F. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D 1.4M.

G. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
   1. ACI 301, "Specifications for Structural Concrete," Sections 1 through 5.
   2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

H. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.
   1. Waterproofing (capillary break) admixture manufacturer will test new concrete slabs for permeability.

1.07 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on concrete mixtures.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage. Avoid damaging coatings on steel reinforcement.

B. Protect foam plastic insulation as follows:
   1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
   2. Protect against ignition at all times. Do not deliver plastic insulating materials to project site before installation time.
   3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

1.09 FIELD CONDITIONS

A. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
   1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
   2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
   3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

B. Hot-Weather Placement: Comply with ACI 301 and as follows:
1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.

2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

PART 2 PRODUCTS

2.01 CONCRETE, GENERAL

A. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
   1. ACI 301.
   2. ACI 117.
   3. ACI 318.
   4. ACI 360.

2.02 FORM-FACING MATERIALS

A. Form-Facing Panels for As-Cast Finishes: Exterior-grade plywood panels, nonabsorptive, that will provide continuous, true, and smooth architectural concrete surfaces, medium-density overlay, Class 1, or better, mill-applied release agent and edge sealed, complying with DOC PS 1.

B. Smooth-Formed Finished Concrete (033000.A16): Form-facing panels that provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
   1. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
      a. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.
   2. Metal, or other approved panel materials.

C. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

D. Pan-Type Forms: Glass-fiber-reinforced plastic or formed steel, stiffened to resist plastic concrete loads without detrimental deformation.

E. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.

F. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum; nonstaining; in longest practicable lengths.

G. Rustication Strips (033000.A05): Metal, dressed wood, or rigid plastic, or with sides beveled and back kerfed; nonstaining; fabricated to configurations indicated, in longest practicable lengths.

H. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.

I. Form Ties: Factory-fabricated, removable or snap-off glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
   1. Furnish units that leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.

2.03 STEEL REINFORCEMENT

A. Reinforcing Bars (033000.A06): ASTM A 615/A 615M, Grade 60, deformed.

B. Plain-Steel Wire: ASTM A 1064/A 1064M, as drawn.

C. Deformed-Steel Wire: ASTM A 1064/A 1064M.


2.04 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.

B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place. Manufacture bar supports from steel wire, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
   1. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.
   2. Slab-on-grade supports: Provide supports specifically designed for bearing on soil.
   3. Where legs of wire bar supports contact forms, use CRSI Class 1, gray, plastic-protected bar supports.
   4. Concrete blocks, bricks and plastic chair supports are not allowed per Owner.

2.05 CONCRETE MATERIALS

A. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

B. Cementitious Materials:
   1. Portland Cement: ASTM C 150/C 150M, Type I or Type III, gray.
   3. Fly Ash: ASTM C 618, Class C.

C. Normal-Weight Aggregates: ASTM C 33/C 33M, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.
   1. Maximum Coarse-Aggregate Size:
      a. 1-inch nominal for slabs on grade and foundations.
      b. 3/4-inch nominal for topping slabs.
      c. 3/4-inch nominal for all other locations.

D. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

E. Air-Entraining Admixture: ASTM C 260/C 260M.

F. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
   1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
   2. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
   3. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
   4. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

G. Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete and complying with ASTM C 494/C 494M, Type C.

H. Non-Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, non-set-accelerating, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete.

2.06 WATERSTOPS

A. Non-Swelling, Pre-formed Waterstops (033000.A13): Manufactured rectangular pre-formed joint sealant strip for watertight bond to fresh and cured concrete surfaces. Material shall be a self-sealing adhesive compound with a square or rectangular cross-section. Waterstop shall bond to cured concrete surfaces and shall fuse with fresh concrete. Resistance to hydrostatic head shall not be less than 60 feet of water (non-moving joints).

   1. Profile: Flat dumbbell with or without center bulb.

2.07 VAPOR RETARDERS (033000.A14)

A. Sheet Vapor Retarder: ASTM E 1745, Class A, except with maximum perm rating of 0.01 US perms, a minimum puncture resistance of 2260 grams and a minimum tensile strength of 57 lbf/in. Include manufacturer's recommended adhesive or pressure-sensitive tape.
   1. Stego Industries, LLC.; Stego Wrap Vapor Barrier 15 mil.
      a. No substitutions will be allowed as directed by the Owner.

2.08 GRANULAR DRAINAGE/ CAPILLARY BREAK MATERIAL

A. Granular Drainage Fill (033000.A15): Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D 448, Size 57, with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.

2.09 PERIMETER INSULATION

A. Foam-Plastic Board Insulation (072100.A01): Provide one of the following:
   1. Provide extruded-polystyrene board insulation complying with ASTM C 578, of type and minimum compressive strength indicated below, with maximum flame-spread and smoke-developed indexes of 25 and 450, respectively, per ASTM E 84.
      a. Type IV, 25 psi.
   2. Provide molded polystyrene board insulation complying with ASTM C 578.
      a. Type IX, 25 psi.

2.10 LIQUID FLOOR TREATMENTS (033000.A21)

A. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or silicate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces, while improving slip resistance.
   1. Basis-of-Design Products: Subject to compliance with requirements, provide Prosoco, Inc.; “Consolideck LS” or comparable product meeting specified performance requirements, submitted to and accepted by Architect prior to bidding.
      a. Description: Clear premium sealer, hardener and densifier. This penetrating lithium silicate treatment reacts with the concrete to produce insoluble calcium silicate hydrate within the concrete pores. The treated surfaces resist damage from water and surface abrasion. The increased surface hardness reduces dusting and simplifies maintenance.
      b. Performance Criteria:
         1) Form: Clear, colorless, odorless liquid.
         2) Specific Gravity: 1.10.
         3) pH: 11.0.
         4) Weight per Gallon: 9.2 pounds.
         5) Active Content: 14.5 percent.
         6) Total Solids: 14.5 percent.
         7) Flash Point: Not applicable.
         8) Freeze Point: 32 degrees Fahrenheit (0 degrees Celsius)
         9) Shelf Life: 2 years in unopened, factory-sealed container
         10) VOC Content: 0 grams per Liter. Complies with all known national, state and district AIM VOC regulations.
2. Products shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.11 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. BASF Construction Chemicals - Building Systems; Confilm.
      b. Conspec by Dayton Superior; Aquafilm.
      c. Dayton Superior Corporation; Sure Film (J-74).
      d. Euclid Chemical Company (The), an RPM company; Eucobar.
      e. L&M Construction Chemicals, Inc.; E-CON.
      f. Meadows, W. R., Inc.; EVAPRE.
      g. SpecChem, LLC; Spec Film
      h. Unitex; PRO-FILM.

B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
   1. For areas to receive decorative polished concrete, use membrane forming curing compound.

C. Clear, Waterborne, Membrane-Forming Curing Compound (Exterior Slabs Only): ASTM C 309, Type 1, Class B, dissipating.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. BASF Construction Chemicals - Building Systems; Kure 200.
      b. Conspec by Dayton Superior; W.B. Resin Cure.
      c. Dayton Superior Corporation; Day-Chem Rez Cure (J-11-W).
      d. Euclid Chemical Company (The), an RPM company; Kurez W VOX; TAMMSCURE WB 30C.
      e. L&M Construction Chemicals, Inc.; L&M Cure R.
      f. Meadows, W. R., Inc.; 1100-CLEAR.
      g. SpecChem, LLC; Spec Rez Clear.
      2. Products shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
      3. For use in areas with exterior concrete flatwork not indicated within Civil Drawings.

2.12 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips (033000.A22): ASTM D 1751, asphalt-saturated cellulosic fiber or W. R. Meadows; "Deck-O-Foam". Thickness for expansion joint filler strip shall be ½ inch, unless otherwise indicated.
   1. For isolation joint filler strips, provide 30# asphalt saturated felt.

B. Semi-rigid Joint Filler (033000.A23): Two-component, semi-rigid, 100 percent solids, aromatic polyurea with a Type A shore durometer hardness range of 85 to 95 per ASTM D 2240.

C. Bonding Agent: ASTM C 1059/C 1059M, Type II, nonredispersible, acrylic emulsion or styrene butadiene.

D. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
   1. Types I and II, nonload bearing and Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

E. Reglets: Fabricate reglets of not less than 0.022-inch-thick, galvanized-steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

F. Dovetail Anchor Slots: Hot-dip galvanized-steel sheet, not less than 0.034 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.
2.13 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
   1. Basis of Design: Subject to compliance with requirements, Provide “Ultraplan 1 Plus” by MAPEI or a comparable product with the following characteristics.
   2. Cement Binder: ASTM C 150/C 150M, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
   3. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
   4. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
   5. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109/C 109M.

B. Repair Overlay: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.
   2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
   3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
   4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C 109/C 109M.

2.14 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
   1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.

B. Cementitious Materials: Use fly ash, as needed to reduce the total amount of portland cement, which would otherwise be used, by not more than 15 percent. Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
   1. Fly Ash: 15 percent.

C. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 to 0.30 percent by weight of cement.

D. Admixtures: Use admixtures according to manufacturer's written instructions.
   1. Use high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
   2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
   3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a w/c ratio below 0.50.
   4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.

2.15 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Footings and Grade Beams: Proportion normal-weight concrete mixture as indicated on the structural drawings.

B. Foundation Walls and Stem Walls: Proportion normal-weight concrete mixture as indicated on the structural drawings.

C. Slabs-on-Grade (Exterior stoop slabs and stairs): Proportion normal-weight concrete mixture as indicated on the structural drawings.

D. Slabs-on-Grade (Interior): Proportion normal-weight concrete mixture as indicated on the structural drawings.

E. Concrete Toppings: Proportion normal-weight concrete mixture as indicated on the structural drawings.
2.16 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI’s "Manual of Standard Practice."

2.17 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.
   1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.
   1. For mixer capacity of 1 cu. yd. (0.76 cu. m) or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
   2. For mixer capacity larger than 1 cu. yd. (0.76 cu. m), increase mixing time by 15 seconds for each additional 1 cu. yd. (0.76 cu. m).
   3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

2.18 FOAM VOID FILL (GEOFOAM)

A. General: Provide Geofoam blocks that have been factory fabricated to fit project dimensions; eliminating field cutting and site generated waste.

B. Rigid Cellular Polystyrene Geofoam Blocks (033000.A04): Molded blocks of cellular polystyrene comply with manufacturer’s requirements, ASTM D6817 for Type EPS22, and the following:
   1. Minimum density: 0.90 pounds per cubic foot (and as indicated on drawings)
   2. Flame-Spread and Smoke-Developed Indexes: 25 and 450 or less, respectively, per ASTM E 84.
   3. Compressive Resistance: at 1 percent deformation shall be 7.3 psi.
   5. Blocks shall contain no CFC’s, HCFC’s, HFC’s, or formaldehyde.

C. Geofoam Accessories:
   1. Gripper Plates: Manufacturer’s standard galvanized barbed plates for installation between Geofoam layers.

2.19 FABRICATING FOAM VOID FILL (GEOFOAM)

A. Fabricate Geofoam blocks, square, and true to dimension.

B. Factory cut individual blocks for delivery to site and installation without the need for subsequent field cutting.
   1. Collect cut-off waste at factory for recycling as post-industrial content. Do not require field fabrication and disposal of Geofoam in the field.

C. Marking and Identification: Individual Geofoam blocks shall be marked as follows:
   1. Room number identification.
   2. Layer I.D. letter and part number identification.

PART 3 EXECUTION

3.01 FORMWORK INSTALLATION

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301 (ACI 301M), to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117 (ACI 117M).
1. Form recessed slabs as indicated.

C. Utilize sides of trenches for forms whenever possible. Where sides of trenches cannot be used; design, erect, support and maintain formwork to support vertical, lateral, static and dynamic loads that might be applied until such loads can be supported by concrete structure.

D. Limit deflection of form-facing panels to not exceed ACI 303.1 requirements.

E. In addition to ACI 303.1 limits on form-facing panel deflection, limit cast-in-place concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
      a. Fins shall be ground smooth with adjacent concrete surface.
   2. Class C, 1/2 inch for rough-formed finished surfaces.

F. Construct forms tight enough to prevent loss of concrete mortar.

G. Construct forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
   1. Kerf wood rustications, keyways, reglets, recesses, and the like, for easy removal.
   2. Do not use rust-stained steel form-facing material.
   3. For concrete exposed-to-view on the building interior, seal form joints and penetrations at form ties with form joint tape or form joint sealant to prevent cement paste leakage.
   4. Construct forms tight enough to prevent loss of concrete mortar.

H. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

I. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

J. Chamfer exterior corners and edges of permanently exposed concrete.

K. Ease edges of tread-to-riser transitions of concrete riser platforms of seating to dimension as indicated on the drawings.

L. Form openings, chases, offsets, sinkages, keyways, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

M. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

N. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

O. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.
   1. Coat contact surfaces of wood rustications and chamfer strips with sealer before placing reinforcement, anchoring devices, and embedded items.

3.02 EMBEDDED ITEM INSTALLATION

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.
3.03 PERIMETER INSULATION

A. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

B. On vertical footing and foundation wall surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions.
   1. If not otherwise indicated, extend insulation a minimum of 36 inches below exterior grade line.

3.04 REMOVING AND REUSING FORMS

A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations, and curing and protection operations need to be maintained.
   1. Leave formwork for beam soffits, joists, slabs, and other structural elements that support weight of concrete in place until concrete has achieved at least 75 percent of its 28-day design compressive strength.
   2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
   3. Do not cut or puncture vapor retarder.
   4. Schedule form removal to maintain surface appearance that matches approved field sample panels and mockups.
   5. Cut off and grind glass-fiber-reinforced plastic form ties flush with surface of concrete.

B. Leave formwork for beam soffits, joists, slabs, and other structural elements that support weight of concrete in place until concrete has achieved at least 75 percent of 28-day design compressive strength. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

C. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material are not acceptable for exposed surfaces. Apply new form-release agent.

D. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.05 SHORING AND RESHORING INSTALLATION

A. Comply with ACI 318 and ACI 301 for design, installation, and removal of shoring and reshoring.
   1. Do not remove shoring or reshoring until measurement of slab tolerances is complete.

B. In multistory construction, extend shoring or reshoring over a sufficient number of stories to distribute loads in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members without sufficient steel reinforcement.

C. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

3.06 GRANULAR DRAINAGE FILL

A. Granular Drainage/Capillary Break Fill Course: Cover vapor retarder with not less than indicated depth of granular drainage fill material, moisten, and compact with mechanical equipment to elevation tolerances of plus 0 inch or minus 1/2 inch.
   1. Compaction Requirements: Compact to within 95 percent maximum density in accordance with ASTM C 698, Standard Proctor compaction, at workable moisture content.
   2. At trenches through existing slabs on grade, provide at additional granular drainage fill/capillary break material to achieve a thickness of not less than 4 inches.
   3. Refer to Section 313200 “Subsoil Stabilization” for additional requirements regarding granular drainage fill.

3.07 VAPOR-RETARDER INSTALLATION

A. Sheet Vapor Retarders for Slabs on Grade: Following leveling and tamping of granular drainage fill course for building slabs on grade, place vapor retarder sheet with longest dimension parallel with direction of pour. Place,
Liberty Public Schools

CAST-IN-PLACE CONCRETE

Project No. 23018, 23019, 23020

September 29, 2023

3.08 STEEL REINFORCEMENT INSTALLATION

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
2. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.
3. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
4. Weld reinforcing bars according to AWS D1.4/D 1.4M, where indicated.
5. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
6. Install welded-wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.09 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
5. Space vertical joints in walls at 100 feet maximum. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
7. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
8. At Load Transfer Joints: Provide one of the following:
   a. 2 by 4 inch continuous keyway.
   b. One #4 by 12 inch long smooth dowel.
   c. Diamond dowel system.
C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
   a. Where joints are not specifically indicated, space joints at 15 feet on center (area not to exceed 225 sq ft.). For polished concrete, space joints at 10 feet on center (area not to exceed 100 sq ft.).
   b. Begin saw cutting of joint no later than 12 hours after finishing.
2. Gymnasium Floor Slabs: Do not provide contraction joints in slabs-on-grade indicated to receive athletic flooring under Section 096566 and 096766.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
1. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch (25 mm) below finished concrete surface where joint sealants, specified in Section 079200 "Joint Sealants," are indicated.
2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Section 079200 "Joint Sealants," are indicated.
3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. Dowelled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.10 WATERSTOP INSTALLATION
A. Flexible Rubber Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, adhesive bonding, mechanically fastening, and firmly pressing into place. Install in longest lengths practicable.

3.11 CONCRETE PLACEMENT
A. General Contractor shall notify Owner's Representative at least 24 hours in advance for mandatory review of the following:
   1. Specification-mandated inspections of rebar placement or specialized formwork, prior to pouring concrete.
   2. Code-required special inspections of rebar placement or specialized formwork, prior to pouring concrete.
   3. Rebar tie-ins of exterior flatwork to all doors or other openings, or exterior stoops.

B. Failure of the General Contractor to secure inspection and approval for any of the above conditions prior to pouring concrete is grounds for Owner to require installed material be removed for inspection and reinstalled at Contractor's expense.

C. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections are completed.

D. Do not add water to concrete during delivery, at Project site, or during placement unless water was withheld at batch plant, amount withheld was documented in writing and adding withheld water is acceptable to Architect.

E. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
   1. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
   2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301 (ACI 301M).
      a. Refer to ACI 303.1 for areas to receive architectural concrete finishes.
   3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
      a. Do not permit vibrators to contact forms.

F. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
1. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
3. Screed slab surfaces with a straightedge and strike off to correct elevations.
4. Slope surfaces uniformly to drains where required.
5. Concrete slab repairs at trenches shall be flush with adjacent concrete surface.
6. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

G. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

H. Hot-Weather Placement: Comply with ACI 301 and as follows:
1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

I. Contractor is responsible for all rinse water runoff.

3.12 FINISHING FORMED SURFACES

A. General - Architectural Concrete Finish: Match Architect's design reference sample, identified and described as indicated, to satisfaction of Architect.

B. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
1. Apply to concrete surfaces not exposed to public view.

C. Smooth-Formed Finish (033000.A16): As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
1. For concrete exposed to view on the interior of the building, fins and other projections shall be removed flush with adjacent surface of concrete.
2. Apply to concrete surfaces exposed to public view, to receive a rubbed finish, or to be covered with a coating or covering material applied directly to concrete.

D. Rubbed Finish (033000.A17): Apply the following to smooth-formed-finished as-cast concrete where indicated:
1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
   a. Apply to concrete surfaces exposed to public view on vertical surfaces of sides of ramps, at sides of stairs and at lightpole bases.

E. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.13 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
B. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraihtening until surface is left with a uniform, smooth, granular texture.
   1. Apply float finish to surfaces to receive trowel finish and to be covered with fluid-applied or sheet waterproofing, and built-up or membrane roofing.

C. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraihten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
   1. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, resilient and fluid-applied athletic flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system. Do not burnish concrete.
   2. Gymnasium Floor: Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.-long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/8 inch.
   3. Finish slab repairs at trenches to be flush with adjacent concrete surfaces.

D. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces where ceramic or quarry tile is to be installed by either thickset or thinset method. While concrete is still plastic, slightly scarify surface with a fine broom.
   1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.

E. Broom Finish (033000.A18): Apply a broom finish to traffic surfaces of exterior concrete platforms, steps, ramps, and elsewhere as indicated.
   1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.14 MISCELLANEOUS CONCRETE ITEM INSTALLATION

A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations:
   1. Coordinate sizes and locations of concrete bases with actual equipment provided.
   2. Construct concrete bases 4 inches high unless otherwise indicated, and extend base not less than 6 inches (150 mm) in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated or unless required for seismic anchor support.
   3. Minimum Compressive Strength: 3500 psi (24.1 MPa) at 28 days.
   4. Minimum Compressive Strength: 4000 psi at 28 days.
   5. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
   6. For supported equipment, install anchor bolts that extend through concrete base and anchor into structural concrete substrate.
   7. Prior to pouring concrete, place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   8. Cast anchor-bolt insert into bases. Install anchor bolts to elevations required for proper attachment to supported equipment.

3.15 CONCRETE PROTECTING AND CURING

A. General:
   1. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 (ACI 301M) for hot-weather protection during curing.
   2. Contractor shall be responsible for providing exposed finishes completely free of graffiti, scratches, and other man-made marks made after wet concrete has been placed. Marked surfaces shall be removed and replaced at no additional cost to Owner.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply
according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for remainder of curing period.

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

E. Cure concrete according to ACI 308.1, as follows:
   1. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
      a. Use moisture-retaining covers to cure concrete slab surfaces to receive all types of floor coverings.
      b. Use moisture-retaining covers to cure concrete slab surfaces to receive penetrating liquid floor treatments, sealed concrete floor treatments and decorative polished concrete floor treatment.
   2. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
      a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer.

3.16 LIQUID FLOOR TREATMENT APPLICATION

A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions.
   1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
   2. Do not apply to concrete that is less than 28 days' old.
   3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.

B. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller according to manufacturer's written instructions.

3.17 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
   1. Defer joint filling until concrete has aged at least four month(s). Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.

C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.
   1. Where control/contraction joints extend to the exterior of the building, beyond aluminum storefront, curtain wall and similar framing, completely fill joints with semi-rigid joint filler from exterior to inside face of framing. Exposed joint shall be completely filled and made water-tight.
   2. Where control/contraction joints occur in floors indicated to receive penetrating sealed concrete finish.

3.18 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 (1.18-mm) sieve, using only enough water for handling and placing.
C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch (13 mm) in any dimension to solid concrete. Limit cut depth to 3/4 inch (19 mm). Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.

2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar matches surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.

3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include spalls, pop-outs, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch (0.25 mm) wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.

2. After concrete has cured at least 14 days, correct high areas by grinding.

3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.

4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.

5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch (6 mm) to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.

6. Repair defective areas, except random cracks and single holes 1 inch (25 mm) or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch (19-mm) clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

7. Repair random cracks and single holes 1 inch (25 mm) or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.19 FIELD QUALITY CONTROL

A. Special Inspections and Testing: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

1. Waterproofing (capillary break) admixture manufacturer shall test new concrete slabs for permeability.

C. Inspections:

1. Steel reinforcement placement.
2. Steel reinforcement welding.
3. Headed bolts and studs.
4. Verification of use of required design mixture.
5. Concrete placement, including conveying and depositing.
6. Curing procedures and maintenance of curing temperature.
7. Verification of concrete strength before removal of shores and forms from beams and slabs.
8. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.

D. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172/C 172M shall be performed according to the following requirements:

1. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. (76 cu. m) or fraction thereof of each concrete mixture placed each day.
   a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.

3. Air Content: ASTM C 231/C 231M, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.

4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F (4.4 deg C) and below or 80 deg F (27 deg C) and above, and one test for each composite sample.

5. Compression Test Specimens: ASTM C 31/C 31M.
   a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
   b. Cast and field cure two sets of two standard cylinder specimens for each composite sample.

6. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
   a. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

7. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.

8. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).

9. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

10. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.

11. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.

12. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

13. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

3.20 PROTECTION OF FLOOR TREATMENTS

A. Protect floor treatments from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by floor treatments installer.

3.21 FOAM VOID FILL (GEOFOAM) INSTALLATION

A. Geofoam Installation: Install blocks in layers at locations indicated on shop drawings. Hold dimensions on shop drawings and Architect's plans. Blocks shall incorporate positive mechanical connection of foam block layers.
   1. Place gripper plates between each layer of Geofoam in quantities as noted on shop drawings.

END OF SECTION 033000
SECTION 075216 - MODIFIED BITUMINOUS MEMBRANE ROOFING

PART 1 GENERAL

1.1 SUMMARY

A. This Section specifies requirements for the modified bituminous sheet roofing system (075216.A01) including but not limited to, the following:
   1. Modified bituminous field ply/plies (smooth and granulated).
   2. Modified bituminous 2-ply base flashing.
   3. Roof insulation, tapered roof insulation, and cover board.
   4. Roof cant strips and tapered edge strips.
   5. Lead flashing at roof drains and plumbing vents.
   7. Walkway protection boards.
   8. Base Sheet.
   9. Vented Base Sheet (for areas with Concrete Deck).
   10. All accessories and fasteners needed to complete the roofing systems indicated.

B. Related Requirements:
   1. Section 053100 “Steel Decking” for steel decking requirements and installation.
   2. Section 061000 “Rough Carpentry” for wood framing, blocking, and nailers associated with roofing.
   3. Section 076200 “Sheet Metal Flashing and Trim” for metal roof flashings and counter flashings.
   4. Division 22 for mechanical roof drain systems.
   5. Division 23 for mechanical equipment and accessory curbs.

1.2 SYSTEM DESCRIPTIONS

A. Modified Bitumen Roofing System over Metal Decking: Roofing system shall consist of base layer of insulation, mechanically fastened to metal decking; second layer of insulation shall be set in low-rise foam adhesive; a cover board set in low rise foam adhesive; a modified bitumen smooth surfaced membrane adhered with manufacturer’s cold adhesive; a modified bitumen surfacing ply (cap sheet) with factory-applied mineral surfacing. Surfacing ply shall be adhered with manufacturer’s cold adhesive. Provide all related accessories for a complete and watertight roofing system. All laps in APP systems shall be hot-air welded.

B. Modified Bitumen Roofing System over Precast Structural Concrete: Roofing system shall consist of base layer of insulation set in low-rise foam adhesive to precast decking; additional layers of insulation shall be set in low-rise foam adhesive; a 1/2 inch thick cover board set in low rise foam adhesive; a modified bitumen smooth surfaced membrane adhered with manufacturer's cold adhesive; a surfacing ply (polyester cap sheet) shall be either a dual-reinforced (glass fiber mat and polyester mat) or a single reinforced (polyester mat) modified bitumen ply with factory-applied mineral surfacing. Surfacing ply shall be adhered with manufacturer's cold adhesive. Provide all related accessories for a complete and watertight roofing system. All laps in system shall be hot-air welded. Provide vented base sheet as required per manufacturer.

1.3 ACTION SUBMITTALS

A. Product Data: Manufacturer’s technical product data, installation instructions and recommendations for each type of roofing product/component required. Include data and certified test reports substantiating that materials comply with requirements.
   1. Submit Factory Mutual and Underwriter’s Laboratory material and systems approvals.
      a. For insulation and roof system component fasteners, include copy of FM Approvals RoofNav listing.
   2. Submit Underwriter’s Laboratory material and systems approvals.
   3. Submittals shall be reviewed and accepted by roofing membrane manufacturer’s technical representative with a submittal cover letter stating all products for the roof assembly including roofing membrane, base flashing, roof insulation, adhesives and fasteners are acceptable.

B. Shop Drawings: Indicate dimensions, general construction, specific modifications, component connections, details at adjoining construction and roof top accessories, anchorage methods, hardware and installation.
procedures; plus the following specific requirements:

1. Indicate base flashing and membrane terminations and, details for perimeter, penetrations, field fabricate curbs and tie-in flashing details.

2. Indicate insulation fasteners, sheet layout and fastening pattern to comply with performance requirements specified. If insulation and cover board is adhered with low rise foam adhesive, indicated adhesive ribbons patterns to comply with performance requirements specified.

3. Indicate layout and thicknesses for tapered insulation and crickets.

4. Indicate details for perimeter, penetrations, and field fabricate curbs and tie-in flashing details as approved by roof membrane manufacturer and in accordance with performance requirements specified for wind uplift classification specified.

5. Shop drawing shall show sequence of placement of roofing system, set-up locations of equipment and traffic patterns. Installation sequence shall be arranged so traffic across finished roofing system is minimized.

6. Shop drawings shall be reviewed and accepted by roofing membrane manufacturer's technical representative. A shop drawing cover letter shall be submitted by the roofing membrane manufacturer’s technical representative stating all products for the roof assembly including roofing membrane, base flashing and roof insulation are acceptable.
   a. Shop drawings for Section 076200 “Sheet Metal Flashing and Trim” shall be reviewed concurrently with shop drawings for Section 075216 “Modified Bituminous Membrane Roofing.”

C. Samples: Submit two sets of samples indicating manufacturer’s full range of standard colors for mineral surfaced cap sheet.

D. Wind Uplift Resistance Submittal: For roofing system indicating compliance with wind uplift performance requirements.

E. Roof Assembly Certification Letters: Manufacturer of primary roof system components shall submit letter certifying that the roofing system will achieve specified warranty, that roofing system components are acceptable and will meet performance requirements specified.

1.4 INFORMATIONAL SUBMITTALS

A. Certifications: Submit written copy of warranty applications.

B. Manufacturer Certificates:
      a. Submit evidence of complying with performance requirements.
   2. Manufacturer's Special Warranty Certificate: Signed by roof membrane manufacturer, certifying that all materials supplied under this Section are acceptable for special warranty.

C. Field Test Reports:
   1. Concrete internal relative humidity test reports.
   2. Fastener-pullout test results and manufacturer's revised requirements for fastener patterns.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing system to include in maintenance manuals.

B. Certified statement from existing roof membrane manufacturer stating that existing roof warranty has not been affected by Work performed under this Section.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Provide primary roofing products including modified bitumen field and surfacing membranes, base sheet, modified bitumen flashing and bitumen/adhesive, successfully produced by a manufacturer, which has produced that type of product for not less than 5 years. Provide secondary products recommended by primary manufacturer.
   1. Manufacturer shall be UL listed for roofing system identical to that used for this Project.
2. Manufacturer shall be listed in SPRI's Directory of Roof Assemblies for roofing system identical to that used for this Project.

B. Installer Qualifications: The Roofing Contractor shall perform the work of this Section; and shall be a firm with not less than seven (7) years of successful experience in installation of modified bitumen roofing systems similar to those required for this project. Roofing Contractor shall be licensed by, trained by or otherwise approved in writing by the manufacturer of primary roof materials. The Contractor must be a member of NRCA or one of its affiliates.
   1. Roofing Contractor must have successfully completed 2 projects of comparable scale within the past two years using the specified system.
   2. Installer shall have an EMR (Experience Modification Ratio) rating of 0.90 or less.
   3. Installer Certification: Obtain written certification from manufacturer of roofing system certifying that Installer is approved by manufacturer for installation of specified roofing system. Provide copy of certification to Architect prior to award of roofing work.
   4. Installer must be approved by roofing system manufacturer to offer specified manufacturer’s warranty.
   5. Installer’s Field Supervision: Require Installer to maintain a full-time supervisor/foreman who is on jobsite during times that roofing work is in progress and who is experienced in installation of roofing system similar to the type and scope required for this Project.
   6. All roofing shall be installed by employees of the installer; contract labor is not allowed.

C. Pre-application Roofing Conference: Approximately two weeks prior to scheduled commencement of modified bitumen roofing installation and associated work, the Contractor shall conduct a meeting at Project site with Roofing Contractor, roofing membrane manufacturer’s technical representative, installer of each component of associated work, installer of rooftop units and other work in and around roofing which must precede or follow roofing work (including mechanical work), Architect if requested, roofing system manufacturer’s technical representative third party inspection agency representative, and other representatives directly concerned with performance of the work. Contractor to record discussions of conference and decisions and agreements (or disagreements) reached, and furnish copy of record to each party attending. Review foreseeable methods and procedures related to roofing work, including but not necessarily limited to the following:
   1. Tour representative areas of roof substrates (decks), inspect and discuss condition of substrate, roof drains, curbs, penetrations and other preparatory work performed by other trades. Identify and record items to be corrected prior to commencement of work of this Section.
   2. Review roofing systems requirements (drawings, specifications and other contract documents).
   3. Review required submittals (all required submittals shall be completed prior to pre-application roofing conference).
   4. Review and finalize construction schedule related to roofing work and verify availability of materials, installer’s personnel, equipment and facilities needed to make progress and avoid delays.
   5. Review required inspection, testing, certifying and material usage accounting procedures.
   6. Review weather and forecasted weather conditions, and procedures for coping with unfavorable conditions, including possibility of temporary roofing (if not a mandatory requirement.)
   7. Review temporary protection requirements for roofing system during and after installation.
   8. Review governing regulations and requirements for insurance and certificates.
   9. Roofing work will not be allowed to commence until submittals (or other language) phase has been completed.

D. Insurance Certification: Assist the Owner in preparation and submittal of roof installation certification as may be necessary with fire and extended coverage insurance on roofing and associated work.

E. UL Listing: Provide modified bitumen roofing materials which have been tested for application and slopes indicated and are listed by Underwriter’s Laboratories, Inc. (UL) for Class A external fire exposure.
   1. Provide roof covering materials bearing Classification Marking (UL) on bundle, package, or container indicating that materials have been produced under UL’s Classification and Follow-up Service.
   2. Provide roof insulation approved in writing by roof system manufacturer as acceptable substrate for this project.
   3. Provide roofing system that can be installed to comply with UL 790 requirements specified for resistance to external fire.

F. Product/Material Qualifications:
   1. Components of the roofing system shall be manufactured or approved by the roofing system manufacturer to comply with guaranty and construction class requirements.
   2. Fastener corrosion resistance shall be in accordance with FM Standard 4470.

G. Independent Third-Party Services: May be used for roof moisture and ES-1 coping and/or edge metal flashing surveys as described in the warranty section. Third party services shall be provided copies of roof plan for
moisture survey and approved shop drawings for coping and/or edge metal (ES-1 standards) for sheet metal surveys. Third party services shall attend the roofing pre-installation conference if they are to perform the roof moisture or coping and metal edge surveys.

1.7 FIELD QUALITY CONTROL

A. Field Audits: Roof membrane manufacturer's technical representative shall perform in progress site audits and review completed contractor's quality control forms, prepare and submit reports to roofing contractor and owner's representative. Site audits include first day of construction and a site audit for every two weeks of construction.

B. Quality Control Form:
   1. Contractor to complete daily quality control form provided by the roofing membrane manufacturer which is included in the documents. Contractor is to note on provided roof plan areas of daily construction. Completed forms are to be submitted with warranty completion notice.

C. Final Roof Inspection: As a part of the roofing membrane manufacturer's standard warranty, arrange for roof membrane manufacturer's technical representative.
   1. Notify Architect and Owner 48 hours in advance of date and time of inspection.

D. Roofing system will be considered defective if it does not pass tests and inspections.
   1. Additional testing and inspecting, at Contractor's expense will be performed to determine if replaced or additional work complies with specified requirements.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store and handle modified bitumen membrane and roofing system components in accordance with roofing system manufacturer's written instructions. Store and handle components in a manner which will ensure that there is no possibility of significant moisture pickup. Unless protected from weather or other moisture sources do not leave unused membrane on the roof overnight or when roofing work is not in progress. Store modified bitumen sheets and other materials on end on pallets or other raised surface. Handle and store materials or equipment in a manner to avoid significant or permanent deflection of deck.
   1. Cover all materials with breathable tarpaulins. Secure tarpaulins such that weather events cannot displace them after installation.
   2. Remove roofing components from job site that show indications of moisture damage and replace with undamaged materials/components.

B. Where heavy loads are placed up on or transported over decking, or where materials are repeatedly landed, provide temporary planking or plywood to distribute imposed loads.

C. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.

1.9 PROJECT CONDITIONS

A. Weather Condition Limitation: Proceed with roofing work only when existing and forecasted weather conditions will permit in conjunction with manufacturer's recommendation and guaranty requirements.

B. Project Phasing: All roof insulation, cover board, edge strips, flashing, and field ply(s) shall be installed in a timely manner to allow for all other work by other trades to be completed on the roof prior to application of the surface ply and associated final layer flashing and stripping.

C. Protect roofing system as specified hereinafter.

1.10 WARRANTY

A. Installer's Special Project Warranty: Submit two (2) executed copies of the most current version of the MRCA “Roofing Contractor Materials and Workmanship Warranty”, for a period of two (2) years, covering work of this Section including roof membrane, composition flashing, roof insulation, fasteners, walkway pads, and roofing
accessories, all stated on face of Warranty, signed and counter signed by Installer (Roofer) and Contractor.

B. Manufacturer’s Warranty: Submit executed copy of roofing manufacturer’s “Full Systems – No Dollar Limit” material and workmanship warranty. Submission shall include a written description of specified services as noted below and shall be endorsed by the Manufacturer’s Technical Director. Warranty shall be from the existing decking up, including roofing system, and flashing endorsement signed by authorized representative of roofing system manufacture, on form which was published with product literature as of date of contract documents, for the following period of time:
   1. Twenty (20) years after date of substantial completion. This warranty shall include the following:
      a. Membrane roofing, base flashings, roof insulation, fasteners, cover boards, and other components of membrane roofing system.
      b. Liquid flashing system at roofing system penetrations.
   2. Two-year re-inspection of the modified bitumen system.

C. Additional Warranty Services: The following services must be provided by the roofing membrane manufacturer’s technical representative:
   1. Roofing submittals shall be reviewed and accepted by roofing membrane manufacturer.
   2. Roofing shop drawings shall be reviewed and accepted by roofing membrane manufacturer.
   3. Pre-installation Conference: Roofing membrane manufacturer’s technical representative shall attend the roofing pre-installation conference and document participation.
   4. Project Start up Audit: Roofing membrane manufacturer’s technical representative shall conduct and document a project start up audit, typically the first or second day of roof construction.
   5. Interim Audit: Roofing membrane manufacturer’s technical representative shall conduct an interim audit, typically one for every two weeks of construction.
   6. Quality Control Form: Contractor to complete daily quality control form provided by the roofing membrane manufacturer which is included in the documents. Contractor is to note on provided roof plan areas of daily construction. Completed forms are to be submitted with warranty completion notice.

D. Roof Management Warranty: The following services must be provided by the roofing membrane manufacturer’s technical department:
   1. Annual inspections for five (5) years.
   2. Manufacturer must maintain digital and/or hard copies of all warranties issued for the duration of the warranty.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Installed roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roofing and base flashings shall remain watertight.
   1. Accelerated Weathering: Roofing system shall withstand 2000 hours of exposure when tested according to ASTM G 152, ASTM G 154, or ASTM G 155.
   2. Impact Resistance: Roofing system shall resist impact damage when tested according to ASTM D 3746 or ASTM D 4272.

B. Material Compatibility: Roofing materials shall be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roofing manufacturer based on testing and field experience.

C. Wind Uplift Resistance: Design and install roofing system to resist the wind uplift pressures set forth on Structural Drawings when tested according to FM Approvals 4474, UL 580, or UL 1897.

D. FM Approvals’ RoofNav Listing: Roof membrane, base flashings, and component materials shall comply with requirements in FM Approvals 4450 or FM Approvals 4470 as part of a roofing system, and shall be listed in FM Approvals’ RoofNav for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals Certification markings.
   1. Fire/Windstorm Classification:
      a. Class A Fire Rating 1A-90.
      b. Class A Fire Rating NC-90.
   2. Hail-Resistance Rating: FM 1-34 VSH.
E. Energy Star Listing: Roofing system shall be listed on the DOE’s ENERGY STAR "Roof Products Qualified Product List" for low-slope roof products.

F. Exterior Fire-Test Exposure: ASTM E108 or UL 790, Class A, for application and roof slopes indicated; testing by a qualified testing agency.
   1. Identify products with appropriate markings of applicable testing agency.

G. Fire-Resistance Ratings: For roof over gymnasium, comply with fire-resistance-rated assembly designs indicated. Unless otherwise indicated, comply with UL Design No. P915 for a 2-hour assembly rating.
   1. Identify products with appropriate markings of applicable testing agency.

H. Impact Resistance: Performance testing for impact resistance shall be in accordance with FM 4450, FM 4470 ASTM D3746 or CGSB 37-GP 56M to meet the following impact resistance:
   1. Meet FM-VSH (Very Severe Hail), ASTM D3746 or CGSB #&-GP 56M.

2.2 MANUFACTURERS

A. General: Subject to compliance with specified requirements, provide roofing system from one of the manufacturers listed below. Additional manufacturers may be considered when submitted to and accepted by Architect prior to bidding. All manufacturers must meet all specified requirements, regardless of inclusion within the list below.
   1. Garland (SBS)
   2. Johns Manville (APP)
   3. Performance Roofing Systems (APP)
   4. Soprema (SBS)
   5. Tremco (SBS)

2.3 BASE-SHEET MATERIALS

A. Vented Base Sheet (075216.A05): ASTM 4897, Type II, venting, non-perforated, heavyweight, asphalt-impregnated and –coated, glass-fiber base sheet with coarse granular surfacing or embossed venting channels on bottom surface.
   1. Basis of Design Products: Subject to compliance with requirements and acceptance by manufacturer of primary roofing materials, provide one of the following:
      a. Garland.
      b. Johns Manville; "Ventsulation" Vented Base Sheet.
      d. Soprema.
      e. Tremco.
      f. Comparable product submitted to and accepted by Architect and roofing material manufacturer prior to bidding.


2.4 VAPOR RETARDER

   1. Manufacturers and Products: Subject to compliance with requirements, provide one of the following or a comparable product submitted to and accepted by Architect with the following product characteristics:
      a. "SOPRAVAP'R" by Soprema.
      b. "JM Vapor Barrier SA" by Johns Manville.
      c. "Derbistick SA" by Performance Roof Systems.
      d. "ExoAir 110 by Tremco.
   2. Product Characteristics:
      a. Membrane Thickness: Not less than 31 mils.
b. Tear Resistance: 95 MD and 103 XMD per ASTM D5147.
c. Static Puncture Resistance: Not less than 90 lbf per ASTM D5602.
d. Lap Adhesion: not less than 68 lbf/ft per ASTM D1876.
e. Water Absorption: 0.1 percent per ASTM D5147.
f. Water Vapor Permeance: 0.03 perms per E96.
g. Provide 12 inch wide strips of self-adhering air barrier/vapor retarder at all joints and gaps between precast double-tees and between double-tees and adjacent structure.

3. Accessories: Provide pressure sensitive tape, lap adhesive, primer and related accessories necessary for complete and proper installation that are recommended by vapor barrier manufacturer to suit conditions involved.

2.5 ROOF INSULATION

A. General: If one of the approved roof insulation systems is provided that alters the system thickness from that specified, Contractor is responsible for any additional cost to add additional courses of cut brick or changes in wood blocking, flashing gravel, guards, etc.
   1. Provide preformed roof insulation boards manufactured or approved by roof membrane manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated, and approved for use in roof assemblies specified.

B. Insulation Products: Acceptable products must be approved by the roofing system manufacturer.
   1. UL approved insulation meeting requirements specified for fire resistance.
   2. FM approved insulation meeting wind uplift resistance requirements specified.
   3. ASCE 7-16 for wind uplift resistance requirements specified.

C. Polyisocyanurate Board Insulation (075423.A20): ASTM C 1289, Type II, Class 1, Grade 2, felt or glass-fiber mat facer on both major surfaces.
   1. Provide insulation in at least two layers, with the first layer 1-1/2 inches thick.
   2. Mechanically fastened first layer to deck to meet wind uplift requirements specified. All subsequent layers shall be installed with adhesive to meet wind uplift requirements.
      a. Note: At areas where vapor retarder occurs, adhere first layer of insulation in lieu of mechanically fastening.
   3. Total thickness of insulation shall not be less than 5-1/2 inches. Thickness at roof drains shall be 1-1/2 inches, minimum.
   4. First layer of insulation shall provide a minimum aged R-value of 8.6 (for 1-1/2 inch thickness).
   5. Second layer of insulation shall be 4.0 inches thick and provide a minimum aged R-value of 23.6.
   6. Total aged R-value for roof insulation shall not be less than R-30.

2.6 INSULATION ACCESSORIES

A. General: Furnish roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with roofing system.

B. Cover Board (075216.A25):
   1. Basis of Design Product: Subject to compliance with requirements, provide one of the following:
      a. Georgia Pacific; DensDeck StormX Prime Roof Board.
      b. Comparable products from other manufacturers meeting specified requirements for VSH requirements.
   2. Product Characteristics:
      a. Description: Glass-mat gypsum roof board compliant with ASTM C1177, Type "X".
      b. Thickness: 5/8 inch, minimum or minimum thickness to obtain a VSH approval with a tested assembly.

C. Insulation Fasteners (steel deck areas only): Basis-of-Design: Derbigum Perlock standard mechanical fasteners for roofing system which has been tested for the required pull-out strength where applicable and compatible with deck type and roofing products used. Roofing Contractor is responsible for testing that may be required to substantiate required fastening methods or procedures.
   1. Fasteners shall meet requirements of FM 4470 for corrosion resistance.
   2. Fastener Plates for Insulation: Provide 3 inch diameter, galvalume coated steel plates as recommended by roofing system manufacturer.
   3. Fastener length shall be adequate to penetrate load bearing surface of steel deck 3/4 inch.
D. Low Rise Foam Adhesive: Manufacturer recommended dual-component low rise urethane adhesive (asbestos free).
   2. VOC Emissions: 245 grams per liter, maximum, per ASTM D 3960-92
   3. Flash Point (COC): 105 degrees F, minimum, per ASTM D 92
   4. Solids Content: 77.5 percent, minimum, by weight per ASTM D 4479
   5. Density: 9.5 pounds/gallon, minimum, at 77 degrees F per ASTM D 70

2.7 MODIFIED BITUMEN ROOFING COMPONENTS

A. General Note:
   1. Total Membrane Thickness shall be defined as the combined thickness of the field ply (base sheet) and surface ply (cap sheet), excluding adhesive layers.
   2. Total Membrane Thickness shall be not less than 300 mils without prior acceptance by Architect, prior to bidding, using the form and guidelines contained in Section 012500 “Substitution Procedures” and Substitution Request Form. The following basis of design thicknesses shall be provided in the absence of written documentation from the Architect.
      a. Field Ply (Base Sheet) Basis of Design Thickness: 120 mils.
      b. Surface Ply (Cap Sheet) Basis of Design Thickness: 180 mils, minimum.
   3. Roof Areas within UL-listed assemblies shall be fabricated and installed per the listed requirements of the UL-listing indicated on the Drawings.
   4. Surface Ply (Cap Sheet) shall be Class A rated per ASTM E 108 and UL 790.

B. Field Ply (Base Sheet) – Provide a smooth-surfaced reinforced modified bituminous membrane from one of the listed manufacturers that will meet the criteria for one of the following standards:
   1. ASTM D6509 – APP modified bituminous membrane with fiberglass reinforcement.
   2. ASTM D6163, Grade S – SBS modified bituminous membrane with fiberglass reinforcement.
   3. ASTM D6164, Grade S – SBS modified bituminous membrane with polyester reinforcement.

C. Surface Ply (Cap Sheet) – Provide a fire retardant, mineral granule-surfaced, reinforced modified bituminous membrane from one of the listed manufacturers that will meet the criteria for one of the following standards:
   1. ASTM D6222, Grade G – APP modified bituminous membrane with polyester reinforcement.
   2. ASTM D6223, Grade G – APP modified bituminous membrane with polyester and fiberglass reinforcement.
   3. ASTM D6162, Grade G – SBS modified bituminous membrane with polyester and fiberglass reinforcement.
   4. ASTM D6163, Grade G – SBS modified bituminous membrane with fiberglass reinforcement.
   5. ASTM D6164, Grade G – SBS modified bituminous membrane with polyester reinforcement.

D. Cold-Applied Adhesive – Provide manufacturer’s recommended cold-applied adhesive for field membrane and base flashing applications to be asphalt-based, asbestos-free and VOC compliant, cold-applied adhesive specially formulated for compatibility and use with modified bituminous membrane roofing and flashing. Cold-applied adhesive shall have the following properties:
   1. VOC Emissions: 180 grams per liter, maximum per ASTM D 3960-92.
   2. Flash Point (COC): 110 degrees F, minimum per ASTM D 92.
   3. Solids Content: 80 percent, minimum by weight per ASTM D4479.
   4. Asphalt Content: 50 percent, minimum per ASTM D4479.
   5. Density: 9.0 lb./gallon at 77 degrees F, per ASTM D 70.
   6. Viscosity: 30,000 cps at 77 degrees F, per ASTM D2196.

E. Modified Bitumen Base Flashing (075216.A10): Provide 2-ply base flashing of same field ply and surfacing ply as specified for field of roof, unless otherwise recommended by roofing system manufacturer. For APP membranes, both plies shall be adhered with manufacturer’s cold-applied adhesive with heat-welded seams or by heat welding.
   2. Granule Color: Match surfacing ply color.

F. Modified Bitumen Vertical Wall Flashing (075213.A11): Provide 2-ply base flashing of same field ply and same surfacing ply (cap sheet) as specified for field of roof. For APP membranes, both plies shall be adhered with manufacturer’s cold-applied adhesive with heat-welded seams or by heat welding.
   2. Granule Color: As selected by Architect from manufacturer's full range.
G. **Vertical Sheet Flashing EPDM (075216.A12):** Provide an adhered, EPDM membrane complying with ASTM D 4637, Type I, non-reinforced; including all adhesives, sealants and accessories for proper and watertight installation.
   1. Thickness: 60 mils min, nominal.
   2. Exposed Face Color: White.
   3. Contractor shall use roofing system manufacturer’s seam tape required by to achieve specified guaranty/warranty. EPDM membrane shall have seam tape factory-applied when required by roofing system manufacturer.

2.8 **MISCELLANEOUS MATERIALS AND ACCESSORIES**

A. **Roof Cant Strips (075216.A22) and Preformed Edge Strips (075216.A24):** Asphalt impregnated organic fiber insulation units, factory molded to form 3-1/2” x 3-1/2” x 45 degree cant strips and 1-5/8” x 18” tapered edge strips to receive roofing ply sheet courses and lift edges above main roofing surface.
   1. Wood cant strips and Nailer Strips (075126.A23): Provide wood cant strips, 2” in nominal thickness, where indicated and as required by roofing system manufacturer.
   2. Locations of nailable wood cant strips shall be determined by roofing system manufacturer’s written recommendations. For manufacturers without written recommendations, refer to NRCA’s Roofing Manual for industry standard practice and minimum requirements.

B. **Asphalt Flashing Cement:** Manufacturer’s recommended asbestos-free cement, complying with ASTM D 4586.

C. **Asphalt Primer:** Comply with ASTM D 41.

D. **Vertical Sheet Flashing EPDM (075216.A12):** ASTM D 4637, Type II, uniform, flexible EPDM sheet.
   1. Thickness: 60 mils min, nominal.
   2. Exposed Face Color: Black.
   3. Contractor shall use roofing system manufacturer’s seam tape required by to achieve specified guaranty/warranty. EPDM membrane shall have seam tape factory-applied when required by roofing system manufacturer.

E. **Fasteners:** Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roofing membrane components to substrate; tested by manufacturer for required pullout strength, and acceptable to roofing system manufacturer (these fasteners are used to fasten roofing material to substrate; not to be confused with roof insulation fasteners).

F. **Lead Flashing Sheet (drains):** 30” by 30” square, 4 pound per square foot.

G. **Lead Flashing Sheet (plumbing vents):** 30” by 30” square, 4 pound per square foot.

H. **Walkway Protection Boards (075216.A41):** Mineral-surfaced bituminous membrane manufactured specifically for hot bituminous application on modified bitumen roofing as a protection course for foot traffic.
   2. Granule Color: As selected by Architect from manufacturer’s full range.

I. **Liquid-Applied Flashing (075216.A44):** Provide a catalyzed acrylic resin specialty flashing system, consisting of liquid-applied, fully reinforced, multi-component acrylic membrane installed over a prepared and/or primed substrate. Flashing system shall consist of a primer, basecoat and topcoat, combined with a non-woven polyester fleece. Use of specialty liquid flashing system shall be specifically approved in advance by the membrane manufacturer for each application.
   1. Subject to compliance with requirements, provide liquid flashing from one of the following as acceptable to manufacturer of primary roofing materials:
      a. Garland; PMMA liquid flashing.
      b. Tremco; PMMA liquid flashing.
      c. Johns Manville (JM); PMMA flashing resin.
      d. Performance Roof Systems; "DerbiFlash RS 230" liquid flashing.

J. **Set on Accessories:** Where small roof accessories are set on modified bitumen roofing membrane, roofing cement, and sealants.
PART 3 EXECUTION

3.1 INSPECTION OF SUBSTRATE

A. Roofing Contractor shall examine substrate surfaces to receive modified bitumen roofing system and associated work and conditions under which roofing will be installed. Do not proceed with roofing until unsatisfactory conditions have been corrected in a manner acceptable to the Architect.

B. Examine surfaces for adequate anchorage, foreign materials, moisture and other conditions which would adversely affect roofing application and performance.

C. Examine substrate to ensure roof openings, curbs, pipes sleeves, ducts or vents through roof are solidly set and cant strips and reglets are in place.

D. Examine precast concrete roofing substrates to ensure sealant work between precast units has been completed.

E. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:
   1. Verify that roof openings and penetrations are in place and curbs are set and braced and that roof drain bodies are securely clamped in place.
   2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and nailers match thicknesses of insulation.
   3. Verify that surface plane flatness and fastening of steel roof deck complies with industry standards.

F. Proceed with installation only after unsatisfactory conditions have been corrected.

G. Prepare written documentation of conditions which could be detrimental to completion or performance of specified Work before commencing such Work. Work shall not start until defects have been corrected.

H. Photograph interior and exterior equipment and surrounding areas and after completion of construction which may be misconstrued as damage related to demolition operations. File photographs with owner’s representative.

I. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer’s written instructions. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

C. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

D. Provide temporary barricades and other forms of protection for Owner’s personnel and public from injury due to demolition work.
   1. Protect from damage, existing finish work that is to remain in place and becomes exposed during demolition operations.
   2. Protect against any material or debris dropping into the building, dropping into roof drains and damaging new roof membrane.

3.3 INSTALLATION, GENERAL

A. Cooperate with inspection and test agencies engaged or required to perform services in connection with modified bitumen roofing system installation.
B. Protect other work from spillage of modified bitumen roofing materials, and prevent liquid materials from entering or clogging drains and conductors. Protect lawn areas, building walls and windows and building equipment. Replace/restore other work damaged by installation of roofing system work.

C. Coordinate flow of work, equipment, materials and personnel to eliminate traffic across completed new roofing systems. Provide plywood walkways for the movement of personnel, equipment and materials.

D. Insurance/Code Compliance: Install modified bitumen roofing system and insulations for (and test where required to show) compliance with governing regulations and roofing system performance requirements specified.

E. Cutoffs: At end of each day's roofing installation, protect exposed edge of incomplete work, including ply sheets and insulation. Provide temporary tie off one ply of modified bitumen membrane set in cold adhesive; remove at beginning of next day's work.

F. Roof surfaces shall be thoroughly dry before application of roofing.

G. Roofing Manufacturer’s Inspection: Inspection of roofing shall be made by a responsible representative of the roofing manufacturer during application and after completion.

H. When application of roofing is begun, total roof system shall be completed before end of day and before wet by elements (with exception of cap sheet). Install staggered water cut-off at completion of each day’s work and remove upon resumption of work.
   1. Precautions shall be taken to protect membrane from punctures, refer to Article 2.4 of this Section.

I. Prior to application of roof insulation, seal all joints between precast roof panels and between precast panels and adjacent construction with self-adhering vapor barrier.

J. Prior to application of roof insulation, provide EPDM membrane strip flashing at all joints between precast roof panels. Adhere strip flashing continuously over joint overlapping and adhering to at least 4 inches on each side.

### 3.4 BASE-SHEET INSTALLATION

A. Install lapped base-sheet course (Cementitious Wood Fiber Deck and Gypsum Deck), extending sheet over and terminating beyond cants. Attach base sheet as follows:
   1. Mechanically fasten to substrate. On 4 inch lap, fasten 12 inches on center; field of sheet, fasten two rows 18 inches on center.

B. Install a vented base sheet (Gypsum Concrete Deck) in accordance with roofing system manufacturer's written instructions and recommendations to suit conditions involved.
   1. Extend vented base sheet a minimum of 6 inches above top edge of cant strip. Modified bitumen base sheet shall be extended 4 inches above cant strip (as noted below), leaving 2 inches of vented base sheet exposed behind flashing for venting.

### 3.5 INSULATION AND COVER BOARD INSTALLATION

A. General: Comply with insulation manufacturer's instructions and recommendation for the handling, installation, and bonding or anchorage of insulation to each different type of substrate. Roof insulation and cover board shall be dry when installed and shall be protected from weather. All materials that become wet shall be removed before the end of the day.
   1. Steel Deck Installation: Secure first layer of insulation to metal deck areas indicated on plans using corrosive resistant mechanical fasteners specifically designed and sized for attachment of specified board type insulation to deck type shown. Run long joints of insulation in continuous straight line, perpendicular to roof slope with ends joints staggered at least 12” between rows.
      a. Secure insulation over entire field area of roofing, including corners and perimeters, at spacing as required by FM for Windstorm Resistance Classification specified and per applicable requirements of FM Loss Prevention Data Sheet 1-28.
         1) Mechanically fasten first layer.
      b. Set prefabricated tapered insulation in low-rise foam adhesive and offset joints 12” each way from preceding insulation layer and to provide positive drainage to all exterior gutters and roof drains. Provide saddles at crickets as needed to insure there is no ponded water.
         1) Insulation board gaps shall not exceed 1/4”. Where joints exceed 1/4”, add baseboard to gap.
2) No more insulation shall be applied than can be covered with required membrane specification on the same day.

2. Concrete Deck Installation: Adhere first layer of insulation to concrete deck areas indicated on plans using manufacturer’s recommended adhesive specifically designed and sized for attachment of specified board type insulation to substrate indicated. Run long joints of insulation in continuous straight line, perpendicular to roof slope with ends joints staggered at least 12” between rows.
   a. Secure insulation over entire field area of roofing, including corners and perimeters, at spacing as required by FM for Windstorm Resistance Classification specified and per applicable requirements of FM Loss Prevention Data Sheet 1-28.
   b. Set prefabricated tapered insulation in low-rise foam adhesive and offset joints 12” each way from preceding insulation layer and to provide positive drainage to all exterior gutters and roof drains. Provide saddles at crickets as needed to insure there is no ponded water.
   1) Insulation board gaps shall not exceed 1/4”. Where joints exceed 1/4”, add baseboard to gap.
   2) No more insulation shall be applied than can be covered with required membrane specification on the same day.

3. Cover boards: Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows and stagger joints a minimum of 6” from preceding insulation layer. Loosely butt cover boards together. Adhere cover boards in low rise foam adhesive over entire field area of roofing, including corners and perimeters, at spacing as required by FM for Windstorm Resistance Classification specified and per applicable requirements of FM Loss Prevention Data Sheet 1-28.
   a. Secure insulation over entire field area of roofing, including corners and perimeters, at spacing as required by FM for Windstorm Resistance Classification specified and per applicable requirements of FM Loss Prevention Data Sheet 1-28.

4. Roof cant strips and tapered edge strips shall be provided at junctures of modified bitumen membrane with vertical surface, unless otherwise indicated. Roof cant strips and edge strips must be set in mastic.

5. Wood cant strips shall be mechanically fastened to supporting structure with hot-dip galvanized or stainless steel fasteners.

3.6 ROOFING MEMBRANE INSTALLATION

A. General: Install in strict accordance with roofing manufacturer’s written specifications and recommended details to achieve Guaranty specified.

B. Multiple-Ply, Modified Bituminous Membrane: Install 2 plies of modified bituminous membrane, consisting of one (1) field ply and one (1) surfacing ply, starting at low point of roofing system (for DDL installation, add one additional field ply). Extend field ply to 2” (nominal) above top edge of cant strip and extend surfacing ply 4” (nominal) above top edge of cant strip; terminate in accordance with requirements to manufacturer of primary roofing materials. For DDL, the second field plies shall be heat welded. Set both plies of membrane in asphalt based cold adhesive.
   1. Nail edges of roofing membrane to exterior side of wood blocking at perimeter edges of roof prior to installing metal gravel stops/fascia. Space nails at minimum of 4” on center.
   2. Shingle in direction to shed water.
   3. Accurately align sheets, without stretching, and maintain uniform side and end laps. Stagger end laps a minimum of 18 inches or as required by manufacturer, no header sheets (belly bands) allowed for surface ply. Completely bond and seal laps, leaving no voids.
      a. Repair tears and voids in laps and lapped seams not completely sealed.
   4. Side and end laps shall be heat welded or hot-air welded.
      a. For DDL, side laps shall be a minimum of 4” and end laps shall be a minimum of 6”.

C. Vertical Flashing (075216.A10): Install vertical base flashing in accordance with the roofing system manufacturer’s written instructions and current published details. Install multiple ply flashing consisting of one ply of APP modified bitumen field ply and one ply of modified bitumen surfacing ply at cant strips, other sloping and vertical surfaces. Flashing shall extend a minimum of 8” above roof surface and 6” onto roof surface. Install modified bitumen surface ply portion of vertical flashing system after installing surface membrane.
   1. Heat weld all seams and laps.
   2. Fasten top of base flashing membranes every 8 inches. Three course the top of base flashing and over the fasteners; layer of asphalt mastic, fabric, and second layer of asphalt mastic.

D. Vertical Flashing (EPDM) (075216.A11): Fully adhere EPDM vertical wall flashing in accordance with the roofing system manufacturer’s written instructions and current published details.

E. Horizontal Flashing (metal edge): Install modified bitumen surfacing ply using specified adhesive (no heat welding permitted). Install 12 inches of stripping ply prior to fastening metal edge. Install surfacing membrane over primed metal flanges. Surfacing membrane shall serve as strip in ply for horizontal details if approved by roofing system manufacturer.
3.7 MISCELLANEOUS INSTALLATION REQUIREMENTS

A. Set on Accessories: Where small roof accessories are set on modified bitumen roofing membrane, prime top surface of metal flange, set metal flange in a bed of manufacturer's recommended roofing cement and seal penetration of membrane. The metal flanges that are required to be fastened with a pattern of 3" on-center (O.C.) Staggered using angular or ring shank nails. Use surfacing ply as strip in membrane.

B. Install liquid flashing and fleece reinforcement for roof penetrations according to roofing system manufacture's written instructions.

C. Roof Drains: Install drain sump using tapered edge strip. Set 30-by-30-inch square lead flashing in bed of roofing-manufacturer-approved asphaltic adhesive on completed roofing membrane. Prime surface of lead flashing. Cover lead flashing with roofing membrane cap-sheet stripping and extend a minimum of 4 inches beyond edge of metal flashing onto field of roofing membrane. Clamp roofing membrane, metal flashing, and stripping into roof-drain clamping ring. Install stripping according to roofing system manufacturer's written instructions.

D. Lead Flashing Sheet (plumbing vents): Set 30 by 30 inch square lead flashing in a bed of roofing manufacturer approved asphaltic adhesive on completed membrane. Prime surface of lead flashing. Cover lead flange with roofing membrane cap sheet and extend 4 inches beyond edge of lead flashing onto field of roof membrane. Bend top of lead flashing down into the penetration a minimum of two inches.

E. Roof Pipe Supports: Beneath pipe supports, provide a sacrificial piece of field membrane (cap sheet) permanently adhered to field membrane.

F. Walkway Strips: Install walkway cap sheet strips over roofing membrane using same application method as used for roofing membrane cap sheet.
   1. Install walkway products according to manufacturer's written instructions.
      a. Install flexible walkways at the following locations:
         1) Perimeter of each rooftop unit.
         2) Between each rooftop unit location, creating a continuous path connecting rooftop unit locations.
         3) Between each roof hatch and each rooftop unit location or path connecting rooftop unit locations.
         4) Top and bottom of each roof access ladder.
         5) Between each roof access ladder and each rooftop unit location or path connecting rooftop unit locations.
         6) Locations indicated on Drawings.
         7) As required by roof membrane manufacturer's warranty requirements.
      b. Provide 6-inch clearance between adjoining pads.
      c. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

3.8 PROTECTION OF ROOFING

A. Upon completion of roofing work (including associated work), Installer shall advise Contractor of recommended procedures for surveillance and protection of roofing during remainder of construction period. At end of construction period, or at a time when remaining construction work will in no way affect or endanger roofing (at Contractor's option), Installer shall make a final inspection of roofing and prepare a written report (to Contractor with copy to Owner) describing nature and extent of deterioration or damage found in the work.
   1. Plan work so traffic over new roofing system is kept to a minimum. Where traffic must continue over new roofing system, provide protection for the finished roof.

B. Installer shall repair or replace (as required) deteriorated or defective work found at time of final inspection. Installer shall be engaged by Contractor to repair damages to roofing which occurred subsequent to roofing installation and prior to final inspection. Repair or replace the roofing and associated work to a condition free of damage and deterioration at time of substantial completion.

C. Existing items, structures or areas damaged during course of construction work shall be restored/repairs to a condition equal or better than it was prior to commencement of work.
3.9 CLEANING

A. As work progresses and prior to completion of roofing membrane installation, clean off cold-applied adhesive, asphalt and other asphalt-based mastic spills to prevent discoloration of roofing membrane as recommended by roofing system manufacturer.

B. Clean off footprints tracked onto roofing membrane surface as recommended by roofing system manufacturer.

C. For general cleaning prior to Substantial Completion, power wash as recommended by roofing system manufacturer. Clean all roof areas prior to turning Project over to Owner.

D. Remove all debris and extra materials from roof surface and the project site.

E. Contractor shall be responsible for the cost of roofing system cleanup and, damage to any property and equipment as a result of a leak during roof system installation. If the cleanup is not performed or contracted for immediately, the District (Owner) will perform or contract the cleanup at the Contractor’s expense.

END OF SECTION 075216
PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Adhered TPO membrane roofing system (075423.A01).
   2. Vented Base Sheet (for areas with Concrete Deck) (075423.A05).
   3. Roof insulation (075423.A20) and tapered roof insulation (075423.A21).
   7. All accessories and fasteners needed to complete the roofing systems indicated.

B. Related Sections:
   1. Section 012100 "Allowances" for allowances related to work of this Section.
   2. Section 012200 "Unit Prices" for unit prices effecting the work of this Section.
   3. Section 012300 "Alternates" for those alternates effecting work of this Section.
   4. Section 034100 "Precast Structural Concrete" for precast decking.
   5. Section 053100 "Steel Decking" for steel decking requirements and installation.
   6. Section 061000 "Rough Carpentry" for wood nailers, curbs, and blocking.
   7. Section 072500 "Weather Barriers" for installation requirements involving weather barriers.
   8. Section 072726 "Fluid Applied Air Barriers" for installation requirements involving fluid applied air barriers.
   9. Section 076200 "Sheet Metal Flashing and Trim" for metal roof penetration flashings, flashings, and counterflashings and roof expansion joints.
   10. Section 079200 "Joint Sealants" for joint sealants, joint fillers, and joint preparation.
   11. Division 22 for roof drains.
   12. Division 23 for mechanical equipment and accessory curbs.

C. Products Installed but not Furnished in this Section:
   1. Acoustical insulation strips and mesh spacers for metal acoustical roof deck, refer to Section 053100.

1.2 DEFINITIONS

A. TPO: Thermoplastic polyolefin.


1.3 SYSTEM DESCRIPTIONS

A. Adhered TPO Roofing System (at Steel Decks). Roofing system shall consist of the following components as specified within this Section and related Sections. Components are described in assembly from bottom up to top application.
   1. A base layer of polyisocyanurate roof insulation, mechanically fastened to deck.
   2. Subsequent layer(s) of polyisocyanurate insulation adhered to initial layer of roof insulation.
   3. Cover board, adhered to roof insulation.
   4. TPO Roofing Membrane, adhered to coverboard.

B. Adhered TPO Roofing System (at Precast Deck). Roofing system shall consist of the following components as specified within this Section and related Sections. Components are described in assembly from bottom up to top application.
   1. Polyisocyanurate roof insulation adhered to precast double t's.
   2. Subsequent layer(s) of polyisocyanurate insulation adhered to initial layer of roof insulation.
   3. Cover board, adhered to roof insulation.
   4. TPO Roofing Membrane, adhered to coverboard.
1.4 PREINSTALLATION MEETINGS

A. Preinstallation Roofing Conference: Conduct conference at Project site approximately two weeks prior to scheduled commencement of roofing installation. Conference shall be conducted concurrently with preinstallation conference for sheet metal flashing and trim.

1. Meet with Owner, Architect, Construction Manager, Owner’s insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer’s representative, deck Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment. Record discussions of conference and decisions and agreements (or disagreements) reached, and furnish copy of record to each party attending.

2. Review methods and procedures related to roofing installation, including manufacturer’s written instructions.

3. Review roofing systems requirements (drawings, specifications and other contract documents).

4. Review required submittals, both completed and yet to be completed.

5. Review and finalize construction schedule, and verify availability of materials, Installer’s personnel, equipment, and facilities needed to make progress and avoid delays.

6. Tour representative areas of roof substrates (decks), inspect and discuss condition of substrate, roof drains, curbs, penetrations and other preparatory work performed by other trades. Identify and record items to be corrected prior to commencement of work of this Section.

   a. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.

7. Review structural loading limitations of roof deck during and after roofing.

8. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.

9. Review governing regulations and requirements for insurance and certificates if applicable.

10. Review temporary protection requirements for roofing system during and after installation.

11. Review roof observation and repair procedures after roofing installation.

1.5 ACTION SUBMITTALS

A. Product Data: Manufacturer’s technical product data, installation instructions and recommendations for each type of roofing product required.

1. Include data and certified test reports substantiating that materials comply with requirements.

   a. Submit Underwriter’s Laboratory material and systems approvals.

2. For insulation and roof system component fasteners, include copy of FM Approvals RoofNav listing.

3. Submittals shall be reviewed and accepted by roofing membrane manufacturer’s technical representative with a submittal cover letter stating all products for the roof assembly including roofing membrane, base flashing, and roof insulation are acceptable.

B. Shop Drawings: For roofing system. Include plans, sections, details, and attachments to other work. Indicate dimensions, general construction, specific modifications, component connections, details at adjoining construction and roof top accessories, anchorage methods, hardware and installation procedures; plus the following specific requirements:

1. Indicate base flashing and membrane terminations and, details for perimeter, penetrations, field fabricate curbs and tie-in flashing details.

2. Indicate layout and thicknesses for insulation.

3. Indicate layout, slopes and thicknesses for tapered insulation and crickets.

4. Roof plan showing orientation of each type of roof deck and orientation of membrane roofing and fastening spacings.

5. Insulation sheet layout and fastening patterns for corner, perimeter, and field-of-roof locations to comply with performance requirements specified. If insulation and cover board is adhered with low rise foam adhesive, indicate adhesive ribbons patterns.

6. Shop drawings shall be reviewed and accepted by roofing membrane manufacturer’s technical representative. A shop drawing cover letter shall be submitted by the roofing membrane manufacturer’s technical representative stating all products for the roof assembly including roofing membrane, base flashing and roof insulation are acceptable.

   a. Shop drawings for Section 076200 “Sheet Metal Flashing and Trim” shall be reviewed concurrently with shop drawings for this Section.

C. Samples for Verification: For the following products:

1. Roof membrane and flashing, of color required.
2. Walkway pads or rolls, of color required.

D. Wind Uplift Resistance Submittal: For roofing system indicating compliance with wind uplift performance requirements.

E. Roof Assembly Certification Letters: Manufacturer of primary roof system components shall submit letter certifying that the roofing system will achieve specified warranty, that roofing system components are acceptable and will meet performance requirements specified.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer and manufacturer.

B. Manufacturer Certificates:
      a. Submit evidence of compliance with performance requirements.
   2. Special Warranty Certificate: Signed by roof membrane manufacturer, certifying that all materials supplied under this Section are acceptable for special warranty.

C. Certification of Installer:
   1. Submit written certification from manufacturer of primary roofing materials that roofing contractor is capable of providing warranty for specified duration.

D. Research/Evaluation Reports: For components of membrane roofing system, from the ICC-ES.

E. Field Test Reports:
   1. Concrete internal relative humidity test reports.

F. Field quality-control reports.

G. Sample Warranties: Sample of manufacturer's special warranty applications.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing system to include in maintenance manuals.

1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is listed in SPRI's Directory of Roof Assemblies approved for membrane roofing system identical to that specified for this Project.

B. Installer Qualifications: The Roofing Contractor shall perform the work of this Section; and shall be a firm with not less than seven (7) years of successful experience in installation of TPO roofing systems similar to those required for this project.
   1. Roofing Contractor shall be a qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.
   2. Contractor must be a member of NRCA or one of its affiliates.
   3. Roofing Contractor must have successfully completed 4 projects of comparable scale within the past two years using the specified system.
   4. Installer Certification: Obtain written certification from manufacturer of roofing system certifying that Installer is approved by manufacturer for installation of specified roofing system. Provide copy of certification to Architect prior to award of roofing work.
   5. Installer’s Field Supervision: Require Installer to maintain a full-time supervisor/foreman who is on jobsite during times that roofing work is in progress and who is experienced in installation of roofing systems similar to type and scope required for this Project.
   6. All roofing shall be installed by employees of the installer; contract labor is not allowed.
C. Pre-application Roofing Conference: Approximately two weeks prior to scheduled commencement of modified bitumen roofing installation and associated work, the Contractor shall conduct a meeting at Project site with Roofing Contractor, roofing membrane manufacturer’s technical representative, Installer of each component of associated work, installer of rooftop units and other work in and around roofing which must precede or follow roofing work (including mechanical work), Architect if requested, roofing system manufacturer’s technical representative third party inspection agency representative, and other representatives directly concerned with performance of the work. Contractor to record discussions of conference and decisions and agreements (or disagreements) reached, and furnish copy of record to each party attending. Review foreseeable methods and procedures related to roofing work, including but not necessarily limited to the following:

1. Tour representative areas of roof substrates (decks), inspect and discuss condition of substrate, roof drains, curbs, penetrations and other preparatory work performed by other trades. Identify and record items to be corrected prior to commencement of work of this Section.
2. Review roofing systems requirements (drawings, specifications and other contract documents).
3. Review required submittals (all required submittals shall be completed prior to pre-application roofing conference).
4. Review and finalize construction schedule related to roofing work and verify availability of materials, Installer’s personnel, equipment and facilities needed to make progress and avoid delays.
5. Review required inspection, testing, certifying and material usage accounting procedures.
6. Review weather and forecasted weather conditions, and procedures for coping with unfavorable conditions, including possibility of temporary roofing (if not a mandatory requirement.)
7. Review temporary protection requirements for roofing system during and after installation.
8. Review governing regulations and requirements for insurance and certificates.
9. Roofing work will not be allowed to commence until submittals (or other language) phase has been completed.

D. Insurance Certification: Assist the Owner in preparation and submittal of roof installation certification as may be necessary with fire and extended coverage insurance on roofing and associated work.

E. UL Listing: Provide TPO roofing system materials which have been tested for application and slopes indicated and are listed by Underwriter’s Laboratories, Inc. (UL) for external fire exposure class specified.

1. Provide roof covering materials bearing Classification Marking (UL) on bundle, package, or container indicating that materials have been produced under UL’s Classification and Follow-up Service.
2. Provide roof insulation approved in writing by roof system manufacturer as acceptable substrate for this project.
3. Provide roofing system that can be installed to comply with UL 790 requirements specified for resistance to external fire.

F. Product/Material Qualifications:

1. Components of the roofing system shall be manufactured or approved by the roofing system manufacturer to comply with warranty and construction class requirements.
2. Fastener corrosion resistance shall be in accordance with FM Standard 4470.

G. Third Party Inspection: The Owner may employ a “Third Party Inspector” to observe the work of this Section. Presence of this Inspector is for Owner’s interest and any information or assistance furnished by the Inspector shall not relieve the Roofing Contractor of responsibilities for the work. Contractor shall provide reasonable notification (not less than 48 hours) whenever work is being done to arrange for Inspector’s observations.

1.9 FIELD QUALITY CONTROL

A. Field Audits: Roof membrane manufacturer’s technical representative shall perform in progress site audits and review completed contractor’s quality control forms, prepare and submit reports to roofing contractor and owner’s representative. Site audits include first day of construction and a site audit for every two weeks of construction.

B. Quality Control Form:

1. Contractor to complete daily quality control form provided by the roofing membrane manufacturer which is included in the documents. Contractor is to note on provided roof plan areas of daily construction. Completed forms are to be submitted with warranty completion notice.

C. Final Roof Inspection: As a part of the roofing membrane manufacturer’s standard warranty, arrange for roof membrane manufacturer’s technical representative.

1. Notify Architect and Owner 48 hours in advance of date and time of inspection.
D. Roofing system will be considered defective if it does not pass tests and inspections.
   1. Additional testing and inspecting, at Contractor’s expense will be performed to determine if replaced or additional work complies with specified requirements.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
   1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.
   1. Where heavy loads are placed upon or transported over decking and where materials are repeatedly landed, provide temporary planking or plywood to distribute imposed loads.

E. Comply with fire and safety regulations.

1.11 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

B. Protect installed roofing system from damage.

1.12 WARRANTY

A. Installer's Special Project Warranty: Submit two (2) executed copies of MRCA Roofing Contractor Materials and Workmanship Warranty; current Form, for a period of two (2) years, covering work of this Section including roof membrane, composition flashing, roof insulation, fasteners, walkway pads and roofing accessories, all stated on face of Warranty, signed and counter signed by Installer (Roofer) and Contractor.

B. Manufacturer’s Warranty: Submit executed copy of roofing manufacturer’s “Full Systems – No Dollar Limit” material and workmanship warranty. Submission shall include a written a description of specified services as noted below and shall be endorsed by the Manufacturer’s Technical Director. Warranty shall be from the decking up, including roofing system, and metal flashing endorsement signed by authorized representative of roofing system manufacture, on form which was published with product literature as of date of contract documents, for the following period of time:
   1. Twenty (20) years, "No Dollar Limit" from date of Substantial Completion. This warranty shall include the following:
      a. Membrane roofing, base flashings, roof insulation, fasteners, cover boards, and other components of membrane roofing system.
      b. Liquid flashing for strip in flashing and pourable sealer pockets and other applications.
   2. Manufacturer shall provide the warranty inspection of the roofing system.
   3. Manufacturer shall provide a two-year re-inspection of the roofing system at no cost to the Owner.

C. Existing Warranted Roofs: At locations where the existing roof is currently under warranty, all work performed shall be verified by all parties involved in the original warranty and coordinated so that work performed will preserve existing warranty.
PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain components including roof insulation for membrane roofing system or approved by membrane roofing manufacturer. Secondary components shall be from a manufacturer approved by membrane roofing manufacturer.

B. 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. Carlisle SynTec Incorporated.
   2. Elevate (formerly Firestone Building Products).
   4. Soprema.

2.2 PERFORMANCE REQUIREMENTS

A. General Performance: Installed membrane roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Membrane roofing and base flashings shall remain watertight.
   1. Accelerated Weathering: Roofing system shall withstand 2000 hours of exposure when tested according to ASTM G 152, ASTM G 154, or ASTM G 155.
   2. Impact Resistance: Roofing system shall resist impact damage when tested according to ASTM D 3746 or ASTM D 4272.

B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by membrane roofing manufacturer based on testing and field experience.

C. Wind Uplift Resistance: Design and install roofing system to resist the wind uplift pressures set forth on Structural Drawings when tested according to FM Approvals 4474, UL 580, or UL 1897.

D. SPRI's Directory of Roof Assemblies Listing: Roof membrane, base flashings, and component materials shall comply with requirements in FM Approvals 4450 or FM Approvals 4470 as part of a roofing system, and shall be listed in SPRI's Directory of Roof Assemblies for roof assembly identical for that specified for this Project.

E. Solar Reflectance Index: Not less than 80 when calculated according to ASTM E 1980, based on testing identical products by a qualified testing agency.

F. Energy Star Listing: Roofing system shall be listed on the DOE's ENERGY STAR "Roof Products Qualified Product List" for low-slope roof products.

G. Energy Performance: Roofing system shall have an initial solar reflectance index of not less than 0.76 and an emissivity of not less than 0.90 when tested according to CRRC-1.

H. Exterior Fire-Test Exposure: ASTM E 108 or UL 790, Class A; for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

I. Fire-Resistance Ratings: Comply with fire-resistance-rated assembly designs indicated. Identify products with appropriate markings of applicable testing agency.
   1. Underwriter’s Laboratories, Inc. (UL); roof covering shall meet external fire exposure Class A material rating.

J. FM Approvals Listing and Performance: Project is not insured by FM Global, however materials and components shall meet FM "approvals" requirements. Provide membrane roofing, base flashings, and component materials that comply with requirements in FM Approvals 4450 and FM Approvals 4470 as part of a membrane roofing system, and that are listed in FM Approvals' "RoofNav" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals markings.
   1. Fire/Windstorm Classification: Class 1-90.

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2.3 TPO MEMBRANE ROOFING

   1. Source Limitations: Obtain components for roofing system from roof membrane manufacturer or manufacturers approved by roof membrane manufacturer.
   2. Thickness: 60 mils, minimum.
   3. Exposed Face Color: As selected by Architect from manufacturer’s standard options.

   1. Source Limitations: Obtain components for roofing system from roof membrane manufacturer or manufacturers approved by roof membrane manufacturer.
   3. Exposed Face Color: As selected by Architect from manufacturer’s standard options.

2.4 AUXILIARY MEMBRANE ROOFING MATERIALS

A. General: Auxiliary roofing materials recommended by roofing system manufacturer for intended use, and compatible with membrane roofing and other roofing components.
   1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.

B. Base/SHEET Flashing (075423.A10): As recommended by roof membrane manufacturer.


D. Sheet Flashing (075423.A14): Manufacturer’s standard unreinforced thermoplastic polyolefin sheet flashing, 55 mils thick, minimum, of same color as sheet membrane.

E. Prefabricated Pipe Flashings (075423.A14): As recommended by roof membrane manufacturer.

F. Slip Sheet: Same as field membrane. Provide beneath each splash block. Cut to extend 2 inches past both sides and both ends of splash block.

G. Liquid Flashing (075423.A44): Manufacturer’s standard reinforced liquid flashing system, same color as sheet membrane.

H. Bonding Adhesive: Manufacturer’s standard.

I. Metal Termination Bars (075423.A40): Manufacturer’s standard, predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.

J. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening membrane to substrate, and acceptable to TPO roofing manufacturer.

K. Premanufactured Pourable Sealer Pockets (075423.A45): A pre-fabricated interlocking pourable sealer pocket system filled with fast setting, solvent free, multi-use waterproof sealer. Prefabricated pockets connect with tongue and groove joints and are composed of high strength, flexible polyurethane elastomer. Pieces join together to create pockets of varying sizes.
   1. Basis-of-Design product: “Lockin’ Pocket Interlocking Pitch Pocket System” by Weather-Tite
   2. Product Characteristics:
      a. Pocket and Sealer Color: Black.
      b. Height: 4 inches tall above field of roof.
      c. Warranty: Not less than 24 months.
   3. Prepare Substrates and install pourable sealer pockets in accordance with manufacturer’s written instructions to accommodate substrates involved.

L. Miscellaneous Accessories: Provide pourable sealer pockets, pourable sealer, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories as indicated and as necessary for a complete, proper and watertight roofing system.
1. Provide flashing accessories of same color as roofing membrane when possible.
2. Provide all pre-manufactured accessories as required by roofing system manufacturer to achieve warranty/guarantee specified.

2.5 BASE SHEET MATERIALS

A. Base Sheet Fastener: 1.4-inch twin lock fastener.
B. Vented Base Sheet (Concrete Deck) (075419.A05): ASTM 4897, Type II, venting, non-perforated, heavyweight, asphalt-impregnated and –coated, glass-fiber base sheet with coarse granular surfacing or embossed venting channels on bottom surface.

2.6 ROOF INSULATION

A. General: If one of the approved roof insulation systems is provided that alters the system thickness from that specified, Contractor is responsible for any additional cost to add additional courses of cut brick or changes in wood blocking, flashing, gravel, guards, etc.
1. Provide preformed roof insulation boards manufactured or approved by roof membrane manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated, and approved for use in roof assemblies specified.
B. Insulation Products: Acceptable products must be approved by the roofing system manufacturer.
1. Approved insulation meeting requirements specified for Class A for fire resistance.
2. Approved insulation meeting wind uplift resistance requirements specified.
C. Polyisocyanurate Board Insulation (075423.A20): ASTM C 1289, Type II, Class 1, Grade 2, felt or glass-fiber mat facer on both major surfaces.
1. Provide insulation in at least two layers, with the first layer 1-1/2 inches thick.
2. Mechanically fastened first layer to deck to meet wind uplift requirements specified. All subsequent layers shall be installed with adhesive to meet wind uplift requirements.
   a. Note: At areas where vapor retarder occurs, adhere first layer of insulation in lieu of mechanically fastening.
3. Total thickness of insulation shall not be less than 5-1/2 inches. Thickness at roof drains shall be 1-1/2 inches, minimum.
4. First layer of insulation shall provide a minimum aged R-value of 8.6 (for 1-1/2 inch thickness).
5. Second layer of insulation shall be 4.0 inches thick and provide a minimum aged R-value of 23.6.
6. Total aged R-value for roof insulation shall not be less than R-30.
D. Tapered Polyisocyanurate Insulation (075423.A21): Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches, and ½ inch per 12 inches at crickets and saddles, unless otherwise indicated.
E. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

2.7 INSULATION ACCESSORIES

A. General: Furnish roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with membrane roofing.
B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer.
C. Full-Spread Applied Insulation Adhesive: Insulation manufacturer's recommended spray-applied, low-rise, two-component urethane adhesive formulated to attach roof insulation to substrate or to another insulation layer.
2.8 ASPHALT MATERIALS

A. Asphalt Primer: ASTM D 41.

2.9 WALKWAYS

   1. Size: Approximately 39 by 60 inches.
   2. Color: Light Gray or as selected by Architect.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:
   1. Verify that roof openings and penetrations are in place and curbs are set and braced and that roof drain bodies are securely clamped in place.
   2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
   3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Section 053100 "Steel Decking."
   4. Where concrete and precast concrete decks occur, perform the following:
      a. Verify that minimum concrete drying period recommended by roofing system manufacturer has passed.
      b. Verify that concrete substrate is visibly dry and free of moisture, and that minimum concrete internal relative humidity is not more than 75 percent, or as recommended by roofing system manufacturer, when tested according to ASTM F 2170.
         1) Test Frequency: One test probe per each 500 sq. ft., or portion thereof, of roof deck, with no fewer than three test probes.
         2) Submit test reports within 24 hours of performing tests.
      c. Verify that concrete curing compounds that will impair adhesion of roofing components to roof deck have been removed.
      d. Verify that joints in precast concrete roof decks have been grouted flush with top of concrete.
   B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

C. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

D. Provide temporary barricades and other forms of protection for Owner's personnel and public from injury due to demolition work.
   1. Protect from damage, existing finish work that is to remain in place and becomes exposed during demolition operations.
   2. Protect against any material or debris dropping into the building or damaging new roof membrane.
3.3 ROOFING INSTALLATION, GENERAL

A. Install roofing system according to roofing system manufacturer's written instructions and to meet performance requirements specified.

B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

C. Coordinate installation and transition of roofing system component serving as an air barrier with air barrier specified under Section 072726 "Fluid-Applied Air Barrier Coatings."

D. Cooperate with inspection and test agencies engaged or required to perform services in connection with roofing system installation.

E. Protect other work from spillage of roofing materials, and prevent liquid materials from entering or clogging drains and conductors. Protect lawn areas, building walls and windows and building equipment. Replace/restore other work damaged by installation of roofing system work.

F. Cutoffs: At end of each day's roofing installation, protect exposed edge of incomplete work, including insulation. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Provide temporary tie-off and remove tie-off at beginning work on adjoining roofing.

G. Coordinate flow of work, equipment, materials and personnel to eliminate traffic across completed new roofing systems. Provide plywood walkways for the movement of personnel, equipment and materials.

H. Roof surfaces shall be thoroughly dry before application of roofing.

I. Install roofing and auxiliary materials to tie into existing roofing to maintain weathertightness of transition and to not void warranty for existing roofing system.

J. Roofing Manufacturer's Inspection: Inspection of roofing shall be made by a responsible representative of the roofing manufacturer during application and after completion.

K. When application of roofing is begun, total roof system shall be completed before end of day and before wet by elements. Install water cut-off at completion of each day's work and remove upon resumption of work. Precautions shall be taken to protect membrane from punctures.

3.4 BASE SHEET INSTALLATION

A. Install a vented base sheet (Concrete Deck) in accordance with roofing system manufacturer's written instructions and recommendations to suit conditions involved.
   1. Extend vented base sheet a minimum of 6 inches above top edge of cant strip. Modified bitumen base sheet shall be extended 4 inches above cant strip (as noted below), leaving 2 inches of vented base sheet exposed behind flashing for venting.

3.5 INSULATION INSTALLATION

A. Installation of Acoustical Insulation and Mesh Spacers for Acoustical Roof Deck:
   1. Prior to placement of acoustical insulation strips and mesh spacers, clean perforated pan of acoustical deck of all debris, grease, oil, water and other foreign matter.
      a. Acoustical insulation strips shall be dry before installation of overlying roof materials.
   2. Place mesh spacers in the perforated pan area of the acoustical deck between the dovetail-shaped ribs. Spacers shall be butt together to form continuous runs.
   3. Place strips of acoustical insulation over mesh spacers in pans between ribs. Tightly butt insulation together to form continuous runs.

B. Comply with membrane roofing system and insulation manufacturer's written instructions for installing roof insulation and as follows:
1. Coordinate installing membrane roofing system components so insulation is not exposed to precipitation or
left exposed at the end of the workday.
2. Install tapered insulation under area of roofing to conform to slopes indicated.
3. Install insulation under area of roofing to achieve required thickness.
4. At concrete decks and decks where vapor retarder is specified, adhere first layer of insulation in place.

C. Installation Over Metal Decking:
1. Install base layer of insulation with joints staggered not less than 24 inches in adjacent rows and with long
joints continuous at right angle to flutes of decking.
   a. Locate end joints over crests of decking.
   b. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping
      roof decks.
   c. Make joints between adjacent insulation boards not more than 1/4 inch in width.
   d. At internal roof drains, slope insulation to create a square drain sump with each side equal to the
diameter of the drain bowl plus 24 inches.
      1) Trim insulation so that water flow is unrestricted.
   e. Fill gaps exceeding 1/4 inch with insulation.
   f. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
   g. Mechanically attach base layer of insulation using mechanical fasteners specifically designed and
      sized for fastening specified board-type roof insulation to metal decks.
      1) Fasten insulation according to requirements in FM Approvals' RoofNav for specified Windstorm
         Resistance Classification.
      2) Fasten insulation to resist specified uplift pressure at corners, perimeter, and field of roof.
2. Install upper layers of insulation and tapered insulation with joints of each layer offset not less than 12
inches from previous layer of insulation.
   a. Staggered end joints within each layer not less than 24 inches in adjacent rows.
   b. Install with long joints continuous and with end joints staggered not less than 12 inches in adjacent
      rows.
   c. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping
      roof decks.
   d. Make joints between adjacent insulation boards not more than 1/4 inch in width.
   e. At internal roof drains, slope insulation to create a square drain sump with each side equal to the
diameter of the drain bowl plus 24 inches.
   f. Trim surface of insulation where necessary and at roof drains so completed surface is flush and does
      not restrict flow of water.
   g. Create insulation sumps at through-gravelstop scuppers, as indicated.
   h. Fill gaps exceeding 1/4 inch with insulation.
   i. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
   j. Adhere each layer of insulation to substrate using low-rise foam adhesive to meet wind uplift
      performance requirements specified and as follows:
         1) Set each layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly
            pressing and maintaining insulation in place.

D. Installation Over Concrete Decks:
1. Install base layer of insulation with joints staggered not less than 24 inches in adjacent rows.
   a. Make joints between adjacent insulation boards not more than 1/4 inch in width.
   b. Internal roof drains, slope insulation to create a square drain sump with each side equal to the
diameter of the drain bowl plus 24 inches.
      1) Trim insulation so that water flow is unrestricted.
   c. Fill gaps exceeding 1/4 inch with insulation.
   d. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
   e. Adhere each layer of insulation to substrate using low-rise foam adhesive to meet wind uplift
      performance requirements specified and as follows:
         1) Set each layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly
            pressing and maintaining insulation in place.
2. Install upper layers of insulation and tapered insulation with joints of each layer offset not less than 12
inches from previous layer of insulation.
   a. Staggered end joints within each layer not less than 24 inches in adjacent rows.
   b. Install with long joints continuous and with end joints staggered not less than 12 inches in adjacent
      rows.
   c. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping
      roof decks.
3.6 INSTALLATION OF COVER BOARDS

A. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches in each direction.
   1. Loosely butt cover boards together.
   2. Trim cover board neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
   3. At internal roof drains, conform to slope of drain sump.
      a. Trim cover board so that water flow is unrestricted.
   4. Cut and fit cover board tight to nailers, projections, and penetrations.
   5. Adhere cover board to substrate using adhesive to meet wind uplift performance requirements specified and as follows:
      a. Set cover board in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.

B. Exposed Insulation Fasteners: Following installation of roofing system above the multi-use room and gymnasiums, trim all mechanical fasteners exposed on underside of metal roof deck. Trim fasteners with wire or bolt cutters, do not break off. Leave a minimum of 3/4" and a maximum of 7/8" exposed while still maintaining pullout resistance to achieve wind uplift resistance specified.
   1. The decks in the multi-use room and gymnasium are the acoustical decks. Fasteners shall be located within the ribs and not at the pans, therefore, eliminating the need to trim fasteners. However, should any fasteners penetrate the pans, they shall be trimmed to leave 3/4" to 7/8" of the fastener penetrating through the deck to maintain FM pullout resistance.

3.7 ADHERED MEMBRANE ROOFING INSTALLATION

A. Adhere membrane roofing over area to receive roofing and install according to membrane roofing system manufacturer's written instructions.

B. Start installation of membrane roofing in presence of membrane roofing system manufacturer's technical personnel.

C. Accurately align membrane roofing and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

D. Bonding Adhesive: Apply to substrate and underside of membrane roofing at rate required by manufacturer and allow to partially dry before installing membrane roofing. Do not apply to splice area of membrane roofing.

E. In addition to adhering, mechanically fasten roofing securely at terminations, penetrations, and perimeters.

F. Apply membrane roofing with side laps shingled with slope of roof deck where possible.

G. Seams: Clean seam areas, overlap membrane roofing, and hot-air weld side and end laps of membrane roofing and sheet flashings according to manufacturer's written instructions to ensure a watertight seam installation.
   1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of sheet membrane.
   2. Verify field strength of seams a minimum of twice daily and repair seam sample areas.
   3. Repair tears, voids, and lapped seams in roofing that does not comply with requirements.
H. Spread sealant bed over deck drain flange at roof drains and securely seal membrane roofing in place with clamping ring.

3.8 BASE FLASHING INSTALLATION

A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to membrane roofing system manufacturer's written instructions.

B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply to seam area of flashing.

C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.

D. Clean seam areas, overlap, and firmly roll sheet flashings into the adhesive. Hot-air weld side and end laps to ensure a watertight seam installation.

E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.9 WALKWAY INSTALLATION

A. Flexible Walkways: Install walkway products according to manufacturer's written instructions.

1. Install flexible walkways at the following locations:
   a. Perimeter of each rooftop unit.
   b. Between each rooftop unit location, creating a continuous path connecting rooftop unit locations.
   c. Between each roof hatch and each rooftop unit location or path connecting rooftop unit locations.
   d. Top and bottom of each roof access ladder.
   e. Between each roof access ladder and each rooftop unit location or path connecting rooftop unit locations.
   f. Locations indicated on Drawings.
   g. As required by roof membrane manufacturer's warranty requirements.

2. Provide 6-inch clearance between adjoining pads.

3. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

3.10 FIELD QUALITY CONTROL

A. Testing Agency: Owner may engage a qualified testing agency to inspect substrate conditions, surface preparation, roof membrane application, sheet flashings, protection, and drainage components, and to furnish reports to Architect.

B. Owner will engage a qualified testing agency to perform the following tests:

1. Infrared Thermography: Testing agency shall survey entire roof area using infrared color thermography according to ASTM C 1153.
   a. Perform tests before overlying construction is placed.
   b. After infrared scan, locate specific areas of leaks by electrical capacitance/impedance testing or nuclear hydrogen detection tests.
   c. After testing, repair leaks, repeat tests, and make further repairs until roofing and flashing installations are watertight.
      1) Cost of retesting is Contractor's responsibility.
   d. Testing agency shall prepare survey report of initial scan indicating locations of entrapped moisture, if any.

C. Project Startup Inspection: Arrange and coordinate for roofing system manufacturer's technical personnel to inspect project on the first or second day of roof construction.

D. Interim Roof Inspections: Arrange and coordinate for roofing system manufacturer's technical personnel to inspect project once per every two weeks of roof construction, minimum.
E. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.
   1. Notify Architect 72 hours in advance of final roof inspection.

F. Repair or remove and replace components of membrane roofing system where inspections indicate that they do not comply with specified requirements.

G. Roofing system will be considered defective if it does not pass tests and inspections.
   1. Additional inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.11 PROTECTING AND CLEANING

A. Clean all roof areas prior to turning Project over to Owner.

B. Protect membrane roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

C. Correct deficiencies in or remove membrane roofing system that does not comply with requirements; repair substrates; and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.
   1. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 075423 075423
SECTION 116143 - STAGE CURTAINS

PART 1 - GENERAL

1.1 REQUIREMENTS

A. As set forth in the headings of Division 0 and Division 1, General Conditions and General Requirements shall apply to this branch of the Work.

1.2 SUMMARY

A. This section includes the fabrication, furnishing, delivery and installation of the following stage equipment:
   1. Acceptable Manufacturers
   2. Dead Hung Stage Rigging
   3. Stage Curtains and Tracks

1.3 SUBMITTALS

A. Comply with the requirements of Liberty School District and submit listed action submittals in accordance with contract conditions.

B. Product Data: Submit manufacturer's material specifications with quantities on bill of materials and installation instructions. Include instruction for handling, storage, protection, and maintenance.

C. Shop Drawings: Show system layouts, electrical requirements, construction methods, material types and thicknesses, hardware and fittings.

D. Submittals: Show equipment, and complete bill of materials. Cut sheets will not be considered submittals and will be returned unread.

E. Samples: If requested, submit samples of any equipment, hardware, fabric or finishes.

1.4 QUALITY ASSURANCE

A. Theatrical Rigging Contractor: All items of work included in this specification shall be furnished and installed by experienced stage technicians in the employ of a single contractor so that there will be no division of responsibility for the proper operation of the equipment after installation.
   1. Each Theatrical Contractor must furnish a written listing of at least five installations that are equal to or surpass the scope of this project and that have been installed within the last five years.

B. The contractor shall employ an Entertainment Technician Certification Program (ETCP) Certified Theatre Rigger. The Certified Theatre Rigger shall be either the project manager or site foreman and be responsible for the overall project including the layout, inspection and training.
   1. A copy of the Certified Theatre Rigger's credentials shall be included with the bid documents.

1.5 DELIVERY, STORAGE AND HANDLING

A. Coordinate storage of all equipment, hardware, and accessories with owner to assure that storage does not inhibit the work of other contractors.

B. The Theatrical Contractor shall be responsible for the handling of all equipment, hardware and accessories, including unloading and transport to the designated storage area.

C. Deliver all hardware components and equipment and their accessories to the job site no sooner than two weeks prior to their installation in order to limit possible damage to the equipment while being stored.
   1. Deliver materials in manufacturer's original undamaged containers with identification labels intact.
   2. Remove packaging materials from site and dispose of at appropriate recycling facilities

D. Deliver curtains to the job site no sooner than two days prior to installation to prevent damage while being stored.

1.6 SCOPE

A. The theatre rigging contractor will be responsible for installing all of the new theatrical rigging and curtain equipment outlined in this specification. All dimensions must be field-verified by the theatrical rigging contractor. Field
conditions which may not be covered in the specifications, shall determine actual equipment needs. The intention of
the specification and drawings is to furnish and safely install new equipment and components that conform to
building conditions and the intent of the bid documents. Install unistrut where needed to support all new rigging.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. It is the intention of this specification to provide a fully functioning dead hung stage rigging system. Actual
equipment and components must reflect building conditions and approved shop drawings. All dimensions must be
field-verified by the theatrical rigging contractor. Conditions detailed in the drawings, which may not be covered in
the specifications, shall determine actual equipment needs.

B. The curtain track equipment shall be manufactured by one of the following:
   1. Automatic Devices Company
   2. Tru-Roll- Theatrical Rigging & Hardware

E. Requests for substitution of other components shall include pertinent performance data; charts and drawings
   showing in what respect the system will function in accordance with the specifications. This information shall be
   mandatory as a basis for determining the intent in meeting the full requirements of the specification including time
   schedule.

F. If required by the Owner, provide working samples of substitute equipment, including all necessary accessories, to
   be delivered as requested for the examination by the Consultant. Handling, shipping, delivery or removal of the
   samples shall be at the cost of the manufacturer. Substitutions will be accepted only by written addendum prior to
   the bid date.

G. It shall be understood that the cost of any additions or revisions required by the use of substitute equipment shall be
   the responsibility of the bidder making the substitution

2.2 DEAD HUNG STAGE RIGGING

A. Provide dead hung tracks. Refer to "TH" drawings for reference.
   1. Provide Two (2) dead hung tracks:
      a. Provide and install lightweight framing (Unistrut or similar) to overhead structure as needed to
         support new dead hung tracks.

B. Fabricate, deliver and install in accordance with the following specification schedules.

C. Properly adjust and trim all sets as indicated on “TH” drawings and the Rigging Schedule.

D. All dead hung tracks will be hung with ¼" 7 X 19 galvanized aircraft cable or 3/16 " proof coil chain. Hanging points
   will be a maximum of 10' 0" on center. All cable termination points shall be finished with ¼" thimbles and a copper
   nicopress sleeve. On the pipe end of the cable a 30" trim chain fabricated from 3/16" proof coil chain. Swage one
   end of the chain into the cable eye, wrap around batten 1 ½ times and secure back to the eye of the cable using a
   1/4" trade size Screw Pin Shackles (with safety wire), leaving approximately 4" of chain for adjustment. The rigging
   may only be attached to the support steel overhead. Provide all hardware as required to attach to or wrap around
   the overhead supports. Any materials required to bridle or span between structural members is the responsibility of
   the theatrical rigging contractor. Properly adjust and trim all sets, tracks, and curtains.

E. All cables, fittings, sleeves and clips shall conform to the wire rope manufacturer's recommendations as to size,
   number and method of installation.
   1. Provide a “Go-No Go Gauge” that conforms to the Compression tool at time of commissioning for consultant
      use.

F. Remove all debris from the site. Leave floors broom clean

2.3 STAGE CURTAINS AND TRACKS

A. Fabricate, deliver and install stage draperies, curtains and tracks in accordance with the following specification
   schedules. Refer to “TH” drawings for reference.

B. Properly adjust and trim all sets, tracks, draperies and curtains.
C. Flame Retardant: All synthetic fabrics utilized for the curtains hereafter specified shall be inherently flame retardant to conform to all applicable building and safety codes. The specified synthetic velours shall be inherently flame retardant to the extent that the curtain will withstand cleanings without being affected. Prior to final approval, the Rigging Contractor shall provide two original signed and notarized, flameproofing certificates stating the process used, the method of Flame Retardant utilized, the fabric, the color and the yardage. All certificates shall be originated by the firm having done the flameproofing and not by the Theatrical Rigging Contractor.

D. Materials provided:
1. Forestage (Grand Drapery, Grand Valance), Color to be selected by Architect shall be manufactured using one of the following fabrics, or approved equal.
   a. 62” Da Vinci Velvet Plus synthetic velour, 21 ounces per linear yard as manufactured by Dazian.
   c. Rose Brand: Encore synthetic velour, 22 ounces per linear yard, 64” wide.
   d. Approved equal.
   a. 62” Milano Velvet Plus synthetic velour, 16 ounces per linear yard as manufactured by Dazian.
   b. Fred Krieger Fabric: Prism synthetic velour, 14 ounces per linear yard, 62” wide.
   c. Rose Brand: Encore synthetic velour, 15 ounces per linear yard, 64” wide.
   d. Approved equal.
3. Curtain tracks and hardware,
   a. Automatic Devices Company,
   b. Tru-Roll,

E. Fabrication of all panels shall be a single piece for the entire height of the curtain. No splicing of fabric to achieve a desired length will be acceptable.

F. The thread shall be the Tex 40 spun polyester for the synthetic fabric curtains and shall be the color of the fabric on which it is used, both in the needle and in the bobbin. The thread shall not be lighter than #16 in size.

G. Bad stitching, missed stitching, puckered seams, hems, etc., shall not be acceptable. All seams shall be sewn in straight and even lines.

H. Forestage Grand Drapery shall be fabricated with 50% sewn in fullness with box pleats every 12” on center. The top shall have 3” poly webbing double stitched to the back. It shall have #3 brass grommets at the center of each pleat, placed 1” from the top. A CCF-2 fastener shall be used at every grommet to attach curtain to the track. The sides shall be finished with a 1’ 0” turned back hem. The bottom shall finish with a 6” hem, weighted with #8 plated jack chain the entire length.

I. Masking curtains shall be fabricated to finish with 25% sewn in fullness with box pleats, 12” on center. The top shall have 3” poly webbing double stitched to the back. It shall have #3 brass grommets at the center of each pleat, placed 1” from the top. The sides shall finish with a 3” turned back hem. The bottom shall finish with a 4” hem which shall contain #8 plated jack chain the entire length of the curtain.

J. Provide the following Curtains and Track Schedule:
1. Provide One (1), Forestage (Grand Drapery) finished in One (1) section total. Finish One (1) section 27’0” wide x 14’4” high, 50% fullness, Encore velour, color to be determined by the Architect. Installed on ADC #114 curtain track, 34’4” in length. Provide all the necessary hardware for one-way draw and an adjustable 5” floor pulley. Install at location as shown on the TH 100 drawings.
2. Provide Three (3) masking legs. Finish each section 10’0” wide x 14’4” high, 25% fullness, Encore velour, color black. Provide and install on ADC #114 with three (3) 90 degree 48” radius and one (1) 180 degree 18” radius. Complete with all necessary hardware for walk along operation. Track length is 65’3” as indicated on TH 100 drawing.
3. Provide Four (4) masking legs. Finish each section 6’0” wide x 14’4” high, 25% fullness, Encore velour, color black. Complete with all necessary hardware for walk along operation. Install on walk along track as describe above.

Q. Upon completion of the installation, clean the fabric of all dust, lint and loose threads. Adjust for proper fit and operation.

PART 3 - EXECUTION

3.1 PREPARATION
A. Inspect the areas and conditions where theatrical equipment will be installed. Notify the architect of any conditions that would adversely affect the installation or subsequent utilization of the equipment. Do not proceed with the installation until unsatisfactory conditions are corrected.
   1. Coordinate work and work schedule with related work in other sections. Provide items to be installed by others in sufficient time to prevent delays.

3.2 GENERAL INSTALLATION

A. Install all theatrical equipment, hardware and accessories at locations indicated in the drawings utilizing qualified stage technicians.
   1. Provide all tools, accessories, connecting and attaching devices as required for a complete and properly functioning installation.

B. Install equipment true, plumb and securely anchor in place in accordance with the manufacture's recommendations.

C. Properly test and demonstrate all curtain equipment after installation for the owner's representative.
   1. Furnish three sets of closeout documents in both printed and electronic (PDF) format. The document should include but not limited to; system layouts, maintenance procedures, operation, and tutorials.
   2. Training and maintenance for the rigging and curtain systems shall be provided by the rigging contractor; training not to exceed one hour.

D. The curtain systems, tracks and rigging shall be guaranteed against defects in material and workmanship for two years from date of substantial completion. The warranty shall be on a factory exchange or repair basis. No equipment having a shorter warranty will be considered and all equipment provided shall be covered by this warranty. The Theatrical Rigging Contractor shall assume all responsibility for workmanship of the installation. Unspecified length warranty will not be acceptable.

3.3 CLEANUP

A. Upon completion of installation, remove all debris from the site.

B. Leave work areas broom clean and ready for use.

END OF SECTION 116143
SECTION 221316 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 SUMMARY
   A. This Section includes the following soil and waste, sanitary drainage and vent piping inside the building:
      1. Pipe, tube, and fittings.
      2. Special pipe fittings.

1.2 DEFINITIONS
   B. EPDM: Ethylene-propylene-diene terpolymer rubber.
   C. LLDPE: Linear, low-density polyethylene plastic.
   D. NBR: Acrylonitrile-butadiene rubber.
   E. PE: Polyethylene plastic.
   F. PVC: Polyvinyl chloride plastic.
   G. TPE: Thermoplastic elastomer.

1.3 PERFORMANCE REQUIREMENTS
   A. Components and installation shall be capable of withstanding the following minimum working pressure, unless otherwise indicated:

1.4 SUBMITTALS
   A. Product Data: For pipe, tube, fittings, and couplings.
   B. Shop Drawings: Include plans, elevations, sections, and details.
   C. Field quality-control inspection and test reports.

1.5 QUALITY ASSURANCE
   A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
   B. Comply with NSF 14, “Plastics Piping Systems Components and Related Materials,” for plastic piping components. Include marking with “NSF-dwv” for plastic drain, waste, and vent piping; and “NSF-drain” for plastic drain piping.
   C. Cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute and shall be listed by NSF International.
   D. CISPI Hubless Couplings (CISPI 310) shall be marked with NSF International.

PART 2 - PRODUCTS

2.1 MANUFACTURERS
   A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
      1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
2.2 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

2.3 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 74, Service class; manufactured by AB&I, Charolotte, or Tyler.
B. Gaskets: ASTM C 564, rubber.
C. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

2.4 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301. manufactured by AB&I, Charolotte, or Tyler.
B. Sovent Stack Fittings: ASME B16.45 or ASSE 1043, hubless, cast-iron aerator and deaerator drainage fittings.
C. Shielded Couplings: ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.
   1. Standard, Shielded, Stainless-Steel Couplings: CISPI 310, with stainless-steel corrugated shield; stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve.
      a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
         1) ANACO.
         2) Mission Rubber Co.
         3) Tyler Pipe; Soil Pipe Div.
         4) Pre-approved equal.
      a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
         1) ANACO/Husky SD 4000.
         2) Clamp-All Corp.-125.
         3) Pre-approved equal.
   3. Heavy-Duty, Shielded, Cast-Iron Couplings: ASTM A 48/A 48M, two-piece, cast-iron housing; stainless-steel bolts and nuts; and ASTM C 564, rubber sleeve.
      a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
         1) MG Piping Products Co.
         2) Pre-approved equal.

2.5 PVC PIPE AND FITTINGS

A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.
   1. PVC Socket Fittings: ASTM D 2665, socket type, made to ASTM D 3311, drain, waste, and vent patterns.
B. Solvent Cement and Adhesive Primer:
   1. Use PVC solvent cement that has a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   2. Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.6 SPECIAL PIPE FITTINGS

A. Flexible, Nonpressure Pipe Couplings: Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition pattern. Include shear ring, ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      b. Fernco, Inc.
      c. Logan Clay Products Company (The).
      d. Mission Rubber Co.
      e. NDS, Inc.
      f. Plastic Oddities, Inc.
      g. Pre-approved equal.
2. **Sleeve Materials:**
   b. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
   c. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

B. **Expansion Joints:** Two or three-piece, ductile-iron assembly consisting of telescoping sleeve(s) with gaskets and restrained-type, ductile-iron, bell-and-spigot end sections complying with AWWA C110 or AWWA C153. Select and assemble components for expansion indicated. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.
   1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
      a. EBAA Iron Sales, Inc.
      b. Romac Industries, Inc.
      c. Star Pipe Products; Star Fittings Div.
      d. Pre-approved equal.

C. **Wall-Penetration Fittings:** Compound, ductile-iron coupling fitting with sleeve and flexing sections for up to 20-degree deflection, gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.
   1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
      a. SIGMA Corp.
      b. Pre-approved equal.

2.7 **ENCASEMENT FOR UNDERGROUND METAL PIPING**

A. **Description:** ASTM A 674 or AWWA C105, high-density, crosslaminted PE film of 0.004-inch or LLDPE film of 0.008-inch minimum thickness.

B. **Form:** Sheet or tube.

C. **Color:** Black or natural.

PART 3 - EXECUTION

3.1 **PIPING APPLICATIONS**

A. Special pipe fittings with pressure ratings at least equal to piping pressure ratings may be used in applications below, unless otherwise indicated.

B. Flanges and unions may be used on aboveground pressure piping, unless otherwise indicated.

C. Aboveground, soil, waste, and vent piping shall be the following:
   1. Hubless cast-iron soil pipe and fittings; standard, shielded, stainless-steel couplings; and hubless-coupling joints.

D. Underground, soil, waste, and vent piping NPS 15 and smaller shall be the following:
   1. Extra-Heavy class, cast-iron soil piping; gaskets; and gasketed joints.
   2. Solid wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
   3. Dissimilar Pipe-Material Couplings: Flexible, nonpressure pipe couplings for joining dissimilar pipe materials with small difference in OD.

3.2 **PIPING INSTALLATION**

A. Basic piping installation requirements are specified in Section "Basic Mechanical Materials and Methods."

B. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.

C. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Section "Basic Mechanical Materials and Methods."
D. Install wall penetration system at each service pipe penetration through foundation wall. Make installation watertight. Wall penetration systems are specified in Section "Basic Mechanical Materials and Methods."

E. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

F. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

G. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

H. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:
   1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
   2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
   3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

I. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.

J. Install ABS soil and waste drainage and vent piping according to ASTM D 2661.

K. Install PVC soil and waste drainage and vent piping according to ASTM D 2665.

L. Install underground ABS and PVC soil and waste drainage piping according to ASTM D 2321.

M. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.3 JOINT CONSTRUCTION

A. Basic piping joint construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."


C. Join hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead and oakum calked joints.

D. Join hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.

E. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

F. Grooved Joints: Assemble joint with keyed coupling, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.

G. PVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.

3.4 HANGER AND SUPPORT INSTALLATION

A. Seismic-restraint devices are specified in Section "Mechanical Vibration and Seismic Controls."
B. Pipe hangers and supports are specified in Section "Hangers and Supports." Install the following:

1. Vertical Piping: MSS Type 8 or Type 42, clamps.
2. Individual, Straight, Horizontal Piping Runs: According to the following:
   a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
   b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
   c. Longer Than 100 Feet, if Indicated: MSS Type 49, spring cushion rolls.
3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Install supports according to Section "Hangers and Supports."

D. Support vertical piping and tubing at base and at each floor.

E. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.

F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
2. NPS 3: 60 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
4. NPS 6: 60 inches with 3/4-inch rod.

5. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.

G. Install supports for vertical cast-iron soil piping every 15 feet.

H. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.5 CONNECTIONS

A. Connect soil and waste piping to existing sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

B. Connect drainage and vent piping to the following:

1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code. Refer to Section "Plumbing Fixtures."
2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code. Refer to Section "Plumbing Specialties."
4. Equipment: Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.

3.6 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction.

1. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
2. Prepare reports for tests and required corrective action.
3.7 CLEANING

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

END OF SECTION 221316
SECTION 221413 - STORM DRAINAGE PIPING

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. This Section includes the following storm drainage piping inside the building:
   1. Pipe, tube, and fittings.
   2. Special pipe fittings.
   3. Encasement for underground metal piping.

B. Related Sections include the following:
   1. Division 22 Section "Sump Pumps."

1.3 DEFINITIONS


B. LLDPE: Linear, low-density polyethylene plastic.

C. PE: Polyethylene plastic.

D. PVC: Polyvinyl chloride plastic.

E. TPE: Thermoplastic elastomer.

1.4 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working-pressure, unless otherwise indicated:
   1. Storm Drainage Piping: 10-foot head of water.

1.5 SUBMITTALS

A. Product Data: For pipe, tube, fittings, and couplings.

B. LEED Submittal:
   1. Product Data for Credit EQ 4.1: For solvent cements and adhesive primers, including printed statement of VOC content.

C. Shop Drawings:

D. Field quality-control inspection and test reports.

1.6 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

2.3 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 74, Service class.

B. Gaskets: ASTM C 564, rubber.

C. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

2.4 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301; manufactured by AB&I, Charlotte or Tyler.

B. Shielded Couplings: ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.
   1. Standard, Shielded, Stainless-Steel Couplings: CISPI 310, with stainless-steel corrugated shield; stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve.
      a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
         1) ANACO.
         2) Mission Rubber Co.
         3) Tyler Pipe; Soil Pipe Div.
         4) Pre-approved equal.
      a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
         1) ANACO/Husky SD 4000.
         2) Clamp-All Corp.-125.
         3) Pre-approved equal.

C. Heavy-Duty, Shielded, Cast-Iron Couplings: ASTM A 48/A 48M, two-piece, cast-iron housing; stainless-steel bolts and nuts; and ASTM C 564, rubber sleeve.
   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      1) MG Piping Products Co.
      2) Pre-approved equal.

2.5 STEEL PIPE AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade A or B, Standard Weight or Schedule 40, galvanized. Include ends matching joining method.

B. Drainage Fittings: ASME B16.12, galvanized, threaded, cast-iron drainage pattern.

C. Pressure Fittings:

D. Grooved-Joint Systems:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Grooved-End, Steel-Piping Fittings: ASTM A 47/A 47M, galvanized, malleable-iron casting; ASTM A 106, galvanized-steel pipe; or ASTM A 536, galvanized, ductile-iron casting; with dimensions matching steel pipe.
3. Grooved-End, Steel-Piping Couplings: AWWA C606, for steel-pipe dimensions. Include ferrous housing sections, gasket suitable for water, and bolts and nuts.

2.6 COPPER TUBE AND FITTINGS

A. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.

B. Hard Copper Tube: ASTM B 88, Type L, water tube, drawn temper.
   2. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.
   3. Copper Unions: MSS SP-123, copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

C. Soft Copper Tube: ASTM B 88, Type L, water tube, annealed temper.

2.7 PVC PIPE AND FITTINGS

A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.

B. Solvent Cement and Adhesive Primer:
   1. Use PVC solvent cement that has a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   2. Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.8 SPECIAL PIPE FITTINGS

A. Flexible, Nonpressure Pipe Couplings: Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition pattern. Include shear ring, ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      b. Fernco, Inc.
      c. Logan Clay Products Company (The).
      d. Mission Rubber Co.
      e. NDS, Inc.
      f. Plastic Oddities, Inc.
      g. Pre-approved equal.
   2. Sleeve Materials:
      b. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
      c. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

B. Expansion Joints: Two or three-piece, ductile-iron assembly consisting of telescoping sleeve(s) with gaskets and restrained-type, ductile-iron, bell-and-spigot end sections complying with AWWA C110 or AWWA C153. Select and assemble components for expansion indicated. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. EBAA Iron Sales, Inc.
      b. Romac Industries, Inc.
      c. Star Pipe Products; Star Fittings Div.
d. Pre-approved equal.

C. Wall-Penetration Fittings: Compound, ductile-iron coupling fitting with sleeve and flexing sections for up to 20-degree deflection, gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. SIGMA Corp.
      b. Pre-approved equal.

PART 3 - EXECUTION

3.1 EXCAVATION

A. Refer to Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

A. Flanges and unions may be used on aboveground pressure piping, unless otherwise indicated.

B. Aboveground storm drainage piping shall be the following:
   1. Hubless cast-iron soil pipe and fittings; heavy-duty, shielded, stainless-steel couplings; and coupled joints.

C. Underground storm drainage piping NPS 6 and smaller shall be any of the following:
   1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
   2. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
   3. Dissimilar Pipe-Material Couplings: Flexible, nonpressure pipe couplings for joining dissimilar pipe materials with small difference in OD.

D. Aboveground storm drainage force mains NPS 1-1/2 and NPS 2 shall be any of the following:
   1. Hard copper tube, Type L; copper pressure fittings; and soldered joints.
   2. Steel pipe, pressure fittings, and threaded joints.

E. Aboveground storm drainage force mains NPS 2-1/2 and NPS 6 shall be any of the following:
   1. Steel pipe, pressure fittings, and threaded joints.
   2. Grooved-end steel pipe, grooved-joint system fittings and couplings, and grooved joints.

3.3 PIPING INSTALLATION

A. Storm sewer and drainage piping outside the building are specified in Division 33 Section "Storm Utility Drainage Piping."

B. Basic piping installation requirements are specified in Division 22 Section "Common Work Results for Plumbing."

C. Install cleanouts at grade and extend to where building storm drains connect to building storm sewers. Cleanouts are specified in Division 22 Section "Storm Drainage Piping Specialties."

D. Install cleanout fitting with closure plug inside the building in storm drainage force-main piping.

E. Install underground, steel, force-main piping. Install encasement on piping according to ASTM A674 or AWWA C105.

F. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 22 Section "Common Work Results for Plumbing."

G. Install wall-penetration fitting system at each service pipe penetration through foundation wall. Make installation watertight.

H. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
   1. Install encasement on underground piping according to ASTM A674 or AWWA C105.
I. Make changes in direction for storm drainage piping using appropriate branches, bends, and long-sweep bends. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

J. Lay buried building storm drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

K. Install storm drainage piping at the following minimum slopes, unless otherwise indicated:
   1. Building Storm Drain: 1 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
   2. Horizontal Storm-Drainage Piping: 2 percent downward in direction of flow.

L. Install force mains at elevations indicated.

M. Install engineered controlled-flow storm drainage piping in locations indicated.

N. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.

O. Install PVC storm drainage piping according to ASTM D 2665.

P. Install underground ABS and PVC storm drainage piping according to ASTM D 2321.

Q. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.4 JOINT CONSTRUCTION

A. Basic piping joint construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."


E. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

F. Grooved Joints: Cut groove ends of pipe and assemble grooved ends of pipes, grooved-end fittings, and grooved-end-piping couplings according to AWWA C606.

G. PVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.

3.5 VALVE INSTALLATION

A. General valve installation requirements are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."

B. Shutoff Valves: Install shutoff valve on each sump pump discharge.
   1. Install gate or full-port ball valve for piping NPS 2 and smaller.
   2. Install gate valve for piping NPS 2-1/2 and larger.

C. Check Valves: Install swing check valve, between pump and shutoff valve, on each sump pump discharge.

D. Backwater Valves: Install backwater valves in piping subject to backflow.
1. Horizontal piping: Horizontal backwater valves. Use normally closed type, unless otherwise indicated.
2. Install backwater valves in accessible locations.
3. Backwater valve are specified in Division 22 Section "Storm Drainage Piping Specialties."

3.6 HANGER AND SUPPORT INSTALLATION

A. Pipe hangers and supports are specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment." Install the following:
1. Vertical Piping: MSS Type 8 or Type 42, clamps.
2. Individual, Straight, Horizontal Piping Runs: According to the following:
   a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
   b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
   c. Longer Than 100 Feet, if Indicated: MSS Type 49, spring cushion rolls.
3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Install supports according to Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.

E. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
   1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
   2. NPS 3: 60 inches with 1/2-inch rod.
   3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
   4. NPS 6: 60 inches with 3/4-inch rod.
   5. NPS 8 to NPS 12: 60 inches with 7/8-inch rod.
   6. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.

F. Install supports for vertical cast-iron soil piping every 15 feet.

G. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:
   1. NPS 1-1/4: 84 inches with 3/8-inch rod.
   2. NPS 1-1/2: 108 inches with 3/8-inch rod.
   3. NPS 2: 10 feet with 3/8-inch rod.
   4. NPS 2-1/2: 11 feet with 1/2-inch rod.
   5. NPS 3: 12 feet with 1/2-inch rod.
   6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.
   7. NPS 6: 12 feet with 3/4-inch rod.
   8. NPS 8 to NPS 12: 12 feet with 7/8-inch rod.

H. Install supports for vertical steel piping every 15 feet.

I. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
   1. NPS 1-1/4: 72 inches with 3/8-inch rod.
   2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
   3. NPS 2-1/2: 108 inches with 1/2-inch rod.
   4. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
   5. NPS 6: 10 feet with 5/8-inch rod.
   6. NPS 8: 10 feet with 3/4-inch rod.

J. Install supports for vertical copper tubing every 10 feet.

K. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.7 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect interior storm drainage piping to exterior storm drainage piping. Use transition fitting to join dissimilar piping materials.
C. Connect storm drainage piping to roof drains and storm drainage specialties.

D. Connect force-main piping to the following:
   1. Storm Sewer: To exterior force main or storm manhole.
   2. Sump Pumps: To sump pump discharge.

3.8 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
   1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in.
   2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test storm drainage piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
   1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
   2. Leave uncovered and unconcealed new, altered, extended, or replaced storm drainage piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
   3. Test Procedure: Test storm drainage piping on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
   4. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
   5. Prepare reports for tests and required corrective action.

E. Test force-main piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
   1. Leave uncovered and unconcealed new, altered, extended, or replaced force-main piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
   2. Cap and subject piping to static-water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
   3. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
   4. Prepare reports for tests and required corrective action.

3.9 CLEANING

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

END OF SECTION 221413
### DOOR SCHEDULE

<table>
<thead>
<tr>
<th>Number</th>
<th>Type</th>
<th>Size (in.)</th>
<th>Material</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>N10</td>
<td>Exterior Window Frame</td>
<td>3'-0&quot; x 7'-0&quot; x 1 3/4&quot;</td>
<td>E9</td>
<td>Fixed Center Mullion</td>
</tr>
<tr>
<td>N13</td>
<td>Interior Window Frame</td>
<td>3'-0&quot; x 7'-0&quot; x 1 3/4&quot;</td>
<td>E9</td>
<td>Removable Center Mullion</td>
</tr>
<tr>
<td>N11</td>
<td>Display Case</td>
<td>3'-0&quot; x 7'-0&quot; x 1 3/4&quot;</td>
<td>E9</td>
<td>Fixed Center Mullion</td>
</tr>
<tr>
<td>N14</td>
<td>Interior Window Frame by Gym</td>
<td>3'-0&quot; x 7'-0&quot; x 1 3/4&quot;</td>
<td>E9</td>
<td>Removable Center Mullion</td>
</tr>
</tbody>
</table>

### SHEET KEYNOTE LEGEND

- **A1**: Metal Frame Types
- **A2**: Door Types
- **K10**: Display Case
- **K14**: Interior Window Frame by Gym

### GLASS LEGEND

- FULLY-TEMPERED MONOLITHIC FLOAT GLASS
- LOW-E CLEAR INSULATED FLOAT GLASS
- CLEAR LAMINATED GLASS
- FULLY-TEMPERED GLASS
- CLEAR II FULLY-TEMPERED GLASS
- CLEAR III FULLY-TEMPERED GLASS

### DOOR TYPE NOTES

1. REFER TO DOOR SCHEDULE FOR GLASS TYPES IN DOORS
2. DIMENSIONS ASSOCIATED WITH VISION LITES ARE TO THE OUTSIDE OF THE VISION LITE FRAME UNLESS NOTED
The page contains a table of contents for construction documents related to the EPiC Elementary Storm Shelter Addition project. The table lists various categories and subcategories of drawings, plans, and details that are included in the project documentation. The documents are categorized under sections such as Architectural Site, Structural, Mechanical, Electrical, and Demolition, among others. Each category contains specific drawings and plans with numbers like A001, A121, A141, G101, etc.

The page also includes a section for Alternatives, indicating that there are multiple options available for certain aspects of the project. Additionally, a Vicinity Map is provided with a layout of the construction site and a contact section with information for project stakeholders, including phone numbers and addresses for various consultants and engineers involved in the project.
CONCRETE STAIRS

EXISTING PLAY AREA
EXISTING PARKING LOT
CONCRETE PADS FOR NEW
CONDENSING UNITS;
COORDINATE EXTENTS W/ FSE DWGS & SPECS

STOOP
RE: STRUCT

EQ EQ EQ
ALIGN

EQ EQ EQ

25' - 3" +/-
EXISTING
STOOP
RE: STRUCT

6" SOLID PIPE CONNECTING PERFORATED PIPE TO SWS,
RE: CIVIL

CIP RETAINING WALL
RE: STRUCT

50' - 9"
16' - 0"
9 EQ TREADS @ 12" EA = 9' - 0"
1' - 0"
1' - 0"
6' - 1"
1' - 6" 7' - 7"

1 1/2" GAP

1 1/2" GAP

1 1/2" DIA

CORE MOUNTED POST @ GUARDRAIL
RE: A4/A332 FOR GUARDRAIL DETAIL

1 1/2" HANDRAIL

SLOPE T.O. WALL W/ STAIR
SSTL BRACKET ATTACH TO POSTS

SSTL WALL BRACKET

LEVEL 1
100' - 0"

J
J13
AS101
A1
AS101
A332
CIP RETAINING WALL BEYOND,
RE: STRUCT

P3

1 1/2" GAP

2' - 10" 8"

3' - 6" 8"

4' - 6"

4' - 2"

3' - 6" 8"

9 EQ RISERS

4' - 2"

03 30 00.A01

05 52 13.A03

05 52 13.A01

05 52 13.A03

05 52 13.A01

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07 95 00.A23
3/8" +/-
EJ-3
1/4" HILTI CP 606 SEALANT
5/8" X 1" MINERAL WOOL STRIPS
Joint Detail to meet UL WW-D-0082

07 92 00.A02
3/4" 3/4".

07 14 16.A04
FILL VOID UP TO 1/2" BELOW FINISH GRADE

07 14 16.A06
4" UP TO 1/2" BELOW FINISH

Thin Brick/ Formliner condition where occurs

Precautionary notes:
- Acceptable joints of high rise shell wall 3/8" wide. 3/8" wide, using tested assembly at offset joints.
- 1/4" HILTI CP 606 sealant. 5/8" x 1" Mineral Wool Strips
- 1/4" HILTI CP 606 sealant. 5/8" x 1" Mineral Wool Strips
- Joint detail to meet UL WW-D-0082

E7
Scale: 3" = 1'-0"
P3 - Precast Panel Joint Exterior - 2 Stage Sealant

E13
Typical Two Stage Exterior Precast Expansion Joint

K1
Exterior Detail - Base of Wall @ Precast Retaining

K7
Exterior Detail - Base of Wall @ Retaining/CP

网站地图

Please consider the environment before printing this.
EPIC Elementary Storm Shelter Addition

Sheet Notes:
1. PROVIDE 1" OVERHANG AT ALL COUNTERTOPS, UNO
2. PROVIDE 4" BACKSPLASH, UNO
3. CONFIRM MOUNTING LOCATIONS WHERE BACKING REQUIRED FOR ELECTRICAL OUTLETS A.F.F. AND/OR ABOVE COUNTERTOPS
4. PROVIDE WOOD CLEAT AT BACK AND SIDE WALLS OF ALL WOOD CABINETS AND OTHER PLUMBING FIXTURES LOCATED WITHIN 1' - 0" OF OUTSIDE SWITCHES, THERMOSTATS, FIRE ALARM STROBES TO BE MOUNTED ADJACENT TO ENTRY DOORS OR AT OUTSIDE CORNERS
5. COORDINATE WITH ELECTRICAL SHEETS FOR HEIGHT OF OUTLETS A.F.F. AND/OR ABOVE COUNTERTOPS
6. PROVIDE 4" BACKSPLASH, UNO
7. PROVIDE WOOD CLEAT AT BACK AND SIDE WALLS OF ALL WOOD CABINETS AND OTHER PLUMBING FIXTURES LOCATED WITHIN 1' - 0" OF OUTSIDE SWITCHES, THERMOSTATS, FIRE ALARM STROBES TO BE MOUNTED ADJACENT TO ENTRY DOORS OR AT OUTSIDE CORNERS
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### Material Finish Legend

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<th>Job No.</th>
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<td>09/29/2023</td>
<td>23020.00</td>
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### General Finish Notes

1. Refer to Foundation Plan, reflected Ceiling Plan, Elevations, and Detail for exact location of Pile Piers Finish.

2. Do not paint Factory or Sprayed Concrete, Brick, Glazed Block or any other Pretreated Materials.

3. Do not paint Aluminum or any other Non-Ferrous Metals that are Prefinished.

4. Match Vertical Finish of all Interior Gypsum Board Soffits to Horizontal Finish as noted on RCP or Room Finish Schedule, UNO.

5. Paint all Exposed Ductwork described in 4th Level Plan. Any noted on RCP or Room Finish Schedule, UNO.

6. Paint all Exposed Erection Decks described in 4th Level Plan. Any noted on RCP or Room Finish Schedule, UNO.

7. Paint all Exposed Concrete Decks and Precast Beams, UNO.

8. Paint or Finish the following items to match Adjacent Paint or Finish:
   - Electrical Panels by separate Vendor
   - Air Conditioning, HVAC systems by separate Vendor, UNO.
   - Visible Portions of Equipment, Starters, Motors, and Components, UNO.
1 ROOF FRAMING PLAN

TOP OF DOUBLE TEE ELEV. = 133' - 9¼"

TOP OF DOUBLE TEE ELEV. = 132' - 0"

W=186k
E=64k

W=216k
E=64k

PRECAST SUPPLIER TO DESIGN DOUBLE TEES FOR WEIGHT OF MECH. EQUIPMENT INDICATED

INDICATES SHEAR WALL

PRECAST SUPPLIER TO DESIGN DOUBLE TEES FOR THEATRICAL RIGGING WEIGHTS INDICATED ON SHEETS TH100 AND TH101

RTU - 14
5,000#

RTU - 13
5,000#

RTU - 15
3,000#

THEATRICAL CONULTANT
109 E Pine St.
Warrensburg, MO 64093
660.429.1383 phone

MISSOURI STATE CERTIFICATE OF AUTHORITY
ARCHITECTURE # 0000161
STRUCTURE # 2006031333
HOLLIS + MILLER ARCHITECTS
900 MIDJAY DR, LIBERTY, MO 64068
660.429.1383 phone

STATE CERTIFICATE OF AUTHORITY
MECHANICAL, ELECTRICAL, & PLUMBING
EGC000178
25618 W 103RD STREET
OLATHE, KS 66061
913.345.2127 phone

THE PROFESSIONAL ARCHITECTS SEAL AFFIXED TO THIS SHEET APPLIES ONLY TO THE MATERIAL AND ITEMS SHOWN ON THIS SHEET. ALL DRAWINGS, INSTRUMENTS OR OTHER DOCUMENTS NOT EXHIBITING THIS SEAL SHALL NOT BE CONSIDERED PREPARED BY THIS ARCHITECT, AND THIS ARCHITECT EXPRESSLY DISCLAIMS ANY AND ALL RESPONSIBILITY FOR SUCH PLAN, DRAWINGS, OR DOCUMENTS NOT EXHIBITING THIS SEAL.
FOUNDATION SECTIONS

1 SECTION

2 SECTION

3 SECTION

EPIC Elementary Storm Shelter Addition
Liberty Public Schools
Liberty, MO 64068

S203
1. INFORMATION SHOWN ON THE DRAWINGS IS INTENDED TO BE USED IN THE BID PRICING. THE CONTRACTOR SHALL PROVIDE THE REFERENCES AT SCHEDULE AND DETAIL. REFER TO ARCHITECTURAL ELEVATIONS AND OTHER DRAWINGS. REFER TO SCHEDULE AND DETAIL. REFER TO ARCHITECTURAL ELEVATIONS AND OTHER DRAWINGS. REFER TO SCHEDULE AND DETAIL. REFER TO ARCHITECTURAL ELEVATIONS AND OTHER DRAWINGS.

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1. Information shown on the drawings is intended to convey scope and is arranged for drawing clarity. It is not to be built condition. The system installation shall be coordinated with structure, ceilings, walls, and all other trades to provide for a complete and working system.

2. Existing structure as well as all other trades to maintain equipment clearances and desired ceiling heights.

3. Waste piping shall be sloped at 1/8" and larger piping at ¼" piping.

4. Storm piping shall be sloped at 1/8" piping.

5. Waste and storm cleanouts as required per code and specifications. More cleanouts may be provided above accessible ceiling or directly above any panels or equipment.

6. Shut off valves above accessible ceiling or directly above any panels or equipment.

7. Provide firestopping at penetrations of all rated walls. Refer to code plans for locations of rated walls.

8. Provide water hammer arrestors per the requirements of the specifications and PDI WH201 for shelter 3" and larger.

9. Provide ICC 500 piping shroud for all penetrations of shelter 3" and larger.

10. Provide water closet up to water closet.

11. Provide janitor sink up to 1½" vent in wall/chose.

12. Provide drinking fountain up to 1½" vent in wall/chose.

13. Provide wall hydrant above grade. Coordinate with civil.

14. All hot water recirc balance devices shall be 1 GPM circuit setters unless otherwise noted.

15. Provide firestopping at penetrations of all rated walls.

16. Coordinate all piping penetrations with structural, ceilings, walls, and all other trades to provide for a complete and working system.

Refer to riser diagram for additional plumbing information.

Provide shut off valves above accessible ceiling or directly above any panels or equipment.
WASTE & VENT RISER DIAGRAM - AREA A

WASTE & VENT RISER DIAGRAM - AREA B

DOMESTIC WATER RISER DIAGRAM - AREA A

DOMESTIC WATER RISER DIAGRAM - AREA B

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<th>CURTAIN HEIGHT</th>
<th>CURTAIN FOLLOWERS</th>
<th>CURTAIN GAP</th>
<th>L.O.G.</th>
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<th>BATTERY LENGTH</th>
<th>BATTERY LOCATION</th>
<th>STACKING</th>
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<td>3/4&quot;</td>
<td>47&quot; PIPE BATTERY</td>
<td>TIE TO BATTERY</td>
<td>420#</td>
<td>300#</td>
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<td>15 oz BLACK</td>
<td>133</td>
<td>3/4&quot;</td>
<td>ENDLESS LINE</td>
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</table>

*Above stage floor, to centerline of electric lower batten, or bottom of curtain.  All dimensions are approximate.  Actual sizes and elevations shall be determined by existing conditions and field measurements.*