

Project Manual

Conformed Construction Documents

Liberty District Renovations

Discovery Middle School – Project No. 23018
800 Midjay Drive, Liberty, Missouri 64068

South Valley Middle School – Project No. 23019
1000 Midjay Drive, Liberty, Missouri 64068

EPiC – Project No. 23020
650 Conistor St, Liberty, Missouri 64068

Prepared For:
Liberty Public Schools
8 Victory Lane
Liberty, Missouri 64068

HM Project No: 23018
HM Project No: 23019
HM Project No: 23020
Issue Date: October 11, 2023

Contents:

Volume 1: Introductory Information, Bidding and Contracting Requirements,
Division 1 – Division 12.

Volume 2: Division 21 through Division 33.



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SECTION 000101 - PROJECT TEAM DIRECTORY

PART 1 - GENERAL

1.1 CONSTRUCTION MANAGER INFORMATION

- A. Newkirk Novak Construction Partners has been selected as the Construction Manager for this project, and as such, will act as the Owner's representative.
- B. All communication, both written and oral, must be directed through the Construction Manager.

1.2 PROJECT TEAM INFORMATION

A. PROJECT:

- 1. Project Number and Name:
 - a. 23018 - Discovery Middle School
 - 1) Location: 800 Midjay Drive, Liberty, Missouri 64068
 - b. 23019 - South Valley Middle School
 - 1) Location: 1000 Midjay Drive, Liberty, Missouri 64068
 - c. 23020 - EPiC Elementary School
 - 1) Location: 650 Conister Street, Liberty, Missouri 64068

B. OWNER:

- 1. Name: Liberty Public Schools
- 2. Address: 8 Victory Lane, Liberty, MO 64068
- 3. Contact: Steve Anderson
- 4. Phone: 816.736.5300

C. CONSTRUCTION MANAGER:

- 1. Name: Newkirk Novak Construction Partners
- 2. Address: 11200 W. 79th Street, Lenexa, Kansas 66241
- 3. Contact: Brandon Stanley
- 4. Email: Brandon.Stanley@newkirknovak.com
- 5. Phone: 913.312.9535.

D. ARCHITECT:

- 1. Name: Hollis + Miller Architects, Inc.
- 2. Address: 1828 Walnut Street, Suite 922, Kansas City, MO 64108.
- 3. Contact: Kyle LaBarre.
- 4. Email: klabarre@hollisandmiller.com
- 5. Phone: 816.442.7700 / Fax: 816.599.2545

E. CIVIL ENGINEER:

- 1. Name: MKEC Engineering, Inc.
- 2. Address: 11827 W 112th Street, Suite 200, Overland Park, Kansas 66210.
- 3. Contact: Brandom Taylor OR Brian Hill.
- 4. Email: btaylor@mkec.com OR bhill@mkec.com
- 5. Phone: 913.317.9390.

F. STRUCTURAL ENGINEER:

- 1. Name: Bob D. Campbell & Co.
- 2. Address: 4338 Bellevue Ave, Kansas City, Missouri 64111.
- 3. Contact: Wayne Davis
- 4. Email: wdavis@bdc-engrs.com
- 5. Phone: 816.531.4114 / Fax: 816.531.8572

G. MEP ENGINEER:

- 1. Name: Smith and Boucher
- 2. Address: 25618 W 103rd Street, Olathe, Kansas 66061.

3. Contact: Jeremy Graham -Mechanical and Plumbing Engineer
4. Email: jgraham@smithandboucher.com
5. Contact: Jeremy Enszt - Electrical Engineer
6. Email: jenszt@smithboucher.com
7. Phone: 913.345.2127.

H. ACOUSTICIAN:

1. Name: Avant Acoustics
2. Address: 14827 West 95th Street, Lenexa, Kansas 66215.
3. Contact: John Hodgson.
4. Email: jhodgson@avantacoustics.com.
5. Phone: 913.888.9111.

I. GEOTECHNICAL ENGINEERS:

1. Name: Kruger Technologies, Inc.
2. Address: 8721 Melrose Drive, Lenexa, Kansas 66214
3. Contact: Dylan Kruger
4. Email: dzkruger@ktionline.com
5. Phone: 913.498.1114 / Fax: 913.498.1116

J. FOOD SERVICE CONSULTANT:

1. Name: MHA Food Facility Consultants
2. Address: 7840 Conser Street, Overland Park, Kansas 66204
3. Contact: Mike Terlouw.
4. Email: mike@mhaconsulting.com.
5. Phone: 785.266.5696.

K. THEATRICAL CONSULTANT:

1. Name: Peerbolte Creative
2. Address: 109 E. Pine Street, Warrensburg, Missouri 64093.
3. Contact: Shannon C. Johnson.
4. Email: shannon@peerbolte.com.
5. Phone: 660.429.1383 x2.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 000101

SECTION 000105 - CERTIFICATIONS PAGE

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 3 SECTION: | 034100. |
| DIVISION 4 SECTION: | 042000. |
| DIVISION 5 SECTIONS: | 055000, 055100, 055213. |
| DIVISION 6 SECTIONS: | 061000, 061600, 064023. |
| DIVISION 7 SECTIONS: | 071326, 071416, 072100, 072726, 074213, 074243, 074400, 074800, 075216, 075423, 076200, 077200, 078100, 078413, 078446, 079200, 079500. |
| DIVISION 8 SECTIONS: | 081113, 081416, 084113, 087100, 088000. |
| DIVISION 9 SECTIONS: | 092116, 092900, 093000, 095113, 096466, 096513, 096566, 096723, 096813, 097253, 097723, 098433, 098436, 099113, 099123, 099600, 099646, 099723. |
| DIVISION 10 SECTIONS: | 101100, 101400, 101423, 102113, 102238, 102600, 102800, 104300, 104413, 104416. |
| DIVISION 11 SECTIONS: | 116143, 116623, 116653. |
| DIVISION 12 SECTIONS: | 122413, 123200, 123666. |
| 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

OCTOBER 11, 2023

ARCHITECT

DATE



OCTOBER 11, 2023


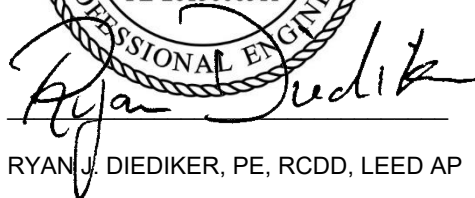
SECTION 000105 - CERTIFICATIONS PAGE-MEP

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:

| | |
|-----------------------|--|
| DIVISION 21 SECTIONS: | 210500, 211200, 211313 |
| DIVISION 22 SECTIONS: | 220500, 220513, 220516, 220517, 220518, 220519, 220523, 220529, 220553, 220719, 221116, 221119, 221123, 221316, 221319, 221413, 221423, 223300, 224000, 224700 |
| DIVISION 23 SECTIONS: | 230500, 230513, 230525, 230548, 230553, 230593, 230713, 230719, 230900, 231123, 232300, 233113, 233300, 233416, 233713, 237416.11, 237416.13, 238126, 238239 |
| DIVISION 26 SECTIONS: | 260500, 260519, 260523, 260526, 260529, 260533, 260553, 260923, 260943, 262200, 262416, 262726, 262813, 262816, 263323, 264113, 265119, 265219, 265619 |
| DIVISION 27 SECTIONS: | 270000, 270500, 270526, 270536, 275116, 275145 |
| DIVISION 28 SECTIONS | 280500, 280513, 283111 |

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.

RYAN J. DIEDIKER, PE, RCDD, LEED AP

10.11.2023

DATE

SECTION 000105 – CERTIFICATIONS & SEALS

Civil Engineer:

I hereby state, pursuant to RSMo 327.411, that the Specifications intended to be authenticated by my seal are limited to Specification Sections listed below:

Division 31 Sections: 311000 & 312000
Division 32 Sections: 321216, 321313, 321373, & 323113
Division 33 Sections: 333100 & 334100

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.

Engineers:

Date



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:

| | |
|-----------------------|--------------------------------|
| DIVISION 1 SECTIONS: | |
| DIVISION 2 SECTIONS: | |
| DIVISION 3 SECTIONS: | 033000, 034100 |
| DIVISION 4 SECTIONS: | |
| DIVISION 5 SECTIONS: | 051200, 052100, 053100, 054000 |
| DIVISION 6 SECTIONS: | |
| DIVISION 7 SECTIONS: | |
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| DIVISION 10 SECTIONS: | |
| DIVISION 11 SECTIONS: | |
| DIVISION 12 SECTIONS: | |
| DIVISION 13 SECTIONS: | |
| DIVISION 14 SECTIONS: | |
| DIVISION 31 SECTIONS: | |
| DIVISION 32 SECTIONS: | |
| DIVISION 33 SECTIONS: | |

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.

RYAN M. HAGEDORN

10/11/2023

ENGINEER

DATE



CERTIFICATION PAGE

AV/ACOUSTICAL CONSULTANT

I HEREBY STATE, THAT THE SPECIFICATIONS UNDER MY RESPONSIBILITY ARE LIMITED TO SPECIFICATIONS LISTED BELOW:

DIVISION 27 SECTIONS: 274116

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.


ACOUSTICAL CONSULTANT

OCTOBER 11, 2023

DATE

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 Project No. & Locations:
 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 Conistor Street, Liberty, Missouri 64068

| Revisions | Date |
|-----------|------------|
| ADD01 | 09.14.2023 |
| ADD02 | 09.22.2023 |
| ADD04 | 09.29.2023 |
| ADD05 | 10.06.2023 |

| | Current Issue | Original Issue |
|--|---------------|----------------|
| INTRODUCTORY INFORMATION | | |
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| 000105 Certifications and Seals | 10.11.2023 | 08.31.2023 |
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| (Refer to Construction Manager's Front End Manual for additional Contracting Requirements) | | |
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|--|--|---------------|----------------|
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| 237416.11 | Packaged, Small-Capacity, Rooftop Air-Conditioning Units | 10.11.2023 | 08.31.2023 |
| 237416.13 | Packaged, Large-Capacity, Rooftop Air-Conditioning Units | 10.11.2023 | 08.31.2023 |
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| 262813 | Fuses | 10.11.2023 | 08.31.2023 |
| 262816 | Enclosed Switches and Circuit Breakers | 10.11.2023 | 08.31.2023 |
| 263323 | Central Battery Equipment for Emergency Lighting | 10.11.2023 | 08.31.2023 |
| 264113 | Lightning Protection for Structures | 10.11.2023 | 08.31.2023 |
| 265119 | LED Interior Lighting | 10.11.2023 | 08.31.2023 |
| 265219 | Emergency and Exit Lighting | 10.11.2023 | 08.31.2023 |
| 265500 | Theatrical Equipment Hook-Up | 10.11.2023 | 08.31.2023 |
| 265619 | LED Exterior Lighting | 10.11.2023 | 08.31.2023 |
| DIVISION 27 – COMMUNICATIONS | | | |
| 270000 | District Cabling Specifications (LPS Standard) | 10.11.2023 | 08.31.2023 |
| 270500 | Common Work Results for Communications | 10.11.2023 | 08.31.2023 |
| 270526 | Grounding and Bonding for Communications | 10.11.2023 | 08.31.2023 |
| 270536 | Cable Trays for Communications Systems | 10.11.2023 | 08.31.2023 |
| 274116 | Audio Video Systems | 10.11.2023 | 08.31.2023 |
| 275116 | Public Address Systems | 10.11.2023 | 08.31.2023 |
| 275145 | Two-Way Emergency Responder Radio System | 10.11.2023 | |
| DIVISION 28 - ELECTRONIC ACCESS CONTROL AND INTRUSION DETECTION | | | |
| 280500 | Common Work Results for Electronic Safety and Security | 10.11.2023 | 08.31.2023 |
| 280513 | Conductors and Cables for Electronic Safety and Security | 10.11.2023 | 08.31.2023 |
| 283111 | Digital, Addressable Fire-Alarm System | 10.11.2023 | 08.31.2023 |

| | | Current Issue | Original Issue |
|-------------------------------------|----------------------------------|---------------|----------------|
| DIVISION 31 - EARTHWORK | | | |
| 311000 | Site Clearing | 10.11.2023 | 08.31.2023 |
| 312000 | Earth Moving | 10.11.2023 | 08.31.2023 |
| DIVISION 32 - EXTERIOR IMPROVEMENTS | | | |
| 321216 | Asphalt Paving | 10.11.2023 | 08.31.2023 |
| 321313 | Concrete Paving | 10.11.2023 | 08.31.2023 |
| 321373 | Concrete Paving Joint Sealants | 10.11.2023 | 08.31.2023 |
| 323113 | Chain Link Fences and Gates | 10.11.2023 | 08.31.2023 |
| DIVISION 33 - UTILITIES | | | |
| 333100 | Sanitary Utility Sewerage Piping | 10.11.2023 | 08.31.2023 |
| 334100 | Storm Utility Drainage Piping | 10.11.2023 | 08.31.2023 |
| 334600 | Subdrainage | 10.11.2023 | 08.31.2023 |
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SECTION 003132 - GEOTECHNICAL DATA

PART 1 - GENERAL

1.1 SUMMARY

- A. The Geotechnical Engineering Report for Discovery Middle School, South Valley Middle School, and EPiC Elementary School, including the boring logs, have been prepared for the Owner by Kruger Technologies, Inc. and bound into the Project Manual and are for background information only and shall not be considered as part of the Contract Documents.
 - 1. Any questions regarding this report should be directed to the Architect.
- B. The Contractor shall account for the existing site conditions in its Bid in consideration of all earthwork, grading, and construction required for the Project as indicated in the Contract Documents.
 - 1. Boring locations and boring logs are included in the reports. The boring logs are for information purposes only and are not intended as representations or warranties of accuracy and continuity between soil borings. The boring logs are not a part of the Contract Documents and are not a warrant of subsurface conditions. The Owner does not warrant the accuracy of the boring logs. Therefore, the Bidders are to make their own investigation of the site.
 - 2. The Site Conditions below grade are noted as **unclassified**.

1.2 PROJECT CONDITIONS

- A. Bidders shall examine the site and the record of investigations and determine for themselves the existing conditions and the character of the subsurface conditions to be encountered. The owner and Architect do not assume responsibility for subsurface conditions other than at the locations and at the time the borings were made.
- B. Claims for additional costs due to subsurface conditions encountered will not be permitted unless specifically noted otherwise in the Contract Documents.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION 003132

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KRUGER TECHNOLOGIES, INC.

GEOTECHNICAL ■ ENVIRONMENTAL ■ TESTING ■ INSPECTION
8271 MELROSE DRIVE ■ LENEXA, KANSAS 66214 ■ VOICE 913-498-1114 ■ FAX 913-498-1116 ■ EMAIL
KTIKC@KTIONLINE.COM

September 18, 2023

Ms. Emily Scaduto, NCIDQ, LEED GA
Hollis & Miller Architects
1828 Walnut Street, Suite 200
Kansas City, MO 64108

Re: KTI Project No. 223118G Addendum #2
EPiC Elementary School Storm Shelter Addition
Liberty, Missouri

Dear Ms. Scaduto:

Kruger Technologies, Inc. (KTI) completed a subsurface exploration and geotechnical report for the above referenced project with the results and subsequent recommendations submitted in our report titled *Report of Geotechnical Exploration –EPiC Elementary School Storm Shelter Addition* dated June 27, 2023. Per request from the project team, we have added a description of settlement monitoring recommendations to be considered for building pad and general site development fills for the project: **This Addendum #2 is being issued to correct an administrative issue with Addendum #1 and rescinds and completely replaces Addendum #1 with this document.**

Consolidation Settlement

We understand that fills up to approximately 16 feet will be placed within the addition site. The greatest thickness of fill will be placed in the area corresponding to B-2. Placement of this fill will initiate time-dependent consolidation settlements within the underlying clay soils which could result in producing a potential for differential settlement of the foundations of the addition building.

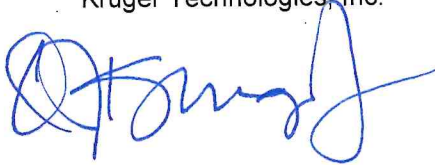
The existing soil below the embankment settles over time when a heavy embankment is constructed. Therefore, settlement control is necessary to measure the settlement and to ensure that the settlement has slowed to an acceptable rate. We recommend placing one steel settlement plate (2 ft by 2 ft by ¼") prior to the beginning of embankment operations near the Boring B-2 and at the area of greatest fill. A second shallow monument should be placed near this location at the surface of the fill immediately after fill placement completion. Care should be taken by the contractor to avoid causing damage to the settlement monitoring apparatus. Fill lifts placed around the settlement apparatuses should be fairly level so that there will be no displacement of the apparatuses during fill placement operations. Survey readings should be taken once a week during and after the embankment is constructed to subgrade elevation. Survey readings should continue until the settlement rate is ¼ inch or less for three consecutive weekly readings.

An example of a monitoring device has been included with this addendum. KTI would provide and install the monitoring devices and evaluate the weekly survey readings provided by others. We anticipate that consolidation and settlement would reach acceptable levels within 60 days of fill completion.

These recommendations should be used in conjunction with the original KTI Geotechnical Report No. 223118G dated June 27, 2023.

We thank you for the opportunity to work with Hollis & Miller Architects. If you have any questions, please contact us at 913.498.1114.

Respectfully submitted,
Kruger Technologies, Inc.



Otto J. Kruger, Jr., P.E.
Missouri P.E.: 23994



**REPORT OF GEOTECHNICAL EXPLORATION
DISCOVERY MIDDLE SCHOOL STORM SHELTER ADDITION
LIBERTY, MISSOURI**

Presented to:

Ms. Emily Scaduto
HOLLIS & MILLER ARCHITECTS

Prepared by:

Otto J. Kruger, Jr., P.E.

Kruger Technologies, Inc.
Lenexa, Kansas

KTI Project No. 223109G

June 23, 2023

KRUGER TECHNOLOGIES, INC.

GEOTECHNICAL ■ ENVIRONMENTAL ■ TESTING ■ INSPECTION
8271 MELROSE DRIVE ■ LENEXA, KANSAS 66214 ■ VOICE 913-498-1114 ■ FAX 913-498-1116 ■ EMAIL
KTIKC@KTIONLINE.COM

June 23, 2023

Ms. Emily Scaduto, NCIDQ, LEED GA
Hollis & Miller Architects
1828 Walnut Street Suite 200
Kansas City, MO 64108

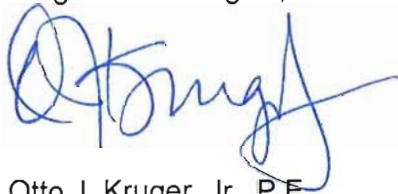
Re: KTI Project No. 223109G
Discovery Middle School Storm Addition
Liberty, Missouri

Dear Ms. Scaduto:

Kruger Technologies, Inc. (KTI) has completed the subsurface exploration and geotechnical report for the above referenced project. The purpose of this report was to describe the surface and subsurface conditions encountered at the site, analyze and evaluate this information, and prepare a summary of existing conditions including subsurface material characteristics and to give site specific geotechnical design recommendations.

We thank you for the opportunity to work with Hollis & Miller Architects. If you have any questions, please contact us at 913.498.1114.

Respectfully submitted,
Kruger Technologies, Inc.



Otto J. Kruger, Jr., P.E.
Missouri: 23994



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**REPORT OF GEOTECHNICAL EXPLORATION
DISCOVERY MIDDLE SCHOOL STORM SHELTER ADDITION
LIBERTY, MISSOURI**

AUTHORIZATION

The following table presents the authorization documentation history for the work performed and presented in this report by Kruger Technologies, Inc.

| Project: Discovery Middle School Storm Shelter Addition in Liberty, Missouri | | |
|--|---------|---|
| Document: | Date: | Requested/Provided: |
| Request for Proposal | 5-17-23 | Emily Scaduto– Hollis & Miller Architects |
| KTI Proposal 23GT095 | 5-31-23 | Dylan Kruger – Kruger Technologies, Inc. |
| Notice to Proceed | 6-2-23 | Emily Scaduto– Hollis & Miller Architects |

PURPOSE AND SCOPE

The purpose of this investigation was to explore the surface and subsurface conditions present within the site to the west side of the existing gymnasium and provide recommendations for the proposed storm shelter addition regarding the following:

- Seismic Considerations
- Site Preparation and Engineered Fill
- Lateral Earth Pressure
- Shallow Foundations Bearing on Native Soil
- Slab on Grade
- Surface Drainage
- Excavation Considerations
- Trench Backfill Recommendations
- Manhole/Inlet Structure Backfill Recommendations

PROJECT DESCRIPTION

The project consists of the design and construction of a storm shelter addition to the existing Discovery Middle School located at 800 Midjay Drive in Liberty, Missouri. We understand that the addition will be approximately 9,000 square feet and will include a multipurpose ICC 500 storm shelter structure and vestibule to be built to the west side of the existing gymnasium.

FIELD EXPLORATION PROCEDURES

Four (4) test borings for the building additions were completed on June 13, 2023. The boring locations were selected by the client and field located by Kruger Technologies using a site photo provided by the client. The boring locations are shown on the attached Boring Location Diagram. Depths indicated on the boring logs are referenced from the ground surface at the time of the exploration. Boring elevation was assumed from google earth.

The borings were drilled using a CME-55 drill rig. Advancement of the test holes was accomplished using 4-inch hollow stem augers. Soil sampling was performed by hydraulically pushing thin wall steel (Shelby) tubes and by driving Standard Penetration Test (SPT).

Site soils were visually and manually classified in general accordance with ASTM D 2488 by the drill crew chief as drilling progressed. The soil samples collected in the field were delivered to the laboratory for applicable testing and verification of the field classifications. The boring logs were created as the borings were advanced and the logs were supplemented with information from the laboratory tests to present data concerning the depth and classification of the various strata, water levels, and other pertinent information. The boring logs are attached in Appendix I.

Groundwater was not encountered at any test borings. It should be noted that water level determinations made in relatively impervious (clay) soils might not present a reliable indication of the actual water table. However, water level determinations made in relatively pervious (sand/silt) soils are considered an accurate indication of the water table at the time that those measurements are made. Fluctuations in the water table should be expected with changing seasons and annual differences.

LABORATORY TESTS

Laboratory tests were performed on the recovered samples to determine the engineering characteristics and for additional verification of the field classifications in accordance with ASTM D 2487. The results of these tests, including moisture/density, plasticity (Atterberg Limits) and unconfined compressive strength of soil are presented in Appendix II.

SITE CONDITIONS

The proposed building addition will be within the existing campus of Discovery Middle School located at 800 Midjay Drive in Liberty, Missouri, and is adjacent to the existing South Valley

Middle School. At the time of the investigation the proposed building addition site was grass/gravel covered and was relatively flat. Based on the approximate test boring elevations (807-811), the site has an approximate 4-foot elevation change across the proposed addition.

GEOLOGY/SUBSURFACE CONDITIONS

The topsoil encountered was generally 6 inches to 1 foot thick. Below the topsoil, site native soils were encountered to the planned drilling depth of 20 feet. The native soils encountered were comprised predominantly of low plasticity (CL) to high plasticity (CH) clays and were generally medium stiff to stiff consistency and moist. Bedrock material was not encountered at any boring within the 20 foot planned drilling depth. As previously stated, free ground water was not encountered at any test borings.

DESIGN CRITERIA AND RECOMMENDATIONS

Laboratory test results of the recovered samples showed the following characteristics that were used as criteria for determining the recommendations for bearing values and design data:

| | |
|--|---------------------|
| Natural Dry Density | 99.2. to 107.6 pcf |
| Natural Moisture Content | 15.7 to 23.9% |
| Liquid Limit..... | 50 to 52 |
| Plastic Limit..... | 31 to 32 |
| Unconfined Compressive Strength of Soil..... | 2,109 to 5,9991 psf |

Seismic Considerations

Based on the International Building Code (IBC) Section 1613.1, the subsurface stratigraphy, and the use of a shallow foundation system bearing on native clay soils, the general Site Class Definition for the project area is Site Class C.

Site Preparation and Engineered Fill

Areas to receive fill should be stripped of vegetation, topsoil, and any other deleterious materials. Any isolated areas of soft or deleterious materials encountered at subgrade elevation should be removed and replaced with engineered fill. The moisture content of the subgrade soils should be appropriate to achieve the required compaction. Proper drainage of the construction areas should be provided to protect foundation and floor slab subgrade soils from the detrimental effects of weather conditions. Excavations should be kept as dry as possible. Any loose or soft materials that accumulate or develop on subgrade or bearing surfaces should

be removed prior to the placement of concrete. Construction traffic, including foot traffic, should be minimized. Concrete should be placed in footing excavations as soon as possible after excavations are completed.

Trucks and other heavy construction vehicles should be restricted as much as possible from trafficking on the finished subgrade in the building to prevent unnecessary disturbances of subgrade soils. Excessive rutting or pumping of the subgrade could occur from construction traffic, particularly during periods of wet weather. If such disturbed areas develop, the subgrade may have to be excavated and replaced with properly compacted fill.

Supplemental engineered fill should be placed in uniform horizontal lifts, with loose thicknesses not exceeding 8 inches. The thickness must be appropriate for the method of compaction and the type of equipment used. The geotechnical engineer should approve any off-site material proposed for use as fill. Engineered fill should be compacted to a minimum of 95 percent of maximum density as determined by ASTM D698 (standard Proctor test) at a moisture content between 0 and 4 percent above optimum moisture for high plasticity clay material and from -2 to +2 percent from optimum moisture content for low plasticity clays. Most of the site soils encountered during the exploration are suitable for reuse as engineered fill except below the slab on grade (see Slab on Grade section for more details).

The fill should be benched in any sloped areas greater than one vertical to five horizontal in order to maintain relatively horizontal lifts. The benching should be placed at not less than 12-inch rises over those areas where it is required as the work is brought up in layers.

Lateral Earth Pressures

The following K values are estimated for the determination of lateral soil resistance for retaining structures and below grade walls based on material characteristics. K_a values are appropriate for calculating lateral pressure behind retaining walls which are unrestrained at the top and will experience some translational or rotational movement i.e. modular retaining wall. K_o values are appropriate for calculating lateral pressure behind retaining walls that are restrained at the top and will experience very little or no movement i.e. basement walls. K_p values are used to calculate the lateral pressure exerted by soil experiencing compression during wall movement. These design values do not include the effects of hydrostatic water or surface surcharges.

In Situ Low Plasticity Cohesive Soils (Estimated ϕ of 26°)

$K_a = 0.39$ (active) $K_p = 2.56$ (passive) $K_o = 0.56$ (at rest)

Coefficient of sliding friction = 0.33

Wet density of in place soil, average (γ) = 125 pcf

Compacted Low Plasticity Cohesive Soils (Estimated ϕ of 28°)

$K_a = 0.36$ (active) $K_p = 2.77$ (passive) $K_o = 0.53$ (at rest)

Coefficient of sliding friction = 0.35

Wet density of in place soil, average (γ) = 130 pcf

Granular backfill (Estimated ϕ of 35°)

$K_a = 0.27$ (active) $K_p = 3.69$ (passive) $K_o = 0.43$ (at rest)

Coefficient of sliding friction = 0.47

Wet density of in-place gravel, average (γ) = 135 pcf

Shallow Foundations Bearing on Native Soils

The recommended foundation system for the storm shelter addition is a shallow foundation system bearing on the site native clay soils. Based on the unconfined compressive strengths of the existing undisturbed soils present at the approximate footing bearing elevations the site soils exhibit net allowable bearing capacities of 2,000 pounds per square foot (psf) for both continuous footings and for rectangular footings. However, a low unconfined value was obtained at boring B-2 and we recommend that the bearing capacity of the foundation soils in this area be checked and evaluated by the geotechnical engineer at the time of construction. It is advisable to place the addition foundations at the same level as the existing building foundations so that stress applied by the addition will not be transmitted to the existing foundations. During construction, the existing foundations must not be undercut.

Anticipated settlements for these bearing capacities in native soils are 0.5-0.75 inches of total settlement, with a likely differential settlement of 0.5 inches over a horizontal distance of 30 feet. The minimum frost depth for this region is 36 inches. We recommend that the minimum column or isolated footing width be 30 inches and the minimum continuous footing width be 18 inches.

Slab on Grade

For slab on grade subgrade, it is recommended that the top 18 inches of subgrade directly below the slab be a low swell potential material or low volume change material (LVC). **The majority of site soils from 1 foot to 3 feet below the assumed FF elevation do not meet the requirement for LVC material and may not be used directly below the slab.** The existing materials present on site at the anticipated elevation for the slab on grade subgrade are considered high-volume change materials. To minimize the swell potential for slabs-on-grade where limited vertical rise is desired, we recommend against utilizing any untreated in-situ materials within the upper 18" of subgrade below slabs on grade. We recommend that to minimize the potential for swell, over-excavate and replace the upper 18" of subgrade (including a capillary break material comprised of clean crushed stone) with low swell material such as crushed limestone screenings, well-graded crushed limestone (AB-3 or MoDOT Type 5), or stabilized parent soil using 12 to 15% flyash or 5% cement.

Movement between slabs on grade and walls may occur. To minimize the effects of this movement, we recommend that slip joints be incorporated between all slabs and walls. All slabs should contain crack control and construction joints, which are formed on 15 to 25-foot centers, each way, or as designed by the project structural engineer. A capillary moisture barrier should be placed under the slabs. This barrier should be a minimum of a 6-inch thick layer of clean granular material extending to the limits of the foundation walls. Should additional moisture protection be desired, it should be a minimum of 6-mil polyethylene sheeting placed between the slab and the base course. As an acceptable alternative levelling and drainage course, we recommend the use of Grading "A" Requirements for soil-Aggregate Material listed on ASTM M147 and the grading requirement listed below in lieu of clean rock.

| <u>Sieve Designation</u> | <u>Percent Passing by Weight</u> |
|--------------------------|----------------------------------|
| 1" | 100 |
| 3/8" | 30 – 65 |
| No. 4 | 25 – 65 |
| No. 10 | 15 – 40 |
| No. 40 | 8 – 20 |
| No. 200 | 2 – 8 |

For the purpose of slab design, a modulus of subgrade reaction (k) of 100-pounds/cubic inch is suggested. This value is based on a subgrade consisting of well-compacted, plastic clay fill. If a stabilized subgrade is used, a k-value of 200-pounds/cubic inch is suggested.

Surface Drainage

In order to reduce the problems related to water infiltration, it is recommended that the final grade around the structure perimeters have a positive slope extending at least six feet away from the structure. Backfill of soils around the foundation should be compacted at a minimum of 95 percent of maximum dry density at moisture content between optimum and four percent above optimum in accordance with ASTM D 698.

Excavation Considerations

We believe that the project soils are Type B as classified in the OSHA Excavation Standard Handbook 29 CFR Parts 1926.650 through 1926.652. Type B soils are characterized by cohesive soils above the water table with unconfined compressive strengths greater than 0.5 tons per square foot (tsf) but less than 1.5 tsf. Type B soils include any fill soils meeting the above criteria, as well as undisturbed soils with unconfined compressive strengths of greater than 1.5 tsf which are subject to vibration from traffic. Temporary excavation slopes for Type B soils can be one horizontal to one vertical with a maximum excavation depth of 20 feet.

Excavations deeper than 20 feet may require the use of supplemental shoring and will require the preparation of an excavation design prepared by a registered professional engineer. Competent bedrock material may generally be cut vertically.

Trench Backfill Recommendations

Deleterious materials such as organic matter, topsoil, rock fragments larger than 3 inches in diameter, debris, and any other materials judged to be unsatisfactory by the geotechnical engineer, should not be included in the backfill. Backfill should not be placed on soft materials or frozen ground. Soil backfill overlying the bedding should be placed in uniform horizontal lifts, with loose thicknesses not exceeding 8 inches. The thickness must be appropriate for the method of compaction and the type of equipment used. The geotechnical engineer should approve any off-site material proposed for use as fill. Trench backfill under driveways/parking lots should be compacted to a minimum of 95 percent of maximum density as defined by Standard Proctor (ASTM D 698) at a moisture content between 0 and 4 percent above optimum moisture (preferred average of plus 2 percent). In common yard areas, the soil backfill should be compacted to a minimum of 90 percent of maximum density (ASTM D 698) using the above moisture parameters. After preparation of the trench bottom, a pipe bed of a minimum of 6

inches shall be prepared using crushed stone or crushed gravel meeting the following requirements:

| <u>Nominal Pipe Size Diameter</u> | <u>AASHTO M43 Size</u> |
|-----------------------------------|------------------------|
| 15" or Less | 67, 7, 8 or washed #9 |
| Greater than 15" | 57, 6, or 67 |

Manhole/Inlet Structure Backfill Recommendations

Soil backfill around structures should be placed in uniform horizontal lifts, with loose thicknesses not exceeding 8 inches. The thickness must be appropriate for the method of compaction and the type of equipment used. The geotechnical engineer should approve any off-site material proposed for use as fill. Backfill should be compacted to a minimum of 95 percent of maximum density as defined by Standard Proctor (ASTM D 698) at a moisture content between 0 and 4 percent above optimum moisture (preferred average of plus 2 percent). Another option is to backfill with a Controlled Low Strength Material (CLSM), or flowable fill. The flowable fill should exhibit a minimum unconfined compressive strength of 250 psi after 28 days. Bedding material for manhole/inlet structure should be clean crushed rock conforming to the following gradation:

| <u>Sieve Designation</u> | <u>Percent Passing by Weight</u> |
|--------------------------|----------------------------------|
| 1 ½" | 100 |
| No. 4 | 0 – 35 |
| No. 200 | 0 – 8 |

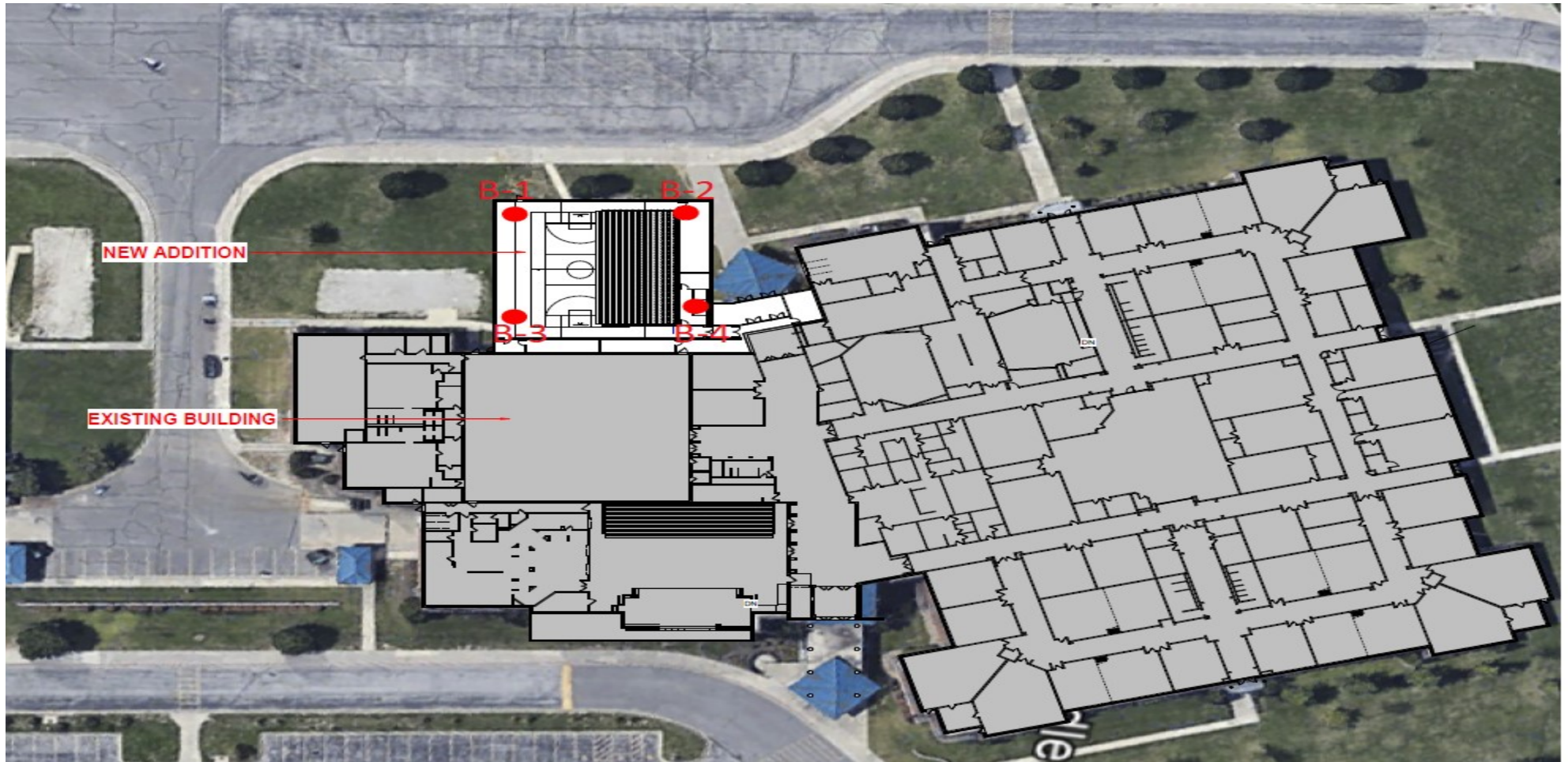
REMARKS

It is recommended that the geotechnical engineer be retained to review the plans and specifications for the project so that an evaluation and comments can be provided regarding the proper incorporation of information from this geotechnical report into the final construction documents. We further recommend that the geotechnical engineer be retained during construction phases for earthwork and foundations to provide observation and testing to aid in determining that design intent has been accomplished.

The findings in this report are based on data acquired to date and are assumed to be representative of conditions at locations between borings. Due to the fact that the area at the borings is very small relative to the overall site, and for other reasons, we make no statement warranting the conditions below our borings or at other locations throughout the site. In addition, we do not warrant that the general strata logged at the borings are necessarily typical of the remaining areas of the site.

Reports shall not be reproduced, except in full, without written approval of KTI. Information in this report applies only to the referenced project in its present configuration and location and shall not be used for any other project or location.

BORING LOCATION DIAGRAM



Boring Location Diagram
Discovery Middle School Storm Shelter Addition
Liberty, Missouri

KRUGER TECHNOLOGIES, INC.

Drawn: TMA

Date: 6/21/23

KTI Project No. 223109G

APPENDIX I

Boring Logs



LOG OF TEST BORING

BORING B-1

PROJECT: Discovery Middle School Addition

CLIENT: Hollis + Miller Architects

PROJECT NO.: 223109G

START: 06/16/23

BORING LOCATION: See Boring Location Plan

METHOD OF DRILLING: 4" Continuous Flight Augers

DEPTH TO - water None

caving

DATE: 6/21/2023

ELEVATION: 807

FINISH: 06/16/23

LOGGER: DC

DATE CHECKED:

| ELEVATION/ DEPTH | SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA | USCS | Description | Sample # & Type | Density pcf | Moist- ure, % | Qu, psf |
|---------------------|--|-------|--|--------------------|----------------|------------------|------------|
| 807 0 | | T | Topsoil | | | | |
| | | CH | Fat clay, stiff, dark brown, moist | 1, ST | 102.5 | 20.1 | |
| 804 3 | | CH | Fat clay, stiff, grayish brown, moist | 2, ST | 102.8 | 22.1 | 4990 |
| 801 6 | | CH | | | | | |
| 798 9 | 4/6" 5/6" 6/6" | CL-CH | Lean to fat clay, stiff, light brown, moist | 1, SS | | 21.0 | |
| 795 12 | | | | | | | |
| | 4/6" 5/6" 7/6" | CL-CH | Lean to fat clay, stiff, orange brown, moist | 2, SS | | 20.6 | |
| 792 15 | | | | | | | |
| 789 18 | 4/6" 5/6" 6/6" | CL-CH | Lean to fat clay, stiff, light brown, moist | 3, SS | | 20.2 | |
| 786 21 | | | Drilling discontinued at 20.0 feet | | | | |

Notes:



LOG OF TEST BORING

BORING B-2

PROJECT: Discovery Middle School Addition

CLIENT: Hollis + Miller Architects

PROJECT NO.: 223109G

START: 06/16/23

BORING LOCATION: See Boring Location Plan

METHOD OF DRILLING: 4" Continuous Flight Augers

DEPTH TO - water None

caving

DATE: 6/21/2023

ELEVATION: 807

FINISH: 06/16/23

LOGGER: DC

DATE CHECKED:

| ELEVATION/ DEPTH | SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA | USCS | Description | Sample # & Type | Density pcf | Moist- ure, % | Qu, psf |
|---------------------|--|------|---|--------------------|----------------|------------------|------------|
| 807 0 | | T | Topsoil | | | | |
| | | CH | Fat clay, stiff, dark brown, moist | 1, ST | 99.8 | 20.5 | |
| 804 3 | | | Fat clay, stiff, dark grayish brown, moist | 2, ST | 99.2 | 17.1 | 2109 |
| 801 6 | | | | | | | |
| 798 9 | | CH | Fat clay, medium stiff, dark brown, moist | 1, SS | | 23.3 | |
| 795 12 | | | | | | | |
| 792 15 | | | Lean to fat clay, stiff, orange brown, moist | 2, SS | | 20.2 | |
| 789 18 | | | | | | | |
| 786 21 | | | Lean to fat clay, stiff, grayish brown, moist | 3, SS | | 19.2 | |
| | | | Drilling discontinued at 20.0 feet | | | | |

Notes:



LOG OF TEST BORING

BORING B-3

PROJECT: Discovery Middle School Addition

CLIENT: Hollis + Miller Architects

PROJECT NO.: 223109G

START: 06/16/23

BORING LOCATION: See Boring Location Plan

METHOD OF DRILLING: 4" Continuous Flight Augers

DEPTH TO - water None

caving

DATE: 6/21/2023

ELEVATION: 811

FINISH: 06/16/23

LOGGER: DC

DATE CHECKED:

| ELEVATION/ DEPTH | SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA | USCS | Description | Sample # & Type | Density pcf | Moist- ure, % | Qu, psf |
|---------------------|--|------|--|--------------------|----------------|------------------|------------|
| 0 | | T | Topsoil | | | | |
| 810 | | CH | Fat clay, stiff, dark grayish brown, moist | 1, ST | 103.0 | 20.6 | |
| 3 | | CH | Fat clay, stiff, orange brown, moist | 1, SS | | 19.1 | |
| 807 | | CH | Fat clay, stiff, dark brown, moist | 2, SS | | 23.9 | |
| 6 | | CH | Fat clay, stiff, dark brown, moist | 2, SS | | 19.6 | |
| 804 | | CH | Fat clay, stiff, dark brown, moist | 4, SS | | 19.2 | |
| 9 | | CH | Fat clay, stiff, dark brown, moist | | | | |
| 801 | | CH | Fat clay, stiff, dark brown, moist | | | | |
| 12 | | CH | Fat clay, stiff, dark brown, moist | | | | |
| 798 | | CH | Fat clay, stiff, dark brown, moist | | | | |
| 15 | | CH | Fat clay, stiff, dark brown, moist | | | | |
| 795 | | CH | Fat clay, stiff, dark brown, moist | | | | |
| 18 | | CH | Fat clay, stiff, dark brown, moist | | | | |
| 792 | | CH | Fat clay, stiff, dark brown, moist | | | | |
| 21 | | CH | Fat clay, stiff, dark brown, moist | | | | |
| 789 | | CH | Fat clay, stiff, dark brown, moist | | | | |

Notes:



LOG OF TEST BORING

BORING B-4

PROJECT: Discovery Middle School Addition

CLIENT: Hollis + Miller Architects

PROJECT NO.: 223109G

START: 06/16/23

BORING LOCATION: See Boring Location Plan

METHOD OF DRILLING: 4" Continuous Flight Augers

DEPTH TO - water None

caving

DATE: 6/21/2023

ELEVATION: 811

FINISH: 06/16/23

LOGGER: DC

DATE CHECKED:

| ELEVATION/ DEPTH | SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA | USCS | Description | Sample # & Type | Density pcf | Moist- ure, % | Qu, psf |
|---------------------|--|-------|---|--------------------|----------------|------------------|------------|
| 0 | | T | Topsoil | | | | |
| 810 | | CH | Fat clay, stiff, dark brown, moist | 1, ST | 93.6 | 17.9 | |
| 3 | | | | | | | |
| 807 | | CH | Fat clay, very stiff, orange brown, moist | 2, ST | 107.6 | 15.7 | 5991 |
| 6 | | | | | | | |
| 804 | | | | | | | |
| 9 | | CH | Fat clay, stiff, dark grayish brown, moist | 1, SS | | 16.4 | |
| 801 | | CH | | | | | |
| 12 | | | | | | | |
| 798 | | CL-CH | Lean to fat clay, stiff, grayish brown, moist | 2, SS | | 20.0 | |
| 15 | | CL-CH | | | | | |
| 795 | | | | | | | |
| 18 | | CL-CH | Lean to fat clay, stiff, brown, moist | 3, SS | | 19.4 | |
| 792 | | CL-CH | | | | | |
| 21 | | | Drilling discontinued at 20.0 feet | | | | |
| 789 | | | | | | | |

Notes:

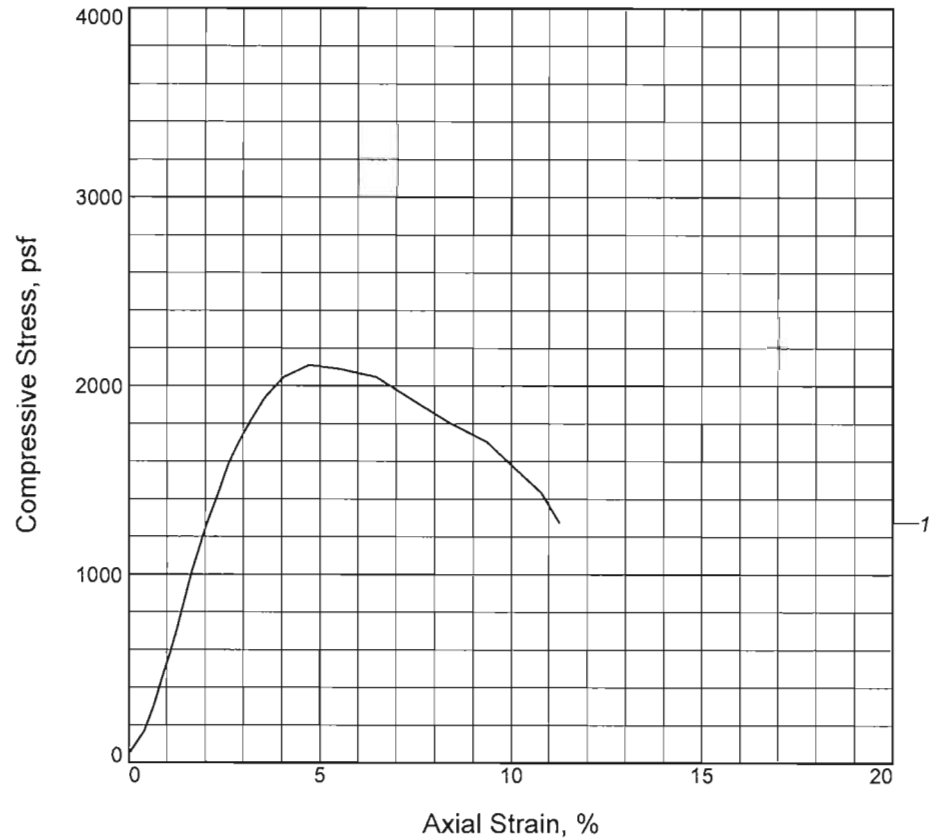
APPENDIX II

Laboratory Results

SUMMARY OF LABORATORY TEST RESULTS UNDISTURBED SAMPLE

| Boring | Depth (Ft) | Sample No./Type | Natural Moisture % | Natural Dry Density (pcf) | Unconfined Compressive Strength (psf) | Atterberg Limits | | Soil Type |
|--------|------------|-----------------|--------------------|---------------------------|---------------------------------------|------------------|--------------------|-----------|
| | | | | | | Liquid Limit % | Plasticity Index % | |
| B-1 | 1.0-3.0 | ST-1 | 20.1 | 102.5 | | 50 | 32 | CH |
| B-1 | 3.0-5.0 | ST-2 | 22.1 | 102.8 | 4990 | | | |
| B-1 | 8.5-10.0 | SS-1 | 21.0 | | | | | |
| B-1 | 13.5-15.0 | SS-2 | 20.6 | | | | | |
| B-1 | 18.5-20.0 | SS-3 | 20.2 | | | | | |
| B-2 | 1.0-3.0 | ST-1 | 20.5 | 99.8 | | | | |
| B-2 | 3.0-5.0 | ST-2 | 17.1 | 99.2 | 2109 | | | |
| B-2 | 8.5-10.0 | SS-1 | 23.3 | | | | | |
| B-2 | 13.5-15.0 | SS-2 | 20.2 | | | | | |
| B-2 | 18.5-20.0 | SS-3 | 19.2 | | | | | |
| B-3 | 1.0-3.0 | ST-1 | 20.6 | 103.0 | | 52 | 31 | CH |
| B-3 | 3.5-5.0 | SS-1 | 19.1 | | | | | |
| B-3 | 8.5-10.0 | SS-2 | 23.9 | | | | | |
| B-3 | 13.5-15.0 | SS-3 | 19.6 | | | | | |
| B-3 | 18.5-20.0 | SS-4 | 19.2 | | | | | |
| B-4 | 1.0-3.0 | ST-1 | 17.9 | 93.6 | | | | |
| B-4 | 3.0-5.0 | ST-2 | 15.7 | 107.6 | 5991 | | | |
| B-4 | 8.5-10.0 | SS-1 | 16.4 | | | | | |
| B-4 | 13.5-15.0 | SS-2 | 20.0 | | | | | |
| B-4 | 18.5-20.0 | SS-3 | 19.4 | | | | | |

UNCONFINED COMPRESSION TEST



| | | | |
|-------------------------------|--------|--|--|
| Sample No. | 1 | | |
| Unconfined strength, psf | 2109 | | |
| Undrained shear strength, psf | 1054 | | |
| Failure strain, % | 4.7 | | |
| Strain rate, in./min. | 0.050 | | |
| Water content, % | 17.1 | | |
| Wet density, pcf | 116.2 | | |
| Dry density, pcf | 99.2 | | |
| Saturation, % | 65.4 | | |
| Void ratio | 0.7118 | | |
| Specimen diameter, in. | 2.83 | | |
| Specimen height, in. | 5.87 | | |
| Height/diameter ratio | 2.07 | | |

Description: Fat clay, stiff, dark grayish brown, moist

LL = PL = PI = Assumed GS= 2.72 Type: ST

Project No.: 223109G
Date Sampled: 6/13/23
Remarks:

Client: Hollis + Miller Architects

Project: Discovery Middle School Addition

Source of Sample: B-2 **Depth:** 3

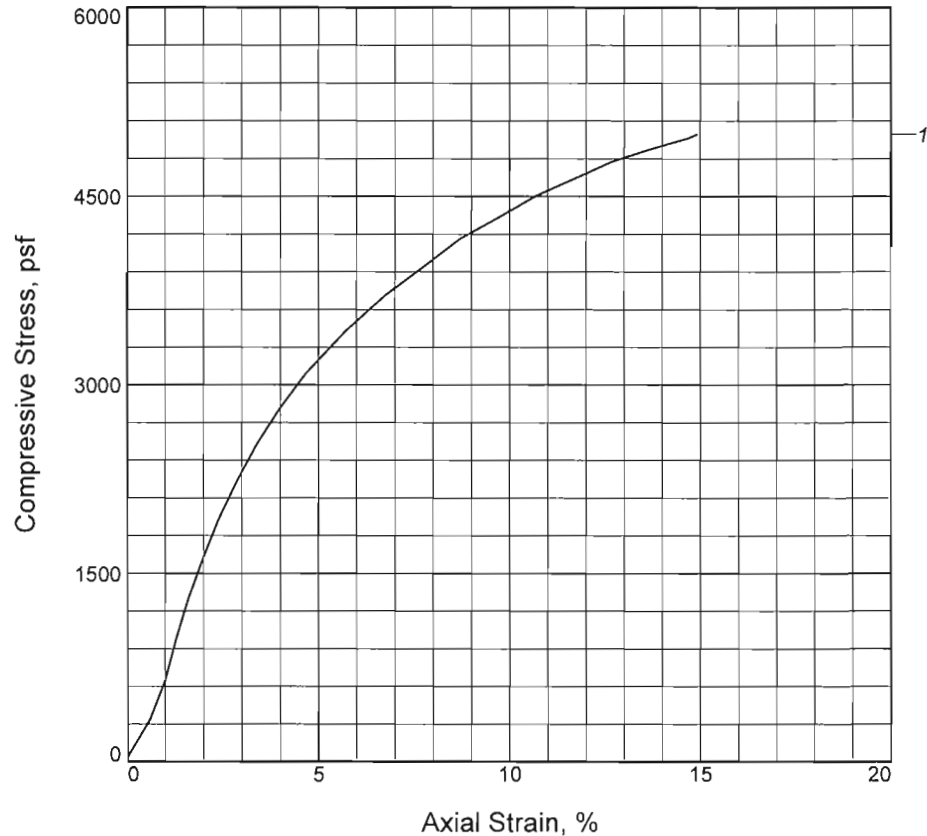
Sample Number: 2

Figure _____



Tested By: TA **Checked By:** OJK

UNCONFINED COMPRESSION TEST



| | | | | |
|-------------------------------|--------|--|--|--|
| Sample No. | 1 | | | |
| Unconfined strength, psf | 4990 | | | |
| Undrained shear strength, psf | 2495 | | | |
| Failure strain, % | 14.9 | | | |
| Strain rate, in./min. | 1.000 | | | |
| Water content, % | 22.1 | | | |
| Wet density, pcf | 125.5 | | | |
| Dry density, pcf | 102.8 | | | |
| Saturation, % | 92.1 | | | |
| Void ratio | 0.6520 | | | |
| Specimen diameter, in. | 2.86 | | | |
| Specimen height, in. | 5.64 | | | |
| Height/diameter ratio | 1.97 | | | |

Description: Fat clay, stiff, grayish brown, moist

LL = PL = PI = Assumed GS= 2.72 Type: ST

Project No.: 223109G
Date Sampled: 6/13/23
Remarks:

Client: Hollis + Miller Architects

Project: Discovery Middle School Addition

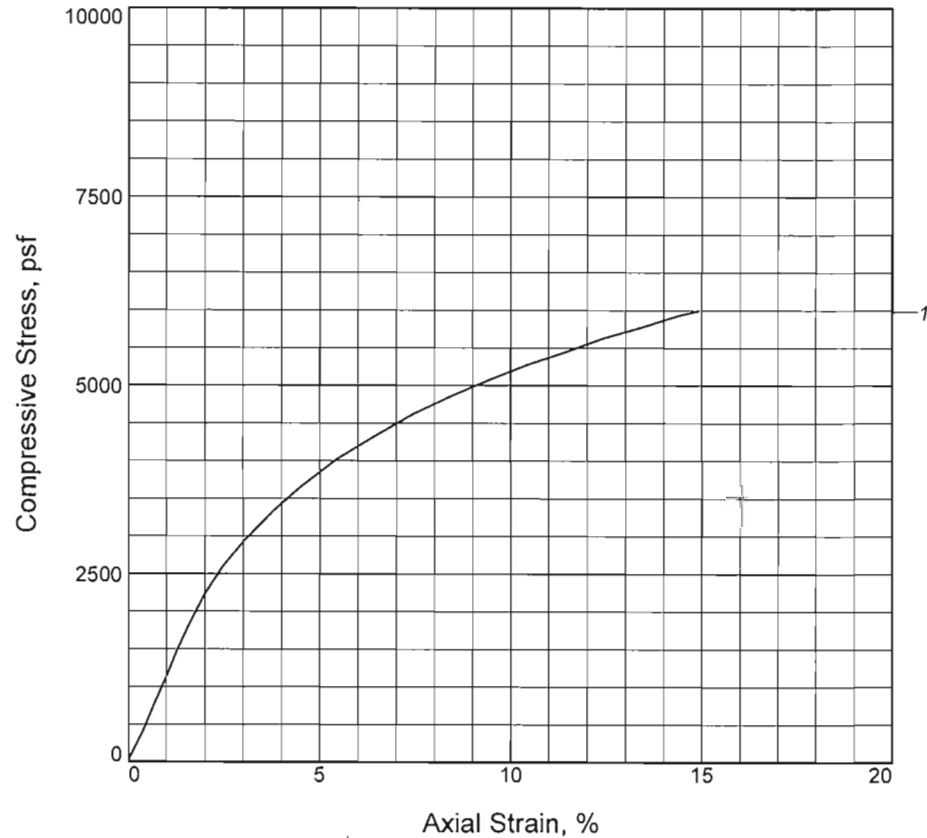
Source of Sample: B-1 **Depth:** 3
Sample Number: 2

Figure _____



Tested By: TA **Checked By:** OJK

UNCONFINED COMPRESSION TEST



| | | | | |
|-------------------------------|--------|--|--|--|
| Sample No. | 1 | | | |
| Unconfined strength, psf | 5991 | | | |
| Undrained shear strength, psf | 2995 | | | |
| Failure strain, % | 14.9 | | | |
| Strain rate, in./min. | 0.050 | | | |
| Water content, % | 15.7 | | | |
| Wet density, pcf | 124.5 | | | |
| Dry density, pcf | 107.6 | | | |
| Saturation, % | 73.9 | | | |
| Void ratio | 0.5779 | | | |
| Specimen diameter, in. | 2.84 | | | |
| Specimen height, in. | 5.63 | | | |
| Height/diameter ratio | 1.98 | | | |

Description: Fat clay, very stiff, orange brown, moist

LL = **PL =** **PI =** **Assumed GS= 2.72** **Type: ST**

Project No.: 223109G

Date Sampled: 6/13/23

Remarks:

Client: Hollis + Miller Architects

Project: Discovery Middle School Addition

Source of Sample: B-4 **Depth:** 3

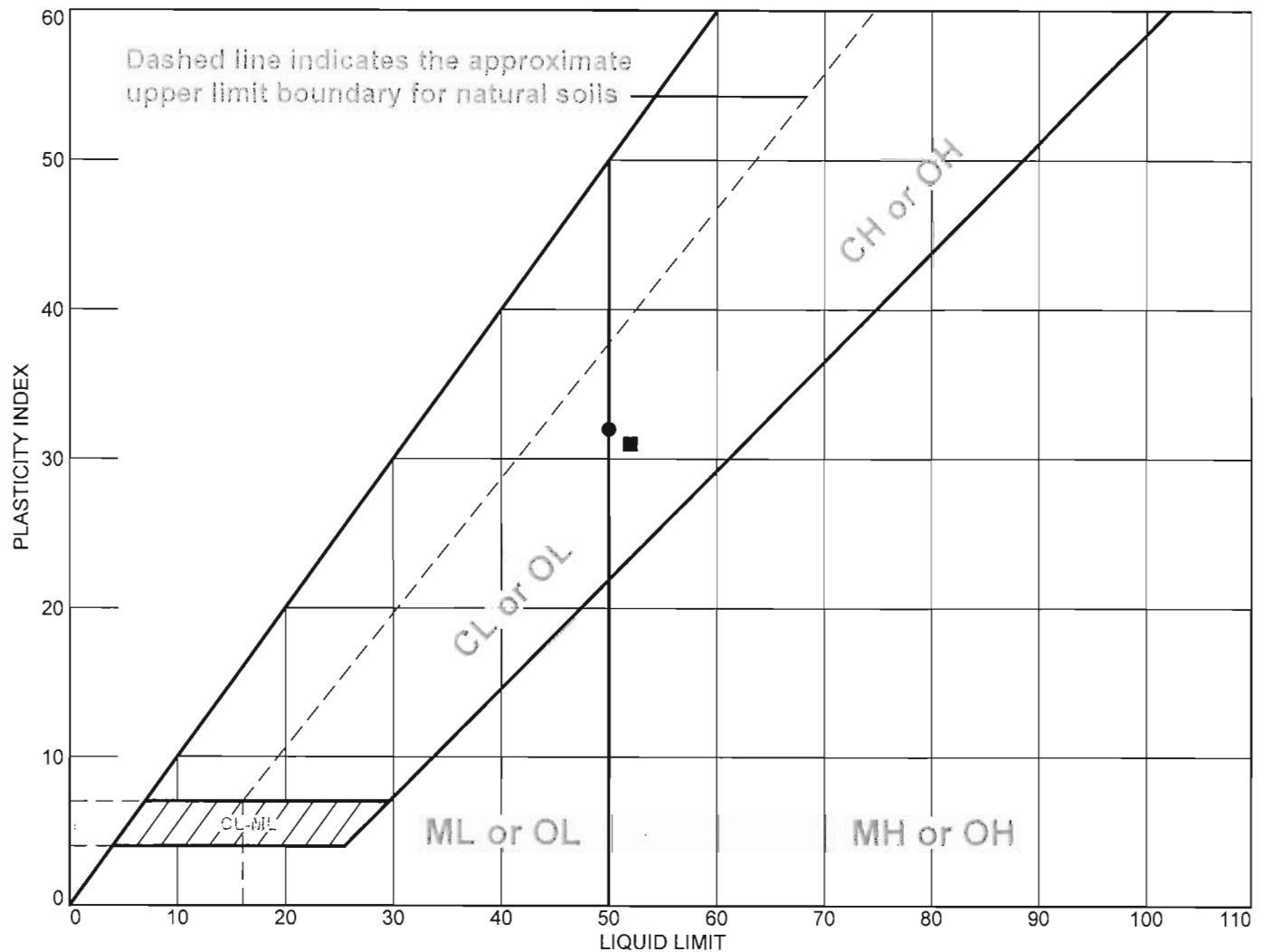
Sample Number: 2

Figure _____



Tested By: TA **Checked By:** OJK

LIQUID AND PLASTIC LIMITS TEST REPORT ASTM D 4318



| | MATERIAL DESCRIPTION | LL | PL | PI | %<#40 | %<#200 | USCS |
|---|--|----|----|----|-------|--------|------|
| ● | Fat clay, stiff, dark brown, moist | 50 | 18 | 32 | | | CH |
| ■ | Fat clay, stiff, dark grayish brown, moist | 52 | 21 | 31 | | | CH |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

Project No. 223109G **Client:** Hollis + Miller Architects

Project: Discovery Middle School Addition

● **Source of Sample:** B-1 **Depth:** 1 **Sample Number:** 1

■ **Source of Sample:** B-3 **Depth:** 1 **Sample Number:** 1

Remarks:

KTI

Figure

GLOSSARY OF GEOTECHNICAL TERMS

| | |
|-------------------|---|
| ALLUVIUM | Sediments deposited by streams, including riverbeds and floodplains. |
| ARGILLACEOUS | Rocks composed of or having a notable portion of fine silt and/or clay in their composition. |
| ATTERBERG LIMITS | Water contents, in percentage of dry weight of soil, that correspond to the boundaries between the states of consistency, i.e. the boundary between the liquid and plastic states (liquid limit) and the boundary between the plastic and solid states (plastic limit). |
| BEDROCK-IN-PLACE | Continuous rock mass which essentially has not moved from its original depositional position. |
| CALCAREOUS | Containing calcium carbonate determined by effervescence when tested with dilute hydrochloric acid. |
| CHANNEL SANDSTONE | Sandstone that has been deposited in a streambed or other channel eroded into the underlying beds. |
| COLLUVIAL | Rock debris of various sizes loose from in-place bedrock mass, often shifted down gradient in conjunction with soil. |
| CROSS-BEDDING | Stratification which is inclined to the original horizontal surface upon which the sediment accumulated. |
| FISSILE BEDDING | Term applied to bedding which consists of laminae less than 2 millimeters in thickness. |
| FORMATION | A distinctive body of rock that serves as a convenient unit for study and mapping. |
| FOSSIL DETRITUS | The accumulation of broken, fragmented fossil debris. |
| FOSSILIFEROUS | Containing organic remains. |
| GLACIAL ERRATIC | A transported rock fragment different from the bedrock on which it lies, either free or as part of a sediment. |
| GLACIAL TILL | Nonsorted, nonstratified sediment carried or deposited by a glacier. |
| GLACIOFLUVIAL | Primarily deposited by streams from glaciers. |
| GROUP | A lithostratigraphic unit consisting of two or more formations. |

| | |
|--------------------------------|---|
| JOINT | A fracture in a rock along which no appreciable displacement has occurred. |
| LIMESTONE | A sedimentary rock composed mostly of calcium carbonate (CaCO_3). |
| LOESS | A homogenous, nonstratified, unindurated deposit consisting predominantly of silt, with subordinate amounts of very fine sand and/or clay. |
| MICA | A mineral group, consisting of phyllosilicates, with sheetlike structures. |
| MEMBER | A specially developed part of a varied formation is called a member, if it has considerable geographic extent. |
| NODULE | A small, irregular, knobby, or rounded rock that is generally harder than the surrounding rock. |
| PERMEABILITY | The capacity of a material to transmit a fluid. |
| RECOVERY | The percentage of bedrock core recovered from a core run length. |
| RELIEF | The difference in elevation between the high and low points of a land surface. |
| RESIDUAL SOIL | Soil formed in place by the disintegration and decomposition of rocks and the consequent weathering of the mineral materials. |
| ROCK QUALITY DESIGNATION (RQD) | Refers to percentage of core sample recovered in unbroken lengths of 4 inches or more. |
| SANDSTONE | Sedimentary rock composed mostly of sand sized particles, usually cemented by calcite, silica, or iron oxide. |
| SERIES | A time-stratigraphic unit ranked next below a system. |
| SHALE | A fine-grained plastic sedimentary rock formed by consolidation of clay and mud. |
| STRATIGRAPHY | Branch of geology that treats the formation, compositions, sequence, and correlation of the stratified rocks as parts of the earth's crust. |
| SYSTEM | Designates rocks formed during a fundamental chronological unit, a period. |
| UNCONFORMITY | A surface of erosion or nondeposition, usually the former, which separates younger strata from older rocks. |
| WEATHERING | The physical and chemical disintegration and decomposition of rocks and minerals. |

General Notes

| Laboratory Test Symbols | |
|-------------------------|---|
| Symbol | Definition |
| LL | Liquid Limit (ASTM D4318) |
| PL | Plastic Limit (ASTM D4318) |
| PI | Plasticity Index (LL minus PL) |
| Qu | Unconfined Compressive Strength, Pounds per Square Foot (psf) |
| Qp | Pocket Penetrometer Reading, Tons per Square Foot (TSF) |
| RQD | Rock Quality Designation % (Sum of rock core pieces >4 inches/length of core run) |

Common Soil Classification Symbols

| Clay | |
|--------|------------------------------|
| Symbol | Soil Type |
| CL | Low plasticity clay |
| CL-ML | Low plasticity clay and silt |
| CL/CH | Medium plasticity clay |
| CH | High plasticity clay |

| Silt | |
|--------|----------------------|
| Symbol | Soil Type |
| ML | Low plasticity silt |
| MH | High plasticity silt |

| Sand | |
|--------|--------------------|
| Symbol | Soil Type |
| SW | Well graded sand |
| SP | Poorly graded sand |
| SM | Silty sand |
| SC | Clayey sand |

| Gravel | |
|--------|----------------------|
| Symbol | Soil Type |
| GW | Well graded gravel |
| GP | Poorly graded gravel |
| GM | Silty gravel |
| GC | Clayey gravel |

Descriptive Terminology

Cohesionless Soils

| Relative Density Term | "N" Value |
|-----------------------|------------|
| Very Loose | 0 - 4 |
| Loose | 5 - 9 |
| Medium Dense | 10 - 29 |
| Dense | 30 - 49 |
| Very Dense | 50 or more |

Cohesive Soils

| Consistency Term | "N" Value |
|------------------|-----------|
| Very soft | 0 - 2 |
| Soft | 3 - 4 |
| Medium | 5 - 8 |
| Stiff | 9 - 15 |
| Very Stiff | 16 - 30 |
| Hard | > 30 |

Relative Proportions and Sizes

| Term | Range |
|----------|----------|
| Trace | < 5% |
| A Little | 5 - 15% |
| Some | 15 - 30% |
| With | 30 - 50% |

| Material | Size |
|---------------|-----------------|
| Boulder | > 12" |
| Cobble | 3" - 12" |
| Gravel | 4.75 - 76.2 mm |
| Sand | 0.075 - 4.75 mm |
| Silt and Clay | < 0.075 mm |

**REPORT OF GEOTECHNICAL EXPLORATION
SOUTH VALLEY MIDDLE SCHOOL STORM SHELTER ADDITION
LIBERTY, MISSOURI**

Presented to:

Ms. Emily Scaduto
HOLLIS & MILLER ARCHITECTS

Prepared by:

Otto J. Kruger, Jr., P.E.

Kruger Technologies, Inc.
Lenexa, Kansas

KTI Project No. 223117G

June 26, 2023

KRUGER TECHNOLOGIES, INC.

GEOTECHNICAL ■ ENVIRONMENTAL ■ TESTING ■ INSPECTION
8271 MELROSE DRIVE ■ LENEXA, KANSAS 66214 ■ VOICE 913-498-1114 ■ FAX 913-498-1116 ■ EMAIL
KTIKC@KTIONLINE.COM

June 26, 2023

Ms. Emily Scaduto, NCIDQ, LEED GA
Hollis & Miller Architects
1828 Walnut Street Suite 200
Kansas City, MO 64108

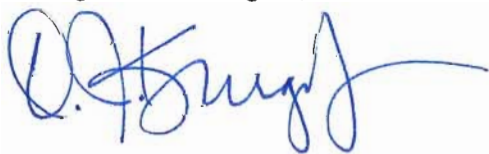
Re: KTI Project No. 223117G
South Valley Middle School Storm Shelter Addition
Liberty, Missouri

Dear Ms. Scaduto:

Kruger Technologies, Inc. (KTI) has completed the subsurface exploration and geotechnical report for the above referenced project. The purpose of this report was to describe the surface and subsurface conditions encountered at the site, analyze and evaluate this information, and prepare a summary of existing conditions including subsurface material characteristics and to give site specific geotechnical design recommendations.

We thank you for the opportunity to work with Hollis & Miller Architects. If you have any questions, please contact us at 913.498.1114.

Respectfully submitted,
Kruger Technologies, Inc.



Otto J. Kruger, Jr., P.E.
Missouri: 23994



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**REPORT OF GEOTECHNICAL EXPLORATION
SOUTH VALLEY MIDDLE SCHOOL STORM SHELTER ADDITION
LIBERTY, MISSOURI**

AUTHORIZATION

The following table presents the authorization documentation history for the work performed and presented in this report by Kruger Technologies, Inc.

| Project: South Valley Middle School Storm Shelter Addition in Liberty, Missouri | | |
|---|---------|---|
| Document: | Date: | Requested/Provided: |
| Request for Proposal | 5-17-23 | Emily Scaduto– Hollis & Miller Architects |
| KTI Proposal 23GT095 | 5-31-23 | Dylan Kruger – Kruger Technologies, Inc. |
| Notice to Proceed | 6-2-23 | Emily Scaduto– Hollis & Miller Architects |

PURPOSE AND SCOPE

The purpose of this investigation was to explore the surface and subsurface conditions present within the site to the west side of the existing gymnasium and provide recommendations for the proposed storm shelter addition regarding the following:

- Seismic Considerations
- Site Preparation and Engineered Fill
- Lateral Earth Pressure
- Shallow Foundations Bearing on Native Soil
- Slab on Grade
- Surface Drainage
- Excavation Considerations
- Trench Backfill Recommendations
- Manhole/Inlet Structure Backfill Recommendations

PROJECT DESCRIPTION

The project consists of the design and construction of a storm shelter addition to the existing South Valley Middle School located at 1000 Midjay Drive in Liberty, Missouri. We understand that the addition will be approximately 9,000 square feet and will include a multipurpose ICC 500 storm shelter structure and vestibule to be built to the west side of the existing gymnasium. We understand that the structure of the project consists of insulated structural precast walls and a double-tee roof at the storm shelter, with structural steel framing for the remainder of the

addition. The design loads for the proposed building addition are assumed to be 70 k for column loads and 3 k/ft for continuous wall loads. Design loads for the gym addition are assumed to be 20 k/ft for continuous wall loads.

FIELD EXPLORATION PROCEDURES

Four (4) test borings for the building additions were completed on June 13, 2023. The boring locations were selected by the client and field located by Kruger Technologies using a site photo provided by the client. The boring locations are shown on the attached Boring Location Diagram. Depths indicated on the boring logs are referenced from the ground surface at the time of the exploration. Boring elevation was assumed from google earth.

The borings were drilled using a CME-55 drill rig. Advancement of the test holes was accomplished using 4-inch hollow stem augers. Soil sampling was performed by hydraulically pushing thin wall steel (Shelby) tubes and by driving Standard Penetration Test (SPT).

Site soils were visually and manually classified in general accordance with ASTM D 2488 by the drill crew chief as drilling progressed. The soil samples collected in the field were delivered to the laboratory for applicable testing and verification of the field classifications. The boring logs were created as the borings were advanced and the logs were supplemented with information from the laboratory tests to present data concerning the depth and classification of the various strata, water levels, and other pertinent information. The boring logs are attached in Appendix I.

Groundwater was not encountered at any test borings. It should be noted that water level determinations made in relatively impervious (clay) soils might not present a reliable indication of the actual water table. However, water level determinations made in relatively pervious (sand/silt) soils are considered an accurate indication of the water table at the time that those measurements are made. Fluctuations in the water table should be expected with changing seasons and annual differences.

LABORATORY TESTS

Laboratory tests were performed on the recovered samples to determine the engineering characteristics and for additional verification of the field classifications in accordance with ASTM D 2487. The results of these tests, including moisture/density, plasticity (Atterberg Limits) and unconfined compressive strength of soil are presented in Appendix II.

SITE CONDITIONS

The proposed building addition will be within the existing campus of South Valley Middle School located at 1000 Midjay Drive in Liberty, Missouri, and is adjacent to the existing Discovery Middle School. At the time of the investigation the proposed building addition site was grass/gravel covered and was relatively flat and minimal cuts/fills operation are expected at the time of mass grading.

GEOLOGY/SUBSURFACE CONDITIONS

The topsoil encountered was generally 6 inches to 1 foot thick. Below the topsoil, site native soils were encountered to the planned drilling depth of 20 feet. The native soils encountered were comprised predominantly of low plasticity (CL) to high plasticity (CH) clays and were generally medium stiff to stiff consistency and moist. Bedrock material was not encountered at any boring within the 20 foot planned drilling depth. As previously stated, free ground water was not encountered at any test borings.

DESIGN CRITERIA AND RECOMMENDATIONS

Laboratory test results of the recovered samples showed the following characteristics that were used as criteria for determining the recommendations for bearing values and design data:

| | |
|--|--------------------|
| Natural Dry Density | 91.1 to 106.7 pcf |
| Natural Moisture Content | 12.6 to 27.1% |
| Liquid Limit..... | 52 to 54 |
| Plastic Limit..... | 28 to 30 |
| Unconfined Compressive Strength of Soil..... | 3,322 to 4,635 psf |

Seismic Considerations

Based on the International Building Code (IBC) Section 1613.1, the subsurface stratigraphy, and the use of a shallow foundation system bearing on native clay soils, the general Site Class Definition for the project area is Site Class C.

Site Preparation and Engineered Fill

Areas to receive fill should be stripped of vegetation, topsoil, and any other deleterious materials. Any isolated areas of soft or deleterious materials encountered at subgrade elevation should be removed and replaced with engineered fill. The moisture content of the subgrade

soils should be appropriate to achieve the required compaction. Proper drainage of the construction areas should be provided to protect foundation and floor slab subgrade soils from the detrimental effects of weather conditions. Excavations should be kept as dry as possible. Any loose or soft materials that accumulate or develop on subgrade or bearing surfaces should be removed prior to the placement of concrete. Construction traffic, including foot traffic, should be minimized. Concrete should be placed in footing excavations as soon as possible after excavations are completed.

Trucks and other heavy construction vehicles should be restricted as much as possible from trafficking on the finished subgrade in the building to prevent unnecessary disturbances of subgrade soils. Excessive rutting or pumping of the subgrade could occur from construction traffic, particularly during periods of wet weather. If such disturbed areas develop, the subgrade may have to be excavated and replaced with properly compacted fill.

Supplemental engineered fill should be placed in uniform horizontal lifts, with loose thicknesses not exceeding 8 inches. The thickness must be appropriate for the method of compaction and the type of equipment used. The geotechnical engineer should approve any off-site material proposed for use as fill. Engineered fill should be compacted to a minimum of 95 percent of maximum density as determined by ASTM D698 (standard Proctor test) at a moisture content between 0 and 4 percent above optimum moisture for high plasticity clay material and from -2 to +2 percent from optimum moisture content for low plasticity clays. Most of the site soils encountered during the exploration are suitable for reuse as engineered fill except below the slab on grade (see Slab on Grade section for more details).

The fill should be benched in any sloped areas greater than one vertical to five horizontal in order to maintain relatively horizontal lifts. The benching should be placed at not less than 12-inch rises over those areas where it is required as the work is brought up in layers.

Lateral Earth Pressures

The following K values are estimated for the determination of lateral soil resistance for retaining structures and below grade walls based on material characteristics. K_a values are appropriate for calculating lateral pressure behind retaining walls which are unrestrained at the top and will experience some translational or rotational movement i.e. modular retaining wall. K_o values are appropriate for calculating lateral pressure behind retaining walls that are restrained at the top

and will experience very little or no movement i.e. basement walls. K_p values are used to calculate the lateral pressure exerted by soil experiencing compression during wall movement. These design values do not include the effects of hydrostatic water or surface surcharges.

In Situ Low Plasticity Cohesive Soils (Estimated ϕ of 26°)

$K_a = 0.39$ (active) $K_p = 2.56$ (passive) $K_o = 0.56$ (at rest)

Coefficient of sliding friction = 0.33

Wet density of in place soil, average (γ) = 125 pcf

Compacted Low Plasticity Cohesive Soils (Estimated ϕ of 28°)

$K_a = 0.36$ (active) $K_p = 2.77$ (passive) $K_o = 0.53$ (at rest)

Coefficient of sliding friction = 0.35

Wet density of in place soil, average (γ) = 130 pcf

Granular backfill (Estimated ϕ of 35°)

$K_a = 0.27$ (active) $K_p = 3.69$ (passive) $K_o = 0.43$ (at rest)

Coefficient of sliding friction = 0.47

Wet density of in-place gravel, average (γ) = 135 pcf

Shallow Foundations Bearing on Native Soils

The recommended foundation system for the storm shelter addition is a shallow foundation system bearing on the site native clay soils. Based on the unconfined compressive strengths of the existing undisturbed soils present at the approximate footing bearing elevations the site soils exhibit net allowable bearing capacities of 2,000 pounds per square foot (psf) for both continuous footings and for rectangular footings. It is advisable to place the addition foundations at the same level as the existing building foundations so that stress applied by the addition will not be transmitted to the existing foundations. During construction, the existing foundations must not be undercut.

Anticipated settlements for these bearing capacities in native soils are 0.5-0.75 inches of total settlement, with a likely differential settlement of 0.5 inches over a horizontal distance of 30 feet. The minimum frost depth for this region is 36 inches. We recommend that the minimum column or isolated footing width be 30 inches and the minimum continuous footing width be 18 inches.

Slab on Grade

For slab on grade subgrade, it is recommended that the top 18 inches of subgrade directly below the slab be a low swell potential material or low volume change material (LVC). **The majority of site soils from 1 foot to 3 feet below the assumed FF elevation do not meet the requirement for LVC material and may not be used directly below the slab.** The existing materials present on site at the anticipated elevation for the slab on grade subgrade are considered high-volume change materials. To minimize the swell potential for slabs-on-grade where limited vertical rise is desired, we recommend against utilizing any untreated in-situ materials within the upper 18" of subgrade below slabs on grade. We recommend that to minimize the potential for swell, over-excavate and replace the upper 18" of subgrade (including a capillary break material comprised of clean crushed stone) with low swell material such as crushed limestone screenings, well-graded crushed limestone (AB-3 or MoDOT Type 5), or stabilized parent soil using 12 to 15% flyash or 5% cement.

Movement between slabs on grade and walls may occur. To minimize the effects of this movement, we recommend that slip joints be incorporated between all slabs and walls. All slabs should contain crack control and construction joints, which are formed on 15 to 25-foot centers, each way, or as designed by the project structural engineer. A capillary moisture barrier should be placed under the slabs. This barrier should be a minimum of a 6-inch thick layer of clean granular material extending to the limits of the foundation walls. Should additional moisture protection be desired, it should be a minimum of 6-mil polyethylene sheeting placed between the slab and the base course. As an acceptable alternative levelling and drainage course, we recommend the use of Grading "A" Requirements for soil-Aggregate Material listed on ASTM M147 and the grading requirement listed below in lieu of clean rock.

| <u>Sieve Designation</u> | <u>Percent Passing by Weight</u> |
|--------------------------|----------------------------------|
| 1" | 100 |
| 3/8" | 30 – 65 |
| No. 4 | 25 – 65 |
| No. 10 | 15 – 40 |
| No. 40 | 8 – 20 |
| No. 200 | 2 – 8 |

For the purpose of slab design, a modulus of subgrade reaction (k) of 100-pounds/cubic inch is suggested. This value is based on a subgrade consisting of well-compacted, plastic clay fill. If a stabilized subgrade is used, a k-value of 200-pounds/cubic inch is suggested.

Surface Drainage

In order to reduce the problems related to water infiltration, it is recommended that the final grade around the structure perimeters have a positive slope extending at least six feet away from the structure. Backfill of soils around the foundation should be compacted at a minimum of 95 percent of maximum dry density at moisture content between optimum and four percent above optimum in accordance with ASTM D 698.

Excavation Considerations

We believe that the project soils are Type B as classified in the OSHA Excavation Standard Handbook 29 CFR Parts 1926.650 through 1926.652. Type B soils are characterized by cohesive soils above the water table with unconfined compressive strengths greater than 0.5 tons per square foot (tsf) but less than 1.5 tsf. Type B soils include any fill soils meeting the above criteria, as well as undisturbed soils with unconfined compressive strengths of greater than 1.5 tsf which are subject to vibration from traffic. Temporary excavation slopes for Type B soils can be one horizontal to one vertical with a maximum excavation depth of 20 feet.

Excavations deeper than 20 feet may require the use of supplemental shoring and will require the preparation of an excavation design prepared by a registered professional engineer. Competent bedrock material may generally be cut vertically.

Trench Backfill Recommendations

Deleterious materials such as organic matter, topsoil, rock fragments larger than 3 inches in diameter, debris, and any other materials judged to be unsatisfactory by the geotechnical engineer, should not be included in the backfill. Backfill should not be placed on soft materials or frozen ground. Soil backfill overlying the bedding should be placed in uniform horizontal lifts, with loose thicknesses not exceeding 8 inches. The thickness must be appropriate for the method of compaction and the type of equipment used. The geotechnical engineer should approve any off-site material proposed for use as fill. Trench backfill under driveways/parking lots should be compacted to a minimum of 95 percent of maximum density as defined by Standard Proctor (ASTM D 698) at a moisture content between 0 and 4 percent above optimum moisture (preferred average of plus 2 percent). In common yard areas, the soil backfill should be compacted to a minimum of 90 percent of maximum density (ASTM D 698) using the above moisture parameters. After preparation of the trench bottom, a pipe bed of a minimum of 6 inches shall be prepared using crushed stone or crushed gravel meeting the following requirements:

| <u>Nominal Pipe Size Diameter</u> | <u>AASHTO M43 Size</u> |
|-----------------------------------|------------------------|
| 15" or Less | 67, 7, 8 or washed #9 |
| Greater than 15" | 57, 6, or 67 |

Manhole/Inlet Structure Backfill Recommendations

Soil backfill around structures should be placed in uniform horizontal lifts, with loose thicknesses not exceeding 8 inches. The thickness must be appropriate for the method of compaction and the type of equipment used. The geotechnical engineer should approve any off-site material proposed for use as fill. Backfill should be compacted to a minimum of 95 percent of maximum density as defined by Standard Proctor (ASTM D 698) at a moisture content between 0 and 4 percent above optimum moisture (preferred average of plus 2 percent). Another option is to backfill with a Controlled Low Strength Material (CLSM), or flowable fill. The flowable fill should exhibit a minimum unconfined compressive strength of 250 psi after 28 days. Bedding material for manhole/inlet structure should be clean crushed rock conforming to the following gradation:

| <u>Sieve Designation</u> | <u>Percent Passing by Weight</u> |
|--------------------------|----------------------------------|
| 1 ½" | 100 |
| No. 4 | 0 – 35 |
| No. 200 | 0 – 8 |

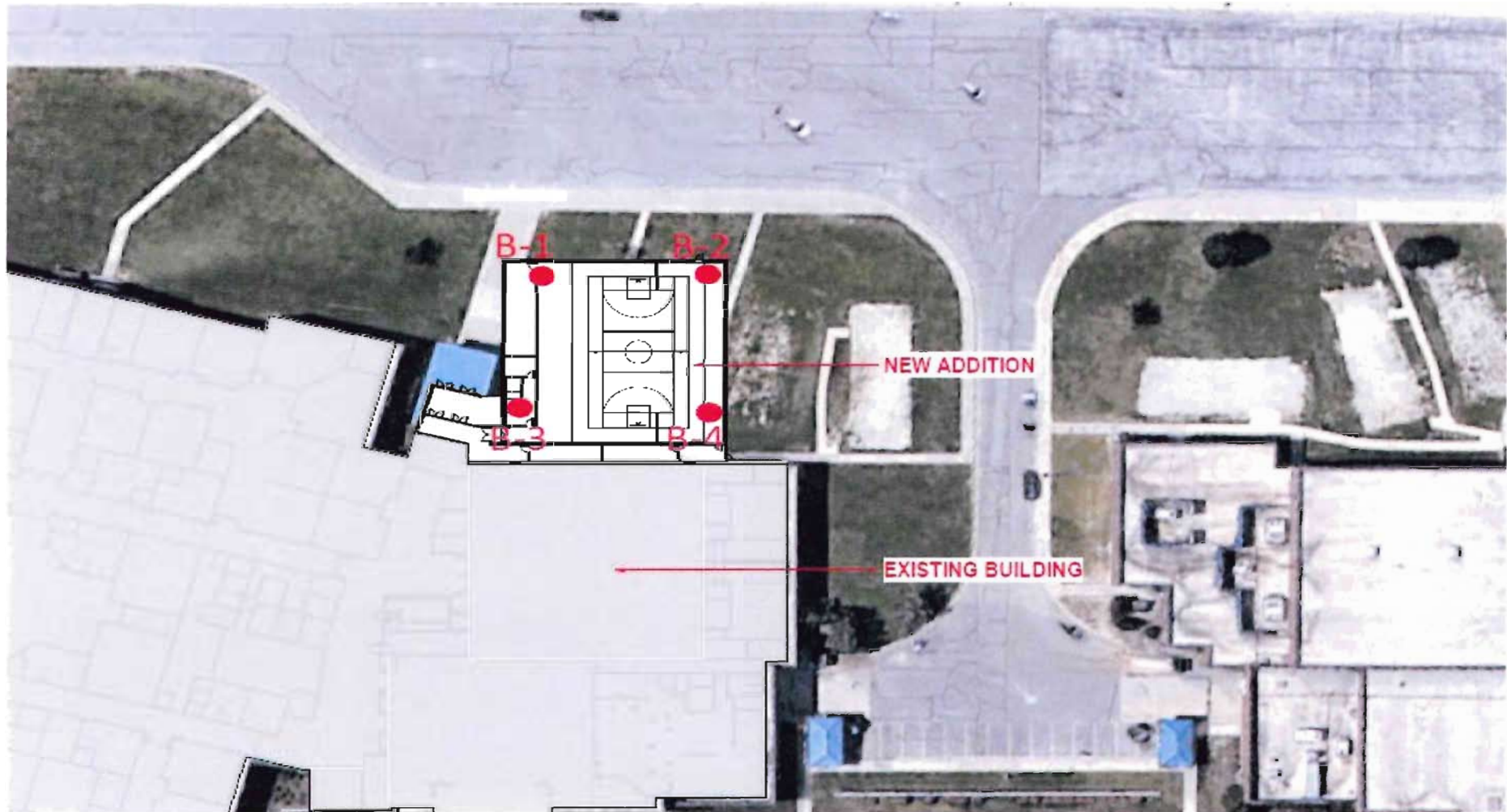
REMARKS

It is recommended that the geotechnical engineer be retained to review the plans and specifications for the project so that an evaluation and comments can be provided regarding the proper incorporation of information from this geotechnical report into the final construction documents. We further recommend that the geotechnical engineer be retained during construction phases for earthwork and foundations to provide observation and testing to aid in determining that design intent has been accomplished.

The findings in this report are based on data acquired to date and are assumed to be representative of conditions at locations between borings. Due to the fact that the area at the borings is very small relative to the overall site, and for other reasons, we make no statement warranting the conditions below our borings or at other locations throughout the site. In addition, we do not warrant that the general strata logged at the borings are necessarily typical of the remaining areas of the site.

Reports shall not be reproduced, except in full, without written approval of KTI. Information in this report applies only to the referenced project in its present configuration and location and shall not be used for any other project or location.

BORING LOCATION DIAGRAM



Boring Location Diagram
South Valley Middle School Storm Shelter Addition
Liberty, Missouri

KRUGER TECHNOLOGIES, INC.

Drawn: TMA

Date: 6/23/23

KTI Project No. 223117G

APPENDIX I

Boring Logs



LOG OF TEST BORING

BORING B-1

PROJECT: South Valley Middle School Storm Addition
CLIENT: Hollis + Miller Architects
PROJECT NO.: 223117G
START: 6/15/23
BORING LOCATION: See Boring Location Plan
METHOD OF DRILLING: 4" Continuous Flight Augers
DEPTH TO - water None **caving**

DATE: 6/23/2023
ELEVATION:
FINISH: 6/15/23

LOGGER: JC
DATE CHECKED:

| ELEVATION/ DEPTH | SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA | USCS | Description | Sample # & Type | Density pcf | Moist- ure, % | Qu, psf |
|---------------------|--|-------|---|--------------------|----------------|------------------|------------|
| 0 | | T | Topsoil | | | | |
| 3 | | CH | Fat clay, stiff, light and dark brown, moist | 1, ST | 91.1 | 20.8 | |
| 7 1/6" | | | Lean to fat clay, stiff, grayish brown, moist | 1, SS | | 22.0 | |
| 6 | | CL-CH | | | | | |
| 9 | | | Lean to fat clay, stiff, dark orange brown, moist | 2, SS | | 22.4 | |
| 12 | | CL-CH | | | | | |
| 15 | | | Lean clay, stiff, dark brown, moist | 3, SS | | 18.4 | |
| 18 | | CL | | | | | |
| 21 | | | Lean clay, stiff, grayish brown, moist | 4, SS | | 12.6 | |
| | | | Drilling discontinued at 20.0 feet | | | | |

Notes:



LOG OF TEST BORING

BORING B-2

PROJECT: South Valley Middle School Storm Addition
CLIENT: Hollis + Miller Architects
PROJECT NO.: 223117G
START: 6/15/23
BORING LOCATION: See Boring Location Plan
METHOD OF DRILLING: 4" Continuous Flight Augers
DEPTH TO - water None **caving**

DATE: 6/23/2023
ELEVATION:
FINISH: 6/15/23

LOGGER: JC
DATE CHECKED:

| ELEVATION/ DEPTH | SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA | USCS | Description | Sample # & Type | Density pcf | Moist- ure, % | Qu, psf |
|---------------------|--|-------|--|--------------------|----------------|------------------|------------|
| 0 | | T | Topsoil | | | | |
| | | CH | Fat clay, stiff, grayish brown, moist | 1, ST | 93.9 | 21.1 | |
| 3 | | | | | | | |
| | | CH | Fat clay, stiff, grayish brown, moist | 2, ST | 96.0 | 26.2 | 3322 |
| 6 | | | | | | | |
| 9 | 4/6" 6/6" 7/6" | CL-CH | Lean to fat clay, stiff, brown and gray, moist | 1, SS | | 12.6 | |
| 12 | | | | | | | |
| 15 | 4/6" 6/6" 6/6" | CL-CH | Lean to fat clay, stiff, dark brown, moist | 1, SS | | 23.9 | |
| 18 | | | | | | | |
| | 4/6" 4/6" 6/6" | CL-CH | Lean to fat clay, stiff, light brown, moist | 1, SS | | 22.2 | |
| 21 | | | Drilling discontinued at 20.0 feet | | | | |

Notes:



LOG OF TEST BORING

BORING B-3

PROJECT: South Valley Middle School Storm Addition
CLIENT: Hollis + Miller Architects
PROJECT NO.: 223117G
START: 6/15/23
BORING LOCATION: See Boring Location Plan
METHOD OF DRILLING: 4" Continuous Flight Augers
DEPTH TO - water None **caving**

DATE: 6/23/2023
ELEVATION:
FINISH: 6/15/23

LOGGER: JC
DATE CHECKED:

| ELEVATION/ DEPTH | SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA | USCS | Description | Sample # & Type | Density pcf | Moist- ure, % | Qu, psf |
|---------------------|--|-------|--|--------------------|----------------|------------------|------------|
| 0 | | T | Topsoil | | | | |
| | | CH | Fat clay, stiff, light and dark brown, moist | 1, ST | 106.7 | 19.9 | |
| 3 | | | | | | | |
| | | CH | Fat clay, stiff, dark brown, moist | 2, ST | 98.0 | 26.5 | 4635 |
| 6 | | | | | | | |
| 9 | | CH | Fat clay, stiff, grayish brown, moist | 1, SS | | 23.6 | |
| 12 | | | | | | | |
| 15 | | CL-CH | Lean to fat clay, stiff, dark grayish brown, moist | 1, SS | | 26.9 | |
| 18 | | | | | | | |
| 21 | | CL-CH | Lean to fat clay, stiff, grayish brown, moist | 1, SS | | 21.5 | |
| | | | Drilling discontinued at 20.0 feet | | | | |

Notes:



LOG OF TEST BORING

BORING B-4

PROJECT: South Valley Middle School Storm Addition
CLIENT: Hollis + Miller Architects
PROJECT NO.: 223117G
START: 6/15/23
BORING LOCATION: See Boring Location Plan
METHOD OF DRILLING: 4" Continuous Flight Augers
DEPTH TO - water None **caving**

DATE: 6/26/2023
ELEVATION:
FINISH: 6/15/23

LOGGER: JC
DATE CHECKED:

| ELEVATION/ DEPTH | SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA | USCS | Description | Sample # & Type | Density pcf | Moist- ure, % | Qu, psf |
|---------------------|--|-------|---|--------------------|----------------|------------------|------------|
| 0 | | T | Topsoil | | | | |
| | | CH | Fat clay, stiff, brown, moist | 1, ST | 104.7 | 14.8 | |
| 3 | | | | | | | |
| | | CH | Fat clay, stiff, dark brown, moist | 2, ST | 101.6 | 20.8 | 4082 |
| 6 | | | | | | | |
| 9 | | CL-CH | Lean to fat clay, stiff, brown, moist | 1, SS | | 27.1 | |
| 12 | | | | | | | |
| 15 | | CL-CH | Lean to fat clay, stiff, grayish brown, moist | 1, SS | | 26.6 | |
| 18 | | | | | | | |
| 21 | | CL-CH | Lean to fat clay, stiff, gray, moist | 1, SS | | 23.9 | |
| | | | Drilling discontinued at 20.0 feet | | | | |

Notes:

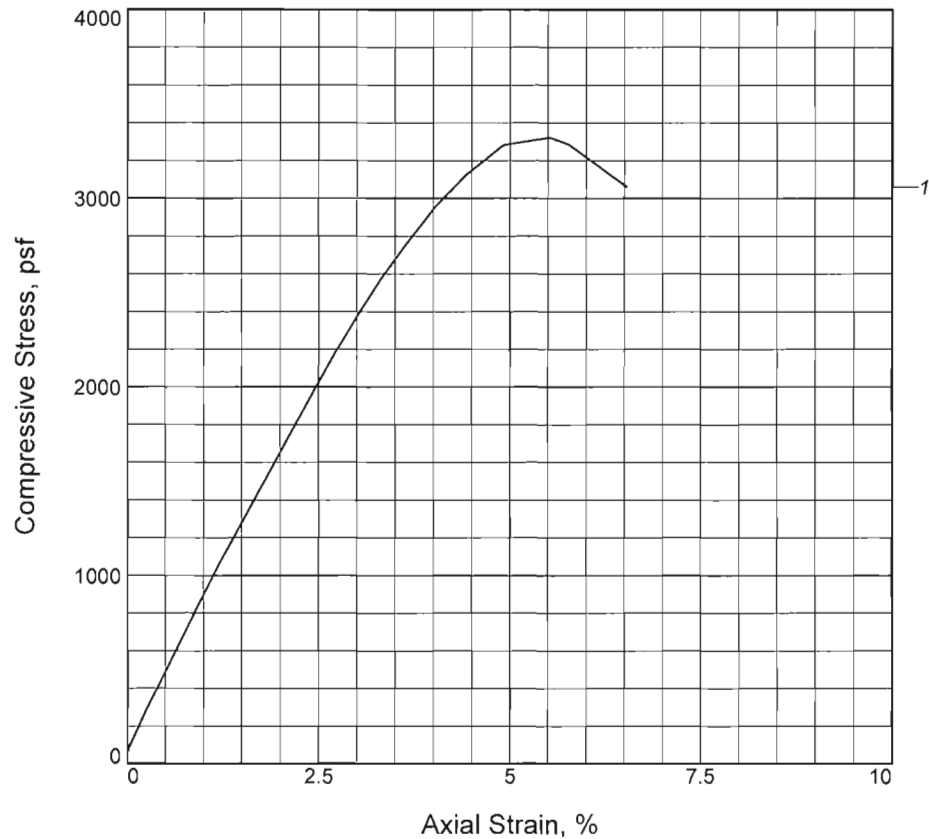
APPENDIX II

Laboratory Results

SUMMARY OF LABORATORY TEST RESULTS UNDISTURBED SAMPLE

| Boring | Depth (Ft) | Sample No./Type | Natural Moisture % | Natural Dry Density (pcf) | Unconfined Compressive Strength (psf) | Atterberg Limits | | Soil Type |
|--------|------------|-----------------|--------------------|---------------------------|---------------------------------------|------------------|--------------------|-----------|
| | | | | | | Liquid Limit % | Plasticity Index % | |
| B-1 | 1.0-3.0 | ST-1 | 20.8 | 91.1 | | 54 | 30 | CH |
| B-1 | 3.0-5.0 | SS-1 | 22.0 | | | | | |
| B-1 | 8.5-10.0 | SS-2 | 22.4 | | | | | |
| B-1 | 13.5-15.0 | SS-3 | 18.4 | | | | | |
| B-1 | 18.5-20.0 | SS-4 | 12.6 | | | | | |
| B-2 | 1.0-3.0 | ST-1 | 21.1 | 93.9 | | | | |
| B-2 | 3.0-5.0 | ST-2 | 26.2 | 96.0 | 3322 | | | |
| B-2 | 8.5-10.0 | SS-1 | 12.6 | | | | | |
| B-2 | 13.5-15.0 | SS-2 | 23.9 | | | | | |
| B-2 | 18.5-20.0 | SS-3 | 22.2 | | | | | |
| B-3 | 1.0-3.0 | ST-1 | 19.9 | 106.7 | | 52 | 28 | CH |
| B-3 | 3.0-5.0 | ST-2 | 26.5 | 98.0 | 4635 | | | |
| B-3 | 8.5-10.0 | SS-1 | 23.6 | | | | | |
| B-3 | 13.5-15.0 | SS-2 | 26.9 | | | | | |
| B-3 | 18.5-20.0 | SS-3 | 21.5 | | | | | |
| B-4 | 1.0-3.0 | ST-1 | 14.8 | 104.7 | | | | |
| B-4 | 3.0-5.0 | ST-2 | 20.8 | 101.6 | 4082 | | | |
| B-4 | 8.5-10.0 | SS-1 | 27.1 | | | | | |
| B-4 | 13.5-15.0 | SS-2 | 26.6 | | | | | |
| B-4 | 18.5-20.0 | SS-3 | 23.9 | | | | | |

UNCONFINED COMPRESSION TEST



| | | | | |
|-------------------------------|--------|--|--|--|
| Sample No. | 1 | | | |
| Unconfined strength, psf | 3322 | | | |
| Undrained shear strength, psf | 1661 | | | |
| Failure strain, % | 5.5 | | | |
| Strain rate, in./min. | 0.050 | | | |
| Water content, % | 26.2 | | | |
| Wet density, pcf | 121.1 | | | |
| Dry density, pcf | 96.0 | | | |
| Saturation, % | 92.8 | | | |
| Void ratio | 0.7694 | | | |
| Specimen diameter, in. | 2.84 | | | |
| Specimen height, in. | 5.59 | | | |
| Height/diameter ratio | 1.97 | | | |

Description: Fat clay, stiff, grayish brown, moist

| | | | | |
|------|------|------|------------------|----------|
| LL = | PL = | PI = | Assumed GS= 2.72 | Type: ST |
|------|------|------|------------------|----------|

Project No.: 223117G

Date Sampled: 6/13/23

Remarks:

Client: Hollis + Miller Architects

Project: South Valley Middle School Storm Addition

Source of Sample: B-2 **Depth:** 3

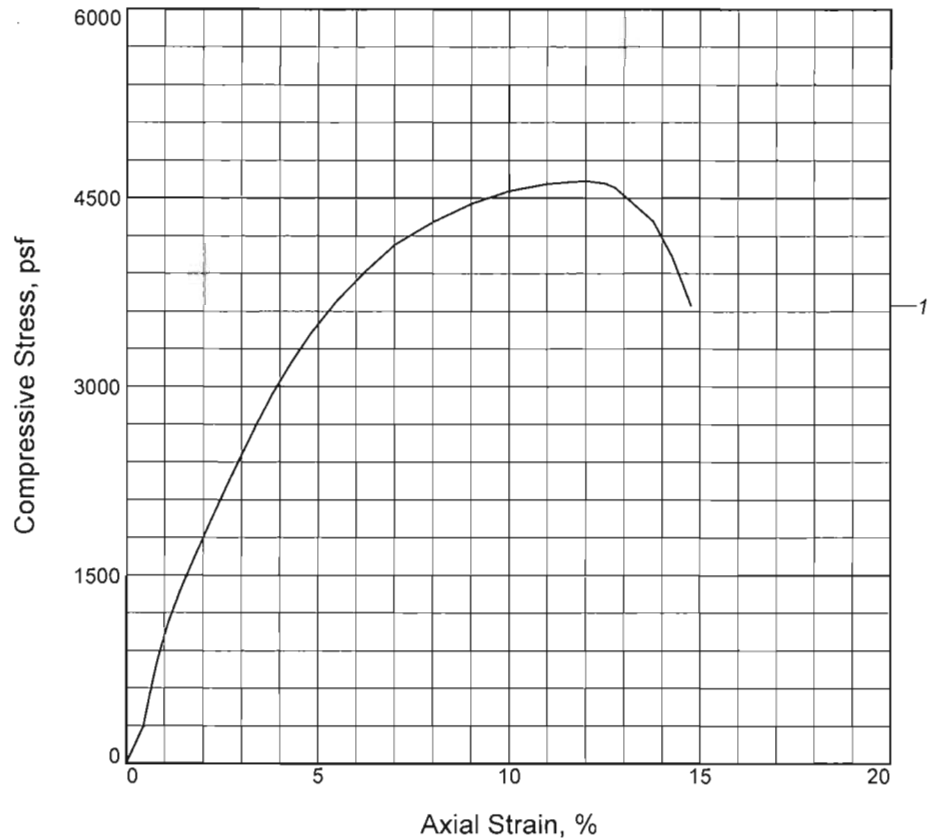
Sample Number: 2

Figure _____



Tested By: TA **Checked By:** OJK

UNCONFINED COMPRESSION TEST



| | | | |
|-------------------------------|--------|--|--|
| Sample No. | 1 | | |
| Unconfined strength, psf | 4635 | | |
| Undrained shear strength, psf | 2317 | | |
| Failure strain, % | 12.0 | | |
| Strain rate, in./min. | 0.050 | | |
| Water content, % | 26.5 | | |
| Wet density, pcf | 124.0 | | |
| Dry density, pcf | 98.0 | | |
| Saturation, % | 98.5 | | |
| Void ratio | 0.7327 | | |
| Specimen diameter, in. | 2.86 | | |
| Specimen height, in. | 5.59 | | |
| Height/diameter ratio | 1.95 | | |

Description: Fat clay, stiff, dark brown, moist

LL = PL = PI = Assumed GS= 2.72 Type: ST

Project No.: 223117G

Date Sampled: 6/13/23

Remarks:

Client: Hollis + Miller Architects

Project: South Valley Middle School Storm Addition

Source of Sample: B-3 **Depth:** 3

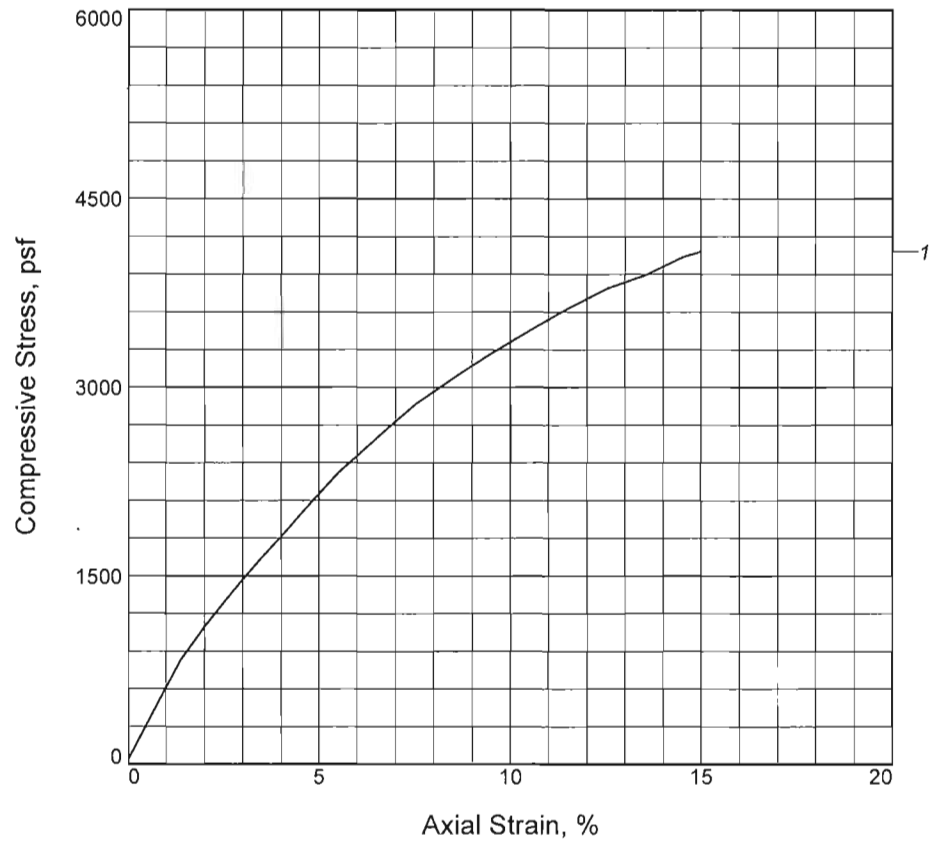
Sample Number: 2

Figure _____



Tested By: TA **Checked By:** OJK

UNCONFINED COMPRESSION TEST



| | | | | |
|-------------------------------|--------|--|--|--|
| Sample No. | 1 | | | |
| Unconfined strength, psf | 4082 | | | |
| Undrained shear strength, psf | 2041 | | | |
| Failure strain, % | 15.0 | | | |
| Strain rate, in./min. | 0.050 | | | |
| Water content, % | 20.8 | | | |
| Wet density, pcf | 122.7 | | | |
| Dry density, pcf | 101.6 | | | |
| Saturation, % | 84.2 | | | |
| Void ratio | 0.6713 | | | |
| Specimen diameter, in. | 2.84 | | | |
| Specimen height, in. | 5.59 | | | |
| Height/diameter ratio | 1.97 | | | |

Description: Fat clay, stiff, dark brown, moist

LL = PL = PI = Assumed GS= 2.72 Type: CH

Project No.: 223117G

Date Sampled: 6/13/23

Remarks:

Client: Hollis + Miller Architects

Project: South Valley Middle School Storm Addition

Source of Sample: B-4 **Depth:** 3

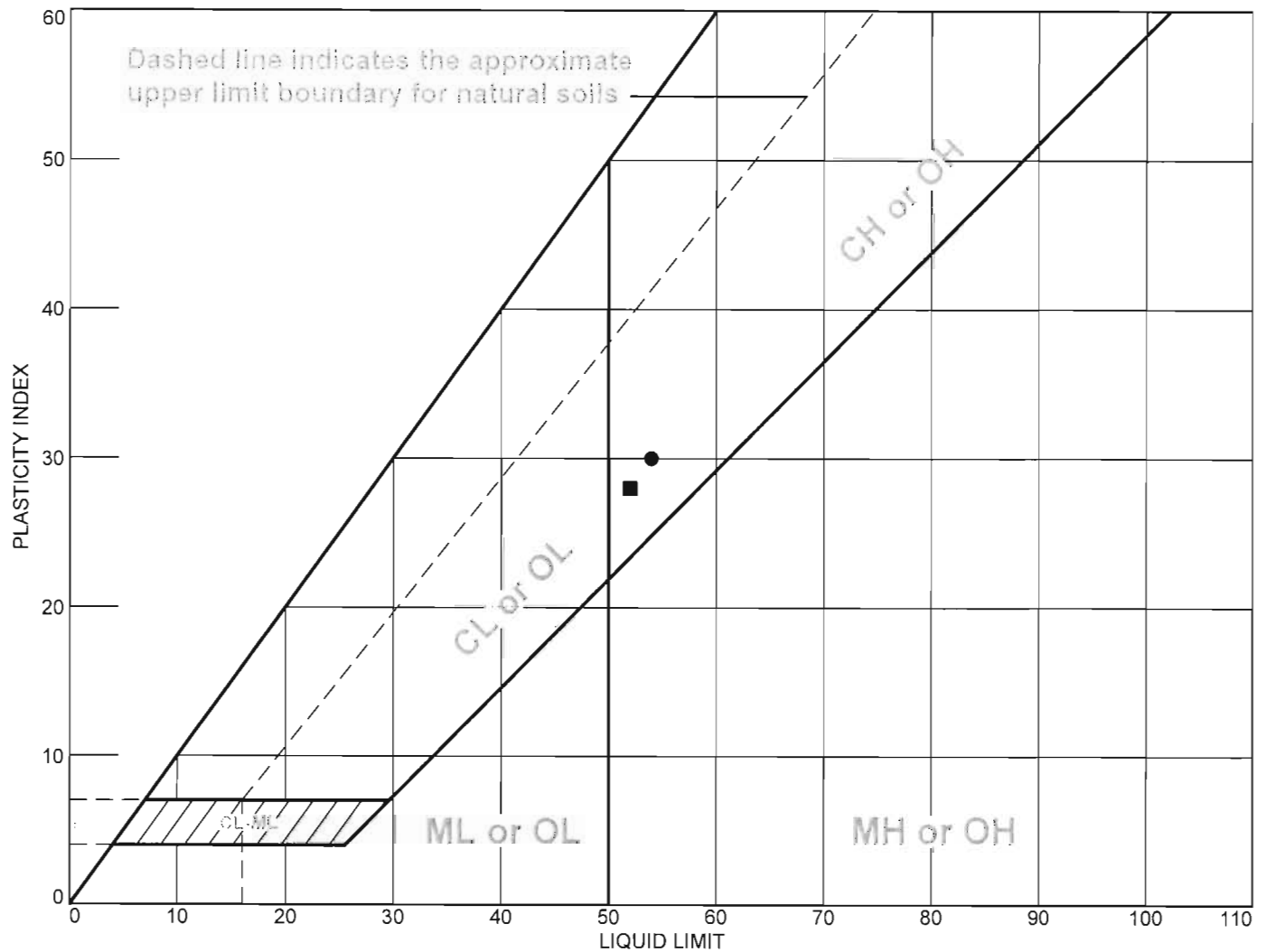
Sample Number: 2

Figure _____



Tested By: TA **Checked By:** OJK

LIQUID AND PLASTIC LIMITS TEST REPORT ASTM D 4318



| | MATERIAL DESCRIPTION | LL | PL | PI | %<#40 | %<#200 | USCS |
|---|--|----|----|----|-------|--------|------|
| ● | Fat clay, stiff, light and dark brown, moist | 54 | 24 | 30 | | | CH |
| ■ | Fat clay, stiff, light and dark brown, moist | 52 | 24 | 28 | | | CH |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

Project No. 223117G **Client:** Hollis + Miller Architects

Project: South Valley Middle School Storm Addition

● **Source of Sample:** B-1

Depth: 1

Sample Number: 1

■ **Source of Sample:** B-3

Depth: 1

Sample Number: 1

Remarks:



Figure

GLOSSARY OF GEOTECHNICAL TERMS

| | |
|-------------------|---|
| ALLUVIUM | Sediments deposited by streams, including riverbeds and floodplains. |
| ARGILLACEOUS | Rocks composed of or having a notable portion of fine silt and/or clay in their composition. |
| ATTERBERG LIMITS | Water contents, in percentage of dry weight of soil, that correspond to the boundaries between the states of consistency, i.e. the boundary between the liquid and plastic states (liquid limit) and the boundary between the plastic and solid states (plastic limit). |
| BEDROCK-IN-PLACE | Continuous rock mass which essentially has not moved from its original depositional position. |
| CALCAREOUS | Containing calcium carbonate determined by effervescence when tested with dilute hydrochloric acid. |
| CHANNEL SANDSTONE | Sandstone that has been deposited in a streambed or other channel eroded into the underlying beds. |
| COLLUVIAL | Rock debris of various sizes loose from in-place bedrock mass, often shifted down gradient in conjunction with soil. |
| CROSS-BEDDING | Stratification which is inclined to the original horizontal surface upon which the sediment accumulated. |
| FISSILE BEDDING | Term applied to bedding which consists of laminae less than 2 millimeters in thickness. |
| FORMATION | A distinctive body of rock that serves as a convenient unit for study and mapping. |
| FOSSIL DETRITUS | The accumulation of broken, fragmented fossil debris. |
| FOSSILIFEROUS | Containing organic remains. |
| GLACIAL ERRATIC | A transported rock fragment different from the bedrock on which it lies, either free or as part of a sediment. |
| GLACIAL TILL | Nonsorted, nonstratified sediment carried or deposited by a glacier. |
| GLACIOFLUVIAL | Primarily deposited by streams from glaciers. |
| GROUP | A lithostratigraphic unit consisting of two or more formations. |

| | |
|--------------------------------|---|
| JOINT | A fracture in a rock along which no appreciable displacement has occurred. |
| LIMESTONE | A sedimentary rock composed mostly of calcium carbonate (CaCO_3). |
| LOESS | A homogenous, nonstratified, unindurated deposit consisting predominantly of silt, with subordinate amounts of very fine sand and/or clay. |
| MICA | A mineral group, consisting of phyllosilicates, with sheetlike structures. |
| MEMBER | A specially developed part of a varied formation is called a member, if it has considerable geographic extent. |
| NODULE | A small, irregular, knobby, or rounded rock that is generally harder than the surrounding rock. |
| PERMEABILITY | The capacity of a material to transmit a fluid. |
| RECOVERY | The percentage of bedrock core recovered from a core run length. |
| RELIEF | The difference in elevation between the high and low points of a land surface. |
| RESIDUAL SOIL | Soil formed in place by the disintegration and decomposition of rocks and the consequent weathering of the mineral materials. |
| ROCK QUALITY DESIGNATION (RQD) | Refers to percentage of core sample recovered in unbroken lengths of 4 inches or more. |
| SANDSTONE | Sedimentary rock composed mostly of sand sized particles, usually cemented by calcite, silica, or iron oxide. |
| SERIES | A time-stratigraphic unit ranked next below a system. |
| SHALE | A fine-grained plastic sedimentary rock formed by consolidation of clay and mud. |
| STRATIGRAPHY | Branch of geology that treats the formation, compositions, sequence, and correlation of the stratified rocks as parts of the earth's crust. |
| SYSTEM | Designates rocks formed during a fundamental chronological unit, a period. |
| UNCONFORMITY | A surface of erosion or nondeposition, usually the former, which separates younger strata from older rocks. |
| WEATHERING | The physical and chemical disintegration and decomposition of rocks and minerals. |

General Notes

| Laboratory Test Symbols | |
|-------------------------|---|
| Symbol | Definition |
| LL | Liquid Limit (ASTM D4318) |
| PL | Plastic Limit (ASTM D4318) |
| PI | Plasticity Index (LL minus PL) |
| Qu | Unconfined Compressive Strength, Pounds per Square Foot (psf) |
| Qp | Pocket Penetrometer Reading, Tons per Square Foot (TSF) |
| RQD | Rock Quality Designation % (Sum of rock core pieces >4 inches/length of core run) |

Common Soil Classification Symbols

| Clay | |
|--------|------------------------------|
| Symbol | Soil Type |
| CL | Low plasticity clay |
| CL-ML | Low plasticity clay and silt |
| CL/CH | Medium plasticity clay |
| CH | High plasticity clay |

| Silt | |
|--------|----------------------|
| Symbol | Soil Type |
| ML | Low plasticity silt |
| MH | High plasticity silt |

| Sand | |
|--------|--------------------|
| Symbol | Soil Type |
| SW | Well graded sand |
| SP | Poorly graded sand |
| SM | Silty sand |
| SC | Clayey sand |

| Gravel | |
|--------|----------------------|
| Symbol | Soil Type |
| GW | Well graded gravel |
| GP | Poorly graded gravel |
| GM | Silty gravel |
| GC | Clayey gravel |

Descriptive Terminology

Cohesionless Soils

| Relative Density Term | "N" Value |
|-----------------------|------------|
| Very Loose | 0 - 4 |
| Loose | 5 - 9 |
| Medium Dense | 10 - 29 |
| Dense | 30 - 49 |
| Very Dense | 50 or more |

Cohesive Soils

| Consistency Term | "N" Value |
|------------------|-----------|
| Very soft | 0 - 2 |
| Soft | 3 - 4 |
| Medium | 5 - 8 |
| Stiff | 9 - 15 |
| Very Stiff | 16 - 30 |
| Hard | > 30 |

Relative Proportions and Sizes

| Term | Range |
|----------|----------|
| Trace | < 5% |
| A Little | 5 - 15% |
| Some | 15 - 30% |
| With | 30 - 50% |

| Material | Size |
|---------------|-----------------|
| Boulder | > 12" |
| Cobble | 3" - 12" |
| Gravel | 4.75 - 76.2 mm |
| Sand | 0.075 - 4.75 mm |
| Silt and Clay | < 0.075 mm |

**REPORT OF GEOTECHNICAL EXPLORATION
EPIC ELEMENTARY SCHOOL STORM SHELTER ADDITION
LIBERTY, MISSOURI**

Presented to:

Ms. Emily Scaduto
HOLLIS & MILLER ARCHITECTS

Prepared by:

Otto J. Kruger, Jr., P.E.

Kruger Technologies, Inc.
Lenexa, Kansas

KTI Project No. 223118G

June 27, 2023

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June 27, 2023

Ms. Emily Scaduto, NCIDQ, LEED GA
Hollis & Miller Architects
1828 Walnut Street Suite 200
Kansas City, MO 64108

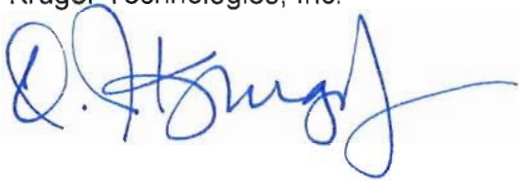
Re: KTI Project No. 223118G
EPiC Elementary School Storm Shelter Addition
Liberty, Missouri

Dear Ms. Scaduto:

Kruger Technologies, Inc. (KTI) has completed the subsurface exploration and geotechnical report for the above referenced project. The purpose of this report was to describe the surface and subsurface conditions encountered at the site, analyze and evaluate this information, and prepare a summary of existing conditions including subsurface material characteristics and to give site specific geotechnical design recommendations.

We thank you for the opportunity to work with Hollis & Miller Architects. If you have any questions, please contact us at 913.498.1114.

Respectfully submitted,
Kruger Technologies, Inc.



Otto J. Kruger, Jr., P.E.
Missouri: 23994



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**REPORT OF GEOTECHNICAL EXPLORATION
EPiC ELEMENTARY SCHOOL STORM SHELTER ADDITION
LIBERTY, MISSOURI**

AUTHORIZATION

The following table presents the authorization documentation history for the work performed and presented in this report by Kruger Technologies, Inc.

| Project: EPiC Elementary School Storm Shelter Addition in Liberty, Missouri | | |
|---|---------|---|
| Document: | Date: | Requested/Provided: |
| Request for Proposal | 5-17-23 | Emily Scaduto– Hollis & Miller Architects |
| KTI Proposal 23GT095 | 5-31-23 | Dylan Kruger – Kruger Technologies, Inc. |
| Notice to Proceed | 6-2-23 | Emily Scaduto– Hollis & Miller Architects |

PURPOSE AND SCOPE

The purpose of this investigation was to explore the surface and subsurface conditions present within the site to the west side of the existing gymnasium and provide recommendations for the proposed storm shelter addition regarding the following:

- Seismic Considerations
- Site Preparation and Engineered Fill
- Lateral Earth Pressure
- Shallow Foundations Bearing on Native Soil
- Slab on Grade
- Surface Drainage
- Excavation Considerations
- Trench Backfill Recommendations
- Manhole/Inlet Structure Backfill Recommendations

PROJECT DESCRIPTION

The project consists of the design and construction of a storm shelter addition to the existing EPiC Elementary School located at 650 Conistor Street in Liberty, Missouri. We understand that the addition will be approximately 7,500 square feet and will include a multipurpose ICC 500 storm shelter structure, a classroom, and a link to the existing building. We understand that the structure of the project consists of insulated structural precast walls and a precast double-tee roof at the storm shelter, with structural steel framing for the remainder of the addition. The

design loads for the proposed building addition are assumed to be 70 k for column loads and 3 k/ft for continuous wall loads. Design loads for the gym addition are assumed to be 20 k/ft for continuous wall loads.

FIELD EXPLORATION PROCEDURES

Four (4) test borings for the building addition were completed on June 13, 2023. The boring locations were selected by the client and field located by Kruger Technologies using a site photo provided by the client. The boring locations are shown on the attached Boring Location Diagram. Depths indicated on the boring logs are referenced from the ground surface at the time of the exploration. Boring elevations were estimated from google earth mapping.

The borings were drilled using a CME-55 drill rig. Advancement of the test holes was accomplished using 4-inch hollow stem augers. Soil sampling was performed by hydraulically pushing thin wall steel (Shelby) tubes and by driving Standard Penetration Test (SPT).

Site soils were visually and manually classified in general accordance with ASTM D 2488 by the drill crew chief as drilling progressed. The soil samples collected in the field were delivered to the laboratory for applicable testing and verification of the field classifications. The boring logs were created as the borings were advanced and the logs were supplemented with information from the laboratory tests to present data concerning the depth and classification of the various strata, water levels, and other pertinent information. The boring logs are attached in Appendix I.

Groundwater was not encountered at any test borings. It should be noted that water level determinations made in relatively impervious (clay) soils might not present a reliable indication of the actual water table. However, water level determinations made in relatively pervious (sand/silt) soils are considered an accurate indication of the water table at the time that those measurements are made. Fluctuations in the water table should be expected with changing seasons and annual differences.

LABORATORY TESTS

Laboratory tests were performed on the recovered samples to determine the engineering characteristics and for additional verification of the field classifications in accordance with ASTM D 2487. The results of these tests, including moisture/density, plasticity (Atterberg Limits) and unconfined compressive strength of soil are presented in Appendix II.

SITE CONDITIONS

The proposed building addition will be within the existing campus of EPiC Elementary School located at 650 Conistor Street in Liberty, Missouri. At the time of the investigation the proposed building addition site was grass/tree covered and sloped down to the west and to the north into trees and a drainage area with an approximate 7-to-9-foot elevation change.

GEOLOGY/SUBSURFACE CONDITIONS

The topsoil encountered was generally 6 to 12 inches thick. Below the topsoil fill soils and site native soils were encountered to the planned drilling depth of 20 feet. The native soils encountered were comprised predominantly of low plasticity (CL) clays and were generally medium stiff to stiff consistency and moist. Bedrock material was not encountered at any boring within the 20-foot planned drilling depth. As previously stated, free ground water was not encountered at any test borings.

DESIGN CRITERIA AND RECOMMENDATIONS

Laboratory test results of the recovered samples showed the following characteristics that were used as criteria for determining the recommendations for bearing values and design data:

| | |
|--|--------------------|
| Natural Dry Density | 99.7 to 112.7 pcf |
| Natural Moisture Content | 8.6 to 25.2% |
| Liquid Limit..... | 43 to 45 |
| Plastic Limit..... | 19 to 21 |
| Unconfined Compressive Strength of Soil..... | 2,367 to 4,395 psf |

Seismic Considerations

Based on the International Building Code (IBC) Section 1613.1, the subsurface stratigraphy, and the use of a shallow foundation system bearing on native clay soils, the general Site Class Definition for the project area is Site Class C.

Site Preparation and Engineered Fill

Areas to receive fill should be stripped of vegetation, topsoil, and any other deleterious materials. Any isolated areas of soft or deleterious materials encountered at subgrade elevation should be removed and replaced with engineered fill. The moisture content of the subgrade soils should be appropriate to achieve the required compaction. Proper drainage of the

construction areas should be provided to protect foundation and floor slab subgrade soils from the detrimental effects of weather conditions. Excavations should be kept as dry as possible. Any loose or soft materials that accumulate or develop on subgrade or bearing surfaces should be removed prior to the placement of concrete. Construction traffic, including foot traffic, should be minimized. Concrete should be placed in footing excavations as soon as possible after excavations are completed.

Trucks and other heavy construction vehicles should be restricted as much as possible from trafficking on the finished subgrade in the building to prevent unnecessary disturbances of subgrade soils. Excessive rutting or pumping of the subgrade could occur from construction traffic, particularly during periods of wet weather. If such disturbed areas develop, the subgrade may have to be excavated and replaced with properly compacted fill.

Supplemental engineered fill should be placed in uniform horizontal lifts, with loose thicknesses not exceeding 8 inches. The thickness must be appropriate for the method of compaction and the type of equipment used. The geotechnical engineer should approve any off-site material proposed for use as fill. Engineered fill should be compacted to a minimum of 95 percent of maximum density as determined by ASTM D698 (standard Proctor test) at a moisture content between 0 and 4 percent above optimum moisture for high plasticity clay material and from -2 to +2 percent from optimum moisture content for low plasticity clays. Most of the site soils encountered during the exploration are suitable for reuse as engineered fill except below the slab on grade (see Slab on Grade section for more details).

The fill should be benched in any sloped areas greater than one vertical to five horizontal in order to maintain relatively horizontal lifts. The benching should be placed at not less than 12-inch rises over those areas where it is required as the work is brought up in layers.

Lateral Earth Pressures

The following K values are estimated for the determination of lateral soil resistance for retaining structures and below grade walls based on material characteristics. K_a values are appropriate for calculating lateral pressure behind retaining walls which are unrestrained at the top and will experience some translational or rotational movement i.e. modular retaining wall. K_o values are appropriate for calculating lateral pressure behind retaining walls that are restrained at the top and will experience very little or no movement i.e. basement walls. K_p values are used to

calculate the lateral pressure exerted by soil experiencing compression during wall movement. These design values do not include the effects of hydrostatic water or surface surcharges.

In Situ Low Plasticity Cohesive Soils (Estimated ϕ of 26°)

$K_a = 0.39$ (active) $K_p = 2.56$ (passive) $K_o = 0.56$ (at rest)

Coefficient of sliding friction = 0.33

Wet density of in place soil, average (γ) = 125 pcf

Compacted Low Plasticity Cohesive Soils (Estimated ϕ of 28°)

$K_a = 0.36$ (active) $K_p = 2.77$ (passive) $K_o = 0.53$ (at rest)

Coefficient of sliding friction = 0.35

Wet density of in place soil, average (γ) = 130 pcf

Granular backfill (Estimated ϕ of 35°)

$K_a = 0.27$ (active) $K_p = 3.69$ (passive) $K_o = 0.43$ (at rest)

Coefficient of sliding friction = 0.47

Wet density of in-place gravel, average (γ) = 135 pcf

Shallow Foundations Bearing on Native Soils

The recommended foundation system for the storm shelter addition is a shallow foundation system bearing on the existing fills and site native clay soils. Based on the unconfined compressive strengths of the existing fills and undisturbed soils present at the assumed footing bearing elevations the site soils exhibit a net allowable bearing capacity of 2,000 pounds per square foot (psf) for both continuous and rectangular footings. It is advisable to place the addition foundations at the same level as the existing building foundations where they are adjacent to the existing so that stress applied by the addition will not be transmitted to the existing foundations. During construction, the existing foundations must not be undercut. It is anticipated that the proposed foundations will step down where necessary to accommodate existing ground elevations.

Anticipated settlements for these bearing capacities in native soils are 0.5-0.75 inches of total settlement, with a likely differential settlement of 0.5 inches over a horizontal distance of 30 feet. The minimum frost depth for this region is 36 inches. We recommend that the minimum column or isolated footing width be 30 inches and the minimum continuous footing width be 18 inches.

Slab on Grade

For slab on grade subgrade, it is recommended that the top 18 inches of subgrade directly below the slab be a low swell potential material or low volume change material (LVC). **The majority of site soils from 1 foot to 3 feet below the existing grades meet the requirement for LVC material and may be used directly below the slab.**

Movement between slabs on grade and walls may occur. To minimize the effects of this movement, we recommend that slip joints be incorporated between all slabs and walls. All slabs should contain crack control and construction joints, which are formed on 15 to 25-foot centers, each way, or as designed by the project structural engineer. A capillary moisture barrier should be placed under the slabs. This barrier should be a minimum of a 6-inch thick layer of clean granular material extending to the limits of the foundation walls. Should additional moisture protection be desired, it should be a minimum of 6-mil polyethylene sheeting placed between the slab and the base course. As an acceptable alternative levelling and drainage course, we recommend the use of Grading "A" Requirements for soil-Aggregate Material listed on ASTM M147 and the grading requirement listed below in lieu of clean rock.

| <u>Sieve Designation</u> | <u>Percent Passing by Weight</u> |
|--------------------------|----------------------------------|
| 1" | 100 |
| 3/8" | 30 – 65 |
| No. 4 | 25 – 65 |
| No. 10 | 15 – 40 |
| No. 40 | 8 – 20 |
| No. 200 | 2 – 8 |

For the purpose of slab design, a modulus of subgrade reaction (k) of 100-pounds/cubic inch is suggested. This value is based on a subgrade consisting of well-compacted, plastic clay fill. If a stabilized subgrade is used, a k-value of 200-pounds/cubic inch is suggested.

Surface Drainage

In order to reduce the problems related to water infiltration, it is recommended that the final grade around the structure perimeters have a positive slope extending at least six feet away from the structure. Backfill of soils around the foundation should be compacted at a minimum of 95 percent of maximum dry density at moisture content between optimum and four percent above optimum in accordance with ASTM D 698.

Excavation Considerations

We believe that the project soils are Type B as classified in the OSHA Excavation Standard Handbook 29 CFR Parts 1926.650 through 1926.652. Type B soils are characterized by cohesive soils above the water table with unconfined compressive strengths greater than 0.5 tons per square foot (tsf) but less than 1.5 tsf. Type B soils include any fill soils meeting the above criteria, as well as undisturbed soils with unconfined compressive strengths of greater than 1.5 tsf which are subject to vibration from traffic. Temporary excavation slopes for Type B soils can be one horizontal to one vertical with a maximum excavation depth of 20 feet.

Excavations deeper than 20 feet may require the use of supplemental shoring and will require the preparation of an excavation design prepared by a registered professional engineer. Competent bedrock material may generally be cut vertically.

Trench Backfill Recommendations

Deleterious materials such as organic matter, topsoil, rock fragments larger than 3 inches in diameter, debris, and any other materials judged to be unsatisfactory by the geotechnical engineer, should not be included in the backfill. Backfill should not be placed on soft materials or frozen ground. Soil backfill overlying the bedding should be placed in uniform horizontal lifts, with loose thicknesses not exceeding 8 inches. The thickness must be appropriate for the method of compaction and the type of equipment used. The geotechnical engineer should approve any off-site material proposed for use as fill. Trench backfill under driveways/parking lots should be compacted to a minimum of 95 percent of maximum density as defined by Standard Proctor (ASTM D 698) at a moisture content between 0 and 4 percent above optimum moisture (preferred average of plus 2 percent). In common yard areas, the soil backfill should be compacted to a minimum of 90 percent of maximum density (ASTM D 698) using the above moisture parameters. After preparation of the trench bottom, a pipe bed of a minimum of 6 inches shall be prepared using crushed stone or crushed gravel meeting the following requirements:

Nominal Pipe Size Diameter

15" or Less
Greater than 15"

AASHTO M43 Size

67, 7, 8 or washed #9
57, 6, or 67

Manhole/Inlet Structure Backfill Recommendations

Soil backfill around structures should be placed in uniform horizontal lifts, with loose thicknesses not exceeding 8 inches. The thickness must be appropriate for the method of compaction and the type of equipment used. The geotechnical engineer should approve any off-site material proposed for use as fill. Backfill should be compacted to a minimum of 95 percent of maximum density as defined by Standard Proctor (ASTM D 698) at a moisture content between 0 and 4 percent above optimum moisture (preferred average of plus 2 percent). Another option is to backfill with a Controlled Low Strength Material (CLSM), or flowable fill. The flowable fill should exhibit a minimum unconfined compressive strength of 250 psi after 28 days. Bedding material for manhole/inlet structure should be clean crushed rock conforming to the following gradation:

| <u>Sieve Designation</u> | <u>Percent Passing by Weight</u> |
|--------------------------|----------------------------------|
| 1 ½" | 100 |
| No. 4 | 0 – 35 |
| No. 200 | 0 – 8 |

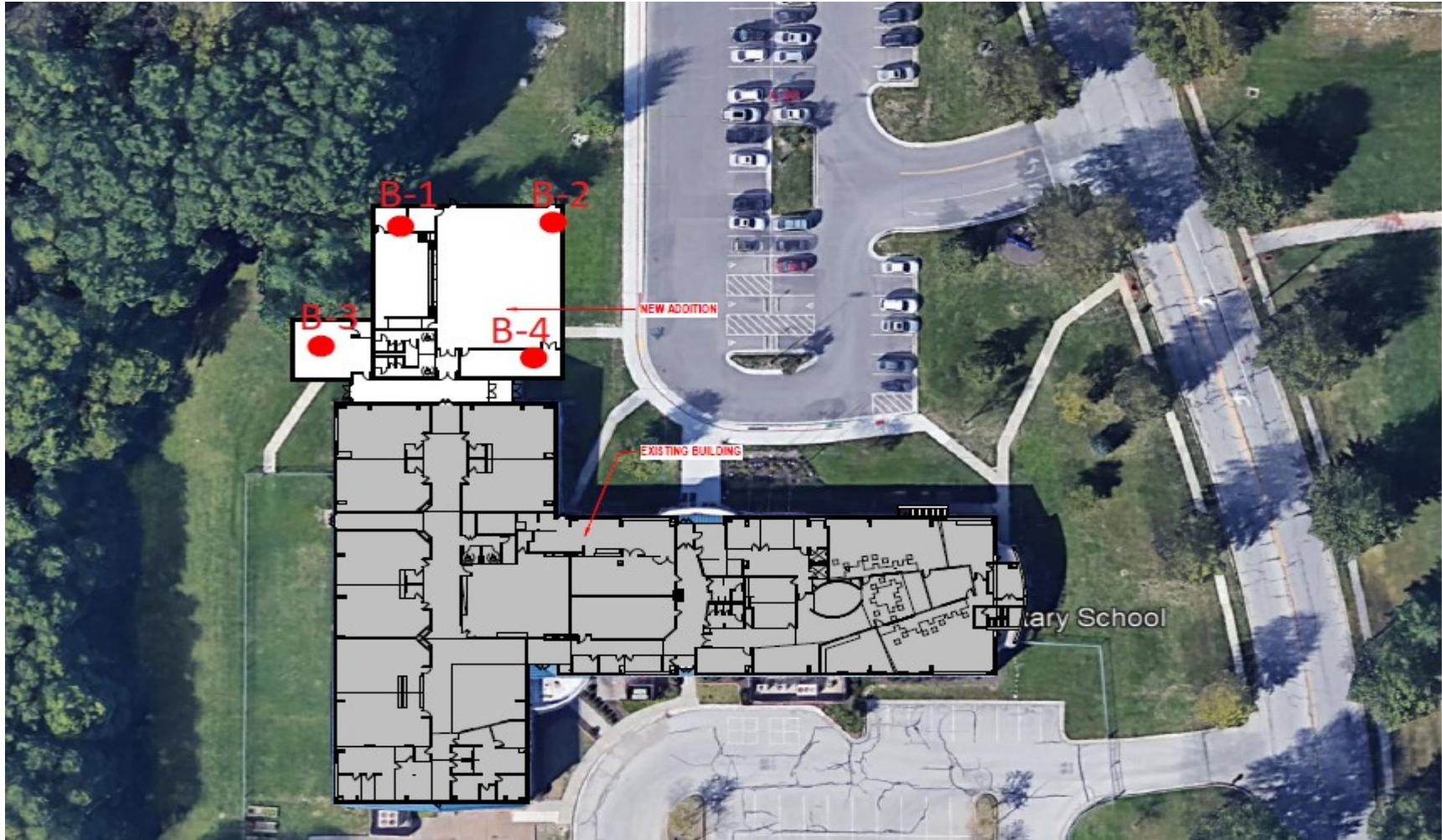
REMARKS

It is recommended that the geotechnical engineer be retained to review the plans and specifications for the project so that an evaluation and comments can be provided regarding the proper incorporation of information from this geotechnical report into the final construction documents. We further recommend that the geotechnical engineer be retained during construction phases for earthwork and foundations to provide observation and testing to aid in determining that design intent has been accomplished.

The findings in this report are based on data acquired to date and are assumed to be representative of conditions at locations between borings. Due to the fact that the area at the borings is very small relative to the overall site, and for other reasons, we make no statement warranting the conditions below our borings or at other locations throughout the site. In addition, we do not warrant that the general strata logged at the borings are necessarily typical of the remaining areas of the site.

Reports shall not be reproduced, except in full, without written approval of KTI. Information in this report applies only to the referenced project in its present configuration and location and shall not be used for any other project or location.

BORING LOCATION DIAGRAM



Boring Location Diagram
EPiC Elementary Storm Shelter Addition
Liberty, Missouri

KRUGER TECHNOLOGIES, INC.

Drawn: TMA

Date: 6/26/23

KTI Project No. 223118G

APPENDIX I

Boring Logs



LOG OF TEST BORING

BORING B-1

PROJECT: EPiC Elementary School Storm Addition
CLIENT: Hollis + Miller Architects
PROJECT NO.: 223118G
BORING LOCATION: See Boring Location Plan
METHOD OF DRILLING: 4" Continuous Flight Augers
DEPTH TO - water None

START: 6/14/23

caving

DATE: 6/26/2023

ELEVATION:

FINISH: 6/14/23

LOGGER: DC

DATE CHECKED:

| ELEVATION/ DEPTH | SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA | USCS | Description | Sample # & Type | Density pcf | Moist- ure, % | Qu, psf |
|---------------------|--|------|--|--------------------|----------------|------------------|------------|
| 0 | | T | Topsoil | | | | |
| | | FILL | Fill, lean clay with gravel, stiff, dark brown, moist to dry | 1, ST | | 11.6 | |
| 3 | | | | | | | |
| | | FILL | Fill, lean clay some gravel, stiff, orange brown and light brown, moist | 2, ST | 105.3 | 21.3 | 2466 |
| 6 | | | | | | | |
| 9 | | CL | Lean clay, medium stiff, dark brown, moist | 1, SS | | 22.5 | |
| 12 | | | | | | | |
| 15 | | CL | Lean clay, stiff, dark grayish brown, moist | 2, SS | | 20.2 | |
| 18 | | | | | | | |
| 21 | | CL | Lean clay with weathered sandstone, very stiff to hard, reddish brown, moist | 3, SS | | 20.1 | |
| | | | Drilling discontinued at 20.0 feet | | | | |

Notes:



LOG OF TEST BORING

BORING B-2

PROJECT: EPiC Elementary School Storm Addition
CLIENT: Hollis + Miller Architects
PROJECT NO.: 223118G
BORING LOCATION: See Boring Location Plan
METHOD OF DRILLING: 4" Continuous Flight Augers
DEPTH TO - water None

DATE: 6/26/2023
ELEVATION:
FINISH: 6/14/23

LOGGER: DC
DATE CHECKED:

| ELEVATION/ DEPTH | SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA | USCS | Description | Sample # & Type | Density pcf | Moist- ure, % | Qu, psf |
|---------------------|--|------|--|--------------------|----------------|------------------|------------|
| 0 | | T | Topsoil | | | | |
| | | FILL | Fill, lean clay with gravel, stiff, dark brown, moist to dry | 1, ST | | 10.1 | |
| 3 | | | | | | | |
| | | FILL | Fill, lean clay some gravel, very stiff, orange brown, moist | 2, ST | 112.7 | 15.5 | 4395 |
| 6 | | | | | | | |
| | | CL | Lean clay, stiff, dark brown, moist | 1, SS | | 21.6 | |
| 9 | 3/6" 4/6" 6/6" | | | | | | |
| 12 | | | | | | | |
| | | CL | Lean clay, stiff to very stiff, orange brown, moist | 2, SS | | 18.7 | |
| 15 | 5/6" 7/6" 9/6" | | | | | | |
| 18 | | | | | | | |
| | | CL | Lean clay some weathered sandstone, very stiff, reddish brown, moist | 3, SS | | 20.1 | |
| 21 | 6/6" 7/6" 11/6" | | | | | | |
| | | | Drilling discontinued at 20.0 feet | | | | |

Notes:



LOG OF TEST BORING

BORING B-3

PROJECT: EPiC Elementary School Storm Addition
CLIENT: Hollis + Miller Architects
PROJECT NO.: 223118G START: 6/14/23
BORING LOCATION: See Boring Location Plan
METHOD OF DRILLING: 4" Continuous Flight Augers
DEPTH TO - water None caving

DATE: 6/26/2023
ELEVATION:
FINISH: 6/14/23

LOGGER: DC
DATE CHECKED:

| ELEVATION/ DEPTH | SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA | USCS | Description | Sample # & Type | Density pcf | Moist- ure, % | Qu, psf |
|---------------------|--|------|---|--------------------|----------------|------------------|------------|
| 0 | | T | Topsoil | | | | |
| | | FILL | Fill, lean clay with gravel, stiff, dark brown and orange brown, moist to dry | 1, ST | | 8.6 | |
| 3 | | | Fill, lean clay some gravel, very stiff, dark brown, moist to dry | 2, ST | 108.6 | 8.6 | 3800 |
| 6 | | FILL | | | | | |
| 9 | | CL | Lean clay, stiff, dark brown, moist | 1, SS | | 22.5 | |
| 12 | | | | | | | |
| 15 | | CL | Lean clay, medium stiff to stiff, dark brown, moist | 2, SS | | 23.8 | |
| 18 | | | | | | | |
| 21 | | CL | Lean clay, stiff, reddish brown, moist | 3, SS | | 21.8 | |
| | | | Drilling discontinued at 20.0 feet | | | | |

Notes:



LOG OF TEST BORING

BORING B-4

PROJECT: EPiC Elementary School Storm Addition
CLIENT: Hollis + Miller Architects
PROJECT NO.: 223118G
START: 6/14/23
BORING LOCATION: See Boring Location Plan
METHOD OF DRILLING: 4" Continuous Flight Augers
DEPTH TO - water None **caving**

DATE: 6/26/2023
ELEVATION:
FINISH: 6/14/23

LOGGER: DC
DATE CHECKED:

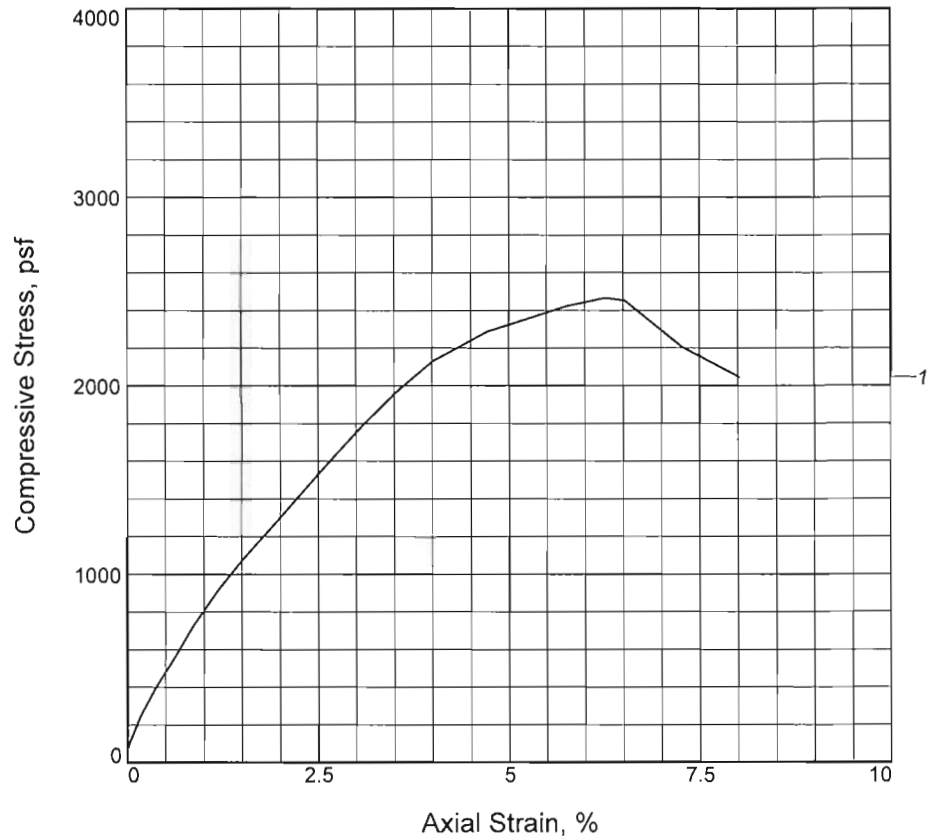
| ELEVATION/ DEPTH | SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA | USCS | Description | Sample # & Type | Density pcf | Moist- ure, % | Qu, psf |
|---------------------|--|------|--|--------------------|----------------|------------------|------------|
| 0 | | T | Topsoil | | | | |
| | | FILL | Fill, lean clay, stiff, dark gray, moist | 1, ST | | 15.9 | |
| 3 | | | Fill, lean clay, stiff, dark brown, moist | 2, ST | 99.7 | 22.2 | 2367 |
| 6 | | FILL | | | | | |
| 9 | | CL | Lean clay, medium stiff, grayish brown, moist | 1, SS | | 25.2 | |
| 12 | | | | | | | |
| 15 | | CL | Lean clay, stiff, light grayish brown, moist to dry | 2, SS | | 13.6 | |
| 18 | | | | | | | |
| 21 | | CL | Lean clay, trace weathered sandstone, very stiff, red and grayish brown, moist | 3, SS | | 16.9 | |
| | | | Drilling discontinued at 20.0 feet | | | | |

Notes:

APPENDIX II

Laboratory Results

UNCONFINED COMPRESSION TEST



| | | | | |
|-------------------------------|--------|--|--|--|
| Sample No. | 1 | | | |
| Unconfined strength, psf | 2466 | | | |
| Undrained shear strength, psf | 1233 | | | |
| Failure strain, % | 6.3 | | | |
| Strain rate, in./min. | 0.050 | | | |
| Water content, % | 21.3 | | | |
| Wet density, pcf | 127.8 | | | |
| Dry density, pcf | 105.3 | | | |
| Saturation, % | 94.7 | | | |
| Void ratio | 0.6121 | | | |
| Specimen diameter, in. | 2.82 | | | |
| Specimen height, in. | 5.71 | | | |
| Height/diameter ratio | 2.02 | | | |

Description: Fill, lean clay some gravel, stiff, orange brown and light brown, moist

LL = **PL =** **PI =** **Assumed GS= 2.72** **Type: ST**

Project No.: 223118G
Date Sampled: 6/14/23
Remarks:

Client: Hollis + Miller Architects

Project: EPiC Elementary School Storm Addition

Source of Sample: B-1 **Depth:** 3

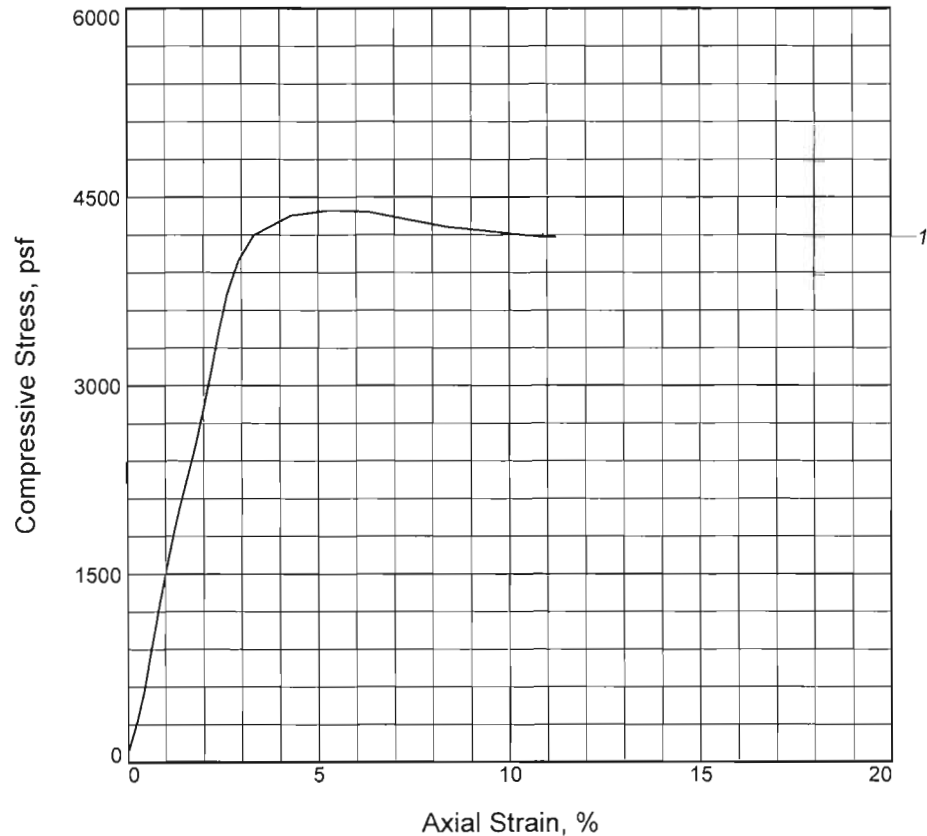
Sample Number: 2

Figure _____



Tested By: TA **Checked By:** OJK

UNCONFINED COMPRESSION TEST



| | | | | |
|-------------------------------|--------|--|--|--|
| Sample No. | 1 | | | |
| Unconfined strength, psf | 4395 | | | |
| Undrained shear strength, psf | 2197 | | | |
| Failure strain, % | 5.3 | | | |
| Strain rate, in./min. | 0.050 | | | |
| Water content, % | 15.5 | | | |
| Wet density, pcf | 130.1 | | | |
| Dry density, pcf | 112.7 | | | |
| Saturation, % | 83.2 | | | |
| Void ratio | 0.5071 | | | |
| Specimen diameter, in. | 2.85 | | | |
| Specimen height, in. | 5.71 | | | |
| Height/diameter ratio | 2.00 | | | |

Description: Fill, lean clay some gravel, very stiff, orange brown, moist

LL = PL = PI = Assumed GS= 2.72 Type: ST

Project No.: 223118G
Date Sampled: 6/14/23
Remarks:

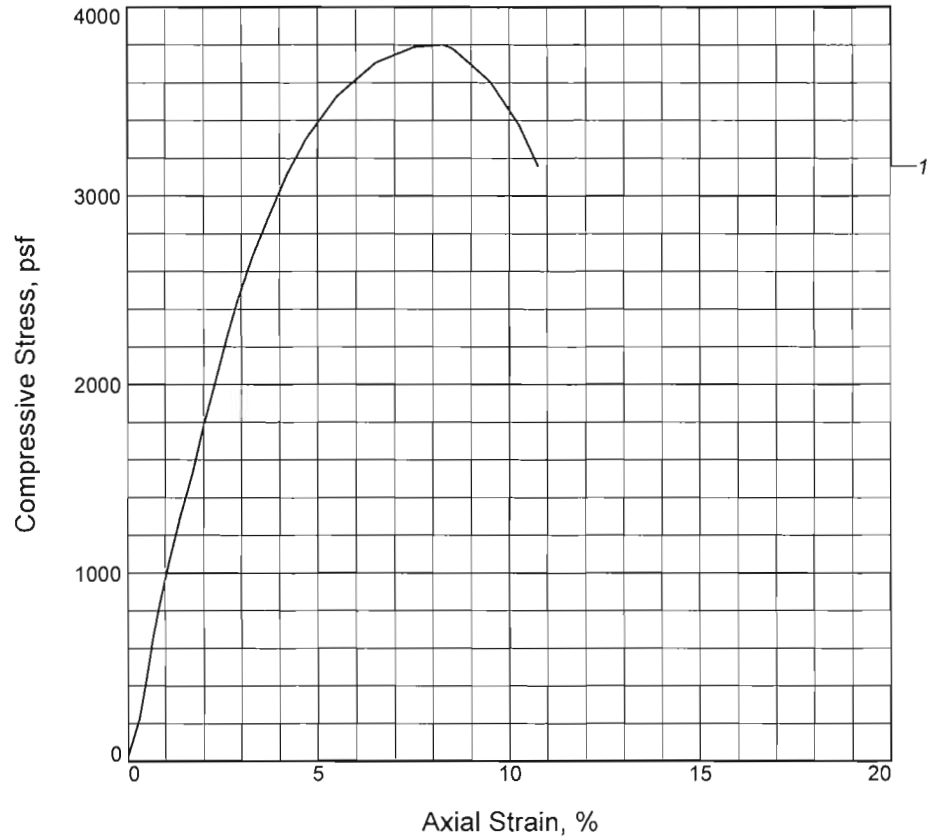
Client: Hollis + Miller Architects
Project: EPiC Elementary School Storm Addition
Source of Sample: B-2 **Depth:** 3
Sample Number: 2

Figure _____



Tested By: TA **Checked By:** OJK

UNCONFINED COMPRESSION TEST



| | | | | |
|-------------------------------|--------|--|--|--|
| Sample No. | 1 | | | |
| Unconfined strength, psf | 3800 | | | |
| Undrained shear strength, psf | 1900 | | | |
| Failure strain, % | 8.3 | | | |
| Strain rate, in./min. | 0.050 | | | |
| Water content, % | 8.6 | | | |
| Wet density, pcf | 117.9 | | | |
| Dry density, pcf | 108.6 | | | |
| Saturation, % | 41.6 | | | |
| Void ratio | 0.5642 | | | |
| Specimen diameter, in. | 2.85 | | | |
| Specimen height, in. | 5.71 | | | |
| Height/diameter ratio | 2.00 | | | |

Description: Fill, lean clay some gravel, stiff, dark brown, moist to dry

LL =

PL =

PI =

Assumed GS= 2.72

Type: ST

Project No.: 223118G

Date Sampled: 6/14/23

Remarks:

Client: Hollis + Miller Architects

Project: EPiC Elementary School Storm Addition

Source of Sample: B-3

Depth: 3

Sample Number: 2

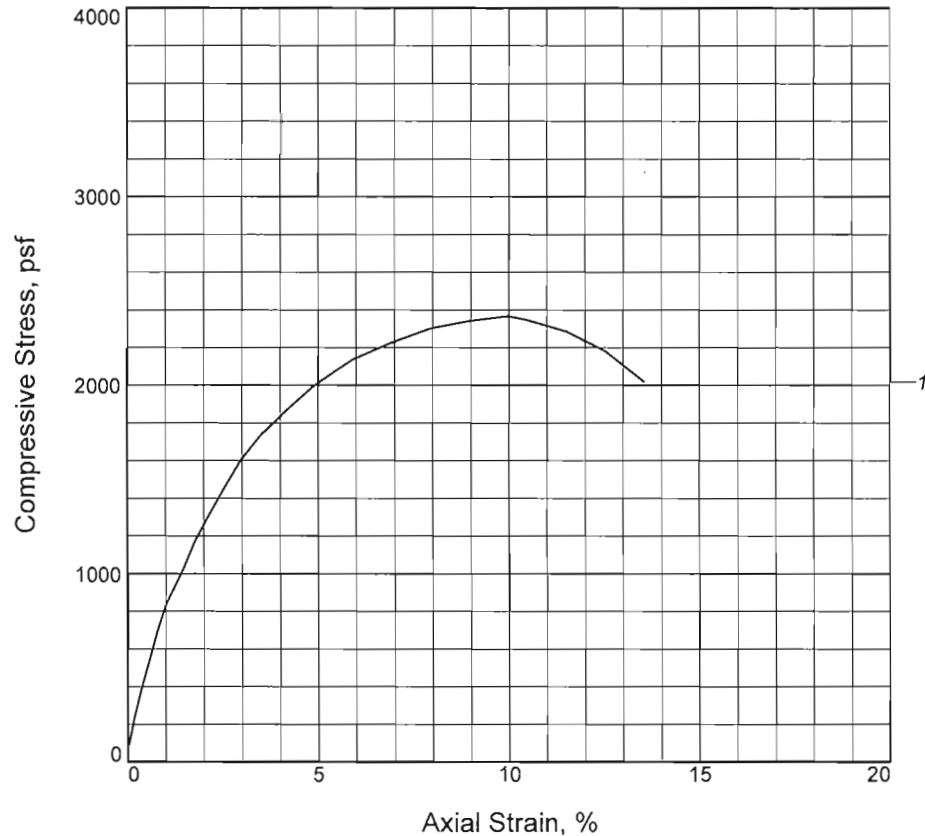
Figure _____



Tested By: TA

Checked By: OJK

UNCONFINED COMPRESSION TEST



| | | | | |
|-------------------------------|--------|--|--|--|
| Sample No. | 1 | | | |
| Unconfined strength, psf | 2367 | | | |
| Undrained shear strength, psf | 1184 | | | |
| Failure strain, % | 10.0 | | | |
| Strain rate, in./min. | 0.050 | | | |
| Water content, % | 22.2 | | | |
| Wet density, pcf | 121.9 | | | |
| Dry density, pcf | 99.7 | | | |
| Saturation, % | 85.9 | | | |
| Void ratio | 0.7028 | | | |
| Specimen diameter, in. | 2.84 | | | |
| Specimen height, in. | 5.60 | | | |
| Height/diameter ratio | 1.97 | | | |

Description: Fill, lean clay, stiff, dark brown, moist

LL = PL = PI = Assumed GS= 2.72 Type: ST

Project No.: 223118G

Date Sampled: 6/14/23

Remarks:

Client: Hollis + Miller Architects

Project: EPiC Elementary School Storm Addition

Source of Sample: B-4 **Depth:** 3

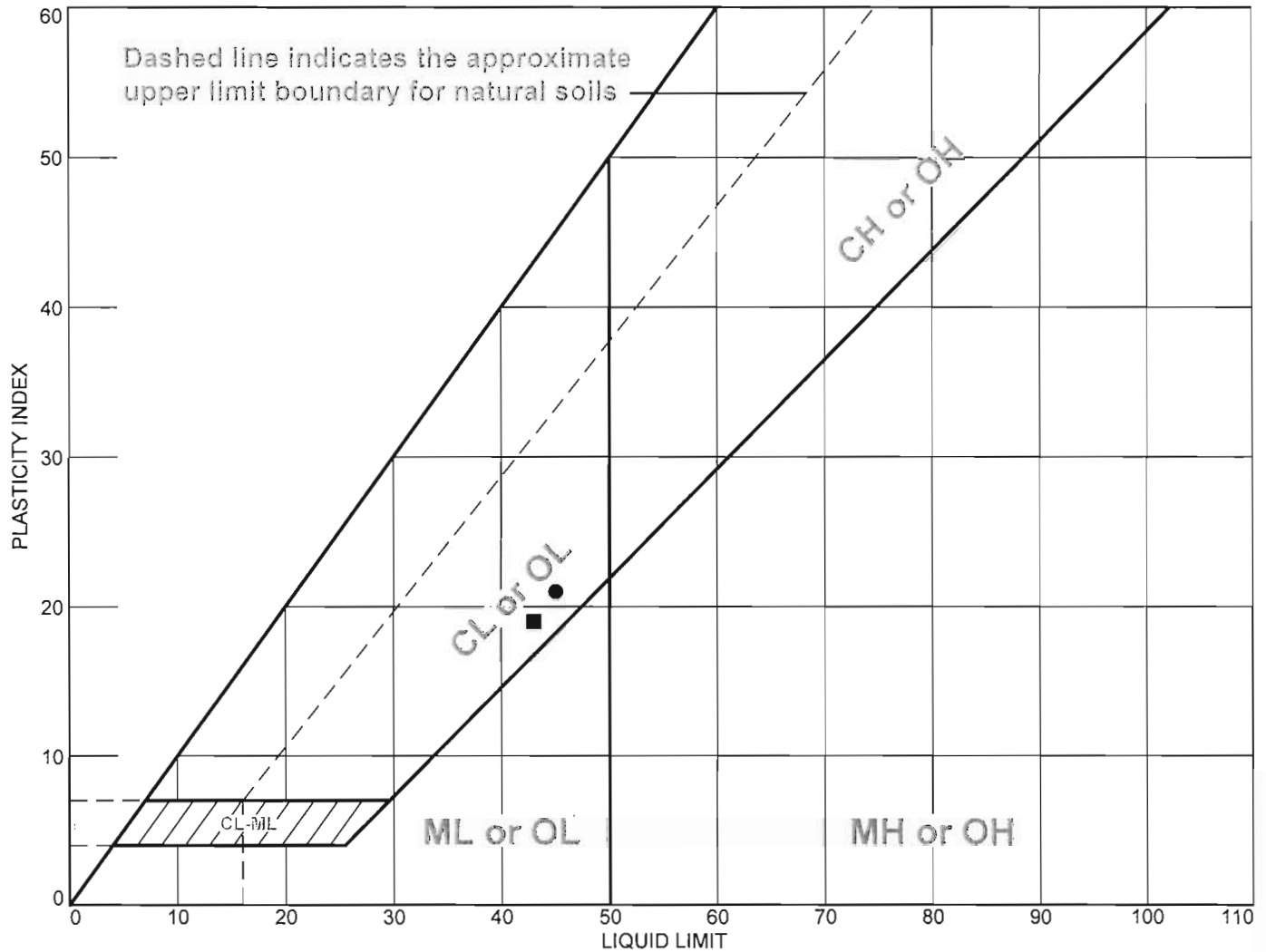
Sample Number: 2

Figure _____



Tested By: TA **Checked By:** OJK

LIQUID AND PLASTIC LIMITS TEST REPORT ASTM D 4318



| | MATERIAL DESCRIPTION | LL | PL | PI | %<#40 | %<#200 | USCS |
|---|--|----|----|----|-------|--------|------|
| ● | Fill, lean clay with gravel, stiff, dark brown, moist | 45 | 24 | 21 | | | CL |
| ■ | Fill, lean clay with gravel, stiff, dark brown and orange brown, moist | 43 | 24 | 19 | | | CL |
| | | | | | | | |
| | | | | | | | |

Project No. 223118G **Client:** Hollis + Miller Architects

Project: EPiC Elementary School Storm Addition

● **Source of Sample:** B-1 **Depth:** 1 **Sample Number:** 1

■ **Source of Sample:** B-3 **Depth:** 1 **Sample Number:** 1

Remarks:

KTI

Figure

GLOSSARY OF GEOTECHNICAL TERMS

| | |
|-------------------|---|
| ALLUVIUM | Sediments deposited by streams, including riverbeds and floodplains. |
| ARGILLACEOUS | Rocks composed of or having a notable portion of fine silt and/or clay in their composition. |
| ATTERBERG LIMITS | Water contents, in percentage of dry weight of soil, that correspond to the boundaries between the states of consistency, i.e. the boundary between the liquid and plastic states (liquid limit) and the boundary between the plastic and solid states (plastic limit). |
| BEDROCK-IN-PLACE | Continuous rock mass which essentially has not moved from its original depositional position. |
| CALCAREOUS | Containing calcium carbonate determined by effervescence when tested with dilute hydrochloric acid. |
| CHANNEL SANDSTONE | Sandstone that has been deposited in a streambed or other channel eroded into the underlying beds. |
| COLLUVIAL | Rock debris of various sizes loose from in-place bedrock mass, often shifted down gradient in conjunction with soil. |
| CROSS-BEDDING | Stratification which is inclined to the original horizontal surface upon which the sediment accumulated. |
| FISSILE BEDDING | Term applied to bedding which consists of laminae less than 2 millimeters in thickness. |
| FORMATION | A distinctive body of rock that serves as a convenient unit for study and mapping. |
| FOSSIL DETRITUS | The accumulation of broken, fragmented fossil debris. |
| FOSSILIFEROUS | Containing organic remains. |
| GLACIAL ERRATIC | A transported rock fragment different from the bedrock on which it lies, either free or as part of a sediment. |
| GLACIAL TILL | Nonsorted, nonstratified sediment carried or deposited by a glacier. |
| GLACIOFLUVIAL | Primarily deposited by streams from glaciers. |
| GROUP | A lithostratigraphic unit consisting of two or more formations. |

| | |
|--------------------------------|---|
| JOINT | A fracture in a rock along which no appreciable displacement has occurred. |
| LIMESTONE | A sedimentary rock composed mostly of calcium carbonate (CaCO_3). |
| LOESS | A homogenous, nonstratified, unindurated deposit consisting predominantly of silt, with subordinate amounts of very fine sand and/or clay. |
| MICA | A mineral group, consisting of phyllosilicates, with sheetlike structures. |
| MEMBER | A specially developed part of a varied formation is called a member, if it has considerable geographic extent. |
| NODULE | A small, irregular, knobby, or rounded rock that is generally harder than the surrounding rock. |
| PERMEABILITY | The capacity of a material to transmit a fluid. |
| RECOVERY | The percentage of bedrock core recovered from a core run length. |
| RELIEF | The difference in elevation between the high and low points of a land surface. |
| RESIDUAL SOIL | Soil formed in place by the disintegration and decomposition of rocks and the consequent weathering of the mineral materials. |
| ROCK QUALITY DESIGNATION (RQD) | Refers to percentage of core sample recovered in unbroken lengths of 4 inches or more. |
| SANDSTONE | Sedimentary rock composed mostly of sand sized particles, usually cemented by calcite, silica, or iron oxide. |
| SERIES | A time-stratigraphic unit ranked next below a system. |
| SHALE | A fine-grained plastic sedimentary rock formed by consolidation of clay and mud. |
| STRATIGRAPHY | Branch of geology that treats the formation, compositions, sequence, and correlation of the stratified rocks as parts of the earth's crust. |
| SYSTEM | Designates rocks formed during a fundamental chronological unit, a period. |
| UNCONFORMITY | A surface of erosion or nondeposition, usually the former, which separates younger strata from older rocks. |
| WEATHERING | The physical and chemical disintegration and decomposition of rocks and minerals. |

General Notes

| Laboratory Test Symbols | |
|-------------------------|---|
| Symbol | Definition |
| LL | Liquid Limit (ASTM D4318) |
| PL | Plastic Limit (ASTM D4318) |
| PI | Plasticity Index (LL minus PL) |
| Qu | Unconfined Compressive Strength, Pounds per Square Foot (psf) |
| Qp | Pocket Penetrometer Reading, Tons per Square Foot (TSF) |
| RQD | Rock Quality Designation % (Sum of rock core pieces >4 inches/length of core run) |

Common Soil Classification Symbols

| Clay | |
|--------|------------------------------|
| Symbol | Soil Type |
| CL | Low plasticity clay |
| CL-ML | Low plasticity clay and silt |
| CL/CH | Medium plasticity clay |
| CH | High plasticity clay |

| Silt | |
|--------|----------------------|
| Symbol | Soil Type |
| ML | Low plasticity silt |
| MH | High plasticity silt |

| Sand | |
|--------|--------------------|
| Symbol | Soil Type |
| SW | Well graded sand |
| SP | Poorly graded sand |
| SM | Silty sand |
| SC | Clayey sand |

| Gravel | |
|--------|----------------------|
| Symbol | Soil Type |
| GW | Well graded gravel |
| GP | Poorly graded gravel |
| GM | Silty gravel |
| GC | Clayey gravel |

Descriptive Terminology

Cohesionless Soils

| Relative Density Term | "N" Value |
|-----------------------|------------|
| Very Loose | 0 - 4 |
| Loose | 5 - 9 |
| Medium Dense | 10 - 29 |
| Dense | 30 - 49 |
| Very Dense | 50 or more |

Cohesive Soils

| Consistency Term | "N" Value |
|------------------|-----------|
| Very soft | 0 - 2 |
| Soft | 3 - 4 |
| Medium | 5 - 8 |
| Stiff | 9 - 15 |
| Very Stiff | 16 - 30 |
| Hard | > 30 |

Relative Proportions and Sizes

| Term | Range |
|----------|----------|
| Trace | < 5% |
| A Little | 5 - 15% |
| Some | 15 - 30% |
| With | 30 - 50% |

| Material | Size |
|---------------|-----------------|
| Boulder | > 12" |
| Cobble | 3" - 12" |
| Gravel | 4.75 - 76.2 mm |
| Sand | 0.075 - 4.75 mm |
| Silt and Clay | < 0.075 mm |

SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Project information.
 - 2. Work covered by Contract Documents.
 - 3. Work by Owner.
 - 4. Work under separate contracts.
 - 5. Future work.
 - 6. Access to site.
 - 7. Coordination with occupants.
 - 8. Work restrictions.
 - 9. Specification and drawing conventions.
 - 10. Miscellaneous provisions.
- B. Related Requirements:
 - 1. Section 015000 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.2 PROJECT INFORMATION

- A. Project Identification:
 - 1. 23018 - Discovery Middle School
 - a. Project Address: 800 Midjay Drive, Liberty, Missouri 64068
 - 2. 23019 - South Valley Middle School
 - a. Project Address: 1000 Midjay Drive, Liberty, Missouri 64068
 - 3. 23020 - EPiC Elementary School
 - a. Project Address: 650 Conister Street, Liberty, Missouri 64068
- B. Owner: **Liberty Public Schools**
 - 1. Refer to Document 000101 "Project Team Directory."
- C. Architect:
 - 1. Refer to Document 000101 "Project Team Directory."
- D. Architect's Consultants: The Architect has retained the following design professionals who have prepared designated portions of the Contract Documents:
 - 1. Refer to Document 000101 "Project Team Directory."
- E. Construction Manager:
 - 1. Refer to Document 000101 "Project Team Directory."
 - 2. Construction Manager's Contact: Contractor's Contact .
 - 3. Construction Manager for this Project is Project's constructor. The terms "Construction Manager" and "Contractor" are synonymous.
 - 4. Construction Manager has been engaged for this Project to serve as an advisor to Owner and to provide assistance in administering the Contract for Construction between Owner and each Contractor, according to a separate contract between Owner and Construction Manager.

1.3 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Work of Project is defined by the Contract Documents and consists of the following:
 - 1. General: All demolition, sitework, architectural, structural, fire suppression, plumbing, mechanical, electrical, access control, technology and utilities as indicated in the Contract Documents and as further defined in the Scopes of Work.
 - 2. Alternates: Refer to Section 012300 "Alternates".

- B. Type of Contract:
 - 1. Project will be constructed under a single prime contract.
 - 2. Project will be constructed under a multiple trade contract.

1.4 ACCESS TO SITE

- A. General: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.
- B. Use of Site: Limit use of Project site to work in areas indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.
 - 1. Limits: Confine construction operations to areas indicated and as directed by Construction Manager.
 - 2. Driveways, Walkways, and Entrances: Keep driveways, loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
 - a. Restrictions: Note that no deliveries to the Project Site will be allowed between the hours of 7:00 am to 8:30 am and 2:00 pm to 3:30 pm.
 - b. Schedule deliveries to minimize use of driveways and entrances by construction operations.
 - c. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
- C. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.

1.5 COORDINATION WITH OCCUPANTS

- A. Partial Owner Occupancy: Owner will occupy the premises during entire construction period, with the exception of areas under construction. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's operations. Maintain existing exits unless otherwise indicated.
 - 1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and authorities having jurisdiction.
 - 2. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.

1.6 WORK RESTRICTIONS

- A. Work Restrictions, General: Comply with restrictions on construction operations.
 - 1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.
- B. On-Site Work Hours: Limit work in the existing building to normal business working hours of 7:00 a.m. to 4:00 p.m., Monday through Friday, unless otherwise indicated.
 - 1. Weekend Hours: Coordinate and schedule all weekend hours with the Owner not less than 48 hours in advance. Comply with regulations of authorities having jurisdiction.
 - 2. Early Morning Hours: Notify Owner of days when early morning hours will be required and comply with regulations of authorities having jurisdiction.
- C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:
 - 1. Notify Architect and Owner not less than three (3) days in advance of proposed utility interruptions.
 - 2. Obtain Owner's written permission before proceeding with utility interruptions.
- D. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.
 - 1. Notify Architect and Owner not less than three (3) days in advance of proposed disruptive operations.
 - 2. Obtain Owner's written permission before proceeding with disruptive operations.

- E. Nonsmoking Buildings and Sites: Smoking is not permitted on School District property.
- F. Controlled Substances: Use of tobacco products and other controlled substances on Project site is not permitted.
- G. Employee Identification: Provide identification tags for Contractor personnel working on Project site. Require personnel to use identification tags at all times.
- H. Employee Screening: Comply with Owner's requirements for drug and background screening of Contractor personnel working on Project site.
 - 1. Maintain list of approved screened personnel with Owner's representative.
 - 2. As a condition for the award of any service contract in excess of \$5,000.00 by the Owner, the service provider must be enrolled in and currently participating in "E-Verify" or any other equivalent electronic verification of work authorization program operated by the U.S. Department of Homeland Security.
 - 3. As a further condition for the award of any service contract in excess of \$5,000.00 the service provider shall not knowingly employ any person who is an un-authorized alien in conjunction with the contracted services.
 - a. E-Verify forms are available for duplication and contractor's use in Section 008400 – Attachments.

1.7 SPECIFICATION AND DRAWING CONVENTIONS

- A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
 - 1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
 - 2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.
- B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.
- C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:
 - 1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
 - 2. Abbreviations: Materials and products are identified by abbreviations published as part of the U.S. National CAD Standard and scheduled on Drawings.
 - 3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION 011000

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SECTION 012100 - ALLOWANCES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements governing allowances.
 - 1. Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when direction will be provided to Contractor. If necessary, additional requirements will be issued by Change Order.
- B. Types of allowances include the following:
 - 1. Lump-sum allowances.
 - 2. Unit-cost allowances.
- C. Related Requirements:
 - 1. Section 012200 "Unit Prices" for procedures for using unit prices.
 - 2. Section 014000 "Quality Requirements" for procedures governing the use of allowances for testing and inspecting.

1.2 SELECTION AND PURCHASE

- A. At the earliest practical date after award of the Contract, advise Architect of the date when final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work.
- B. At Architect's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.
- C. Purchase products and systems selected by Architect from the designated supplier.

1.3 ACTION SUBMITTALS

- A. Submit proposals for purchase of products or systems included in allowances, in the form specified for Change Orders.

1.4 INFORMATIONAL SUBMITTALS

- A. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.
- B. Submit time sheets and other documentation to show labor time and cost for installation of allowance items that include installation as part of the allowance.
- C. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.5 COORDINATION

- A. Coordinate allowance items with other portions of the Work. Furnish templates as required to coordinate installation.

1.6 LUMP-SUM AND UNIT-COST ALLOWANCES

- A. Allowance shall include cost to Contractor of specific products and materials ordered by Owner or selected by Architect under allowance and shall include taxes, freight, and delivery to Project site.

1. Sales and Use Taxes shall be omitted for this project.
- B. Unless otherwise indicated, Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials ordered by Owner and/or selected by Architect under allowance shall be included as part of the Contract Sum and not part of the allowance.
- C. Unused Materials: Return unused materials purchased under an allowance to manufacturer or supplier for credit to Owner, after installation has been completed and accepted.
 1. If requested by Architect, retain and prepare unused material for storage by Owner. Deliver unused material to Owner's storage space as directed.
- D. Refer to "Bid Packages" for further clarification of required allowances.

1.7 ADJUSTMENT OF ALLOWANCES

- A. Allowance Adjustment: To adjust allowance amounts, prepare a Change Order proposal based on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place where applicable. If applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.
 1. Include installation costs in purchase amount only where indicated as part of the allowance.
 2. If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other margins claimed.
 3. Submit substantiation of a change in scope of work, if any, claimed in Change Orders related to unit-cost allowances.
 4. Owner reserves the right to establish the quantity of work-in-place by independent quantity survey, measure, or count.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.2 PREPARATION

- A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

3.3 SCHEDULE OF ALLOWANCES

- A. General: Refer to individual Bid Package – Scopes of Work for Allowances.

END OF SECTION 012100

SECTION 012200 - UNIT PRICES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for unit prices.
- B. Related Requirements:
 - 1. Section 012600 "Contract Modification Procedures" for procedures for submitting and handling Change Orders.
 - 2. Section 014000 "Quality Requirements" for general testing and inspecting requirements.

1.2 DEFINITIONS

- A. Unit price is an amount incorporated in the Agreement, applicable during the duration of the Work as a price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of Work or estimated quantities of Work required by the Contract Documents are increased or decreased.

1.3 PROCEDURES

- A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, applicable taxes (other than sales and use tax), overhead, and profit.
- B. Measurement and Payment: See individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.
- C. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.
- D. List of Unit Prices: A schedule of unit prices is included in Part 3. Specification Sections referenced in the schedule contain requirements for materials described under each unit price.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 SCHEDULE OF UNIT PRICES

- A. Refer to Individual Bid Package – Scopes of Work.

END OF SECTION 012200

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SECTION 012300 - ALTERNATES

PART 1 - GENERAL

1.1 SUMMARY

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

1.2 DEFINITIONS

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

1.3 PROCEDURES

- A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
 - 1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.
- B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated revisions to alternates.
- C. Execute accepted alternates under the same conditions as other work of the Contract.
- D. Schedule: A schedule of alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 SCHEDULE OF ALTERNATES

- A. Alternate No. 1: Ceiling Tile.
 - 1. Alternate: Alternate includes all labor, materials, equipment and appurtenances necessary to replace all existing ceiling tile. Refer to sheets DA101 and reflected ceiling plans indicated on Drawings as Alternate No. 1.
 - 2. Base Bid: Do not provide work as indicated on Drawings as Alternate No. 1.
- B. Alternate No. 2: Light Fixtures.
 - 1. Alternate: Alternate includes all labor, materials, equipment and appurtenances necessary to replace all existing light fixtures. Refer to lighting plans.
 - 2. Base Bid: Do not provide work as indicated on Drawings as Alternate No. 2.

END OF SECTION 012300

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SECTION 012500.01 - SUBSTITUTION PROCEDURES FORM

PROJECT: Discovery Middle School, South Valley Middle School, EPiC Elementary School

MAIL TO: HOLLIS + MILLER ARCHITECTS, 1828 WALNUT STREET, SUITE 922, KANSAS CITY, MISSOURI 64108

SPECIFIED ITEM/ KEYNOTE #: _____

PROPOSED SUBSTITUTE: _____

SUBMITTED BY: _____

FIRM: _____

ADDRESS: _____

SIGNATURE: _____ **DATE:** _____

PHONE NUMBER: _____

ATTACH COMPLETE DESCRIPTION, DESIGNATION, CATALOG OR MODEL NUMBER, SPEC DATA SHEET AND OTHER TECHNICAL DATA AND SAMPLES, INCLUDING LABORATORY TESTS IF APPLICABLE.

FILL IN BLANKS BELOW:

1. WILL SUBSTITUTION AFFECT DIMENSION INDICATED ON DRAWINGS?
2. WILL SUBSTITUTION AFFECT WIRING, PIPING, DUCTWORK, ETC., INDICATED ON DRAWINGS?
3. WHAT EFFECT WILL SUBSTITUTION HAVE ON OTHER TRADES?
4. DIFFERENCES BETWEEN PROPOSED SUBSTITUTION AND SPECIFIED ITEM?
5. ANY AND ALL IMPACTS ON COSTS, DESIGN MODIFICATIONS, ADDITIONAL ARCHITECTURAL AND ENGINEERING SERVICES, MATERIAL AND LABOR CHANGES, SCHEDULE CHANGES, AND OTHER UNANTICIPATED CONSEQUENCES, RESULTING FROM THIS SUBSTITUTION IN LIEU OF THE SPECIFIED ITEM, SHALL BE THE FULL RESPONSIBILITY OF THE CONTRACTOR AND HIS SUBCONTRACTORS AND SUPPLIER.

6. MANUFACTURER'S WARRANTIES OF THE SPECIFIED ITEMS AND PROPOSED ITEMS ARE: ☐ SAME OR
☐ DIFFERENT, *EXPLAIN:* _____

REVIEW COMMENTS:

☐ **NO EXCEPTION TAKEN TO SUBMITTED MANUFACTURER**

*MANUFACTURER ONLY, IS ACCEPTED DUE TO TIME LIMITATIONS FOR FULL REVIEW OF PRODUCT, OR
BECAUSE NO SPECIFIC PRODUCT DATA IS SUBMITTED, OR OTHER UNSPECIFIED REASONS. CONTRACTOR
MUST STILL BEAR FULL RESPONSIBILITY FOR COMPLIANCE WITH CONTRACT REQUIREMENTS.*

☐ **NO EXCEPTION TAKEN TO SPECIFIC PRODUCTS**

☐ **EXCEPTIONS NOTED**

SEE ATTACHED COPY OR NOTES ON PRODUCT LITERATURE

☐ **NOT ACCEPTED**

☐ **RECEIVED TOO LATE**

BY: _____ DATE: _____

REMARKS: _____

END OF SECTION

SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
 - 1. General coordination procedures.
 - 2. Coordination drawings.
 - 3. Requests for Information (RFIs).
 - 4. On-line Project file.
 - 5. Project meetings.
- B. Each contractor shall participate in coordination requirements. Certain areas of responsibility are assigned to a specific contractor.
- C. Related Requirements:
 - 1. Section 013200 "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
 - 2. Section 017300 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
 - 3. Section 017700 "Closeout Procedures" for coordinating closeout of the Contract.

1.2 DEFINITIONS

- A. RFI: Request from Owner, Construction Manager, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

1.3 INFORMATIONAL SUBMITTALS

- A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Use form acceptable to Construction Manager. Include the following information in tabular form:
 - 1. Name, address, and telephone number of entity performing subcontract or supplying products.
 - 2. Number and title of related Specification Section(s) covered by subcontract.
 - 3. Drawing number and detail references, as appropriate, covered by subcontract.
- B. Key Personnel Names: Within ten (10) days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project. Keep list current at all times.
 - 1. Post paper copies of list in project meeting room, in temporary field office, and by each temporary telephone.

1.4 GENERAL COORDINATION PROCEDURES

- A. Coordination: Each contractor shall coordinate its construction operations with those of other contractors and entities to ensure efficient and orderly installation of each part of the Work. Each contractor shall coordinate its operations with operations, included in different Sections that depend on each other for proper installation, connection, and operation.
 - 1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
 - 2. Coordinate installation of different components with other contractors to ensure maximum performance and accessibility for required maintenance, service, and repair.
 - 3. Make adequate provisions to accommodate items scheduled for later installation.

- B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
 - 1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.
- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
 - 1. Preparation of Contractor's construction schedule.
 - 2. Preparation of the schedule of values.
 - 3. Installation and removal of temporary facilities and controls.
 - 4. Delivery and processing of submittals.
 - 5. Progress meetings.
 - 6. Preinstallation conferences.
 - 7. Project closeout activities.
 - 8. Startup and adjustment of systems.
- D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.
 - 1. Refer to Section 017419 "Construction Waste Management and Disposal" for additional requirements.

1.5 COORDINATION DRAWINGS

- A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.
 - 1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
 - a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
 - b. Coordinate the addition of trade-specific information to the coordination drawings by multiple contractors in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
 - c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
 - d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
 - e. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
 - f. Indicate required installation sequences.
 - g. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.
- B. Coordination Drawing Organization: Organize coordination drawings as follows:
 - 1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.
 - 2. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within ceiling plenum to accommodate layout of light fixtures indicated on Drawings. Indicate areas of conflict between light fixtures and other components.
 - 3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.
 - 4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
 - 5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
 - 6. Mechanical and Plumbing Work: Show the following:

- a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
 - b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.
 - c. Fire-rated enclosures around ductwork.
 7. Electrical Work: Show the following:
 - a. Runs of vertical and horizontal conduit 1-1/4 inches in diameter and larger.
 - b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire-alarm locations.
 - c. Panel board, switch board, switchgear, transformer, busway, generator, and motor control center locations.
 - d. Location of pull boxes and junction boxes, dimensioned from column center lines.
 8. Fire-Protection System: Show the following:
 - a. Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.
 9. Review: Architect will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Architect determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Architect will so inform Contractor, who shall make changes as directed and resubmit.
 10. Coordination Drawing Prints: As deemed necessary by Construction Manager, prepare coordination drawing prints according to requirements in Section 013300 "Submittal Procedures."
- C. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:
1. File Preparation Format: Same digital data software program, version, and operating system as original Drawings.
 2. File Submittal Format: Submit or post coordination drawing files using Portable Data File (PDF) format.
 3. BIM File Incorporation: Develop and incorporate coordination drawing files into Building Information Model established for Project.
 - a. Refer to individual Scopes of Work for Trades required to perform three-dimensional component conflict analysis as part of preparation of coordination drawings. Resolve component conflicts prior to submittal. Indicate where conflict resolution requires modification of design requirements by Architect.
 4. Architect, through Construction Manager, will furnish Contractor one set of digital data files of Drawings for use in preparing coordination digital data files.
 - a. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Drawings.
 - b. Digital Drawing Software Program: The Contract Drawings are available in Revit version 2022 using Windows 10 operating system.
 - 1) **[VERIFY REVIT VERSION]**
 - c. Contractor shall execute a data licensing agreement in the form of Agreement included in Project Manual.
 - 1) **[VERIFY]**

1.6 REQUESTS FOR INFORMATION (RFIS)

- A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
 1. Architect will return RFIs submitted to Architect by other entities controlled by Contractor with no response.
 2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
- B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
 1. Project name.
 2. Project number.
 3. Date.
 4. Name of Contractor.
 5. Name of Architect.
 6. Name of Construction Manager.
 7. RFI number, numbered sequentially.
 8. RFI subject.
 9. Specification Section number and title and related paragraphs, as appropriate.
 10. Drawing number and detail references, as appropriate.
 11. Field dimensions and conditions, as appropriate.

12. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
 13. Contractor's signature.
 14. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
 - a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.
- C. RFI Forms: AIA Document G716 or a software-generated form with substantially the same content as indicated above, acceptable to Architect.
1. Attachments shall be electronic files in Adobe Acrobat PDF format.
- D. Architect's and Construction Manager's Action: Architect and Construction Manager will review each RFI, determine action required, and respond. Allow seven (7) working days for Architect's response for each RFI. RFIs received by Architect or Construction Manager after 1:00 p.m. will be considered as received the following working day.
1. The following Contractor-generated RFIs will be returned without action:
 - a. Requests for approval of submittals.
 - b. Requests for approval of substitutions.
 - c. Requests for approval of Contractor's means and methods.
 - d. Requests for coordination information already indicated in the Contract Documents.
 - e. Requests for adjustments in the Contract Time or the Contract Sum.
 - f. Requests for interpretation of Architect's actions on submittals.
 - g. Incomplete RFIs or inaccurately prepared RFIs.
 2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of additional information.
 3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 012600 "Contract Modification Procedures."
 - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect and Construction Manager in writing within 10 days of receipt of the RFI response.
- E. RFI Log: Use software log that is part of on-line collaborative Project file through Procore.
- F. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly in form acceptable to Architect. Include the following:
1. Project name.
 2. Name and address of Contractor.
 3. Name and address of Architect.
 4. Name and address of Construction Manager.
 5. RFI number including RFIs that were returned without action or withdrawn.
 6. RFI description.
 7. Date the RFI was submitted to the Architect.
 8. Date Architect's and Construction Manager's response was received.
- G. On receipt of Architect's and Construction Manager's action, immediately distribute the RFI response to affected parties. Review response and notify Architect and Construction Manager within seven (7) days if Contractor disagrees with response.
1. Change in Work shall be recorded to the Project Record set per Section 017839 "Project Record Documents".

1.7 PROJECT MEETINGS

- A. General: Construction Manager will schedule and conduct meetings and conferences at Project site unless otherwise indicated.
1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
 2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
 3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner, Construction Manager, and Architect, within three (3) days of the meeting.

- B. Preconstruction Conference: Construction Manager will schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement.
1. Conduct the conference to review responsibilities and personnel assignments.
 2. Attendees: Authorized representatives of Owner, Owner's Commissioning Authority, Construction Manager, Architect, and their consultants; each Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
 3. Agenda: Discuss items of significance that could affect progress, including the following:
 - a. Tentative construction schedule.
 - b. Phasing.
 - c. Critical work sequencing and long-lead items.
 - d. Designation of key personnel and their duties.
 - e. Lines of communications.
 - f. Procedures for processing field decisions and Change Orders.
 - g. Procedures for RFIs.
 - h. Procedures for testing and inspecting.
 - i. Procedures for processing Applications for Payment.
 - j. Distribution of the Contract Documents.
 - k. Submittal procedures.
 - l. Preparation of record documents.
 - m. Use of the premises.
 - n. Work restrictions.
 - o. Working hours.
 - p. Owner's occupancy requirements.
 - q. Responsibility for temporary facilities and controls.
 - r. Procedures for moisture and mold control.
 - s. Procedures for disruptions and shutdowns.
 - t. Construction waste management and recycling.
 - u. Parking availability.
 - v. Office, work, and storage areas.
 - w. Equipment deliveries and priorities.
 - x. First aid.
 - y. Security.
 - z. Progress cleaning.
 4. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.
- C. LEED Coordination Conference: Construction Manager will schedule and conduct a LEED coordination conference before starting construction, at a time convenient to Owner, Construction Manager, Architect, and Contractor.
1. **[FOR LEED PROJECTS]**
 2. Attendees: Authorized representatives of Owner, Owner's Commissioning Authority, Construction Manager, Architect, and their consultants; Contractor and its superintendent and LEED coordinator; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
 3. Agenda: Discuss items of significance that could affect meeting requirements for LEED certification, including the following:
 - a. LEED Project Checklist.
 - b. General requirements for LEED-related procurement and documentation.
 - c. Project closeout requirements and LEED certification procedures.
 - d. Role of LEED coordinator.
 - e. Construction waste management.
 - f. Construction operations and LEED requirements and restrictions.
 4. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.
- D. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.
1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect, Construction Manager, and Owner's Commissioning

- Authority of scheduled meeting dates.
 - 2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
 - a. Contract Documents.
 - b. Options.
 - c. Related RFIs.
 - d. Related Change Orders.
 - e. Purchases.
 - f. Deliveries.
 - g. Submittals.
 - h. Review of mockups.
 - i. Possible conflicts.
 - j. Compatibility requirements.
 - k. Time schedules.
 - l. Weather limitations.
 - m. Manufacturer's written instructions.
 - n. Warranty requirements.
 - o. Compatibility of materials.
 - p. Acceptability of substrates.
 - q. Temporary facilities and controls.
 - r. Space and access limitations.
 - s. Regulations of authorities having jurisdiction.
 - t. Testing and inspecting requirements.
 - u. Installation procedures.
 - v. Coordination with other work.
 - w. Required performance results.
 - x. Protection of adjacent work.
 - y. Protection of construction and personnel.
 - 3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
 - 4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
 - 5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
- E. Project Closeout Conference: Construction Manager will schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, but no later than 60 days prior to the scheduled date of Substantial Completion.
- 1. Conduct the conference to review requirements and responsibilities related to Project closeout.
 - 2. Attendees: Authorized representatives of Owner, Owner's Commissioning Authority, Construction Manager, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
 - 3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
 - a. Preparation of record documents.
 - b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
 - c. Submittal of written warranties.
 - d. Requirements for preparing operations and maintenance data.
 - e. Requirements for delivery of material samples, attic stock, and spare parts.
 - f. Requirements for demonstration and training.
 - g. Preparation of Contractor's punch list.
 - h. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
 - i. Submittal procedures.
 - j. Owner's partial occupancy requirements.
 - k. Installation of Owner's furniture, fixtures, and equipment.
 - l. Responsibility for removing temporary facilities and controls.
 - 4. Minutes: Entity conducting meeting will record and distribute meeting minutes.
- F. Progress Meetings: Construction Manager will conduct progress meetings at **biweekly** intervals.

1. **[BOD is biweekly] [JEFFCO requires weekly]**
2. Coordinate dates of meetings with preparation of payment requests.
3. Attendees: In addition to representatives of Owner, Owner's Commissioning Authority, Construction Manager, and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
4. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 - 1) Review schedule for next period.
 - b. Review present and future needs of each entity present, including the following:
 - 1) Interface requirements.
 - 2) Sequence of operations.
 - 3) Resolution of BIM component conflicts.
 - 4) Status of submittals.
 - 5) Status of sustainable design documentation.
 - 6) Deliveries.
 - 7) Off-site fabrication.
 - 8) Access.
 - 9) Site utilization.
 - 10) Temporary facilities and controls.
 - 11) Progress cleaning.
 - 12) Quality and work standards.
 - 13) Status of correction of deficient items.
 - 14) Field observations.
 - 15) Status of RFIs.
 - 16) Status of proposal requests.
 - 17) Pending changes.
 - 18) Status of Change Orders.
 - 19) Pending claims and disputes.
 - 20) Documentation of information for payment requests.
5. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.
 - a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION 013100

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SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
 - 1. Startup construction schedule.
 - 2. Contractor's construction schedule.
 - 3. Construction schedule updating reports.
 - 4. Daily construction reports.
 - 5. Material location reports.
 - 6. Site condition reports.
 - 7. Special reports.
- B. Related Requirements:
 - 1. Section 013300 "Submittal Procedures" for submitting schedules and reports.
 - 2. Section 014529 "Testing and Inspections" for submitting a schedule of tests and inspections.

1.2 DEFINITIONS

- A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
 - 1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
 - 2. Predecessor Activity: An activity that precedes another activity in the network.
 - 3. Successor Activity: An activity that follows another activity in the network.
- B. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.
- C. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.
- D. Event: The starting or ending point of an activity.
- E. Float: The measure of leeway in starting and completing an activity.
 - 1. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
 - 2. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.
- F. Resource Loading: The allocation of manpower and equipment necessary for the completion of an activity as scheduled.

1.3 INFORMATIONAL SUBMITTALS

- A. Format for Submittals: Submit required submittals in the following format:
 - 1. Working electronic copy of schedule file, where indicated.
 - 2. PDF electronic file
- B. Startup construction schedule.
 - 1. Approval of cost-loaded, startup construction schedule will not constitute approval of schedule of values for cost-loaded activities.

- C. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.
 - 1. Submit a working electronic copy of schedule, using software indicated, and labeled to comply with requirements for submittals. Include type of schedule (initial or updated) and date on label.
- D. Construction Schedule Updating Reports: Submit with Applications for Payment.
- E. Daily Construction Reports: Submit at monthly intervals.
- F. Material Location Reports: Submit at monthly intervals.
- G. Site Condition Reports: Submit at time of discovery of differing conditions.
- H. Special Reports: Submit at time of unusual event.
 - 1. Adverse Weather Days: Document conditions effecting construction activities and submit within 24 hours of the event.

1.4 QUALITY ASSURANCE

- A. Prescheduling Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to the preliminary construction schedule and Contractor's construction schedule, including, but not limited to, the following:
 - 1. Review software limitations and content and format for reports.
 - 2. Verify availability of qualified personnel needed to develop and update schedule.
 - 3. Discuss constraints, including phasing, work stages, area separations and interim milestones.
 - 4. Review delivery dates for Owner-furnished products.
 - 5. Review submittal requirements and procedures.
 - 6. Review time required for review of submittals and resubmittals.
 - 7. Review requirements for tests and inspections by independent testing and inspecting agencies.
 - 8. Review time required for Project closeout and Owner startup procedures, including commissioning activities.
 - 9. Review and finalize list of construction activities to be included in schedule.
 - 10. Review procedures for updating schedule.

1.5 COORDINATION

- A. Coordinate Contractor's construction schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports.
 - 1. Secure time commitments for performing critical elements of the Work from entities involved.
 - 2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

- A. Time Frame: Extend schedule from date established for the Notice to Proceed to date of final completion.
 - 1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.
- B. Activities: Treat each story or separate area as a separate numbered activity for each main element of the Work. Comply with the following:
 - 1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.
 - 2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.

3. Submittal Review Time: Include review and resubmittal times indicated in Section 013300 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
 4. Startup and Testing Time: Include no fewer than 20 days for startup and testing.
 5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's and Construction Manager's administrative procedures necessary for certification of Substantial Completion.
 6. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and final completion.
- C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
1. Phasing: Arrange list of activities on schedule by phase.
 2. Work under More Than One Contract: Include a separate activity for each contract.
 3. Work by Owner: Include a separate activity for each portion of the Work performed by Owner, if any.
 4. Products Ordered in Advance: Include a separate activity for each product. Include delivery date indicated in Section 011000 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
 5. Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Section 011000 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
 6. Work Restrictions: Show the effect of the following items on the schedule:
 - a. Coordination with existing construction.
 - b. Uninterruptible services.
 - c. Use of premises restrictions.
 - d. Provisions for future construction.
 - e. Seasonal variations.
 - f. Environmental control.
 7. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:
 - a. Subcontract awards.
 - b. Submittals.
 - c. Purchases.
 - d. Mockups.
 - e. Fabrication.
 - f. Sample testing.
 - g. Deliveries.
 - h. Installation.
 - i. Tests and inspections.
 - j. Adjusting.
 - k. Curing.
 - l. Building flush-out.
 - m. Startup and placement into final use and operation.
 8. Construction Areas: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:
 - a. Structural completion.
 - b. Temporary enclosure and space conditioning.
 - c. Permanent space enclosure.
 - d. Completion of mechanical installation.
 - e. Completion of electrical installation.
 - f. Substantial Completion.
- D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and final completion.
- E. Cost Correlation: Superimpose a cost correlation timeline, indicating planned and actual costs. On the line, show planned and actual dollar volume of the Work performed as of planned and actual dates used for preparation of payment requests.
1. See Section 012900 "Payment Procedures" for cost reporting and payment procedures.
- F. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:
1. Unresolved issues.

2. Unanswered Requests for Information.
 3. Rejected or unreturned submittals.
 4. Notations on returned submittals.
 5. Pending modifications affecting the Work and Contract Time.
- G. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, and equipment required to achieve compliance, and date by which recovery will be accomplished.
- H. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.

2.2 STARTUP CONSTRUCTION SCHEDULE

- A. Bar-Chart Schedule: Submit startup, horizontal, bar-chart-type construction schedule within seven (7) days of date established for the Notice to Proceed or Notice of Award, whichever is earlier.
- B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line. Outline significant construction activities for first 90 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

2.3 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)

- A. General: Prepare network diagrams using AON (activity-on-node) format.
- B. Startup Network Diagram: Submit diagram within 14 days of date established for the Notice to Proceed. Outline significant construction activities for the first 90 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.
- C. CPM Schedule: Prepare Contractor's construction schedule using a time-scaled CPM network analysis diagram for the Work.
1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted for use no later than 30 days after date established for the Notice to Proceed.
 - a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates, regardless of Architect's approval of the schedule.
 2. Conduct educational workshops to train and inform key Project personnel, including subcontractors' personnel, in proper methods of providing data and using CPM schedule information.
 3. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
 4. Use "one workday" as the unit of time for individual activities. Indicate nonworking days and holidays incorporated into the schedule in order to coordinate with the Contract Time.
- D. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the startup network diagram, prepare a skeleton network to identify probable critical paths.
1. Refer to Section 007300 for additional requirements.
- E. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using a network fragment to demonstrate the effect of the proposed change on the overall project schedule.
- F. Initial Issue of Schedule: Prepare initial network diagram from a sorted activity list indicating straight "early start-total float." Identify critical activities.
- G. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:
1. Identification of activities that have changed.
 2. Changes in early and late start dates.
 3. Changes in early and late finish dates.
 4. Changes in activity durations in workdays.
 5. Changes in the critical path.

6. Changes in total float or slack time.
7. Changes in the Contract Time.

2.4 CONTRACTOR'S CONSTRUCTION SCHEDULE (GANTT CHART)

- A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal, Gantt-chart-type, Contractor's construction schedule within 30 days of date established for the Notice to Proceed or the Notice of Award, whichever is earlier. Base schedule on the startup construction schedule and additional information received since the start of Project.
- B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.
 1. For construction activities that require three months or longer to complete, indicate an estimated completion percentage in 10 percent increments within time bar.

2.5 REPORTS

- A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
 1. List of subcontractors at Project site.
 2. List of separate contractors at Project site.
 3. Approximate count of personnel at Project site.
 4. Equipment at Project site.
 5. Material deliveries.
 6. High and low temperatures and general weather conditions, including presence of rain or snow.
 7. Accidents.
 8. Meetings and significant decisions.
 9. Unusual events (see special reports).
 10. Stoppages, delays, shortages, and losses.
 11. Meter readings and similar recordings.
 12. Emergency procedures.
 13. Orders and requests of authorities having jurisdiction.
 14. Change Orders received and implemented.
 15. Construction Change Directives received and implemented.
 16. Services connected and disconnected.
 17. Equipment or system tests and startups.
 18. Partial completions and occupancies.
 19. Substantial Completions authorized.
- B. Material Location Reports: At monthly intervals, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site. Indicate the following categories for stored materials:
 1. Material stored prior to previous report and remaining in storage.
 2. Material stored prior to previous report and since removed from storage and installed.
 3. Material stored following previous report and remaining in storage.
- C. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

2.6 SPECIAL REPORTS

- A. General: Submit special reports directly to Owner, Architect and Construction Manager within two day(s) of an occurrence. Distribute copies of report to parties affected by the occurrence.
- B. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

PART 3 EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.
 - 1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
 - 2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
 - 3. As the Work progresses, indicate final completion percentage for each activity.
- B. Distribution: Distribute copies of approved schedule to Architect, Construction Manager, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
 - 1. Post copies in Project meeting rooms and temporary field offices.
 - 2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 013200

SECTION 013233 - PHOTOGRAPHIC DOCUMENTATION

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
 - 1. Preconstruction photographs.
 - 2. Periodic construction photographs.
 - 3. Final completion construction photographs.
- B. Related Requirements:
 - 1. Section 017700 "Closeout Procedures" for submitting photographic documentation as Project Record Documents at Project closeout.
 - 2. Section 017900 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.2 INFORMATIONAL SUBMITTALS

- A. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph. Indicate elevation or story of construction. Include same information as corresponding photographic documentation.
- B. Digital Photographs: Submit image files within three days of taking photographs.
 - 1. Submit photos by uploading to web-based project software site or via email. Include copy of key plan indicating each photograph's location and direction.
 - 2. Identification: Provide the following information with each image description:
 - a. Name of Project.
 - b. Name and contact information for photographer.
 - c. Name of Architect.
 - d. Name of Contractor.
 - e. Date photograph was taken.
 - f. Description of location, vantage point, and direction.
 - g. Unique sequential identifier keyed to accompanying key plan.

1.3 FORMATS AND MEDIA

- A. Digital Photographs: Provide color images in JPG format, produced by a digital camera with minimum sensor size of 12 megapixels, and at an image resolution of not less than 3200 by 2400 pixels. Use flash in low light levels or backlit conditions.
- B. Digital Images: Submit digital media as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.
- C. Metadata: Record accurate date and time from camera.
- D. File Names: Name media files with date, Project area, and sequential numbering suffix.

1.4 CONSTRUCTION PHOTOGRAPHS

- A. General: Take photographs with maximum depth of field and in focus.
 - 1. Maintain key plan with each set of construction photographs that identifies each photographic location.
- B. Preconstruction Photographs: Before starting construction, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Architect.
 - 1. Flag construction limits before taking construction photographs.

2. Take a minimum of 20 photographs to show existing conditions adjacent to property before starting the Work.
 3. Take a minimum of 20 photographs of existing buildings either on or adjoining property to accurately record physical conditions at start of construction.
 4. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.
- C. Periodic Construction Photographs: Take a minimum of 20 photographs biweekly. Select vantage points to show status of construction and progress since last photographs were taken.
- D. Final Completion Construction Photographs: Take a minimum of 20 photographs after date of Substantial Completion for submission as Project Record Documents. Architect will inform photographer of desired vantage points.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION 013233

SECTION 014000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. **[NOTE: FOR SOME CMs THIS SECTION IS NUMBERED AS 014500]**
- B. Section includes administrative and procedural requirements for quality assurance and quality control.
- C. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
 - 1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
 - 2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
 - 3. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, Commissioning Authority, Construction Manager, or authorities having jurisdiction are not limited by provisions of this Section.
 - 4. Specific test and inspection requirements are not specified in this Section.

1.2 DEFINITIONS

- A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect or Construction Manager.
- C. Mockups/Field Samples: Full-size physical assemblies that are constructed on-site. Mockups/field samples are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups/Field Samples are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.
 - 1. Laboratory Mockups: Full-size physical assemblies constructed and tested at testing facility to verify performance characteristics.
 - a. **[[VERIFY - LABORATORY]]**
 - 2. Integrated Exterior Mockups: Mockups of the exterior envelope erected separately from the building but on Project site, consisting of multiple products, assemblies, and subassemblies.
 - a. **[[VERIFY - EXTERIOR]]**
 - 3. Integrated Field Samples: Field samples of select portions exterior envelope or interior construction erected as part of the Work. Field samples may consist of multiple products, assemblies, and subassemblies.
 - 4. Room Mockups: Mockups of typical interior spaces complete with wall, floor, and ceiling finishes; doors; windows; millwork; casework; specialties; furnishings and equipment; and lighting.
- D. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.
- E. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.
- F. Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.

- G. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
- I. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
 - 1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).
- J. Experienced: When used with an entity or individual, "experienced" means, unless otherwise specified in the individual specification section, having successfully completed a minimum of five (5) previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.3 DELEGATED-DESIGN SERVICES

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
 - 1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

1.4 CONFLICTING REQUIREMENTS

- A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect for a decision before proceeding.
- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.
 - 1. Whenever Contract Documents reasonably infer materials or installation as necessary to produce the intended results, but do not fully detail or specify such materials, the Contractor shall provide the more expensive method or material, or greater quantity, unless he has obtained a written decision from the Architect.

1.5 ACTION SUBMITTALS

- A. Shop Drawings: For integrated exterior mockups/field samples, provide plans, sections, and elevations, indicating materials and size of mockup construction.
 - 1. Indicate manufacturer and model number of individual components.
 - 2. Provide axonometric drawings for conditions difficult to illustrate in two dimensions.
- B. Delegated-Design Services Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit a statement signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.

1.6 INFORMATIONAL SUBMITTALS

- A. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.
- B. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility sent to authorities having jurisdiction before starting work on the following systems:
 - 1. Seismic-force-resisting system, designated seismic system, or component listed in the designated seismic system quality-assurance plan prepared by Architect.
 - 2. Main wind-force-resisting system or a wind-resisting component listed in the wind-force-resisting system quality-assurance plan prepared by Architect.
- C. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
- D. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
 - 1. Specification Section number and title.
 - 2. Entity responsible for performing tests and inspections.
 - 3. Description of test and inspection.
 - 4. Identification of applicable standards.
 - 5. Identification of test and inspection methods.
 - 6. Number of tests and inspections required.
 - 7. Time schedule or time span for tests and inspections.
 - 8. Requirements for obtaining samples.
 - 9. Unique characteristics of each quality-control service.

1.7 CONTRACTOR'S QUALITY-CONTROL PLAN

- A. Quality-Control Plan, General: Submit quality-control plan within 10 days of Notice to Proceed, and not less than five days prior to preconstruction conference. Submit in format acceptable to Architect. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities. Coordinate with Contractor's construction schedule.
- B. Quality-Control Personnel Qualifications: Engage qualified full-time personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.
 - 1. Project quality-control manager may also serve as Project superintendent.
- C. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.
- D. Testing and Inspection: In quality-control plan, include a comprehensive schedule of Work requiring testing or inspection, including the following:
 - 1. Contractor-performed tests and inspections including subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections.
 - 2. Special inspections required by authorities having jurisdiction and indicated on the "Statement of Special Inspections."
 - 3. Owner-performed tests and inspections indicated in the Contract Documents, including tests and inspections indicated to be performed by the Commissioning Authority.
- E. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring work into compliance with standards of workmanship established by Contract requirements and approved mockups.
- F. Monitoring and Documentation: Maintain testing and inspection reports including log of approved and rejected results. Include work Architect has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

1.8 REPORTS AND DOCUMENTS

- A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
 - 1. Date of issue.
 - 2. Project title and number.
 - 3. Name, address, and telephone number of testing agency.
 - 4. Dates and locations of samples and tests or inspections.
 - 5. Names of individuals making tests and inspections.
 - 6. Description of the Work and test and inspection method.
 - 7. Identification of product and Specification Section.
 - 8. Complete test or inspection data.
 - 9. Test and inspection results and an interpretation of test results.
 - 10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
 - 11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
 - 12. Name and signature of laboratory inspector.
 - 13. Recommendations on retesting and reinspecting.
- B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
 - 1. Name, address, and telephone number of technical representative making report.
 - 2. Statement on condition of substrates and their acceptability for installation of product.
 - 3. Statement that products at Project site comply with requirements.
 - 4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
 - 5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 - 6. Statement whether conditions, products, and installation will affect warranty.
 - 7. Other required items indicated in individual Specification Sections.
- C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:
 - 1. Name, address, and telephone number of factory-authorized service representative making report.
 - 2. Statement that equipment complies with requirements.
 - 3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 - 4. Statement whether conditions, products, and installation will affect warranty.
 - 5. Other required items indicated in individual Specification Sections.
- D. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.9 QUALITY ASSURANCE

- A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a

record of successful in-service performance.

1. Refer to individual specification sections for additional requirements.
- E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar in material, design, and extent to those indicated for this Project.
- F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.
- G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.
1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
 2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.
- H. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- I. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- J. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
1. Contractor responsibilities include the following:
 - a. Provide test specimens representative of proposed products and construction.
 - b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
 - c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
 - d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
 - e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
 - f. When testing is complete, remove test specimens, assemblies, and mockups; do not reuse products on Project.
 2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, through Construction Manager, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.
- K. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect or Construction Manager.
 2. Notify Architect and Construction Manager seven days in advance of dates and times when mockups will be constructed.
 3. Employ supervisory personnel who will oversee mockup construction. Employ workers that will be employed during the construction at Project.
 4. Demonstrate the proposed range of aesthetic effects and workmanship.
 5. Obtain Architect's and Construction Manager's approval of mockups before starting work, fabrication, or construction.
 - a. Allow seven days for initial review and each re-review of each mockup.
 6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 7. Unless otherwise indicated in the Contract Documents, demolish and remove mockups when directed unless otherwise indicated.

- L. Integrated Exterior Mockups: Construct integrated exterior mockup as indicated on Drawings. Coordinate installation of exterior envelope materials and products for which mockups are required in individual Specification Sections, along with supporting materials.
- M. Field Samples: Construct/apply field samples using required materials, products, finishes and assemblies, finished according to requirements for the completed work. Provide required lighting and additional lighting where required to enable Architect to evaluate quality of the Work:
 - 1. Build field sample of size indicated or, if not indicated, as directed by Architect.
 - 2. Notify Architect three (3) days in advance of dates and times when field samples will be constructed/applied.
 - 3. Notify Architect and Construction Manager seven (7) days in advance of dates and times when field sample will be constructed/applied.
 - 4. Demonstrate the proposed aesthetic effects and workmanship to be incorporated into the Work.
 - 5. Obtain Architect's approval of field sample before starting remainder of work.
 - a. Allow three (3) days for initial review and each re-review of each field sample.
 - 6. Field samples not acceptable to Architect shall be re-constructed/re-applied until field sample is accepted to Architect.
 - 7. Maintain field sample during construction in an undisturbed condition as a standard for judging the completed Work
 - 8. Unless otherwise indicated in the Contract Documents, dispose of field sample when directed by Architect and Owner.

1.10 QUALITY CONTROL

- A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
 - 1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
 - 2. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.
- B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.
 - 1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
 - 2. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
 - a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
 - 3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
 - 4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
 - 5. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
 - 6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 013300 "Submittal Procedures."
- D. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.
- E. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

- F. Testing Agency Responsibilities: Cooperate with Architect, Commissioning Authority, Construction Manager, and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
 - 1. Notify Architect, Commissioning Authority, Construction Manager, and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
 - 2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
 - 3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
 - 4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
 - 5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
 - 6. Do not perform any duties of Contractor.
- G. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
 - 1. Access to the Work.
 - 2. Incidental labor and facilities necessary to facilitate tests and inspections.
 - 3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
 - 4. Facilities for storage and field curing of test samples.
 - 5. Delivery of samples to testing agencies.
 - 6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
 - 7. Security and protection for samples and for testing and inspecting equipment at Project site.
- H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
 - 1. Schedule times for tests, inspections, obtaining samples, and similar activities.
- I. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents as a component of Contractor's quality-control plan. Coordinate and submit concurrently with Contractor's construction schedule. Update as the Work progresses.
 - 1. Distribution: Distribute schedule to Owner, Architect, Commissioning Authority, Construction Manager, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.11 SPECIAL TESTS AND INSPECTIONS

- A. Special Tests and Inspections: Owner will engage a qualified testing agency or special inspector to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, and as follows:
 - 1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviews the completeness and adequacy of those procedures to perform the Work.
 - 2. Notifying Architect, Commissioning Authority, Construction Manager, and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
 - 3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect and Commissioning Authority, through Construction Manager, with copy to Contractor and to authorities having jurisdiction.
 - 4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
 - 5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
 - 6. Retesting and reinspecting corrected work.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 TEST AND INSPECTION LOG

- A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
 - 1. Date test or inspection was conducted.
 - 2. Description of the Work tested or inspected.
 - 3. Date test or inspection results were transmitted to Architect.
 - 4. Identification of testing agency or special inspector conducting test or inspection.
- B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's, Commissioning Authority's, and Construction Manager's reference during normal working hours.

3.2 REPAIR AND PROTECTION

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
 - 1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 017300 "Execution."
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 014000

SECTION 014200 - REFERENCES

PART 1 GENERAL

1.1 DEFINITIONS

- A. General: Basic Contract definitions are included in the Conditions of the Contract.
- B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.
- C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."
- D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."
- E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.
- F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. "Install": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.
- H. "Provide": Furnish and install, complete and ready for the intended use.
- I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.2 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
- B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
- C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
 - 1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.3 ABBREVIATIONS AND ACRONYMS

- A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.
 - 1. AABC - Associated Air Balance Council; www.aabc.com
 - 2. AAMA - American Architectural Manufacturers Association; www.aamanet.org.
 - 3. AAPFCO - Association of American Plant Food Control Officials; www.aapfco.org.
 - 4. AASHTO - American Association of State Highway and Transportation Officials; www.transportation.org.
 - 5. AATCC - American Association of Textile Chemists and Colorists; www.aatcc.org.
 - 6. ABMA - American Bearing Manufacturers Association; www.americanbearings.org.
 - 7. ABMA - American Boiler Manufacturers Association; www.abma.com.
 - 8. ACI - American Concrete Institute; (Formerly: ACI International); www.concrete.org.

9. ACPA - American Concrete Pipe Association; www.concrete-pipe.org.
10. AEIC - Association of Edison Illuminating Companies, Inc. (The); www.aeic.org.
11. AF&PA - American Forest & Paper Association; www.afandpa.org.
12. AGA - American Gas Association; www.aga.org.
13. AHAM - Association of Home Appliance Manufacturers; www.aham.org.
14. AHRI - Air-Conditioning, Heating, and Refrigeration Institute (The); www.ahrinet.org.
15. AI - Asphalt Institute; www.asphaltinstitute.org.
16. AIA - American Institute of Architects (The); www.aia.org.
17. AISC - American Institute of Steel Construction; www.aisc.org.
18. AISI - American Iron and Steel Institute; www.steel.org.
19. AITC - American Institute of Timber Construction; www.aitc-glulam.org.
20. AMCA - Air Movement and Control Association International, Inc.; www.amca.org.
21. ANSI - American National Standards Institute; www.ansi.org.
22. AOSA - Association of Official Seed Analysts, Inc.; www.aosaseed.com.
23. APA - APA - The Engineered Wood Association; www.apawood.org.
24. APA - Architectural Precast Association; www.archprecast.org.
25. API - American Petroleum Institute; www.api.org.
26. ARI - Air-Conditioning & Refrigeration Institute; (See AHRI).
27. ARI - American Refrigeration Institute; (See AHRI).
28. ARMA - Asphalt Roofing Manufacturers Association; www.asphaltroofing.org.
29. ASCE - American Society of Civil Engineers; www.asce.org.
30. ASCE/SEI - American Society of Civil Engineers/Structural Engineering Institute; (See ASCE).
31. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers; www.ashrae.org.
32. ASME - ASME International; (American Society of Mechanical Engineers); www.asme.org.
33. ASSE - American Society of Safety Engineers (The); www.asse.org.
34. ASSE - American Society of Sanitary Engineering; www.asse-plumbing.org.
35. ASTM - ASTM International; www.astm.org.
36. ATIS - Alliance for Telecommunications Industry Solutions; www.atis.org.
37. AWEA - American Wind Energy Association; www.awea.org.
38. AWI - Architectural Woodwork Institute; www.awinet.org.
39. AWMAC - Architectural Woodwork Manufacturers Association of Canada; www.awmac.com.
40. AWPA - American Wood Protection Association; www.awpa.com.
41. AWS - American Welding Society; www.aws.org.
42. AWWA - American Water Works Association; www.awwa.org.
43. BHMA - Builders Hardware Manufacturers Association; www.buildershardware.com.
44. BIA - Brick Industry Association (The); www.gobrick.com.
45. BICSI - BICSI, Inc.; www.bicsi.org.
46. BIFMA - BIFMA International; (Business and Institutional Furniture Manufacturer's Association); www.bifma.org.
47. BISSC - Baking Industry Sanitation Standards Committee; www.bissc.org.
48. BWF - Badminton World Federation; (Formerly: International Badminton Federation); www.bwfbadminton.org.
49. CDA - Copper Development Association; www.copper.org.
50. CEA - Canadian Electricity Association; www.electricity.ca.
51. CEA - Consumer Electronics Association; www.ce.org.
52. CFFA - Chemical Fabrics and Film Association, Inc.; www.chemicalfabricsandfilm.com.
53. CFSEI - Cold-Formed Steel Engineers Institute; www.cfsei.org.
54. CGA - Compressed Gas Association; www.cganet.com.
55. CIMA - Cellulose Insulation Manufacturers Association; www.cellulose.org.
56. CISCA - Ceilings & Interior Systems Construction Association; www.cisca.org.
57. CISPI - Cast Iron Soil Pipe Institute; www.cispi.org.
58. CLFMI - Chain Link Fence Manufacturers Institute; www.chainlinkinfo.org.
59. CPA - Composite Panel Association; www.compositepanel.org.
60. CRI - Carpet and Rug Institute (The); www.carpet-rug.org.
61. CRRC - Cool Roof Rating Council; www.coolroofs.org.
62. CRSI - Concrete Reinforcing Steel Institute; www.crsi.org.
63. CSA - Canadian Standards Association; www.csa.ca.
64. CSA - CSA International; (Formerly: IAS - International Approval Services); www.csa-international.org.
65. CSI - Construction Specifications Institute (The); www.csiresources.org.
66. CSSB - Cedar Shake & Shingle Bureau; www.cedarbureau.org.
67. CTI - Cooling Technology Institute; (Formerly: Cooling Tower Institute); www.cti.org.
68. CWC - Composite Wood Council; (See CPA).

69. DASMA - Door and Access Systems Manufacturers Association; www.dasma.com.
70. DHI - Door and Hardware Institute; www.dhi.org.
71. ECA - Electronic Components Association; (See ECIA).
72. ECAMA - Electronic Components Assemblies & Materials Association; (See ECIA).
73. ECIA - Electronic Components Industry Association; www.eciaonline.org.
74. EIA - Electronic Industries Alliance; (See TIA).
75. EIMA - EIFS Industry Members Association; www.eima.com.
76. EJMA - Expansion Joint Manufacturers Association, Inc.; www.ejma.org.
77. ESD - ESD Association; (Electrostatic Discharge Association); www.esda.org.
78. ESTA - Entertainment Services and Technology Association; (See PLASA).
79. EVO - Efficiency Valuation Organization; www.evo-world.org.
80. FCI - Fluid Controls Institute; www.fluidcontrolsintstitute.org.
81. FIBA - Federation Internationale de Basketball; (The International Basketball Federation); www.fiba.com.
82. FIVB - Federation Internationale de Volleyball; (The International Volleyball Federation); www.fivb.org.
83. FM Approvals - FM Approvals LLC; www.fmglobal.com.
84. FM Global - FM Global; (Formerly: FMG - FM Global); www.fmglobal.com.
85. FRSA - Florida Roofing, Sheet Metal & Air Conditioning Contractors Association, Inc.; www.floridarooft.com.
86. FSA - Fluid Sealing Association; www.fluidsealing.com.
87. FSC - Forest Stewardship Council U.S.; www.fscus.org.
88. GA - Gypsum Association; www.gypsum.org.
89. GANA - Glass Association of North America; www.glasswebsite.com.
90. GS - Green Seal; www.greenseal.org.
91. HI - Hydraulic Institute; www.pumps.org.
92. HI/GAMA - Hydronics Institute/Gas Appliance Manufacturers Association; (See AHRI).
93. HMMA - Hollow Metal Manufacturers Association; (See NAAMM).
94. HPVA - Hardwood Plywood & Veneer Association; www.hpva.org.
95. HPW - H. P. White Laboratory, Inc.; www.hpwhite.com.
96. IAPSC - International Association of Professional Security Consultants; www.iapsc.org.
97. IAS - International Accreditation Service; www.iasonline.org.
98. IAS - International Approval Services; (See CSA).
99. ICBO - International Conference of Building Officials; (See ICC).
100. ICC - International Code Council; www.iccsafe.org.
101. ICEA - Insulated Cable Engineers Association, Inc.; www.icea.net.
102. ICPA - International Cast Polymer Alliance; www.icpa-hq.org.
103. ICRI - International Concrete Repair Institute, Inc.; www.icri.org.
104. IEC - International Electrotechnical Commission; www.iec.ch.
105. IEEE - Institute of Electrical and Electronics Engineers, Inc. (The); www.ieee.org.
106. IES - Illuminating Engineering Society; (Formerly: Illuminating Engineering Society of North America); www.ies.org.
107. IESNA - Illuminating Engineering Society of North America; (See IES).
108. IEST - Institute of Environmental Sciences and Technology; www.iest.org.
109. IGMA - Insulating Glass Manufacturers Alliance; www.igmaonline.org.
110. IGSHPA - International Ground Source Heat Pump Association; www.igshpa.okstate.edu.
111. ILI - Indiana Limestone Institute of America, Inc.; www.ili.ai.
112. Intertek - Intertek Group; (Formerly: ETL SEMCO; Intertek Testing Service NA); www.intertek.com.
113. ISA - International Society of Automation (The); (Formerly: Instrumentation, Systems, and Automation Society); www.isa.org.
114. ISAS - Instrumentation, Systems, and Automation Society (The); (See ISA).
115. ISFA - International Surface Fabricators Association; (Formerly: International Solid Surface Fabricators Association); www.isfanow.org.
116. ISO - International Organization for Standardization; www.iso.org.
117. ISSFA - International Solid Surface Fabricators Association; (See ISFA).
118. ITU - International Telecommunication Union; www.itu.int/home.
119. KCMA - Kitchen Cabinet Manufacturers Association; www.kcma.org.
120. LMA - Laminating Materials Association; (See CPA).
121. LPI - Lightning Protection Institute; www.lightning.org.
122. MBMA - Metal Building Manufacturers Association; www.mbma.com.
123. MCA - Metal Construction Association; www.metalconstruction.org.
124. MFMA - Maple Flooring Manufacturers Association, Inc.; www.maplefloor.org.
125. MFMA - Metal Framing Manufacturers Association, Inc.; www.metalframingmfg.org.
126. MHIA - Material Handling Industry of America; www.mhia.org.
127. MIA - Marble Institute of America; www.marble-institute.com.

128. MMPA - Moulding & Millwork Producers Association; www.wmmpa.com.
129. MPI - Master Painters Institute; www.paintinfo.com.
130. MSS - Manufacturers Standardization Society of The Valve and Fittings Industry Inc.; www.mss-hq.org.
131. NAAMM - National Association of Architectural Metal Manufacturers; www.naamm.org.
132. NACE - NACE International; (National Association of Corrosion Engineers International); www.nace.org.
133. NADCA - National Air Duct Cleaners Association; www.nadca.com.
134. NAIMA - North American Insulation Manufacturers Association; www.naima.org.
135. NBGQA - National Building Granite Quarries Association, Inc.; www.nbgqa.com.
136. NBI - New Buildings Institute; www.newbuildings.org.
137. NCAA - National Collegiate Athletic Association (The); www.ncaa.org.
138. NCMA - National Concrete Masonry Association; www.ncma.org.
139. NEBB - National Environmental Balancing Bureau; www.nebb.org.
140. NECA - National Electrical Contractors Association; www.necanet.org.
141. NeLMA - Northeastern Lumber Manufacturers Association; www.nelma.org.
142. NEMA - National Electrical Manufacturers Association; www.nema.org.
143. NETA - InterNational Electrical Testing Association; www.netaworld.org.
144. NFHS - National Federation of State High School Associations; www.nfhs.org.
145. NFPA - National Federation of State High School Associations; www.nfpa.org.
146. NFPA - NFPA International; (See NFPA).
147. NFRC - National Fenestration Rating Council; www.nfrc.org.
148. NHLA - National Hardwood Lumber Association; www.nhla.com.
149. NLGA - National Lumber Grades Authority; www.nlga.org.
150. NOFMA - National Oak Flooring Manufacturers Association; (See NWFA).
151. NOMMA - National Ornamental & Miscellaneous Metals Association; www.nomma.org.
152. NRCA - National Roofing Contractors Association; www.nrca.net.
153. NRMCA - National Ready Mixed Concrete Association; www.nrmca.org.
154. NSF - NSF International; www.nsf.org.
155. NSPE - National Society of Professional Engineers; www.nspe.org.
156. NSSGA - National Stone, Sand & Gravel Association; www.nssga.org.
157. NTMA - National Terrazzo & Mosaic Association, Inc. (The); www.ntma.com.
158. NWFA - National Wood Flooring Association; www.nwfa.org.
159. PCI - Precast/Prestressed Concrete Institute; www.pci.org.
160. PDI - Plumbing & Drainage Institute; www.pdionline.org.
161. PLASA - PLASA; (Formerly: ESTA - Entertainment Services and Technology Association); www.plasa.org.
162. RCSC - Research Council on Structural Connections; www.boltcouncil.org.
163. RFCI - Resilient Floor Covering Institute; www.rfci.com.
164. RIS - Redwood Inspection Service; www.redwoodinspection.com.
165. SAE - SAE International; www.sae.org.
166. SCTE - Society of Cable Telecommunications Engineers; www.scte.org.
167. SDI - Steel Deck Institute; www.sdi.org.
168. SDI - Steel Door Institute; www.steeldoor.org.
169. SEFA - Scientific Equipment and Furniture Association (The); www.sefalabs.com.
170. SEI/ASCE - Structural Engineering Institute/American Society of Civil Engineers; (See ASCE).
171. SIA - Security Industry Association; www.siaonline.org.
172. SJI - Steel Joist Institute; www.steeljoist.org.
173. SMA - Screen Manufacturers Association; www.smainfo.org.
174. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association; www.smacna.org.
175. SMPTE - Society of Motion Picture and Television Engineers; www.smpte.org.
176. SPFA - Spray Polyurethane Foam Alliance; www.sprayfoam.org.
177. SPIB - Southern Pine Inspection Bureau; www.spib.org.
178. SPRI - Single Ply Roofing Industry; www.spri.org.
179. SRCC - Solar Rating & Certification Corporation; www.solar-rating.org.
180. SSINA - Specialty Steel Industry of North America; www.ssina.com.
181. SSPC - SSPC: The Society for Protective Coatings; www.sspc.org.
182. STI - Steel Tank Institute; www.steeltank.com.
183. SWI - Steel Window Institute; www.steelwindows.com.
184. SWPA - Submersible Wastewater Pump Association; www.swpa.org.
185. TCA - Tilt-Up Concrete Association; www.tilt-up.org.
186. TCNA - Tile Council of North America, Inc.; www.tileusa.com.
187. TEMA - Tubular Exchanger Manufacturers Association, Inc.; www.tema.org.
188. TIA - Telecommunications Industry Association (The); (Formerly: TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance); www.tiaonline.org.

189. TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance; (See TIA).
 190. TMS - The Masonry Society; www.masonrysociety.org.
 191. TPI - Truss Plate Institute; www.tpinst.org.
 192. TPI - Turfgrass Producers International; www.turfgrasssod.org.
 193. TRI - Tile Roofing Institute; www.tilerroofing.org.
 194. UL - Underwriters Laboratories Inc.; www.ul.com.
 195. UNI - Uni-Bell PVC Pipe Association; www.uni-bell.org.
 196. USAV - USA Volleyball; www.usavolleyball.org.
 197. USGBC - U.S. Green Building Council; www.usgbc.org.
 198. USITT - United States Institute for Theatre Technology, Inc.; www.usitt.org.
 199. WASTEC - Waste Equipment Technology Association; www.wastec.org.
 200. WCLIB - West Coast Lumber Inspection Bureau; www.wclib.org.
 201. WCMA - Window Covering Manufacturers Association; www.wcmanet.org.
 202. WDMA - Window & Door Manufacturers Association; www.wdma.com.
 203. WI - Woodwork Institute; www.wicnet.org.
 204. WSRCA - Western States Roofing Contractors Association; www.wsrca.com.
 205. WWPA - Western Wood Products Association; www.wwpa.org.
- B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is believed to be accurate as of the date of the Contract Documents.
1. DIN - Deutsches Institut für Normung e.V.; www.din.de.
 2. IAPMO - International Association of Plumbing and Mechanical Officials; www.iapmo.org.
 3. ICC - International Code Council; www.iccsafe.org.
 4. ICC-ES - ICC Evaluation Service, LLC; www.icc-es.org.
- C. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Information is subject to change and is up to date as of the date of the Contract Documents.
1. COE - Army Corps of Engineers; www.usace.army.mil.
 2. CPSC - Consumer Product Safety Commission; www.cpsc.gov.
 3. DOC - Department of Commerce; National Institute of Standards and Technology; www.nist.gov.
 4. DOD - Department of Defense; www.quicksearch.dla.mil.
 5. DOE - Department of Energy; www.energy.gov.
 6. EPA - Environmental Protection Agency; www.epa.gov.
 7. FAA - Federal Aviation Administration; www.faa.gov.
 8. FG - Federal Government Publications; www.gpo.gov/fdsys.
 9. GSA - General Services Administration; www.gsa.gov.
 10. HUD - Department of Housing and Urban Development; www.hud.gov.
 11. LBL - Lawrence Berkeley National Laboratory; Environmental Energy Technologies Division; www.eetd.lbl.gov.
 12. OSHA - Occupational Safety & Health Administration; www.osha.gov.
 13. SD - Department of State; www.state.gov.
 14. TRB - Transportation Research Board; National Cooperative Highway Research Program; The National Academies; www.trb.org.
 15. USDA - Department of Agriculture; Agriculture Research Service; U.S. Salinity Laboratory; www.ars.usda.gov.
 16. USDA - Department of Agriculture; Rural Utilities Service; www.usda.gov.
 17. USDJ - Department of Justice; Office of Justice Programs; National Institute of Justice; www.ojp.usdoj.gov.
 18. USP - U.S. Pharmacopeial Convention; www.usp.org.
 19. USPS - United States Postal Service; www.usps.com.
- D. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.
1. CFR - Code of Federal Regulations; Available from Government Printing Office; www.gpo.gov/fdsys.
 2. DOD - Department of Defense; Military Specifications and Standards; Available from DLA Document Services; www.quicksearch.dla.mil.
 3. DSCC - Defense Supply Center Columbus; (See FS).
 4. FED-STD - Federal Standard; (See FS).
 5. FS - Federal Specification; Available from DLA Document Services; www.quicksearch.dla.mil.
 - a. Available from Defense Standardization Program; www.dsp.dla.mil.
 - b. Available from General Services Administration; www.gsa.gov.

- c. Available from National Institute of Building Sciences/Whole Building Design Guide; www.wbdg.org/ccb.
 - 6. MILSPEC - Military Specification and Standards; (See DOD).
 - 7. USAB - United States Access Board; www.access-board.gov.
 - 8. USATBCB - U.S. Architectural & Transportation Barriers Compliance Board; (See USAB).
- E. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.
- 1. CBHF; State of California; Department of Consumer Affairs; Bureau of Electronic and Appliance Repair, Home Furnishings and Thermal Insulation; www.bearhfti.ca.gov.
 - 2. CCR; California Code of Regulations; Office of Administrative Law; California Title 24 Energy Code; www.calregs.com.
 - 3. CDHS; California Department of Health Services; (See CDPH).
 - 4. CDPH; California Department of Public Health; Indoor Air Quality Program; www.cal-iaq.org.
 - 5. CPUC; California Public Utilities Commission; www.cpuc.ca.gov.
 - 6. SCAQMD; South Coast Air Quality Management District; www.aqmd.gov.
 - 7. TFS; Texas A&M Forest Service; Sustainable Forestry and Economic Development; www.txforestservation.tamu.edu.
 - 8. Colorado Department of Public Health & Environment; www.colorado.gov/pacific/cdphe
 - 9. Colorado Air Quality Control Commission; www.colorado.gov/pacific/cdphe/aqcc
 - 10. Colorado Water Quality Control Division; www.colorado.gov/pacific/cdphe/wqcd
 - 11. Colorado Geological Survey; Land Use Regulations; www.coloradogeologicalsurvey.org/land-use-regulations/

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION 014200

SECTION 014529 - TESTING AND INSPECTIONS

PART 1 - GENERAL

1.1 GENERAL

- A. The preceding "General Conditions" are a part of these specifications and the Contractor shall consult them in detail in connection with this part of the work.

1.2 SCOPE OF WORK

- A. Employment of a testing and inspection firm approved and paid for by the Owner. Approximate scope of testing and inspection shall be as indicated on the drawings and herein specified in the sections of the specifications.
 - 1. Refer to attachment for scope of testing to be provided by Owner.

1.3 TESTING AND INSPECTION CHARGES

- A. For the following conditions, costs of testing and inspection services shall be paid for by the Contractor, apart from the Testing and Inspection.
 - 1. Costs arising from errors or omissions by the Contractor.
 - 2. Costs of concrete cores, of re-testing materials that fail, and of required identification of materials (mill tests, manufacturers certifications, etc.).
 - 3. Costs of test and inspections required to expedite the Contractors operations.

1.4 EARTHWORK

- A. The Soils Engineer shall be notified for inspection by the Contractor and shall work in cooperation with the Architect. This inspection shall be made before any excavation is attempted on the site. If any undesirable conditions are encountered during Construction, the Soils Engineer shall be notified so that supplemental recommendations can be made. Tests shall be made to define maximum densities of all compaction work. All densities shall be expressed as a relative compaction, in terms of the maximum dry density obtained in the laboratory. The Soils Engineer shall supervise all engineered fill, and make field tests to insure compliance with the required placement of footings; methods of placing and compacting fills; filter and/or rock fill materials.

1.5 CONCRETE WORK

- A. Reinforcement shall be positively identified by heat numbers and mill analysis. Otherwise, Contractor shall provide test by qualified laboratory, one test for each 5 tons or fraction thereof, each size and type of reinforcing steel. Cement shall be from tested bins and properly identified at the mixing plant. Contractor shall provide to the testing laboratory, aggregate samples for approval. Testing laboratory shall prepare 3 concrete cylinders for each 25 cubic yards, or fraction thereof placed – 2 cylinders to be tested at 7 days, and 1 cylinder at 28 days. Follow ASTM standards throughout.

1.6 GENERAL TESTS AND INSPECTIONS

- A. Observe all building code test and inspection requirements. Notify proper State, County and City authorities, for their required inspections.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION 014529

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SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.
- B. Related Requirements:
 - 1. Section 012100 "Allowances" for products selected under an allowance.
 - 2. Section 012200 "Unit Prices" for products selected under a unit price.
 - 3. Section 012300 "Alternates" for products selected under an alternate.
 - 4. Section 012500 "Substitution Procedures" for requests for substitutions.
 - 5. Section 014200 "References" for applicable industry standards for products specified.

1.2 DEFINITIONS

- A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
 - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
 - 2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
 - 3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.
- C. Subject to Compliance with Requirements: Where the phrase "Subject to compliance with requirements" introduces a product selection procedure in an individual Specification Section, provide products qualified under the specified product procedure. In the event that a named product or product by a named manufacturer does not meet the other requirements of the specifications, select another named product or product from another named manufacturer that does meet the requirements of the specifications.

1.3 ACTION SUBMITTALS

- A. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.
 - 2. Architects Action: For comparable products submitted for "Cause", if necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within fifteen (15) days of receipt of request, or seven (7) days of receipt of additional information or documentation, whichever is later. For comparable products submitted for "Contractor's Convenience", Contractor must submit all information necessary to make a direct comparison to specified product for Architect's review, no additional information may be submitted.
 - a. Form of Approval: As specified in Section 012500 "Substitution Procedures."
 - b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

- B. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 013300 "Submittal Procedures." Show compliance with requirements.

1.4 QUALITY ASSURANCE

- A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.
 - 1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
 - 2. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.
- B. Delivery and Handling:
 - 1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
 - 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
 - 3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
 - 4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.
- C. Storage:
 - 1. Store products to allow for inspection and measurement of quantity or counting of units.
 - 2. Store materials in a manner that will not endanger Project structure.
 - 3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
 - 4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
 - 5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
 - 6. Protect stored products from damage and liquids from freezing.

1.6 PRODUCT WARRANTIES

- A. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
 - 1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
 - 2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
 - 3. See other Sections for specific content requirements and particular requirements for submitting special warranties.
- B. Warranty Exclusions:
 - 1. **[[DPS REQUIREMENTS]]**
 - 2. Warranty requirements contained in these Specifications take precedence. Exclusion clauses shall be superseded by warranty coverage requirements of the Specifications.
 - 3. The Contractor shall notify the Architect of design conditions which cannot be fully warranted. Such notice shall be in writing prior to purchase of the affected product or system.
 - 4. Failure to provide such notice shall not be grounds for waiver of warranty requirements contained in the Specifications.

5. Upon receipt of such notice, the Architect will consider modifications necessary to assure that final construction is warrantable to the full extent of Contract requirements.

C. Submittal Time: Comply with requirements in Section 017700 "Closeout Procedures."

PART 2 PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

- A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
 1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
 2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
 3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
 4. Where products are accompanied by the term "as selected," Architect will make selection.
 5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
- B. Product Selection Procedures:
 1. Products:
 - a. Restricted List: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will be considered prior to bidding only.
 - b. Nonrestricted List: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product.
 2. Manufacturers:
 - a. Restricted List: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will be considered prior to bidding only.
 - b. Nonrestricted List: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed manufacturer's product.
 3. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.
- C. Visual Matching Specification: Where Specifications require "match Architect's sample", provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
 1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 012500 "Substitution Procedures" for proposal of product.
- D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 COMPARABLE PRODUCTS

- A. Conditions for Consideration: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:

1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

PART 3 EXECUTION (NOT USED)

END OF SECTION 016000

SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
 - 1. Salvaging nonhazardous demolition waste.
 - 2. Disposing of nonhazardous demolition and construction waste.
- B. Related Requirements:
 - 1. Section 024119 "Selective Demolition" for disposition of waste resulting from partial demolition of buildings, structures, and site improvements.

1.2 DEFINITIONS

- A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
- B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.
- C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.
- D. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.
- E. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.3 INFORMATIONAL SUBMITTALS

- A. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- B. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

1.4 QUALITY ASSURANCE

- A. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.
- B. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

- A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
 - 1. Comply with operation, termination, and removal requirements in Section 015000 "Temporary Facilities and Controls."

- B. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work.
- C. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
 - 1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
 - 2. Comply with Section 015000 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

3.2 SALVAGING DEMOLITION WASTE

- A. Salvaged Items for Reuse in the Work: Salvage items for reuse and handle as follows:
 - 1. Clean salvaged items.
 - 2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
 - 3. Store items in a secure area until installation.
 - 4. Protect items from damage during transport and storage.
 - 5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.
- B. Salvaged Items for Owner's Use: Salvage items for Owner's use and handle as follows:
 - 1. Clean salvaged items.
 - 2. Store items in a secure area until delivery to Owner.
 - 3. Transport items to Owner's storage area designated by Owner.
- C. Doors and Hardware: Brace open end of door frames. Except for removing door closers, leave door hardware attached to doors.
- D. Equipment: Drain tanks, piping, and fixtures. Seal openings with caps or plugs. Protect equipment from exposure to weather.
- E. Plumbing Fixtures: Separate by type and size.
- F. Lighting Fixtures: Separate lamps by type and protect from breakage.
- G. Electrical Devices: Separate switches, receptacles, switchgear, transformers, meters, panelboards, circuit breakers, and other devices by type.

3.3 DISPOSAL OF WASTE

- A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
 - 1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
 - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Burning: Do not burn waste materials.
- C. Disposal: Remove waste materials from Owner's property and legally dispose of them.

END OF SECTION 017419

SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
 - 1. Substantial Completion procedures.
 - 2. Final completion procedures.
 - 3. Warranties.
 - 4. Final cleaning.
 - 5. Repair of the Work.
- B. Related Requirements:
 - 1. Section 017300 "Execution" for progress cleaning of Project site.
 - 2. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.
 - 3. Section 017839 "Project Record Documents" for submitting record Drawings and record Product Data.
 - 4. Section 017900 "Demonstration and Training" for requirements for instructing Owner's personnel.

1.2 ACTION SUBMITTALS

- A. Product Data: For cleaning agents.
- B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.
- C. Certified List of Incomplete Items: Final submittal at Final Completion.

1.3 CLOSEOUT SUBMITTALS

- A. Certificates of Release: From authorities having jurisdiction.
- B. Certificate of Insurance: For continuing coverage.
- C. Field Report: For pest control inspection.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

1.5 SUBSTANTIAL COMPLETION PROCEDURES

- A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.
- B. Submittals Prior to Substantial Completion: Complete the following a minimum of ten (10) days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
 - 1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 - 2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.
 - 3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.

4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number where applicable.
 - a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Architect's signature for receipt of submittals.
 5. Submit test/adjust/balance records.
 6. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
- C. Procedures Prior to Substantial Completion: Complete the following a minimum of ten (10) days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
1. Advise Owner of pending insurance changeover requirements.
 2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
 3. Complete startup and testing of systems and equipment.
 4. Perform preventive maintenance on equipment used prior to Substantial Completion.
 5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 017900 "Demonstration and Training."
 6. Advise Owner of changeover in heat and other utilities.
 7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
 8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
 9. Complete final cleaning requirements, including touchup painting.
 10. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of ten (10) days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect and Construction Manager will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
 2. Results of completed inspection will form the basis of requirements for final completion.

1.6 FINAL COMPLETION PROCEDURES

- A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:
1. Submit a final Application for Payment according to Section 012900 "Payment Procedures."
 2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
 3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
 4. Submit pest-control final inspection report.
- B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect and Construction Manager will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.7 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are

outside the limits of construction. Use CSI Form 14.1A.

1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:
 - a. Project name.
 - b. Date.
 - c. Name of Architect
 - d. Name of Construction Manager.
 - e. Name of Contractor.
 - f. Page number.
4. Submit list of incomplete items in the following format:
 - a. PDF electronic file. Architect, through Construction Manager, will return annotated file.

1.8 SUBMITTAL OF PROJECT WARRANTIES

- A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty.
- B. Partial Occupancy: Submit properly executed warranties within fifteen (15) days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.
- C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.
 1. General: Provide one (1) electronic copy and one (1) paper copy of warranties.
 2. Bind warranties and bonds in heavy-duty, three-ring, white vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
 3. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
 4. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
 5. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
- D. Provide additional copies of each warranty to include in operation and maintenance manuals.

1.9 PROJECT CLOSEOUT CHECK LIST

- A. Requirements: Contractor must provide the following prior to the Architect and Construction Manager approving the release of final payment:
 1. Verification that final punch list is complete.
 2. Final Affidavit.
 3. Consent of Surety.
 4. Final Lien Waiver.
 5. Affidavit of compliance with Prevailing Wage requirements.
 6. As-Built drawings applicable to this Contract.
 7. Operation and Maintenance Manuals applicable to this Contract.
 8. Current Insurance Certificate.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might

damage finished surfaces.

PART 3 EXECUTION

3.1 FINAL CLEANING

- A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
 - 1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:
 - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
 - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
 - c. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - d. Remove snow and ice to provide safe access to building, as applicable.
 - e. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
 - f. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
 - g. Sweep concrete floors broom clean in unoccupied spaces.
 - h. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
 - i. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
 - j. Remove labels that are not permanent.
 - k. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
 - l. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
 - m. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
 - n. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
 - o. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
 - p. Leave Project clean and ready for occupancy.
- C. Pest Control: Comply with pest control requirements in Section 015000 "Temporary Facilities and Controls." Prepare written report.
- D. Construction Waste Disposal: Comply with waste disposal requirements in Section 015000 "Temporary Facilities and Controls."

3.2 REPAIR OF THE WORK

- A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.
- B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.
 - 1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.

2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that that already show evidence of repair or restoration.
 - a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.
3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION 017700

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SECTION 017823 - OPERATION AND MAINTENANCE DATA

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
 - 1. Operation and maintenance documentation directory.
 - 2. Emergency manuals.
 - 3. Operation manuals for systems, subsystems, and equipment.
 - 4. Product maintenance manuals.
 - 5. Systems and equipment maintenance manuals.
- B. Related Requirements:
 - 1. Section 013300 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.

1.2 DEFINITIONS

- A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.
- B. Subsystem: A portion of a system with characteristics similar to a system.

1.3 CLOSEOUT SUBMITTALS

- A. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
 - 1. Architect and Commissioning Authority, as applicable, will comment on whether content of operations and maintenance submittals are acceptable.
 - 2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.
- B. Format: Submit operations and maintenance manuals in the following format:
 - 1. General: Provide one (1) pdf electronic file and one (1) paper copy as follows:
 - a. PDF electronic file: Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Architect.
 - 1) Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
 - 2) Enable inserted reviewer comments on draft submittals.
 - b. Paper copy: Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves. Architect, through Construction Manager, will transmit paper copy to Owner upon acceptance.
- C. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least thirty (30) days before commencing demonstration and training. Architect and Commissioning Authority will return copy with comments.
 - 1. Correct or revise each manual to comply with Architect's and, as applicable, Commissioning Authority's comments. Submit copies of each corrected manual within ten (10) days of receipt of Architect's and Commissioning Authority's comments and prior to commencing demonstration and training.

PART 2 PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

- A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information. Include a section in the directory for each of the following:
 - 1. List of documents.
 - 2. List of systems
 - 3. List of equipment.
 - 4. Table of contents.
- B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
- C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
- D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.
- E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

2.2 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

- A. General: Submit one (1) paper copy and one (1) copy in pdf electronic file format.
- B. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
 - 1. Title page.
 - 2. Table of contents.
 - 3. Manual contents.
- C. Title Page: Include the following information:
 - 1. Subject matter included in manual.
 - 2. Name and address of Project.
 - 3. Name and address of Owner.
 - 4. Date of submittal.
 - 5. Name and contact information for Contractor and Installer (if applicable).
 - 6. Name and contact information for Construction Manager.
 - 7. Name and contact information for Architect.
 - 8. Name and contact information for Commissioning Authority, as applicable.
 - 9. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
 - 10. Cross-reference to related systems in other operation and maintenance manuals.
- D. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
 - 1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.
- E. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
- F. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.

1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
 2. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.
- G. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.
1. Binders: Heavy-duty, three-ring, white vinyl-covered, post-type binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
 - a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
 - b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents, and indicate Specification Section number on bottom of spine. Indicate volume number for multiple-volume sets.
 2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
 3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.
 4. Supplementary Text: Prepared on 8-1/2-by-11-inch white bond paper.
 5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
 - a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
 - b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.3 EMERGENCY MANUALS

- A. Content: Organize manual into a separate section for each of the following:
1. Type of emergency.
 2. Emergency instructions.
 3. Emergency procedures.
- B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
1. Fire.
 2. Flood.
 3. Flood.
 4. Gas leak.
 5. Water leak.
 6. Power failure.
 7. Water outage.
 8. System, subsystem, or equipment failure.
 9. Chemical release or spill.
- C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.
- D. Emergency Procedures: Include the following, as applicable:
1. Instructions on stopping.
 2. Shutdown instructions for each type of emergency.
 3. Operating instructions for conditions outside normal operating limits.
 4. Required sequences for electric or electronic systems.
 5. Special operating instructions and procedures.

2.4 OPERATION MANUALS

- A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
 - 1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
 - 2. Performance and design criteria if Contractor has delegated design responsibility.
 - 3. Operating standards.
 - 4. Operating procedures.
 - 5. Operating logs.
 - 6. Wiring diagrams.
 - 7. Control diagrams.
 - 8. Piped system diagrams.
 - 9. Precautions against improper use.
 - 10. License requirements including inspection and renewal dates.
- B. Descriptions: Include the following:
 - 1. Product name and model number. Use designations for products indicated on Contract Documents.
 - 2. Manufacturer's name.
 - 3. Equipment identification with serial number of each component.
 - 4. Equipment function.
 - 5. Operating characteristics.
 - 6. Limiting conditions.
 - 7. Performance curves.
 - 8. Engineering data and tests.
 - 9. Complete nomenclature and number of replacement parts.
- C. Operating Procedures: Include the following, as applicable:
 - 1. Startup procedures.
 - 2. Equipment or system break-in procedures.
 - 3. Routine and normal operating instructions.
 - 4. Regulation and control procedures.
 - 5. Instructions on stopping.
 - 6. Normal shutdown instructions.
 - 7. Seasonal and weekend operating instructions.
 - 8. Required sequences for electric or electronic systems.
 - 9. Special operating instructions and procedures.
- D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.
- E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.5 PRODUCT MAINTENANCE MANUALS

- A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.
- B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
- C. Product Information: Include the following, as applicable:
 - 1. Product name and model number.
 - 2. Manufacturer's name.
 - 3. Color, pattern, and texture.
 - 4. Material and chemical composition.
 - 5. Reordering information for specially manufactured products.

- D. Maintenance Procedures: Include manufacturer's written recommendations and the following:
 - 1. Inspection procedures.
 - 2. Types of cleaning agents to be used and methods of cleaning.
 - 3. List of cleaning agents and methods of cleaning detrimental to product.
 - 4. Schedule for routine cleaning and maintenance.
 - 5. Repair instructions.
- E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
 - 1. Include procedures to follow and required notifications for warranty claims.

2.6 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

- A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.
- B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
- C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
 - 1. Standard maintenance instructions and bulletins.
 - 2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
 - 3. Identification and nomenclature of parts and components.
 - 4. List of items recommended to be stocked as spare parts.
- D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
 - 1. Test and inspection instructions.
 - 2. Troubleshooting guide.
 - 3. Precautions against improper maintenance.
 - 4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 - 5. Aligning, adjusting, and checking instructions.
 - 6. Demonstration and training video recording, if available.
- E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
 - 1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
 - 2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.
- F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
- H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
 - 1. Include procedures to follow and required notifications for warranty claims.

PART 3 EXECUTION

3.1 MANUAL PREPARATION

- A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.
- B. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.
- C. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- D. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
 - 1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
 - 2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.
- E. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
 - 1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.
- F. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.
 - 1. Do not use original project record documents as part of operation and maintenance manuals.
 - 2. Comply with requirements of newly prepared record Drawings in Section 017839 "Project Record Documents."
- G. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 017823

SECTION 017839 - PROJECT RECORD DOCUMENTS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for project record documents, including the following:
 - 1. Record Drawings.
 - 2. Record Specifications.
 - 3. Record Product Data.
 - 4. Miscellaneous record submittals.
- B. Related Requirements:
 - 1. Section 017300 "Execution" for final property survey.
 - 2. Section 017700 "Closeout Procedures" for general closeout procedures.
 - 3. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.2 CLOSEOUT SUBMITTALS

- A. General: Final Payment will not be made until Project Record Documents are submitted to, reviewed by and are acceptable to the Architect.
- B. Record Drawings: Comply with the following:
 - 1. Number of Copies: Submit copies of record Drawings as follows:
 - a. Initial Submittal:
 - 1) Submit one paper-copy set(s) of marked-up record prints.
 - 2) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
 - b. Final Submittal:
 - 1) Submit PDF electronic files of scanned record prints and one (1) paper-copy set of marked-up record prints.
 - 2) Print each drawing, whether or not changes and additional information were recorded.
- C. Record Specifications: Comply with the following:
 - 1. Initial Submittal:
 - a. Submit one paper-copy set(s) of marked-up record specifications.
 - b. Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
 - 2. Final Submittal:
 - a. Submit PDF electronic files of scanned and marked-up record specifications.
- D. Record Product Data: Submit one (1) paper copy and one (1) annotated PDF electronic file and directory of each submittal.
 - 1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.
- E. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit one (1) paper copy and one (1) annotated PDF electronic file and directory of each submittal.
- F. Reports: Submit written report weekly, indicating items incorporated into project record documents concurrent with progress of the Work, including revisions, concealed conditions, field changes, product selections, and other notations incorporated.

PART 2 PRODUCTS

2.1 RECORD DRAWINGS

- A. Record Prints: Maintain one (1) set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.
 - 1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
 - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
 - b. Accurately record information in an acceptable drawing technique.
 - c. Record data as soon as possible after obtaining it.
 - d. Record and check the markup before enclosing concealed installations.
 - 2. Content: Types of items requiring marking include, but are not limited to, the following:
 - a. Dimensional changes to Drawings.
 - b. Revisions to details shown on Drawings.
 - c. Depths of foundations below first floor.
 - d. Locations and depths of underground utilities.
 - e. Revisions to routing of piping and conduits.
 - f. Revisions to electrical circuitry.
 - g. Actual equipment locations.
 - h. Duct size and routing.
 - i. Locations of concealed internal utilities.
 - j. Changes made by Change Order or Construction Change Directive.
 - k. Changes made following Architect's written orders.
 - l. Details not on the original Contract Drawings.
 - m. Field records for variable and concealed conditions.
 - n. Record information on the Work that is shown only schematically.
 - 3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
 - 4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
 - 5. Mark important additional information that was either shown schematically or omitted from original Drawings.
 - 6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- B. Record Digital Data Files:
 - 1. Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect and Construction Manager. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:
 - a. Format: Annotated PDF electronic file with comment function enabled.
 - b. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
 - c. Refer instances of uncertainty to Architect through Construction Manager for resolution.
 - d. Architect will furnish Contractor one set of digital data files of the Contract Drawings for use in recording information.
 - 1) See Section 013300 "Submittal Procedures" for requirements related to use of Architect's digital data files.
 - 2) Architect will provide data file layer information. Record markups in separate layers.
- C. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
 - 1. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
 - 2. Format: Annotated PDF electronic file with comment function enabled.

3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
4. Identification: As follows:
 - a. Project name.
 - b. Date.
 - c. Designation "PROJECT RECORD DRAWINGS."
 - d. Name of Construction Manager.
 - e. Name of Architect.
 - f. Name of Contractor.

2.2 RECORD SPECIFICATIONS

- A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
 3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
 4. For each principal product, indicate whether record Product Data has been submitted in operation and maintenance manuals instead of submitted as record Product Data.
 5. Note related Change Orders, record Product Data, and record Drawings where applicable.
- B. Format: Refer to previous Article.

2.3 RECORD PRODUCT DATA

- A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
 3. Note related Change Orders and record Drawings where applicable.
- B. Format: Submit one (1) copy of record Product Data as scanned PDF electronic file(s) of marked-up paper copy of Product Data.
 1. Include record Product Data directory organized by Specification Section number and title, electronically linked to each item of record Product Data.

2.4 MISCELLANEOUS RECORD SUBMITTALS

- A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.
- B. Format: Submit miscellaneous record submittals as one PDF electronic file and a separate paper copy of marked-up miscellaneous record submittals].
 1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

PART 3 EXECUTION

3.1 RECORDING AND MAINTENANCE

- A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.
- B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's and Construction Manager's reference during normal working hours.

END OF SECTION 017839 017839

SECTION 017900 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
 - 1. Demonstration of operation of systems, subsystems, and equipment.
 - 2. Training in operation and maintenance of systems, subsystems, and equipment.
 - 3. Pre-Produced demonstration and training videos.

1.2 INFORMATIONAL SUBMITTALS

- A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
 - 1. Indicate proposed training modules using manufacturer-produced (pre-produced) demonstration and training video recordings for systems, equipment, and products.
- B. Qualifications: For Instructor.
- C. Attendance Record: For each training module, submit list of participants and length of instruction time.

1.3 CLOSEOUT SUBMITTALS

- A. Pre-Produced Demonstration and Training Video Recordings: Submit two (2) copies within seven days of end of training.
 - 1. Identification: On each copy, provide an applied label with the following information:
 - a. Name of Project.
 - b. Name of Architect.
 - c. Name of Construction Manager.
 - d. Name of Contractor.
 - e. Date of video recording.
 - f. Name and address of videographer.
 - 2. Transcript: Prepared in PDF electronic format. Include a cover sheet with same label information as the corresponding video recording and a table of contents with links to corresponding training components. Include name of Project and date of video recording on each page.
 - 3. At completion of training, submit complete training manual(s) for Owner's use. One copy shall be prepared and bound in format matching operation and maintenance manuals, and the second copy shall be in PDF electronic file format on compact disc.

1.4 QUALITY ASSURANCE

- A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.
- B. Videographer Qualifications: A professional videographer who is experienced photographing demonstration and training events similar to those required.
- C. Pre-instruction Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to demonstration and training including, but not limited to, the following:
 - 1. Inspect and discuss locations and other facilities required for instruction.
 - 2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.

3. Review required content of instruction.
4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

1.5 COORDINATION

- A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.
- B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.
- C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

PART 2 PRODUCTS

2.1 INSTRUCTION PROGRAM

- A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.
- B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:
 1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
 - a. System, subsystem, and equipment descriptions.
 - b. Performance and design criteria if Contractor is delegated design responsibility.
 - c. Operating standards.
 - d. Regulatory requirements.
 - e. Equipment function.
 - f. Operating characteristics.
 - g. Limiting conditions.
 - h. Performance curves.
 2. Documentation: Review the following items in detail:
 - a. Emergency manuals.
 - b. Operations manuals.
 - c. Maintenance manuals.
 - d. Project record documents.
 - e. Identification systems.
 - f. Warranties and bonds.
 - g. Maintenance service agreements and similar continuing commitments.
 3. Emergencies: Include the following, as applicable:
 - a. Instructions on meaning of warnings, trouble indications, and error messages.
 - b. Instructions on stopping.
 - c. Shutdown instructions for each type of emergency.
 - d. Operating instructions for conditions outside of normal operating limits.
 - e. Sequences for electric or electronic systems.
 - f. Special operating instructions and procedures.
 4. Operations: Include the following, as applicable:
 - a. Startup and shutdown procedures.
 - b. Equipment or system break-in procedures.
 - c. Routine and normal operating instructions.
 - d. Regulation and control procedures.
 - e. Control sequences.
 - f. Safety procedures.
 - g. Instructions on stopping.

- h. Normal shutdown instructions.
- i. Operating procedures for emergencies.
- j. Operating procedures for system, subsystem, or equipment failure.
- k. Seasonal and weekend operating instructions.
- l. Required sequences for electric or electronic systems.
- m. Special operating instructions and procedures.
- 5. Adjustments: Include the following:
 - a. Alignments.
 - b. Checking adjustments.
 - c. Noise and vibration adjustments.
 - d. Economy and efficiency adjustments.
- 6. Troubleshooting: Include the following:
 - a. Diagnostic instructions.
 - b. Test and inspection procedures.
- 7. Maintenance: Include the following:
 - a. Inspection procedures.
 - b. Types of cleaning agents to be used and methods of cleaning.
 - c. List of cleaning agents and methods of cleaning detrimental to product.
 - d. Procedures for routine cleaning
 - e. Procedures for preventive maintenance.
 - f. Procedures for routine maintenance.
 - g. Instruction on use of special tools.
- 8. Repairs: Include the following:
 - a. Diagnosis instructions.
 - b. Repair instructions.
 - c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 - d. Instructions for identifying parts and components.
 - e. Review of spare parts needed for operation and maintenance.

PART 3 EXECUTION

3.1 PREPARATION

- A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 017823 "Operation and Maintenance Data."
- B. Set up instructional equipment at instruction location.

3.2 INSTRUCTION

- A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.
- B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
 - 1. Coordinate with Owner for number of participants, instruction times and location.
 - 2. Describe system design, operational requirements, criteria and regulatory requirements.
 - 3. Owner will furnish Contractor with names and positions of participants.
 - a. Owner will have in attendance a participant to describe Owner's operational philosophy.
- C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
 - 1. Schedule training with Owner, through Construction Manager, with at least seven (7) days' advance notice.
 - a. Notify Architect in writing of training schedule.
- D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.

- E. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

3.3 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

- A. Pre-Produced Video Recordings. Video recordings may be used as a component of each training module. Upon completion of training, furnish to Owner one (1) copy of each video used for training.

END OF SECTION 017900

SECTION 024119 - SELECTIVE DEMOLITION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Demolition and removal of selected portions of building or structure as indicated, and as required to accommodate new construction.
 - 2. Demolition and removal of selected site elements.
 - 3. Salvage of existing items to be reused or recycled.
- B. Related Requirements:
 - 1. Section 011000 "Summary" for restrictions on use of the premises, Owner-occupancy requirements, and phasing requirements.
 - 2. Section 017300 "Execution" for cutting and patching procedures.
 - 3. Section 311000 "Site Clearing" for site clearing and removal of above- and below-grade improvements not part of selective demolition.

1.2 DEFINITIONS

- A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged or reinstalled.
- B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and deliver to Owner ready for reuse.
- C. Remove and Reinstall: Detach items from existing construction, in a manner to prevent damage, prepare for reuse, and reinstall where indicated.
- D. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.
- E. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

1.3 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.
 - 1. Owner will retain "first right of refusal" for all demolished items.
- B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.
 - 1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.4 PREINSTALLATION MEETINGS

- A. Predemolition Conference: Conduct conference at Project site.
 - 1. Inspect and discuss condition of construction to be selectively demolished.
 - 2. Review structural load limitations of existing structure.
 - 3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
 - 4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
 - 5. Review areas where existing construction is to remain and requires protection.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For refrigerant recovery technician.
- B. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, for dust control and, for noise control. Indicate proposed locations and construction of barriers.
- C. Schedule of Selective Demolition Activities: Indicate the following:
 - 1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.
 - 2. Interruption of utility services. Indicate how long utility services will be interrupted.
 - 3. Coordination for shutoff, capping, and continuation of utility services.
 - 4. Use of elevator and stairs.
 - 5. Coordination of Owner's continuing occupancy of portions of existing building to ensure uninterrupted progress of Owner's on-site operations and of Owner's partial occupancy of completed Work.
- D. Predemolition Photographs or Video: Show existing conditions of adjoining construction, including finish surfaces, that might be misconstrued as damage caused by demolition operations.
 - 1. Comply with Section 013233 "Photographic Documentation." Submit before Work begins.
- E. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.
- F. Warranties: Documentation indicating that existing warranties are still in effect after completion of selective demolition.

1.6 CLOSEOUT SUBMITTALS

- A. Inventory: Submit a list of items that have been removed and salvaged.
 - 1. Prior to commencement of demolition, representatives of the Owner and the Contractor will inspect the project areas where work will be conducted, and designate items to be salvaged. Items to be salvaged shall be identified by tagging/labeling and listed on the inventory.

1.7 QUALITY ASSURANCE

- A. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.

1.8 FIELD CONDITIONS

- A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
- B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
 - 1. Before selective demolition, Owner will remove the following items:
- C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
 - 1. Hazardous materials will be removed by Owner before the start of Work.
 - a. Scheduling and phasing of hazardous materials removal shall be conducted prior to start of work in consultation with Contractor and Owner's forces. It may be necessary for portions of hazardous materials removal to occur after the start of construction. In such cases, areas where hazardous materials removal occurs shall be abandoned by Contractor during removal until hazardous materials removal is complete.

2. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.
 3. Contractor and Owner's forces shall each conduct work according to all applicable OSHA and EPA regulations.
- E. Storage or sale of removed items or materials on-site is not permitted.
- F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
1. Maintain fire-protection facilities in service during selective demolition operations.

1.9 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials and using approved contractors so as not to void existing warranties. Notify warrantor before proceeding. Existing warranties include the following:
1. Roof Warranty.
- B. Notify warrantor on completion of selective demolition, and obtain documentation verifying that existing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

1.10 COORDINATION

- A. Arrange selective demolition schedule so as not to interfere with Owner's operations.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ASSE A10.6 and NFPA 241.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting selective demolition operations.
- B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.
- C. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.
- D. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs or video.
1. Comply with requirements specified in Section 013233 "Photographic Documentation."
 2. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage operations.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.

1. Comply with requirements for existing services/systems interruptions specified in Division 01 Section "Summary"
- B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.
1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
 2. Arrange to shut off utilities with utility companies.
 3. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
 4. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated on Drawings to be removed.
 - a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
 - c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 - d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 - e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
 - f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
 - g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material and leave in place.
- C. Refrigerant: Before starting demolition, remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction.

3.3 PREPARATION

- A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
1. Comply with requirements for access and protection specified in Section 015000 "Temporary Facilities and Controls."
- B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
 2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
 3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
 4. Cover and protect furniture, furnishings, and equipment that have not been removed.
 5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Division 01 Section "Temporary Facilities and Controls."
- C. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
 2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
 3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
 4. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 015000 "Temporary Facilities and Controls."

- D. Temporary Shoring: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
 - 1. Strengthen or add new supports when required during progress of selective demolition.
- E. Remove temporary barricades and protections where hazards no longer exist.

3.4 SELECTIVE DEMOLITION, GENERAL

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
 - 1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
 - 2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
 - 3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 - 4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
 - 5. Maintain adequate ventilation when using cutting torches.
 - 6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
 - 7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
 - 8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
 - 9. Locate temporary wall/knockout panels and remove to extent indicated, minimizing damage to existing adjacent construction to remain.
 - 10. Dispose of demolished items and materials promptly.
- B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
- C. Removed and Salvaged Items:
 - 1. Clean salvaged items.
 - 2. Pack or crate items after cleaning. Identify contents of containers.
 - 3. Store items in a secure area until delivery to Owner.
 - 4. Transport items to Owner's storage area designated by Owner.
 - 5. Protect items from damage during transport and storage.
- D. Removed and Reinstalled Items:
 - 1. Clean and repair items to functional condition adequate for intended reuse.
 - 2. Pack or crate items after cleaning and repairing. Identify contents of containers.
 - 3. Protect items from damage during transport and storage.
 - 4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.
- E. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

- A. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, and then remove concrete between saw cuts.

- B. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, and then remove masonry between saw cuts.
- C. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, and then break up and remove.
- D. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI's "Recommended Work Practices for the Removal of Resilient Floor Coverings." Do not use methods requiring solvent-based adhesive strippers.
- E. Roofing: Remove no more existing roofing than what can be covered in one day by new roofing and so that building interior remains watertight and weathertight.
 - 1. Remove existing roof membrane, flashings, copings, and roof accessories.
 - 2. Remove existing roofing system down to substrate.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

- A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction.
 - 1. Do not allow demolished materials to accumulate on-site.
 - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
 - 3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
 - 4. Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."
- B. Burning: Do not burn demolished materials.

3.7 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 024119

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.
 1. Chamfer strips shall be 3/4 by 3/4 inch, minimum.
- 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.
 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- 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.

- D. Plain-Steel Welded-Wire Reinforcement (033000.A09): ASTM A 1064/A 1064M, plain, fabricated from as-drawn steel wire into flat sheets.
- E. Deformed-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, flat sheet.

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.
 - 2. Blended Hydraulic Cement: ASTM C595/C595M, Type IL, portland-limestone cement.
 - 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.
- I. Water: ASTM C 94/C 94M and potable.

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).
- B. Flexible Rubber Waterstops (033000.A13): CE CRD-C 513, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.
 - 1. Profile: Flat dumbbell with or without center bulb.
 - 2. Dimensions: 6 inches by 3/8 inch thick; nontapered.

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.
 - b. Basis-of-Design Product: ACH Foam Technologies; "Foam-Control Plus+ 250".

2.10 LIQUID FLOOR TREATMENTS (033000.A21)

- A. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or siliconate 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 Overlayment: 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.
 - 1. Cement Binder: ASTM C 150/C 150M, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 - 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.
 - 4. Water Absorption: Not greater than 4 percent.
 - 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:
 - 1. Class A, 1/8 inch for smooth-formed finished surfaces.
 - 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. Align and secure joints to avoid offsets. 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,

protect, and repair sheet vapor retarder according to ASTM E 1643, manufacturer's written instructions and as follows:

1. Lap joints 6 inches and seal with manufacturers' recommended tape.
 2. Lap vapor retarder over and seal to footings, foundation, strip footings, grade beam and any edge of slab that terminates at existing building conditions, as occurs.
 3. Seal pipe penetrations with pipe boot made from vapor retarder material, seal with pressure sensitive tape and vapor retarder manufacturer's recommended mastic.
 4. Repair punctures and tears with patches of vapor retarder material, lapping 6 inches on all sides and sealing with pressure sensitive tape.
- B. Sheet Vapor Retarders at Trenches in Existing Slabs on Grade: At trenches through existing slabs on grade, place vapor retarder over granular drainage fill/capillary break material and bring up tight to sides of opening to receive concrete. Extend vapor retarder up sides 2 inches and seal with asphaltic mastic. Lap joints 6 inches and seal with vapor retarder manufacturer's recommended mastic or pressure sensitive tape. Repair tears and punctures with patches of vapor retarder material lapping 6 inches on all sides of puncture/tear and seal with mastic of pressure sensitive tape. Seal all penetrations.

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.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.
- C. 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.
1. Weld reinforcing bars according to AWS D1.4/D 1.4M, where indicated.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- E. 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. Doweled 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.
 2. Maintain reinforcement in position on chairs during concrete placement.
 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 restraightening 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 restraighten 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 unlevelled, 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 034100 - PRECAST STRUCTURAL CONCRETE

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Precast structural concrete with architectural finish.
 - a. Double tee's.
2. Thin Brick-Faced Precast Structural Concrete (034100.A03 - PCB1, PCB2, PCB3, PCB4, PCB5, PCB6, PCB21).
3. Reinforcing Bars (034100.A06).
4. Welded Wire Reinforcement (034100.A07).
5. Connection Materials (034100.A08).
6. Grout (034100.A10).
7. Insulation (034100.A11).
8. Abrasive-Blast Finish (034100.A21 - PC1, PC22).
9. Formliner Finish (034100.A26 - PC21).
10. Rustication Joint (034100.A28).

B. Related Requirements:

1. Section 012300 "Alternates" for those alternates affecting work of this Section.
2. Section 033000 "Cast-in-Place Concrete" for concrete topping and placing connection anchors in concrete.
3. Section 042000 "Unit Masonry" for matching requirements and sourcing of full bed depth masonry products.
4. Section 044319 "Adhered Thin Masonry Veneer" for thin brick veneer specified in this Section used to face CMU and cast-in-place concrete walls.
5. Section 051200 "Structural Steel Framing" for furnishing and installing connections attached to structural-steel framing.
6. Section 055000 "Metal Fabrications" for kickers and other miscellaneous steel shapes not provided in this Section.
7. Section 078413 "Penetration Firestopping" for joint filler materials for fire-resistance-rated construction.
8. Section 079200 "Joint Sealants" for elastomeric joint sealants and sealant backings between slab edges at exposed underside of floor and roof members and/or perimeter of members.
9. Section 079500 "Expansion Control" for thermal cellular foam seal required between panels.
10. Section 099723 "Concrete and Masonry Coatings" for applied finish.
11. Section 104300 "Emergency Aid Specialties" for required equipment for storm shelter.
12. Section 104413 "Fire Extinguisher Cabinet" for required equipment.

1.2 DEFINITIONS

- A. Face-down Surface: Concealed surface of as-cast, precast panel formed against formwork.

1.3 REFERENCE STANDARDS

- A. ACI 318 - Building Code Requirements for Structural Concrete and Commentary 2014 (Errata 2018).
- B. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- C. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- D. ASTM A416/A416M - Standard Specification for Low-Relaxation, Seven-Wire Steel Strand for Prestressed Concrete 2018.
- E. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement 2020.

- F. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete 2018a.
- G. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation 2019.
- H. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete 2019.
- I. AWS D1.1/D1.1M - Structural Welding Code - Steel 2020.
- J. AWS D1.4/D1.4M - Structural Welding Code - Reinforcing Steel 2018.
- K. IAS AC157 - Accreditation Criteria for Fabricator Inspection Programs for Reinforced and Precast/Prestressed Concrete 2017.
- L. PCI MNL-116 - Manual for Quality Control for Plants and Production of Structural Precast Concrete Products 2021.
- M. PCI MNL-120
- N. PCI MNL-123
- O. PCI MNL-124
- P. PCI MNL-135 - Tolerance Manual for Precast and Prestressed Concrete Construction 2000.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Before submitting design mixes, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of Owner, Architect/Engineer and each entity directly concerned with precast concrete to attend, including the following:
 - a. Contractor's superintendent.
 - b. Independent testing agency responsible for concrete design mixtures.
 - c. Ready-mix concrete manufacturer.
 - d. Precast concrete Subcontractor.
 - 2. Review special inspection procedures; testing and inspecting agency procedures for field quality control; precast concrete finishes and finishing; cold- and hot-weather concreting procedures; form release agents to be used, curing procedures; flatness and levelness, finish, and joint requirements; steel reinforcement installation; hoisting and erection plans; measurement of fabrication and erection tolerances; precast concrete repair procedures; and precast concrete protection.

1.5 ACTION SUBMITTALS

- A. Product Data: Indicate standard component configurations, design loads, deflections, cambers, and bearing requirements.
- B. Design Mixtures: For each precast concrete mixture. Include compressive strength and, if required, water-absorption tests. Submit alternate design mixes when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.
- C. Shop Drawings:
 - 1. Include member locations, plans, elevations, dimensions, shapes and sections, openings, support conditions, and types of reinforcement, including special reinforcement.
 - 2. Detail fabrication and installation of precast structural concrete units, including connections at member ends and to adjoining construction.
 - 3. Indicate joints, reveals, drips, chamfers, and extent and location of each surface finish.
 - a. On elevations, indicate each color and surface texture/finish.
 - b. Provide details of reveals, drips and profiles to confirm compliance with drawings and dimensions.
 - 4. Indicate separate face and backup mixture locations and thicknesses.

5. Indicate type, size, and length of welded connections by AWS standard symbols.
 6. Detail loose and cast-in hardware, lifting and erection inserts, connections, and joints.
 7. Indicate locations, tolerances, and details of anchorage devices to be embedded in or attached to structure or other construction.
 8. On elevations, label the discipline (electrical, technology, Audio/Visual, fire, mechanical controls etc.) and label the device (receptacle, light switch, data, etc.) that is to be installed. Label boxes as well as penetrations for each discipline.
 9. Include and locate openings larger than 10 inches. Where additional structural support is required, include header design.
 10. Indicate location of each precast structural concrete unit by same identification mark placed on panel.
 11. Indicate relationship of precast structural concrete units to adjacent materials.
 12. Indicate locations, dimensions, and details of thin-brick units, including corner units and special shapes, and joint treatment.
 13. Indicate shim sizes and grouting sequence.
 14. If design modifications are proposed to meet performance requirements and field conditions, submit design calculations and Shop Drawings. Do not adversely affect the appearance, durability, or strength of units when modifying details or materials and maintain the general design concept. Note that structural wythe thickness may NOT be reduced.
- D. Samples for Initial Selection:
1. Prior to fabricating precast concrete units, produce a minimum of three sets of samples for each surface finish, not less than 4 by 4 by 1 inches, representing anticipated range of each color and texture for Architect's selection.
 - a. Separate samples may be submitted to illustrate each texture required.
 2. Samples for each thin-brick unit required, showing full range of color and texture expected. Include Samples showing color and texture of joint treatment.
- E. Samples for Verification:
1. Before fabricating precast concrete units, produce a minimum of two sets of representative samples for each exposed surface finish. Samples shall be of color, and texture variations expected; approximately 12 by 12 by 2 inches. Maintain one set of samples at Project site and remaining sample set at manufacturer's plant as color and texture approval reference.
 - a. Where other faces of precast concrete unit are exposed, include Samples illustrating workmanship, color, and texture of backup concrete as well as facing concrete.
 2. Samples for each thin-brick unit required, showing full range of color and texture expected. Include Samples showing color and texture of joint treatment.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For fabricator.
- B. Welding certificates.
- C. Material Certificates: For the following:
1. Cementitious materials.
 2. Reinforcing materials and prestressing tendons.
 3. Admixtures.
 4. Bearing pads.
 5. Insulation.
 6. Structural-steel shapes and hollow structural sections.
 7. Thin-brick units and accessories.
- D. Material Test Reports: For aggregates, by a qualified testing agency.
- E. Source quality-control reports.
- F. Field quality-control and special inspection reports.

1.7 QUALITY ASSURANCE

- A. Fabricator Qualifications: A firm that assumes responsibility for engineering precast structural concrete units to comply with performance requirements. Responsibility includes preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.
1. Designated as a PCI-certified plant as follows:
 - a. Group CA, Category C3A - Prestressed Straight-Strand Structural Members or Category C4A - Prestressed Deflected-Strand Structural Members.
 - b. Fabricator shall have a recorded ten-year history of successfully completing project of similar complexity, size and type as required for this Project.
 - c. Fabricator shall provide evidence of the firm's ability to maintain production capacity and schedule required for this Project.
- B. Installer Qualifications: A precast concrete erector experienced in erection of systems similar in complexity to those required for this Project and as follows:
1. Not less than five years of experience under the current company name.
 2. Successfully completed a minimum of 10 comparable scale projects using specified or similar systems.
- C. Testing Agency Qualifications: Qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
- D. Quality-Control Standard: For manufacturing procedures, testing requirements, and quality-control recommendations for types of units required, comply with PCI MNL 116, "Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products."
- E. Welding Qualifications: Qualify procedures and personnel according to the following:
1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 2. AWS D1.4/D1.4M, "Structural Welding Code - Reinforcing Steel."
- F. Mockups: After approval of samples for verification, but before production of precast structural concrete units with architectural finish, construct mockup of pre-production samples, to verify selections made under Sample submittals, to demonstrate aesthetic effects and to set quality standards for materials and execution.
1. Build mockups for typical exterior precast concrete wall areas. Mockup shall be in dimensions and location indicated on Drawings.
 - a. Each panel shall include face mix, insulation and backup mix. Include all necessary steel connection materials, bearing pads, grout, sealant and accessories to erect mockup panels.
 - b. At connection between both panels, provide a 1-inch wide vertical 2-stage weeping sealant joint. Include exterior sealant (in color selected), backer rod, secondary sealant joint and interior sealant with backer rod.
 2. Panel Finishes:
 - a. Thin Brick finish in color selected. Locate on as indicated on Drawings.
 - b. Backs of panels shall have smooth steel-troweled finish.
 - c. Abrasive Blast finish: Match Architect's approved sample.
 - d. Mockup panels shall include reveals, recesses, chamfers, and other profiles as required in finished panels. Panels shall be used in multi-component mockup demonstrating components of the completed wall system. Include the following:
 - 1) Corner condition.
 - 2) Window openings.
 - 3) Refer to drawings for additional requirements.
 - (a) Discovery Middle School - Sheet A001.
 - (b) EPiC Elementary School - Sheet A001.
 - (c) South Valley Middle School - Sheet A001.
 - e. Insulated panels in each finish and thickness.
 - f. Erection clips, plates and bearing pads. Erect panels on concrete footings to simulate actual foundations to wall interface. Apply specified waterproofing, transition strips, and panel to panel sealants. Include complete sealant system.
 - g. Embeds and reglets.
 - h. Make panels ready for other trades to follow.
 3. Clean one-half of each exposed face finish of mockup with cleaner.
 4. Patch imperfections on back of one panel to show aesthetic qualities and quality of workmanship. Location of this panel on mockup shall be determined by Architect.
 5. Protect accepted mockups from the elements with weather-resistant membrane.

6. Approval of mockups is for color, texture, relationship of sealant colors to precast colors; joints; and aesthetic qualities of workmanship.
 - a. Approval of mockups is also for other material and construction qualities specifically approved by Architect in writing.
 - b. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by Architect in writing.
7. Demolish and legally dispose of mockup after date established for Substantial Completion.

1.8 COORDINATION

- A. Furnish loose connection hardware and anchorage items to be embedded in or attached to other construction before starting that Work. Provide locations, setting diagrams, templates, instructions, and directions, as required, for installation.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Support units during shipment on nonstaining shock-absorbing material in same position as during storage.
- B. Store units with adequate bracing and protect units to prevent contact with soil, to prevent staining, and to prevent cracking, distortion, warping or other physical damage.
 1. Store units with dunnage across full width of each bearing point unless otherwise indicated.
 2. Place adequate dunnage of even thickness between each unit.
 3. Place stored units so identification marks are clearly visible, and units can be inspected.
- C. Handle and transport units in a manner that avoids excessive stresses that cause cracking or damage.
- D. Lift and support units only at designated points indicated on Shop Drawings.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design precast structural concrete members and connections capable of withstanding design loads indicated within limits and under conditions indicated on Drawings.
 1. Design all openings within the limits of the Storm Shelter as indicated on the Drawings in accordance with Sections 309.1 and 306.3 of the 2014 ICC 500 "Standard for the Design and Construction of Storm Shelters."
- B. Design Standards: Comply with ACI 318 and with design recommendations in PCI MNL 120, "PCI Design Handbook - Precast and Prestressed Concrete," applicable to types of precast structural concrete units indicated.
 1. Comply with provisions of the 2014 ICC 500 "Standard for the Design and Construction of Storm Shelters."
 2. Precast concrete supplier shall provide all necessary documentation according to Sections 107.3.1 and 107.3.2 of the 2014 ICC 500 "Standard for the Design and Construction of Storm Shelters."
 3. Precast concrete supplier shall maintain a 3/8 inch maximum joint/gap between precast panels. Supplier may submit for a variance to the authority having jurisdiction to maintain a 3/4 inch maximum joint/gap between precast panels if joint compound meets ASTM C 920.
 4. Precast concrete supplier shall maintain the minimum panel wythe thicknesses indicated on the Drawings at brick insets, reveal locations, chamfers, etc.
 - a. At no point shall the thickness of the precast panel wythe be less than ~~4 inches~~ **3 inches** thick.
- C. Fire-Resistance Calculations: Where indicated, provide precast structural concrete units whose fire resistance meets prescriptive requirements of authorities having jurisdiction or has been calculated according to ACI 216.1 or PCI MNL 124, "Design for Fire Resistance of Precast Prestressed Concrete," and is acceptable to authorities having jurisdiction.
 1. Fire-Resistance Rating: Select material and minimum thicknesses to provide 2-hour fire rating.
- D. Structural Performance: Precast structural concrete units and connections capable of withstanding the following design loads within limits and under conditions indicated on Contract Documents and as follows:
 1. Loads: As indicated on Drawings.

2. Design precast structural concrete units, framing and connections to maintain clearances at openings, to allow for fabrication and construction tolerances, to accommodate live-load deflection, shrinkage and creep of primary building structure, and other building movements. Maintain precast structural concrete deflections within limits of ACI 318.
 - a. Thermal Movements: Allow for in-plane thermal movements resulting from annual ambient temperature changes of minus 18 to plus 120 deg F.
3. Fire-Resistance Rating: Select material and minimum thicknesses to provide indicated fire rating, as applicable.

2.2 MOLD MATERIALS

- A. Molds: Rigid, dimensionally stable, non-absorptive material, warp and buckle free, that provides continuous precast concrete surfaces within fabrication tolerances indicated; nonreactive with concrete and suitable for producing required finishes.
 1. Mold-Release Agent: Commercially produced form-release agent that does not bond with, stain, or adversely affect precast concrete surfaces and does not impair subsequent surface or joint treatments of precast concrete.
- B. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch.
- C. Reveal/Rustication Strips: Metal, PVC, or straight dressed wood; with sides kerfed; nonstaining; fabricated to configurations indicated, in longest practicable lengths.

2.3 REINFORCING MATERIALS

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- B. Reinforcing Bars (034100.A06): ASTM A 615/A 615M, Grade 60, deformed.
- C. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.
- D. Plain-Steel Welded Wire Reinforcement (034100.A07): ASTM A 1064/A 1064M, fabricated from as-drawn steel wire into flat sheets.
- E. Supports: Suspend reinforcement from back of mold or use bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place according to PCI MNL 116.

2.4 PRESTRESSING TENDONS

- A. Pretensioning Strand: ASTM A 416/A 416M, Grade 270, uncoated, seven-wire, low-relaxation strand.

2.5 CONCRETE MATERIALS

- A. Portland Cement: ASTM C 150/C 150M, Type I or Type III, white where surface is exposed to view in final position and gray where surface is indicated to be covered by another exterior finish material.
 1. Use cement, of same type, brand, and mill source.
 2. For backup mixes, use gray cement, of same type, brand, and mill source.
- B. Blended Hydraulic Cement: ASTM C 595/C 595M, Type IL, white where surface is exposed to view in final position and gray where surface is indicated to be covered by another exterior finish material.
 1. Use cement, of same type, brand, and mill source.
 2. For backup mixes, use gray cement, of same type, brand, and mill source.
- C. Supplementary Cementitious Materials:
 1. Fly Ash: ASTM C 618, Class C or F, with maximum loss on ignition of 3 percent.
 2. Silica Fume: ASTM C 1240, with optional chemical and physical requirement.

- D. Normal-Weight Aggregates: Except as modified by PCI MNL 116, ASTM C 33/C 33M, with coarse aggregates complying with Class 5S. Stockpile fine and coarse aggregates for each type of exposed finish from a single source (pit or quarry) for Project.
 - 1. Face-Mixture-Coarse Aggregates: Selected, hard, and durable; free of material that reacts with cement or causes staining; to match selected finish sample.
 - a. Gradation: To match design reference sample.
 - 2. Face-Mixture-Fine Aggregates: Selected, natural or manufactured sand compatible with coarse aggregate to match approved finish sample.
- E. Coloring Admixture: ASTM C 979/C 979M, synthetic or natural mineral-oxide pigments or colored water-reducing admixtures, temperature stable, and nonfading.
- F. Water: Potable; free from deleterious material that may affect color stability, setting, or strength of concrete and complying with chemical limits of PCI MNL 116.
- G. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.
- H. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and to not contain calcium chloride, or more than 0.15 percent chloride ions or other salts by weight of admixture.
 - 1. Water-Reducing Admixtures: ASTM C 494/C 494M, Type A.
 - 2. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
 - 3. Plasticizing Admixture: ASTM C 1017/C 1017M, Type I.
 - 4. Corrosion-Inhibiting Admixture: ASTM C 1582/C 1582M.

2.6 STEEL CONNECTION MATERIALS (034100.A08)

- A. Carbon-Steel Shapes and Plates: ASTM A 36/A 36M.
- B. Carbon-Steel-Headed Studs: ASTM A 108, Grade 1010 through 1020, cold finished, AWS D1.1/D1.1M, Type A or B, with arc shields and with minimum mechanical properties of PCI MNL 116.
- C. Carbon-Steel Plate: ASTM A 283/A 283M, Grade C.
- D. Carbon-Steel Castings: ASTM A 27/A 27M, Grade 60-30.
- E. High-Strength, Low-Alloy Structural Steel: ASTM A 572/A 572M.
- F. Carbon-Steel Structural Tubing: ASTM A 500/A 500M, Grade B or Grade C.
- G. Deformed-Steel Wire or Bar Anchors: ASTM A 496/A 496M or ASTM A 706/A 706M.
- H. Carbon-Steel Bolts and Studs: ASTM A 307, Grade A; carbon-steel, hex-head bolts and studs; carbon-steel nuts, ASTM A 563; and flat, unhardened steel washers, ASTM F 844.
- I. High-Strength Bolts and Nuts: ASTM A 325 or ASTM A 490, Type 1, heavy hex steel structural bolts; heavy hex carbon-steel nuts, ASTM A 563; and hardened carbon-steel washers, ASTM F 436.
 - 1. Do not zinc coat ASTM A 490 bolts.
- J. Zinc-Coated Finish: For steel in high wind shelter walls and items indicated for galvanizing, apply zinc coating by hot-dip process according to ASTM A 123/A 123M or ASTM A 153/A 153M.
 - 1. For steel shapes, plates, and tubing to be galvanized, limit silicon content of steel to less than 0.03 percent or to between 0.15 and 0.25 percent or limit sum of silicon and 2.5 times phosphorous content to 0.09 percent.
 - 2. Galvanizing Repair Paint: High-zinc-dust-content paint with dry film containing not less than 94 percent zinc dust by weight, and complying with DOD-P-21035B or SSPC-Paint 20.
- K. Shop-Primed Finish: Prepare surfaces of nongalvanized-steel items, except those surfaces to be embedded in concrete, according to requirements in SSPC-SP 3, and shop apply lead- and chromate-free, rust-inhibitive primer, complying with performance requirements in MPI 79 according to SSPC-PA 1.
- L. Welding Electrodes: Comply with AWS standards.

- M. Precast Accessories: Provide clips, hangers, plastic or steel shims, and other accessories required to install precast structural concrete units.

2.7 BEARING PADS

- A. Provide one of the following bearing pads for precast structural concrete units as recommended by precast fabricator for application:
 - 1. Elastomeric Pads: AASHTO M 251, plain, vulcanized, 100 percent polychloroprene (neoprene) elastomer, molded to size or cut from a molded sheet, 50 to 70 Shore, Type A durometer hardness, ASTM D 2240; minimum tensile strength 2250 psi, ASTM D 412.
 - 2. Random-Oriented-Fiber-Reinforced Elastomeric Pads: Preformed, randomly oriented synthetic fibers set in elastomer. 70 to 90 Shore, Type A durometer hardness, ASTM D 2240; capable of supporting a compressive stress of 3000 psi with no cracking, splitting, or delaminating in the internal portions of pad. Test one specimen for every 200 pads used in Project.
 - 3. Frictionless Pads: PTFE, glass-fiber reinforced, bonded to stainless- or mild-steel plate, or random-oriented-fiber-reinforced elastomeric pads; of type required for in-service stress.
 - 4. High-Density Plastic: Multimonomer, nonleaching, plastic strip.

2.8 ACCESSORIES

- A. Flashing Reglets: Open type having continuous groove not less than 1-1/8 inches deep by 3/16 inch wide at opening and sloped upward to 45 degrees. Temporarily fill or cover face openings of reglets to prevent intrusion of concrete or debris.
 - 1. Stainless Steel: ASTM A 240/A 240M, Type 304, soft annealed, not less than 0.0187 inch thick.
- B. Precast Accessories: Provide clips, hangers, high-density plastic or steel shims, and other accessories required to install structural precast concrete units.
- C. Refer to Section 079500 "Expansion Control" for Pre-Formed Cellular Foam expansion joints.

2.9 GROUT MATERIALS

- A. Nonmetallic, Nonshrink Grout (034100.A10): Packaged, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, plasticizing and water-reducing agents, complying with ASTM C 1107/C 1107M, Grade A for drypack and Grades B and C for flowable grout and of consistency suitable for application within a 30-minute working time. Water-soluble chloride ion content less than 0.06 percent by weight of cement when tested according to ASTM C 1218/C 1218M.

2.10 THIN BRICK AND ACCESSORIES (034100.A03)

- A. Basis of Design Product: Subject to compliance with requirements, provide products indicated on Exterior Material Finish Legend. Thin brick from other manufacturers, meeting specified requirements, will be considered when submitted to and accepted by Architect prior to bidding only.
 - 1. Substitutions for thin brick shall include full-size color samples of not less than 5 units showing full range of color and texture variations to be expected. Intent is to match Architect's sample.
- B. Thin Brick: Comply with ASTM C 1088 Type TBX, exterior grade. Thickness not less than 1/2 inch or more than 1 inch thick, and as follows:
 - 1. Face size: 2-1/4 inches high by 7-5/8 inches long.
 - 2. Dimensional Tolerances: Plus 0 inch or minus 1/16 inch for any dimension 8 inches or less and plus 0 inch or minus 3/32 inch for any dimension more than 8 inches.
 - 3. Out-of-Square Tolerance: Plus or minus 1/16 inch.
 - 4. Warpage Tolerance: Plus 0 inch or minus 1/16 inch.
 - 5. Variation of Shape from Specified Angle: Plus or minus one degree.
 - 6. Modulus of Rupture: Not less than 250 psi when tested according to ASTM C 67.
 - 7. Tensile Bond Strength: Not less than 150 psi when tested before and after freeze-thaw test according to ASTM E 488 as modified. Adhere a steel plate with a welded rod on a single thin-brick face with epoxy for each test.

8. 24-Hour Cold-Water Absorption: Not more than 6 percent when tested according to ASTM C 67.
 - a. Sample average: 5.13.
9. Freeze-Thaw Resistance: No detectable disintegration or separation after 300 freezing-and-thawing cycles when tested according to ASTM C 666/C 666M, Method B.
 - a. Sample average: 0.06 percent weight loss.
10. Chemical Resistance: Tested according to ASTM C 650 and rated "not affected."
11. Efflorescence: Tested according to ASTM C 67 and rated "not effloresced."
12. Back Surface Texture: Scored, combed, wire roughened, ribbed, keybacked, or dovetailed.

C. Special Shapes: Include corners, edge corners, and end edge corners.

2.11 INSULATED FLAT-WALL PANEL ACCESSORIES (034100.A02)

- A. Extruded-Polystyrene Board Insulation (034100.A11): ASTM C 578, Type IV, 1.55 lb/cu. ft.; square or ship-lap edges.
 1. Thickness: 3 inches.
- B. Wythe Connectors: At Contractor's option, provide glass-fiber-reinforced vinylester connectors, or polypropylene pin connectors or epoxy-coated carbon-fiber grid manufactured to connect wythes of precast concrete panels.

2.12 CONCRETE MIXTURES

- A. Prepare design mixtures for each type of precast concrete required.
 1. Limit use of fly ash to 20 percent replacement of portland cement by weight.
 2. DO NOT use fly ash in facing mixes.
 3. DO NOT use fly ash for colored concrete.
- B. Design mixtures may be prepared by a qualified independent testing agency or by qualified precast plant personnel at precast structural concrete fabricator's option.
- C. Limit water-soluble chloride ions to maximum percentage by weight of cement permitted by ACI 318 or PCI MNL 116 when tested according to ASTM C 1218/C 1218M.
- D. Normal-Weight Concrete Mixtures: Proportion face and backup mixtures or full-depth mixtures, at fabricator's option by either laboratory trial batch or field test data methods according to ACI 211.1, with materials to be used on Project, to provide normal-weight concrete with the following properties:
 1. Compressive Strength (28 Days): 5000 psi.
 2. Maximum Water-Cementitious Materials Ratio: 0.45.
 3. Add colorant as necessary to match approved sample.
- E. Water Absorption: For structural precast concrete with an architectural finish, limit water absorption to 6 percent by weight or 14 percent by volume, tested according to ASTM C 642, except for boiling requirement.
- F. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content complying with PCI MNL 116.
- G. When included in design mixtures, add other admixtures to concrete mixtures according to manufacturer's written instructions.
- H. Concrete Mix Adjustments: Concrete mix design adjustments may be proposed if characteristics of materials, Project conditions, weather, test results, or other circumstances warrant.

2.13 MOLD FABRICATION

- A. Molds: Accurately construct molds, mortar tight, of sufficient strength to withstand pressures due to concrete-placement operations and temperature changes and for prestressing and detensioning operations. Coat contact surfaces of molds with release agent before reinforcement is placed. Avoid contamination of reinforcement and prestressing tendons by release agent.

- B. Maintain molds to provide completed precast structural concrete units of shapes, lines, and dimensions indicated, within fabrication tolerances specified.
 - 1. Form joints are not permitted on faces of structural precast concrete with an architectural finish that is exposed to view in the finished work.
 - 2. Edge and Corner Treatment: Uniformly chamfered.

2.14 THIN-BRICK FACINGS

- A. Place form-liner templates accurately to provide grid for thin-brick facings. Provide solid backing and supports to maintain stability of liners while placing thin bricks and during concrete placement.
 - 1. Drawings show very specific coursing with overall dimensions, number of bricks and 3/8" joints – panels are determined from these overall dimensions to limit awkwardly cut bricks. Coursing dimensions are shown both horizontally and vertically. It is critical for precaster to match these dimensions.
- B. Securely place thin-brick units face down into form-liner pockets and place concrete backing mixture.
 - 1. Tool joints to a slightly concave shape when pointing grout is thumbprint hard.
- C. Clean faces and joints of thin-brick facing.

2.15 FABRICATION

- A. Cast-in Anchors, Inserts, Plates, Angles, and Other Anchorage Hardware: Fabricate anchorage hardware with sufficient anchorage and embedment to comply with design requirements. Accurately position for attachment of loose hardware, and secure in place during precasting operations. Locate anchorage hardware where it does not affect position of main reinforcement or concrete placement.
 - 1. Weld-headed studs and deformed bar anchors used for anchorage according to AWS D1.1/D1.1M and AWS C5.4, "Recommended Practices for Stud Welding."
- B. Furnish loose hardware items including steel plates, clip angles, seat angles, anchors, dowels, cramps, hangers, and other hardware shapes for securing precast structural concrete units to supporting and adjacent construction.
- C. Cast-in reglets, slots, holes, and other accessories in precast structural concrete units as indicated on the Contract Drawings.
- D. Cast-in openings larger than 10 inches in any dimension. Do not drill or cut openings or prestressing strand without Architect's approval.
- E. Cast-in and harden openings in high wind shelter areas per ICC 500 and FEMA 361. Do not drill or cut openings or prestressing strand without Architect's approval.
- F. Reinforcement: Comply with recommendations in PCI MNL 116 for fabricating, placing, and supporting reinforcement.
 - 1. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy the bond with concrete. When damage to epoxy-coated reinforcement exceeds limits specified in ASTM A 775/A 775M, repair with patching material compatible with coating material and epoxy coat bar ends after cutting.
 - 2. Accurately position, support, and secure reinforcement against displacement during concrete-placement and consolidation operations. Completely conceal support devices to prevent exposure on finished surfaces.
 - 3. Place reinforcing steel and prestressing strand to maintain at least 3/4-inch minimum concrete cover. Increase cover requirements for reinforcing steel to 1-1/2 inches when units are exposed to corrosive environment or severe exposure conditions. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position while placing concrete. Direct wire tie ends away from finished, exposed concrete surfaces.
 - 4. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh spacing and wire tie laps, where required by design. Offset laps of adjoining widths to prevent continuous laps in either direction.
- G. Reinforce precast structural concrete units to resist handling, transportation, and erection stresses and specified in-place loads.

- H. Prestress tendons for precast structural concrete units by either pretensioning or post-tensioning methods. Comply with PCI MNL 116.
 - 1. Delay detensioning or post-tensioning of precast, prestressed structural concrete units until concrete has reached its indicated minimum design release compressive strength as established by test cylinders cured under same conditions as concrete unit.
 - 2. Detension pretensioned tendons either by gradually releasing tensioning jacks or by heat cutting tendons, using a sequence and pattern to prevent shock or unbalanced loading.
 - 3. If concrete has been heat cured, detension while concrete is still warm and moist to avoid dimensional changes that may cause cracking or undesirable stresses.
 - 4. Protect strand ends and anchorages with bituminous, zinc-rich, or epoxy paint to avoid corrosion and possible rust spots.
 - 5. Protect strand ends and anchorages with a minimum of 1-inch-thick, nonmetallic, nonshrink, grout mortar and sack rub surface. Coat or spray the inside surfaces of pocket with bonding agent before installing grout.
- I. Comply with requirements in PCI MNL 116 and in this Section for measuring, mixing, transporting, and placing concrete. After concrete batching, no additional water may be added.
- J. Place face mixture to a minimum thickness after consolidation of the greater of 1 inch or 1.5 times the maximum aggregate size, but not less than the minimum reinforcing cover specified.
- K. Place concrete in a continuous operation to prevent cold joints or planes of weakness from forming in precast concrete units.
 - 1. Place backup concrete mixture to ensure bond with face-mixture concrete.
- L. Thoroughly consolidate placed concrete by vibration without dislocating or damaging reinforcement and built-in items, and minimize pour lines, honeycombing, or entrapped air voids on surfaces. Use equipment and procedures complying with PCI MNL 116.
- M. Comply with PCI MNL 116 procedures for hot- and cold-weather concrete placement.
- N. Identify pickup points of precast structural concrete units and orientation in structure with permanent markings, complying with markings indicated on Shop Drawings. Imprint or permanently mark casting date on each precast structural concrete unit on a surface that does not show in finished structure.
- O. Cure concrete, according to requirements in PCI MNL 116, by moisture retention without heat or by accelerated heat curing using live steam or radiant heat and moisture. Cure units until compressive strength is high enough to ensure that stripping does not have an effect on performance or appearance of final product.
- P. Discard and replace precast structural concrete units that do not comply with requirements, including structural, manufacturing tolerance, and appearance, unless repairs meet requirements in PCI MNL 116 and meet Architect's approval.

2.16 CASTING INSULATED WALL PANELS

- A. Cast, screed, and consolidate wythe supported by mold.
- B. Place insulation boards abutting edges and ends of adjacent boards. Insert wythe connectors through insulation, and consolidate concrete around connectors according to connector manufacturer's written instructions.
- C. Ensure bottom wythe and insulation layer are not disturbed after bottom wythe reaches initial set.
- D. Cast, screed, and consolidate top wythe to meet required finish.
- E. Maintain temperature below 150 deg F in bottom concrete wythe.

2.17 FABRICATION TOLERANCES

- A. Fabricate precast concrete units to shapes, lines, and dimensions indicated so each finished unit complies with PCI MNL 116 product dimension tolerances as well as position tolerances for cast-in items.

- B. Fabricate precast concrete units to shapes, lines, and dimensions indicated so each finished unit complies with the following product tolerances:
1. Overall Height and Width of Units, Measured at the Face Exposed to View: As follows:
 - a. 10 feet or under, plus or minus 1/8 inch.
 - b. 10 to 20 feet, plus 1/8 inch, minus 3/16 inch.
 - c. 20 to 40 feet, plus or minus 1/4 inch.
 - d. Each additional 10 feet, plus or minus 1/16 inch.
 2. Overall Height and Width of Units, Measured at the Face Not Exposed to View: As follows:
 - a. 10 feet or under, plus or minus 1/4 inch.
 - b. 10 to 20 feet, plus 1/4 inch, minus 3/8 inch.
 - c. 20 to 40 feet, plus or minus 3/8 inch.
 - d. Each additional 10 feet, plus or minus 1/8 inch.
 3. Total Thickness or Flange Thickness: Plus 1/4 inch, minus 1/8 inch.
 4. Rib Thickness: Plus or minus 1/8 inch.
 5. Rib to Edge of Flange: Plus or minus 1/8 inch.
 6. Distance between Ribs: Plus or minus 1/8 inch.
 7. Variation from Square or Designated Skew (Difference in Length of the Two Diagonal Measurements): Plus or minus 1/8 inch/72 inches or 1/2 inch total, whichever is greater.
 8. Length and Width of Block-outs and Openings within One Unit: Plus or minus 1/4 inch.
 9. Location and Dimension of Block-outs Hidden from View and Used for HVAC and Utility Penetrations: Plus or minus 3/4 inch.
 10. Dimensions of Haunches: Plus or minus 1/4 inch.
 11. Haunch Bearing Surface Deviation from Specified Plane: Plus or minus 1/8 inch.
 12. Difference in Relative Position of Adjacent Haunch Bearing Surfaces from Specified Relative Position: Plus or minus 1/4 inch.
 13. Bowing: Plus or minus L/360, maximum 1 inch.
 14. Local Smoothness: 1/4 inch/10 feet.
 15. Warping: 1/16 inch/12 inches of distance from nearest adjacent corner.
 16. Tipping and Flushness of Plates: Plus or minus 1/4 inch.
 17. Dimensions of Architectural Features and Rustications: Plus or minus 1/8 inch.
- C. Position Tolerances: For cast-in items measured from datum line location, as indicated on Shop Drawings.
1. Weld Plates: Plus or minus 1 inch.
 2. Inserts: Plus or minus 1/2 inch.
 3. Handling Devices: Plus or minus 3 inches.
 4. Reinforcing Steel and Welded Wire Reinforcement: Plus or minus 1/4 inch where position has structural implications or affects concrete cover; otherwise, plus or minus 1/2 inch.
 5. Reinforcing Steel Extending out of Member: Plus or minus 1/2 inch of plan dimensions.
 6. Tendons: Plus or minus 1/4 inch, vertical; plus or minus 1 inch, horizontal.
 7. Location of Rustication Joints: Plus or minus 1/8 inch.
 8. Location of Opening within Panel: Plus or minus 1/4 inch.
 9. Location of Flashing Reglets: Plus or minus 1/4 inch.
 10. Location of Flashing Reglets at Edge of Panel: Plus or minus 1/8 inch.
 11. Reglets for Glazing Gaskets: Plus or minus 1/8 inch.
 12. Electrical Outlets, Hose Bibs: Plus or minus 1/2 inch.
 13. Location of Bearing Surface from End of Member: Plus or minus 1/4 inch.
 14. Allowable Rotation of Plate, Channel Inserts, and Electrical Boxes: 2-degree rotation or 1/4 inch maximum over the full dimension of unit.
 15. Position of Sleeve: Plus or minus 1/2 inch.
 16. Location of Window Washer Track or Buttons: Plus or minus 1/8 inch.
- D. Thin-Brick-Faced Precast Structural Concrete Units (034100.A03): Restrict the following misalignments to 2 percent of number of thin bricks in a unit:
1. Alignment of Mortar Joints:
 - a. Jog in Alignment: 1/8 inch.
 - b. Alignment with Panel Centerline: Plus or minus 1/8 inch.
 2. Variation in Width of Exposed Mortar Joints: Plus or minus 1/8 inch.
 3. Tipping of Individual Thin Bricks from the Panel Plane of Exposed Thin-Brick Surface: Plus 0 inch; minus 1/4 inch less than or equal to depth of form-liner joint.
 4. Exposed Thin-Brick Surface Parallel to Primary Control Surface of Panel: Plus 1/4 inch; minus 1/8 inch.

5. Individual Thin-Brick Step in Face from Panel Plane of Exposed Thin-Brick Surface: Plus 0 inch; minus 1/4 inch less than or equal to depth of form-liner joint.
6. Brick Types:
 - a. Face Brick Type PCB1, PCB3, PCB21: Facing brick complying with ASTM C 216.
 - 1) Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 10,000 psi.
 - 2) Initial Rate of Absorption: Less than 30 g/30 sq. in. per minute when tested according to ASTM C 67.
 - 3) Saturation Coefficient: Less than 3% when tested according to ASTM C 1088.
 - 4) Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
 - 5) Size (Actual Dimensions): 5/8 inch thick by 2-1/4 inches high by 7-5/8 inches long.
 - 6) Application: Use where brick is exposed unless otherwise indicated.
 - 7) Colors and Textures: Refer to Exterior Material Finish Legends.
 - b. Face Brick Type PCB2, PCB4, PCB6: Facing brick complying with ASTM C 216.
 - 1) Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 10,000 psi.
 - 2) Initial Rate of Absorption: Less than 6% when tested according to ASTM C 67.
 - 3) Saturation Coefficient: Ranging between 0.55 to 0.60 when tested according to ASTM C 67.
 - 4) Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
 - 5) Size (Actual Dimensions): 9/16 inches wide by 2-1/4 inches high by 7-5/8 inches long (Modular).
 - 6) Application: Use where brick is exposed unless otherwise indicated.
 - 7) Colors and Textures: Match Architect's samples.
 - c. Face Brick Type PCB5: Facing brick complying with ASTM C 216.
 - 1) Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 11,000 psi.
 - 2) Initial Rate of Absorption: Less than 30 g/30 sq. in. per minute when tested according to ASTM C 67.
 - 3) Saturation Coefficient: Ranging between 0.55 to 0.65 when tested according to ASTM C 67.
 - 4) Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
 - 5) Size (Actual Dimensions): 1/2 inches wide by 2-1/4 inches high by 7-5/8 inches long (Modular).
 - 6) Application: Use where brick is exposed unless otherwise indicated.
 - 7) Colors and Textures: Match Architect's samples.

2.18 COMMERCIAL FINISHES

- A. Where Grade A Finish is indicated on drawings: Repair surface blemishes and fill air holes with the exception of air holes 1/16 inch (1.6 mm) in width or smaller, and from marks where the surface deviation is less than 1/16 inch (1.6 mm). Float apply a neat cement-paste coating to exposed surfaces. Rub dried paste coat with burlap to remove loose particles. Discoloration at form joints is permitted. Grind smooth all form joints.
- B. Where Grade B Finish is indicated on drawings: Fill air pockets and holes larger than 1/4 inch in diameter with sand-cement paste matching color of adjacent surfaces. Fill air holes greater than 1/8 inch in width that occur more than once per 2 sq. in.. Grind smooth form offsets or fins larger than 1/8 inch. Repair surface blemishes due to holes or dents in molds. Discoloration at form joints is permitted.
- C. Screed or float finish unformed surfaces (034100.A16). Strike off and consolidate concrete with vibrating screeds to a uniform finish. Hand screed at projections. Normal color variations, minor indentations, minor chips, and spalls are permitted. Major imperfections, honeycombing, or defects are not permitted.
- D. Smooth, steel trowel finish unformed surfaces (034100.A17). Consolidate concrete, bring to proper level with straightedge, float, and trowel to a smooth, uniform finish.
- E. Apply roughened surface finish according to ACI 318 to precast concrete units that receive concrete topping after installation.
- F. Precast concrete surfaces exposed to public view shall have a Concrete Surface Classification of CSC4 as defined by ACI 347.3R-13 "Guide to Formed Concrete Surfaces" and as described below per Table 3.1a of ACI 347.3R-13.
 1. Texture: T4 per Table 3.1.b of ACI 347.3R.
 2. Surface Void Ratio: SVR4 per Table 3.1.d of ACI 347.3R.

3. Color Uniformity: CU3 per Table 3.1.b of ACI 347.3R.
4. Surface Irregularities: SI4 per Table 3.1.b of ACI 347.3R.
5. Construction and Facing Joint: CJ4 per Table 3.1.b of ACI 347.3R.
6. Form Facing Category: FC3 per Table 3.1.c of ACI 347.3R.

2.19 COMMERCIAL ARCHITECTURAL FINISHES

- A. Manufacture member faces free of joint marks, grain, and other obvious defects with corners, including false joints, uniform and straight. Finish exposed-face surfaces of precast concrete units to match approved sample panels, mockups and as follows:
 1. Thin-Brick Facing (034100.A03): See "Thin-Brick Facings" Article.
 2. Smooth Surface Finish (034100.A18).
 3. Abrasive-Blast Finish (034100.A21): Use abrasive grit, equipment, application techniques, and cleaning procedures to expose aggregate and surrounding matrix surfaces.
 - a. Apply light to medium exposure abrasive-blast finish using abrasive grit, equipment, application techniques, and cleaning procedures to expose aggregate and surrounding matrix surfaces to match Architect's design reference samples and as follows:
 - 1) Light Exposure: Expose fine aggregate with occasional exposure of coarse aggregate and uniform color; maximum reveal of 1/16 inch.
 - 2) Medium Exposure: Generally expose coarse aggregate with slight reveal; maximum reveal of 1/4 inch.
 - 3) Heavy Exposure: Sufficient to generally expose and reveal the coarse aggregate to a maximum projection of 1/3 of the diameter; aggregate exposure 1/4 to 1/2 in. (6 to 12 mm); the surface is rugged and uneven.
 - b. Cleaning: After abrasive blasting, clean surfaces with a non-acidic cleaner acceptable to precast manufacturer. Thoroughly remove cleaner from finished surfaces with low-pressure water wash.
 4. Face-Up Finish for Interior Exposed Panels (Public and Non-Public Spaces): Finish exposed back surfaces of exposed precast units to have a smooth, steel trowel finish for unformed surfaces. Consolidate concrete, bring to proper level with straightedge, float, and trowel to a monolithically uniform smooth texture and appearance, free of trowel marks.
 5. Face-Up Finish for Interior Concealed Panels (concealed by gypsum wall panels): Provide screed finish.
 6. Formliner finish (034100.A26): Use formliner indicated on Exterior Finish Legend.

2.20 SOURCE QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to evaluate precast structural concrete fabricator's quality-control and testing methods.
 1. Allow testing agency access to material storage areas, concrete production equipment, concrete placement, and curing facilities. Cooperate with testing agency and provide samples of materials and concrete mixtures as may be requested for additional testing and evaluation.
- B. Testing: Test and inspect precast structural concrete according to PCI MNL 116 requirements and ASTM C 1610/C 1610M, ASTM C 1611/C 1611M, ASTM C 1621/C 1621M, and ASTM C 1712/C 1712M.
- C. Strength of precast structural concrete units is considered deficient if units fail to comply with ACI 318 requirements for concrete strength.
- D. If there is evidence that strength of precast concrete units may be deficient or may not comply with ACI 318 requirements, employ a qualified testing agency to obtain, prepare, and test cores drilled from hardened concrete to determine compressive strength according to ASTM C 42/C 42M.
 1. A minimum of three representative cores shall be taken from units of suspect strength, from locations directed by Architect.
 2. Test cores in an air-dry condition or, if units are wet under service conditions, test cores after immersion in water in a wet condition.
 3. Strength of concrete for each series of three cores is considered satisfactory if average compressive strength is equal to at least 85 percent of 28-day design compressive strength and no single core is less than 75 percent of 28-day design compressive strength.
 4. Report test results in writing on same day that tests are performed, with copies to Architect, Contractor, and precast concrete fabricator. Test reports include the following:
 - a. Project identification name and number.
 - b. Date when tests were performed.

- c. Name of precast concrete fabricator.
 - d. Name of concrete testing agency.
 - e. Identification letter, name, and type of precast concrete unit(s) represented by core tests; design compressive strength; type of break; compressive strength at breaks, corrected for length-diameter ratio; and direction of applied load to core in relation to horizontal plane of concrete as placed.
- E. Patching: If core test results are satisfactory and precast structural concrete units comply with requirements, clean and dampen core holes and solidly fill with same precast concrete mixture that has no coarse aggregate, and finish to match adjacent precast concrete surfaces.
- F. Defective Units: Discard and replace precast structural concrete units that do not comply with requirements, including strength, manufacturing tolerances, and color and texture range. Chipped, spalled, or cracked units may be repaired, subject to Architect's approval. Architect reserves the right to reject precast units that do not match approved samples, sample panels, and mockups. Replace unacceptable units with precast concrete units that comply with requirements.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine supporting structural frame or foundation and conditions for compliance with requirements for installation tolerances, bearing surface tolerances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. Do not install precast concrete units until supporting, cast-in-place concrete has attained minimum allowable design compressive strength and until supporting steel or other structure is structurally ready to receive loads from precast concrete units.

3.2 INSTALLATION

- A. Install clips, hangers, bearing pads, and other accessories required for connecting precast structural concrete units to supporting members and backup materials.
 - 1. Refer to manufacturer's written instructions for pre-formed cellular foam installation.
- B. Erect precast structural concrete level, plumb, and square within specified allowable tolerances. Provide temporary structural framing, shoring, and bracing as required to maintain position, stability, and alignment of units until permanent connections are complete.
 - 1. Install temporary steel or plastic spacing shims or bearing pads as precast structural concrete units are being erected. Tack weld steel shims to each other to prevent shims from separating.
 - 2. Maintain horizontal and vertical joint alignment and uniform joint width as erection progresses.
 - 3. Remove projecting lifting devices and use plastic patch caps or sand-cement grout to fill voids within recessed lifting devices flush with surface of adjacent precast surfaces when recess is exposed.
- C. Connect precast structural concrete units in position by bolting, welding, grouting, or as otherwise indicated on Shop Drawings. Remove temporary shims, wedges, and spacers as soon as practical after connecting and grouting are completed.
 - 1. Do not permit connections to disrupt continuity of roof flashing.
- D. Field cutting of precast units is not permitted without approval of Architect.
- E. Fasteners: Do not use drilled or powder-actuated fasteners for attaching accessory items to precast, prestressed concrete units.
- F. Welding: Comply with applicable requirements in AWS D1.1/D1.1M and AWS D1.4/D1.4M for welding, welding electrodes, appearance, quality of welds, and methods used in correcting welding work.
 - 1. Protect precast structural concrete units and bearing pads from damage by field welding or cutting operations, and provide noncombustible shields as required.
 - 2. Clean weld-affected steel surfaces with chipping hammer followed by brushing, and apply a minimum 4.0-mil-thick coat of galvanized repair paint to galvanized surfaces according to ASTM A 780/A 780M.
 - 3. Visually inspect welds and remove, reweld, or repair incomplete and defective welds.

- G. At bolted connections, use lock washers, tack welding, or other approved means to prevent loosening of nuts after final adjustment.
 - 1. Where slotted connections are used, verify bolt position and tightness. For sliding connections, properly secure bolt but allow bolt to move within connection slot.
 - 2. For slip-critical connections, use one of the following methods to assure proper bolt pretension:
 - a. Turn-of-Nut: According to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
 - b. Calibrated Wrench: According to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
 - c. Twist-off Tension Control Bolt: ASTM F 1852.
 - d. Direct-Tension Control Bolt: ASTM F 1852.
 - 3. For slip-critical connections, use method and inspection procedure approved by Architect and Structural Engineer and coordinated with inspection agency.
- H. Grouting or Dry-Packing Connections and Joints: Grout connections and joints and open spaces at keyways, connections, and joints where required or indicated on Shop Drawings. Retain flowable grout in place until hard enough to support itself. Alternatively, pack spaces with stiff dry-pack grout material, tamping until voids are completely filled.
 - 1. Place grout and finish smooth, level, and plumb with adjacent concrete surfaces.
 - 2. Fill joints completely without seepage to other surfaces.
 - 3. Trowel top of grout joints on roofs smooth and uniform. Finish transitions between different surface levels not steeper than 1 to 12.
 - 4. Promptly remove grout material from exposed surfaces before it affects finishes or hardens.
 - 5. Keep grouted joints damp for not less than 24 hours after initial set.

3.3 ERECTION TOLERANCES

- A. Erect precast structural concrete units level, plumb, square, and in alignment without exceeding the noncumulative erection tolerances of PCI MNL 135.
- B. Minimize variations between adjacent slab members by jacking, loading, or other method recommended by fabricator and approved by Architect.
- C. Comply with the more restrictive tolerance requirements of PCI MNL 135 or the following: Erect architectural precast concrete units level, plumb, square, and in alignment, without exceeding the following noncumulative erection tolerances:
 - 1. Plan Location from Building Grid Datum: Plus or minus 1/2 inch.
 - 2. Plan Location from Centerline of Steel: Plus or minus 1/2 inch.
 - 3. Top Elevation from Nominal Top Elevation: As follows:
 - a. Exposed Individual Panel: Plus or minus 1/4 inch.
 - b. Non-Exposed Individual Panel: Plus or minus 1/2 inch.
 - c. Exposed Panel Relative to Adjacent Panel: 1/4 inch.
 - d. Non-Exposed Panel Relative to Adjacent Panel: 1/2 inch.
 - 4. Support Elevation from Nominal Support Elevation: As follows:
 - a. Maximum Low: 1/2 inch.
 - b. Maximum High: 1/4 inch.
 - 5. Maximum Plumb Variation over the Lesser of Height of Structure or 100 Feet: 1 inch.
 - 6. Plumb in Any 10 Feet of Element Height: 1/4 inch.
 - 7. Maximum Jog in Alignment of Matching Edges: 1/4 inch.
 - 8. Joint Width (Governs over Joint Taper): Plus or minus 1/4 inch.
 - 9. Maximum Joint Taper: 3/8 inch.
 - 10. Joint Taper in 10 Feet: 1/4 inch.
 - 11. Maximum Jog in Alignment of Matching Faces: 1/4 inch.
 - 12. Differential Bowing or Camber, as Erected, between Adjacent Members of Same Design: 1/4 inch.
 - 13. Opening Height between Spandrels: Plus or minus 1/4 inch.

3.4 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:

1. Erection of precast structural concrete members.
- B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- C. Visually inspect field welds and test according to ASTM E 165 or to ASTM E 709 and ASTM E 1444. High-strength bolted connections are subject to inspections.
- D. Testing agency will report test results promptly and in writing to Contractor and Architect.
- E. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.
- F. Additional testing and inspecting, at Contractor's expense, shall be performed to determine compliance of replaced or additional work with specified requirements.
- G. Prepare test and inspection reports.

3.5 REPAIRS

- A. Repair precast structural concrete units if permitted by Architect.
 1. Repairs may be permitted if structural adequacy, serviceability, durability, and appearance of units have not been impaired.
- B. Mix patching materials and repair units so cured patches blend with color, texture, and uniformity of adjacent exposed surfaces and show no apparent line of demarcation between original and repaired work, when viewed in typical daylight illumination from a distance of 20 feet.
- C. Prepare and repair damaged galvanized coatings with galvanizing repair paint according to ASTM A 780/A 780M.
- D. Wire brush, clean, and paint damaged prime-painted components with same type of shop primer.
- E. Remove and replace damaged precast structural concrete units that cannot be repaired or when repairs do not comply with requirements as determined by Architect.

3.6 CLEANING

- A. Clean mortar, plaster, fireproofing, weld slag, and other deleterious material from concrete surfaces and adjacent materials immediately.
- B. Clean exposed surfaces of precast concrete units after erection and completion of joint treatment to remove weld marks, other markings, dirt, and stains.
 1. Perform cleaning procedures, if necessary, according to precast concrete fabricator's written recommendations. Protect other work from staining or damage due to cleaning operations.
 2. Do not use cleaning materials or processes that could change the appearance of exposed concrete finishes or damage adjacent materials.
- C. Where cleaning requires water and related cleaning materials, use non-acidic cleaners approved by the precast manufacturer and water applied by low-pressure spray.

END OF SECTION 034100

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SECTION 042000 - UNIT MASONRY

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Concrete masonry units (042000.A01).
2. Clay face brick (042000.A12).
3. Concrete Lintels (042000.A09).
4. Lintels and Bond Beams
 - a. U-Shaped Masonry Lintels (042000.A10).
 - b. Knock-Out Masonry Bond Beam (042000.A11).
5. Mortar (042000.A19)
6. Grout (042000.A22).
7. Reinforcement
 - a. Steel reinforcing bars (042000.A23).
 - b. Masonry-joint reinforcement (042000.A24).
 - c. Ties and anchors.
 - d. Adjustable Masonry Veneer Anchors (042000.A26).
 - e. Rigid Anchors (042000.A27).
8. Masonry flashing materials:
 - a. Embedded Metal Flashing (042000.A30).
 - b. Drip Edge (042000.A31).
 - c. Embedded flexible through-wall flashing (042000.A32).
 - d. Single wythe CMU flashing system (042000.A33).
 - e. Termination Bars (042000.A34).
 - f. Isolation strip flashing (042000.A42).
9. Miscellaneous masonry accessories.
 - a. Compressible filler (042000.A35).
 - b. Tubular compressible filler (042000.A36).
 - c. Wicking Material/Rope Weeps (042000.A38).
 - d. Weep Vents (042000.A39).
 - e. Cavity drainage material (042000.A40).
 - f. Cavity wall insulation (042000.A45).
 - g. CMU control joint (042000.A46).

B. Products Installed but not Furnished under This Section:

1. Loose steel lintels in unit masonry.
2. Steel shelf angles for supporting unit masonry.
3. Cavity wall insulation.

C. Related Requirements:

1. Section 014000 "Quality Requirements" for independent testing agency procedures and administrative requirements.
2. Section 024119 "Selective Demolition" for salvaged brick.
3. Section 034100 "Precast Structural Concrete" for thin brick incorporated as precast facing.
4. Section 051200 "Structural Steel Framing" for installing anchor sections of adjustable masonry anchors for connecting to structural steel frame.
5. Section 055000 "Metal Fabrications" for furnishing steel lintels and shelf angles for unit masonry.
6. Section 071326 "Self Adhered Waterproofing" for additional moisture barrier product and installation requirements.
7. Section 071900 "Water Repellents and Sealers" for water repellent products applied to the unit masonry.
8. Section 072100 "Thermal Insulation" for cavity wall insulation.
9. Section 072726 "Fluid-Applied Air Barrier Coating" for air barrier and transition membrane.
10. Section 076200 "Sheet Metal Flashing and Trim" for exposed sheet metal flashing and for furnishing manufactured reglets installed in masonry joints.

1.2 DEFINITIONS

- A. CMU(s): Concrete masonry unit(s).
- B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Before installation of unit masonry, review procedures and tolerances for ensuring quality of masonry materials. Require representatives of each entity directly concerned with unit masonry to attend, including but not limited to the following:
 - a. Owner's representative
 - b. Architect and Engineer.
 - c. Contractor's superintendent.
 - d. Masonry subcontractor.
 - e. Manufacturer's representative for masonry units.
 - f. Manufacturer's representative for flashing components.
 - g. Manufacturer's representative for moisture barrier system.
 - h. Manufacturer's representative for fluid applied air barrier system.
 - 2. Review field quality control measures for the following items:
 - a. Field dimensions and tolerances for unit masonry installation.
 - b. Installation procedures for flashing components.
 - c. Review of shop drawing elevations indicating colors of unit masonry and locations.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Submit product data for cavity wall insulation concurrently with product data for cavity wall insulation air barrier coatings.
- B. Shop Drawings: For the following:
 - 1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
 - 2. Reinforcing Steel: Detail bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315. Show elevations of reinforced walls.
 - 3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.
- C. Samples for Initial Selection:
 - 1. Clay face brick, in the form of straps of five or more bricks.
 - 2. Decorative concrete masonry units, in the form of small-scale units.
 - 3. Weep holes and cavity vents.
- D. Samples for Verification: For each type and color of the following:
 - 1. Clay face brick, in the form of straps of five or more bricks.
 - 2. Special shapes for the following:
 - a. Clay face brick.
 - b. Concrete masonry units.
 - 3. Pigmented and colored-aggregate mortar. Make Samples using same sand and mortar ingredients to be used on Project.
 - 4. Adjustable veneer anchors.
 - 5. Flexible through wall flashing.
 - 6. Weep holes and cavity vents.
 - 7. Accessories embedded in masonry.

1.5 INFORMATIONAL SUBMITTALS

- A. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.
 - 1. Submittal is for information only. Neither receipt of list nor approval of mockup constitutes approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Architect and approved in writing.
- B. Qualification Data: For testing agency.
- C. Material Certificates: For each type and size of the following:
 - 1. Masonry units.
 - a. Include material test reports substantiating compliance with requirements.
 - b. For exposed brick, include test report for efflorescence according to ASTM C 67, including testing for Initial Rate of Absorption (IRA).
 - c. For concrete masonry units, include data and calculations establishing average net-area compressive strength of units.
 - d. For concrete masonry units included within fire resistant construction, provide certificate from manufacturer indicating compliance with ACI 216.1, latest edition for production of fire rated concrete masonry products.
 - 2. Cementitious materials. Include name of manufacturer, brand name, and type.
 - 3. Mortar admixtures.
 - 4. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
 - 5. Grout mixes. Include description of type and proportions of ingredients.
 - 6. Reinforcing bars.
 - 7. Joint reinforcement.
 - 8. Anchors, ties, and metal accessories.
 - 9. Flexible flashing: Include independent testing to verify the 8 mil and 32 mil requirements.
- D. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
 - 1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91/C 91M for air content.
 - 2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.
- E. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to TMS 602/ACI 530.1/ASCE 6.
- F. Grout Procedures: Detailed description of methods, materials, and equipment to be used to comply with grouting requirements.
- G. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM C 1093 for testing indicated.
- B. Mockups for Interior Walls: Build mockups to verify selections made under sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
 - 1. Build mockups for typical interior wall areas indicated on Drawings.
 - 2. Protect accepted mockups from the elements with weather-resistant membrane.
 - 3. Approval of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship.
 - a. Approval of mockups is also for other material and construction qualities specifically approved by Architect in writing.

- b. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by Architect in writing.
 - 4. Subject to compliance with requirements, approved field sample(s) may become part of the completed Work.
- C. Mockups for Exterior Walls: Build mockups to verify selections made under sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
 - 1. Build mockups for typical exterior wall areas indicated on Drawings. Mockup shall be built to dimensions as indicated on Drawings and shall include the following features.
 - a. Some areas shall utilize masonry block backup. Some areas shall utilize stud backup. Refer to Drawings for sizes and locations.
 - b. In approximately the center of each leg of mockup shall be a 3/8 inch wide sealant-filled control joint. All backup substrates shall receive fluid-applied air barrier coating.
 - c. Include fixed aluminum window openings in dimensions and locations indicated on Drawings. Include window glazing and all accessories. Seal perimeter of window at head, sill and one jamb, leaving one jamb open for observation.
 - d. Include through-wall flashing installed for full length of all legs of mockup.
 - e. Include cavity insulation, veneer anchors, flashing, cavity drainage material, and weep holes and rope weeps (as applicable) in exterior masonry-veneer wall mockup.
 - f. Include each type of metal wall panel and composite metal wall panel.
 - 2. Clean one-half of exposed faces of mockups with masonry cleaner as indicated.
 - 3. Protect accepted mockups from the elements with weather-resistant membrane.
 - 4. Approval of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship.
 - a. Approval of mockups is also for other material and construction qualities specifically approved by Architect in writing.
 - b. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by Architect in writing.
 - 5. Demolish and legally dispose of mockup after date established for Substantial Completion.
 - 6. Mockup shall be tested under AAMA 501.2 (Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems.)

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
- B. Deliver preblended, dry mortar mix in moisture-resistant containers designed for use with dispensing silos. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in covered weatherproof dispensing silos.
- C. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.8 FIELD CONDITIONS

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
 - 1. Extend cover a minimum of 24 inches down both sides of walls, and hold cover securely in place.
 - 2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe, and hold cover in place.
- B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.
- C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
 - 1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
 - 2. Protect sills, ledges, and projections from mortar droppings.

3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
 4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
- D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 402/602-16.
1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.
- E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 402/602-16.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.
- B. Source Limitations for Face Brick: Obtain exposed face brick of a uniform texture, color and size, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.
 1. Provide Thin Brick from same source as Face Brick.
- C. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

2.2 PERFORMANCE REQUIREMENTS

- A. Provide structural unit masonry that develops indicated net-area compressive strengths at 28 days.
 1. Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to TMS 402/602-16.

2.3 UNIT MASONRY, GENERAL

- A. Masonry Standard: Comply with TMS 402/602-16, except as modified by requirements in the Contract Documents.
- B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work.
- C. Fire-Resistance Ratings: Comply with requirements for fire-resistance-rated assembly designs indicated as determined by testing according to ASTM E119, by equivalent masonry thickness, or by other means, as acceptable to authorities having jurisdiction.
 1. Where fire-resistance-rated construction is indicated, units shall be listed by a qualified testing agency acceptable to authorities having jurisdiction. Documentation of listing and sourcing shall be provided by manufacturer to Owner and Architect.

2.4 CONCRETE MASONRY UNITS

- A. Regional Materials: CMUs shall be manufactured within 500 miles of Project site from aggregates and cement that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.
- B. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.

1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
 2. Provide bullnose units for outside corners unless otherwise indicated.
 - a. At areas indicated to receive tile as the finish surface use a non-bullnose unit at outside corners.
 3. Provide double bullnose units for tops of walls as indicated.
- C. CMUs (042000.A01): ASTM C 90.
1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2650 psi.
 2. Density Classification: Lightweight.
 3. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.
 4. Fire Resistance: Concrete masonry units within fire rated wall construction shall be produced in accordance with ACI 216.1, latest edition.

2.5 CONCRETE LINTEL

- A. Concrete Lintels (042000.A09): ASTM C 1623, matching CMUs in color, texture, and density classification; and with reinforcing bars indicated.
- B. Concrete Lintels (042000.A09): Precast or formed-in-place concrete lintels complying with ASTM C 1623 with requirements in Section 033000 "Cast-in-Place Concrete," and with reinforcing bars indicated.

2.6 MASONRY LINTELS AND BOND BEAMS

- A. U-Shaped Masonry Lintels (042000.A10): Prefabricated (site cast) or built-in-place masonry lintels made from U-shaped lintel CMUs matching adjacent CMUs in color, texture, and density classification, with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.
- B. Knock-Out Masonry Bond Beams (042000.A11): Prefabricated (site cast) or built-in-place masonry bond beams made from U-shaped bond beam CMUs matching adjacent CMUs in color, texture, and density classification, with reinforcing bars placed as indicated and filled with coarse grout.

2.7 BRICK

- A. Regional Materials: Brick shall be manufactured within 500 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.
- B. General: Provide shapes indicated and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units:
 1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
 2. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.
 3. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.
 4. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.
- C. Face Brick (042000.A12 - UM21): Facing brick complying with ASTM C 216.
 1. Grade: SW.
 2. Type: TBX.
 3. Unit Compressive Strength: Provide units with minimum average net-area compressive strength as follows:
 - a. 10,000 psi.
 - b. Match existing compressive strength of existing installed adjacent brick as determined by Architect and Contractor, verified by manufacturer and Contractor's field testing data.
 4. Initial Rate of Absorption:
 - a. Less than 30 g/30 sq. in. per minute when tested according to ASTM C 67.
 5. Saturation Coefficient:
 - a. Less than 3% when tested according to ASTM C 1088.

6. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
7. Size (Actual Dimensions):
 - a. Modular: 3-5/8 inches wide by 2-1/4 inches high by 7-5/8 inches long.
 - b. Match existing brick at project site as determined by Architect and Owner.
8. Application: Use where brick is exposed unless otherwise indicated.
9. Color and Texture: Refer to the Exterior Material Legend on the drawings..

2.8 MORTAR (042000.A19) AND GROUT (042000.A22) MATERIALS

- A. Regional Materials: Aggregate for mortar and grout shall be manufactured within 100 miles (160 km) of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 100 miles (160 km) of Project site.
- B. Portland Cement: ASTM C 150/C 150M, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
 1. Alkali content shall not be more than 0.1 percent when tested according to ASTM C 114.
- C. Hydrated Lime: ASTM C 207, Type S.
- D. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.
- E. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C 979/C 979M. Use only pigments with a record of satisfactory performance in masonry mortar.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Davis Colors; True Tone Mortar Colors.
 - b. Lanxess Corporation; Bayferrox Iron Oxide Pigments.
 - c. Solomon Colors, Inc.; SGS Mortar Colors.
 2. Color:
 - a. As selected by Architect from manufacturer's full range of available colors.
 3. Location: Refer to Mortar and Grout Mixes in Part 3 of this Section.
- F. Aggregate for Mortar: ASTM C 144.
 1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
 2. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.
- G. Aggregate for Grout: ASTM C 404.
- H. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
- I. Water: Potable.

2.9 REINFORCEMENT

- A. Uncoated-Steel Reinforcing Bars (042000.A23): ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60.
- B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to hold reinforcing bars in center of cells. Units are formed from 0.148-inch steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.
- C. Masonry-Joint Reinforcement, General (042000.A24): ASTM A 951/A 951M.
 1. Interior Walls: Hot-dip galvanized carbon steel, Class B-2.
 2. Exterior Walls: Hot-dip galvanized carbon steel, Class B-2.
 3. Wire Size for Side Rods: 0.148-inch diameter.
 4. Wire Size for Cross Rods: 0.148-inch diameter.
 5. Wire Size for Veneer Ties: 0.148-inch diameter.
 6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.

7. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.
- D. Masonry-Joint Reinforcement for Multiwythe Masonry:
1. Adjustable (two-piece) type, ladder design, with one side rod at each face shell of backing wythe and with separate adjustable ties with pintle-and-eye connections having a maximum horizontal play of 1/16 inch and maximum vertical adjustment of 1-1/4 inches. Size ties to extend at least halfway through facing wythe but with at least 5/8-inch cover on outside face.
 - a. At Contractor's option, masonry joint reinforcement for single-wythe masonry may be used in backup wythe in conjunction with individual adjustable masonry veneer anchors for exterior wythe.

2.10 TIES AND ANCHORS

- A. General: Ties and anchors shall extend at least 1-1/2 inches into veneer but with at least a 5/8-inch cover on outside face.
- B. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:
1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M, with ASTM A 153/A 153M, Class B-2 coating.
 2. Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, with ASTM A 153/A 153M, Class B coating.
 3. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- C. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch-diameter, hot-dip galvanized steel wire.
 2. Tie Section: Triangular-shaped wire tie made from 0.25-inch- diameter, hot-dip galvanized steel wire, Class B-2.
- D. Adjustable Anchors for Connecting to Concrete: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
1. Use adjustable masonry veneer anchors specified later in this Section.
- E. Partition Top Anchors: 0.105-inch-thick metal plate with a 3/8-inch-diameter metal rod 6 inches long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication.
- F. Rigid Anchors: Fabricate from steel bars 1-1/2 inches wide by 1/4 inch thick by 24 inches long, with ends turned up 2 inches or with cross pins unless otherwise indicated.
1. Corrosion Protection: Hot-dip galvanized to comply with ASTM A 153/A 153M.
- G. Adjustable Masonry-Veneer Anchors (042000.A26):
1. General: Provide anchors that allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall, for attachment over sheathing to metal studs, and as follows:
 - a. Structural Performance Characteristics: Capable of withstanding a 100-lbf load in both tension and compression without deforming or developing play in excess of 0.05 inch.
 2. Provide anchors designed for attachment over sheathing to metal studs and other substrates indicated.
 3. Fabricate sheet metal anchor sections and other sheet metal parts from 0.075-inch-thick steel sheet, galvanized after fabrication.
 4. Wire Ties: Fabricate ties from 0.187-inch- diameter, hot-dip galvanized-steel wire unless otherwise indicated.
 - a. Wire ties shall be triangular-, or rectangular-shaped.
 5. Masonry-Veneer Anchors - Contractor's Option: Unless otherwise indicated, provide one of the adjustable masonry-veneer anchors specified.
 - a. Screw-Attached, Masonry-Veneer Anchors: Units consisting of a wire tie, a metal anchor section and insulation support plate. Provide one of the following anchor sections for masonry backup and metal stud with sheathing:
 - 1) Provide "CTP-16" adjustable masonry veneer anchors with insulation support plate as manufactured by Construction Tie Products, Inc.
 - 2) Provide "Slotted Rap-Tie" masonry veneer anchors with insulation support plate as manufactured by FERRO Corporation.
 - b. Fabricate sheet metal anchors sections and other sheet metal parts from 0.075 inch thick, steel sheet, galvanized after fabrication.

6. Polymer-Coated, Steel Drill Screws for Steel Studs: ASTM C 954 except manufactured with hex washer head and neoprene or EPDM washer, No. 10 diameter by length required to penetrate steel stud flange with not less than three exposed threads, and with organic polymer coating with salt-spray resistance to red rust of more than 800 hours according to ASTM B 117.
7. Steel Tapping Screws for Concrete and Masonry: Self-tapping screws tapcon with specially designed threads for tapping and wedging into masonry, with hex washer head and neoprene washer, 3/16" diameter by 1-1/2" length, and with the following corrosion-protective coating:
 - a. Organic polymer coating with salt-spray resistance to red rust of more than 500 hours per ASTM B 117.

2.11 MISCELLANEOUS ANCHORS

- A. Unit Type Inserts in Concrete: Cast-iron or malleable-iron wedge-type inserts.
- B. Anchor Bolts: L-shaped steel bolts complying with ASTM A307, Grade A (ASTM 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and , where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153/A 153M, Class C; of dimensions indicated.
- C. Postinstalled Anchors: Torque-controlled expansion anchors or chemical anchors.
 1. Load Capacity: Capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
 2. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F1941 (ASTM F1941M), Class Fe/Zn 5 unless otherwise indicated.
 3. Material for Exterior Locations and Where Stainless Steel is Indicated: Alloy Group 1 (A1) stainless-steel bolts, ASTM F 593 (ASTM F738M) and nuts, ASTM F594 (ASTM F836M).
- D. Stainless Steel Dowels: ASTM A 276 or ASTM A666, Type 304, 1/2 inch diameter and not less than 5 inches long to provide at least 2 inch embedment in to adjoining units/substrates.

2.12 EMBEDDED FLASHING MATERIALS

- A. Embedded Metal Flashing (042000.A30):
 1. Stainless Steel: ASTM A 240/A 240M, Type 304:
 - a. 26 gage for backing plate at butt laps.
 - b. 22 gage for receiver flashing and metal sealant stop.
 2. Fabricate continuous flashings in sections 96 inches long minimum, but not exceeding 12 feet.
 3. Adhesive to adhere stainless steel flashing to top of lintel or substrate.
 4. Silicone sealant between stainless steel flashing at butt-laps.
- B. Flexible Flashing (042000.A32):
 1. Rubberized Asphalt Flashing: Composite flashing product consisting of a pliable, adhesive.
 - a. Composite Sheet: Flashing shall be 40 mils in nominal thickness, consisting of 32 mil self-adhering rubberized asphalt membrane laminated to an 8 mil, cross-laminated and high-density polyethylene film.
 - b. Basis-of-Design Product: Subject to compliance with requirements, provide one of the products listed below or comparable product from other manufacturers, meeting specified requirements, submitted to and accepted by Architect prior to bidding.
 - 1) Acceptable Manufacturers and Products:
 - (a) Carlisle Coatings and Waterproofing; CCW-705-TWF.
 - (b) Henry; Blueskin TWF.
 - (c) Firestone Building Products; Enverge Flashgard.
 - (d) Grace Construction; Perm-A-Barrier Wall Flashing.
 - 2) Fire Propagation Characteristics: Flexible strip flashing is used in exterior walls
 - 3) Flexible flashing shall pass NFPA 285 testing as part of an approved assembly. Flashing shall be compatible with air barrier coating specified in Section 072729.
 - c. Accessories: Provide preformed corners, end dams, other special shapes, and seaming materials produced by flashing manufacturer.
- C. Application: Unless otherwise indicated, use the following:

1. For through-wall flashing, use flexible flashing to exterior face of exterior wythe, adhere flexible flashing to top of metal drip edge. Adhere stainless steel drip edges to masonry, steel lintels and adjacent construction beneath drip edge as occurs.
- D. Accessories for Flexible Flashing:
1. Drip Edges (042000.A31): Provide stainless steel drip edges fabricated from ASTM A 240/A 240M, Type 304, not less than 0.016 inch thick. Fabricate drip edges with a 2-1/2 inch minimum flange and a 3/8 inch drip. All exposed corners shall be welded and the edge rounded. Mitering of outside corners will not be accepted.
 - a. Termination Drip Edges at Steel Lintels and Shelf Angles: Provide stainless steel drip edges fabricated to configuration indicated from ASTM A 240/A 240M, Type 304, not less than 0.016 inch thick. Stainless steel flashing shall be preformed to wrap around exposed portion of steel lintels and shelf angles and provide a drip edge.
 2. Termination Bars (042000.A34): Provide stainless steel or aluminum bars; 1/8 inch thick with a 1 inch face and 1/4 inch minimum bent top (lip) to receive sealant and 8'-0" to 10'-0" length. Bars shall be predrilled at 8 inch centers starting 4 inch from each end.
 - a. Termination bars shall be similar to Wire-Bond, Model 4210.
 3. Adhesives: Provide adhesives as recommended by flexible flashing manufacturer for adhering flexible flashing to drip edge and adhering drip edge to supporting substrate.
- E. Solder and Sealants for Sheet Metal Flashings:
1. Solder for Stainless Steel: ASTM B 32, Grade Sn60, with acid flux of type recommended by stainless-steel sheet manufacturer.
 2. Elastomeric Sealant: ASTM C 920, chemically curing urethane or polysulfide sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and remain watertight.
- F. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.
- G. Moisture Barrier:
1. Refer to Section 071326 "Self Adhered Sheet Waterproofing" for additional moisture barrier system product and installation requirements.

2.13 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler (042000.A35): Premolded filler strips, compressible up to 50 percent; of width and thickness indicated; formulated from neoprene or urethane.
1. Synthetic Foam complying with ASTM D 5249, Type 2; of width and thickness indicated.
 - a. Basis of Design Product: W.R. Meadows; "Ceramair".
 2. Neoprene complying with ASTM D 1056, Grade 2A1; of width and thickness indicated.
 - a. Basis of Design Product: Hohmann & Barnard, "NS Closed Cell Neoprene Sponge".
 3. Thickness:
 - a. Jambs 3/8 inch.
 - b. Expansion Joints: 1/2 inch.
 4. Width:
 - a. Expansion joints above base flashing: 3 inches, held back 1 inch.
 - b. Expansion joints below base flashing: 6 inches, held back 1 inch.
 - c. Jambs: 4 inches, unless otherwise indicated..
- B. Tubular Compressible Fillers (042000.A36): Pre-molded, neoprene, butyl, EPDM or silicone tubing complying with ASTM D1056, non-absorbent to water and gas, capable of remaining resilient at temperatures down to 26 deg. F. Provide products with low compression set and of shapes and sizes as follows:
1. Outside diameter shall be 1/4 inch greater than air cavity between face brick and backup construction.
 2. Basis of Design Product: Subject to compliance with requirements, provide "Insul-Tube" by Namoco K-Flex.
- C. Bond-Breaker Strips: Asphalt-saturated felt complying with ASTM D 226/D 226M, Type I (No. 15 asphalt felt).
- D. Weep/Cavity Vent Products: Use one of the following unless otherwise indicated:
1. Wicking Material/Rope Weeps (042000.A38): Absorbent rope, made from cotton, 1/4 to 3/8 inch in diameter, in length required to produce 2-inch exposure on exterior and 18 inches in cavity. Use only for weeps.

2. Mesh Weep/Vent (042000.A39): Free-draining mesh; made from polyethylene strands, full height and width of head joint and depth 1/8 inch less than depth of outer wythe; in color selected from manufacturer's standard.
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) Mortar Net USA, Ltd.; Mortar Net Weep Vents.
 - 2) CavClear/Archovations, Inc.: CavClear Weep Vents.
 - 3) Hohmann & Barnard, Inc.: Mortar Trap Weep Vents.
 - b. Size: Weep shall be sized for full vertical dimension of masonry units indicated.
- E. Cavity Drainage Material (042000.A40): Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.
 1. Products: Subject to compliance with requirements, provide the following:
 - a. Mortar Net USA, Ltd.; "Wall Defender".
 - b. Mortar Net Solutions; "MortarNet with Insect Barrier".
 - c. Comparable products from other manufactures submitted to and accepted by Architect prior to bidding will be considered.
 2. Thickness: 2 inches.
 3. Configuration: Provide the following:
 - a. Strips, full depth of cavity and 10 inches high, with dovetail-shaped notches 7 inches deep that prevent clogging with mortar droppings.
- F. Isolation Strip Flashing (042000.A42): Provide self-adhering, polyethylene-sheet backed rubberized asphalt membrane, 40 mils thick.
 1. Available Products: Subject to compliance with requirements, products that may be incorporated in the work included, but are not limited to, the following:
 - a. Air-Shield by W. R. Meadows, Inc.
 - b. Blueskin by Henry Corp.
 - c. CCW 705 by Carlisle Coatings & Waterproofing.
 - d. Hyload S/A Through Wall Flashing by Hyload, Inc.

2.14 CAVITY-WALL INSULATION (042000.A45)

- A. Polyisocyanurate Board Insulation: Refer to Section 072100 for requirements.
 1. Provide behind steel lintels prior to installation of through-wall flashing and at other locations where indicated. Shape to configurations shown.

2.15 MASONRY CLEANERS

- A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned. Do not use acidic cleaners on manufactured stone masonry.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Diedrich Technologies, Inc.
 - b. EaCo Chem, Inc.
 - c. ProSoCo, Inc.

2.16 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
 1. Do not use calcium chloride in mortar or grout.
 2. Use portland cement-lime mortar unless otherwise indicated.
 3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.
- B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

- C. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated.
 - 1. For masonry below grade or in contact with earth, use Type S.
 - 2. For reinforced masonry, use Type S.
 - 3. For mortar parge coats, use Type S or Type N.
 - 4. For exterior, above-grade, load-bearing and nonload-bearing walls and parapet walls, use Type S.
 - 5. For interior load-bearing walls, use Type S.
 - 6. For interior nonload-bearing partitions, use Type N.
 - 7. For exterior masonry veneer, use Type N.
 - 8. For other applications where another type is not indicated, use Type N.
- D. Pigmented Mortar: Use colored cement product or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products].
 - 1. Pigments shall not exceed 10 percent of portland cement by weight.
 - 2. Mix to match Architect's sample.
 - 3. Application: Use pigmented mortar for exposed mortar joints with the following units:
 - a. Concrete face brick.
 - b. Clay face brick.
- E. Grout for Unit Masonry: Comply with ASTM C 476.
 - 1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 602/ACI 530.1/ASCE 6 for dimensions of grout spaces and pour height.
 - 2. Proportion grout in accordance with ASTM C 476, Table 1 or paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 3000 psi.
 - 3. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143/C 143M.

2.17 MATERIALS FOR CLEANING OF EXISTING MASONRY

- A. General: Cleaning methods are to be tested on field sample mockup areas and are to progress from least harsh (bucket and brush) method to more harsh (chemical cleaning) methods.
- B. Water for Cleaning: Clean, potable, free of oils, acids, alkalis, salts, and organic matter.
- C. Warm Water: Heat water to temperature of 140 deg F-180 deg F (60 deg C-82 deg C).
- D. Brushes: Fiber bristle only.
- E. Brick Cleaner: Manufacturer's alkaline masonry cleaner.
 - 1. Product: Subject to compliance with requirements, provide one of the following:
 - a. Enviro Klean "ReKlaim" cleaner and Sure Klean "Limestone and Masonry Afterwash", both as manufactured by ProSoCo, Inc.
 - 1) For mold and mildew removal, provide Enviro Klean "ReVive" by ProSoCo.
 - b. Diedrich Chemicals; comparable product.
- F. Protective Film: For windows, glass, metal and polished stone surfaces during acidic and alkaline masonry cleaning, use self-adhesive, translucent polyethylene protective film.
 - 1. Products: 3M Long-mask Masking Tape #2090 and the self-adhesive, thin, window protection film by 3M, 3M Protective Tape 2A26B. Catalog No. RM2090, 24" or 35" side.
- G. Spray Equipment: Provide equipment for controlled spray application of water and chemical cleaners, if any, at rates indicated for pressure, measured at spray tip, and for volume.
 - 1. For spray application of chemical cleaners provide low-pressure tank or chemical pump suitable for chemical cleaner indicated, equipped with cone-shaped spray-tip.
 - 2. For spray application of water provide fan-shaped spray-tip which disperses water at angle of not less than 45 degrees.
- H. Chemical Cleaning Solutions:
 - 1. When recommended by chemical cleaner manufacturer, dilute chemical cleaning materials with water to produce solutions of concentration indicated but not greater than that recommended by chemical cleaner manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 - 1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
 - 2. Verify that foundations are within tolerances specified.
 - 3. Verify that reinforcing dowels are properly placed.
 - 4. Verify that substrates are free of substances that impair mortar bond.
 - 5. Verify that fluid applied air barrier and bellows are complete.
- B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build singlewythe walls to actual widths of masonry units, using units of widths indicated.
- B. Build chases and recesses to accommodate items specified in this and other Sections.
- C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match construction immediately adjacent to opening.
- D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
- E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.
- F. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested according to ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.
- G. Do not lay units containing with surface chips larger than a nickel.
- H. Coordination with Spray-Applied Membrane Air Barrier Coating: Adjustable veneer anchors shall be installed after to application of air barrier.
- I. Fluid Applied Air Barrier Requirements: This project will have fluid-applied Air Barrier material applied to the cavity side of the CMU. Special attention and care must be taken to provide a smooth, filled surface to receive the membrane. The care is necessary to insure the design performance of the selected materials. Concrete masonry unit (CMU) wall shall be prepared as follows to accept the air & vapor barrier:
 - 1. Surfaces shall be free of contaminants such as grease, oil and wax on surfaces to receive membrane.
 - 2. CMU surfaces shall be free from projections.
 - 3. Strike all mortar joints flush to the face of the concrete block.
 - 4. Fill all voids and holes greater than 1/4 inch across at any point with mortar, sealant or other approved fill material.
 - 5. Surface irregularities exceeding 1/4 inch in height or sharp to touch shall be ground flush or made smooth.
 - 6. Fill around all penetrations with mortar, sealant or other approved fill material and strike flush.
 - 7. Remove mortar droppings on brick ties, shelf angles, brick shelves or other horizontal obstructions.

3.3 TOLERANCES

- A. Dimensions and Locations of Elements:
 - 1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch or minus 1/4 inch.
 - 2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch.
 - 3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.
- B. Lines and Levels:
 - 1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 feet, or 1/2-inch maximum.
 - 2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.
 - 3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.
 - 4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.
 - 5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.
 - 6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet or 1/2-inch maximum.
 - 7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.
- C. Joints:
 - 1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
 - 2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
 - 3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
 - 4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.
 - 5. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch from one masonry unit to the next.

3.4 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in bond pattern indicated on Drawings; do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.
 - 1. Bond pattern refer to Exterio Material Legend.
- C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4 inches. Bond and interlock each course of each wythe at corners. Do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.
- D. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.
- E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.
- G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below, and rod mortar or grout into core.

- H. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.
 - 1. Fill cores in exterior masonry veneer and hollow CMUs with grout or mortar under through-wall flashing.
 - 2. Fill base of wall between exterior masonry veneer and CMUs (collar joint) with grout as indicated and apply mortar across top if insulation and grout to form a mortar wash directly beneath horizontal leg of through-wall flashing.
- I. Build nonload-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.
 - 1. Install compressible filler in joint between top of partition and underside of structure above.
 - 2. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide 1/2-inch clearance between end of anchor rod and end of tube. Space anchors 48 inches o.c. unless otherwise indicated.
 - 3. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Section 078446 "Fire-Resistive Joint Systems."

3.5 MORTAR BEDDING AND JOINTING

- A. Lay hollow brick and CMUs as follows:
 - 1. Fully bed face shells in mortar and make head joints of depth equal to bed joints.
 - 2. Fully bed webs in mortar in all courses of piers, columns, and pilasters.
 - 3. Fully bed webs in mortar in grouted masonry, including starting course on footings.
 - 4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.
 - 5. Fully bed units and fill cells with mortar at anchors and ties as needed to fully embed anchors and ties in mortar.
 - 6. For concrete unit masonry at window infills, provide horizontal joint reinforcement at 16 inches on center vertically starting at 8 inches above bottom of opening. Provide mesh ties secured to sides of existing opening, spaced vertically to match horizontal joint reinforcing.
- B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
- C. Exposed Joints: Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
- D. Covered Joints: Cut joints flush where indicated to receive the following finishes unless otherwise indicated.
 - 1. Strike mortar joints flush in exterior face of CMU walls that receive finishes noted below to provide smooth trowel-cut mortar joints, struck full and flush.
 - a. Fill all voids and holes, particularly in the mortar joints by striking joint flush.
 - b. Mortar joints shall be free of voids exceeding 1/4 inch across.
 - 2. Finishes:
 - a. Waterproofing
 - b. Moisture Barrier.
 - c. Cavity wall insulation
 - d. Fluid applied air barriers

3.6 CAVITY WALLS

- A. Bond wythes of cavity walls together using one of the following methods:
 - 1. Where air/moisture barrier is integral with exterior wall sheathing, use adjustable-type (two-piece-type) ties.
 - 2. Individual Metal Ties: Provide ties as shown installed in horizontal joints, but not less than one metal tie for 2.0 sq. ft. of wall area spaced not to exceed 16 inches o.c. horizontally and 16 inches o.c. vertically. Provide additional ties within 12 inches of openings and space not more than 36 inches apart around perimeter of openings. At intersecting and abutting walls, provide ties at no more than 24 inches o.c. vertically.
 - a. Use adjustable-type (two-piece-type) ties.
 - b. At base of wall, within 12 inches of horizontal leg of through-wall flashing, provide adjustable veneer anchors. Install in joint indicated and space at 32 inches o.c.
 - c. Install additional anchors within 12 inches of openings, expansion joints, corners and similar conditions, and at intervals, not exceeding 8 inches, around perimeter.

- d. Provide additional anchors as needed where tie spacing is not sufficient to maintain 16 inch on center spacing each way.
 - e. Provide additional anchors one course below base flashing to hold veneer wythe below flashing during grouting. Space anchors at 24 inches on center horizontally, maximum.
 - 3. Masonry-Joint Reinforcement: Installed in horizontal mortar joints.
 - a. Use adjustable-type (two-piece-type with eyelets and pintles) reinforcement to allow for differential movement regardless of whether bed joints align.
 - b. Provide additional individual adjustable anchors as needed where tie spacing is not sufficient to maintain 16 inch on center spacing each way and as follows:
 - 1) At base of wall, within 12 inches of horizontal leg of through-wall flashing, provide adjustable veneer anchors. Install in joint indicated and space at 32 inches o.c.
 - 2) Install additional anchors within 12 inches of openings, expansion joints, corners and similar conditions, and at intervals, not exceeding 8 inches, around perimeter.
 - 3) Provide additional anchors one course below base flashing to hold veneer wythe below flashing during grouting. Space anchors at 24 inches on center horizontally, maximum.
 - 4. Masonry-Veneer Anchors: Comply with requirements for anchoring masonry veneers.
- B. Keep cavities clean of mortar droppings and other materials during construction. Bevel beds away from cavity, to minimize mortar protrusions into cavity. Do not attempt to trowel or remove mortar fins protruding into cavity.

3.7 ANCHORED MASONRY VENEERS

- A. Anchor masonry veneers to wall framing and concrete and masonry backup with masonry-veneer anchors to comply with the following requirements:
 - 1. General: Place adjustable masonry veneer anchors prior to application of spray-applied air barrier.
 - 2. Fasten screw-attached anchors through sheathing to wall framing and to concrete and masonry backup with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.
 - 3. Embed tie sections in masonry joints. Provide not less than 2 inches of air space between back of masonry veneer and backup substrate.
 - 4. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
 - 5. Space anchors as indicated, but not more than 16 inches o.c. vertically and 16 inches o.c. horizontally, with not less than 1 anchor for each 2 sq. ft. of wall area. Install additional anchors within 12 inches of openings, expansion joints, corners and similar conditions, and at intervals, not exceeding 8 inches, around perimeter.
 - a. Provide additional anchors as needed where tie spacing is not sufficient to maintain 16 inch on center spacing each way.
 - b. Provide additional anchors within 12 inches above horizontal leg of through-wall flashing and lintel flashing. Space anchors at intervals of 32 inches horizontally.
 - c. Provide additional anchors one course below base flashing to hold veneer wythe below flashing during grouting. Space anchors at 24 inches on center horizontally, maximum.
- B. Anchor masonry veneers to wall framing and concrete and masonry backup with masonry-veneer anchors to comply with the following requirements:
- C. Provide not less than 1-3/4 inch of airspace between back of masonry veneer and face of insulation.
 - 1. Keep airspace clean of mortar droppings and other materials during construction. Bevel beds away from airspace, to minimize mortar protrusions into airspace. Do not attempt to trowel or remove mortar fins protruding into airspace.

3.8 CAVITY-WALL INSULATION

- A. Installing Cavity Wall Insulation: Place insulation over veneer anchors and push anchors through insulation and tight against backup. or attach with plastic fasteners designed for this purpose. Fit courses of insulation between wall ties and other confining obstructions in cavity, with edges butted tightly both ways. Press units firmly against inside wythe of masonry or other construction as shown.
 - 1. Fill cracks and open gaps in insulation with crack sealer compatible with insulation and masonry.
 - 2. Rigid Insulation:
 - a. Below Base Flashing (through wall flashing):
 - 1) Install anchors over moisture barrier.
 - 2) Push rigid insulation over anchors to hold it in place prior to laying veneer.
 - b. Above Base Flashing (through wall flashing):

- 1) Cut strip to fit size of first course gap above mortar wash.

3.9 MASONRY-JOINT REINFORCEMENT

- A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.
 1. Space reinforcement not more than 16 inches o.c.
 2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
 3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings in addition to continuous reinforcement.
- B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.
- C. Provide continuity at wall intersections by using prefabricated T-shaped units or provide rigid anchors.
- D. Provide continuity at corners by using prefabricated L-shaped units or provide rigid anchors.

3.10 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

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

3.11 CONTROL AND EXPANSION JOINTS

- A. General: Install control- and expansion-joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.
- B. Form control joints in concrete masonry as follows (042000.A46):
 1. At 4-hour fire-rated walls, fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout and rake out joints in exposed faces for application of sealant.
 2. At 2-hour fire-rated walls, install sash block on each side of joint, install preformed gasket, rake back mortar to allow for installation of backer rod and sealant, or install square-end block on each side of joint, fill head joint between block with ceramic fiber felt, rake back mortar to allow for installation of backer rod and sealant.
 3. At non-fire-rated walls, install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete for application of sealant.
- C. Form expansion joints in brick as follows (042000.A47):
 1. Build in compressible joint fillers where indicated.
 2. Form open joint full depth of brick wythe and of width indicated, but not less than 1/2 inch for installation of compressible filler and, sealant and backer rod specified in Section 079200 "Joint Sealants."
- D. Provide horizontal, pressure-relieving joints (042000.A48) by either leaving an airspace or inserting a compressible filler of width required for installing sealant and backer rod specified in Section 079200 "Joint Sealants," but not less than 3/8 inch.
 1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

3.12 LINTELS

- A. Install steel lintels where indicated.
- B. Provide masonry lintels where shown and where openings of more than 12 inches for brick-size units and 24 inches for block-size units are shown without structural steel or other supporting lintels.
- C. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

3.13 FLASHING, WEEP HOLES, CAVITY VENTS AND CAVITY DRAINAGE

- A. General:
 - 1. Install embedded flashing, weep holes and cavity drainage material in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.
 - 2. Install cavity vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities, and where indicated.
- B. Install flashing as follows unless otherwise indicated:
 - 1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar (creating a "mortar wash" sloping towards exterior face of wall) and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
 - a. Where flashing is within air cavity, place through-wall flashing on sloping bed of mortar (creating a "mortar wash").
 - b. At bases of walls, where flashing abuts a vertical obstruction such as hollow metal frame, aluminum frame, etc., place through-wall flashing on sloping bed of mortar (creating a "mortar wash") to slope away from obstruction for 4 inches.
 - 2. At multiwythe masonry walls, including cavity walls, provide through wall flashing with stainless steel drip edge. Continuously adhere drip edge to supporting substrate and then adhere through wall flashing to drip edge. Extend flashing from exterior face of outer wythe, through outer wythe, across airspace and over mortar wash, turned up not less than 16 inches onto backup substrate. Securely fasten top of flashing to backup substrate with continuous termination bars. Anchor termination bars to backup substrate and seal top of termination bar watertight.
 - a. Where through-wall flashing abuts vertical obstructions and becomes discontinuous, turn up not less than 2 inches to form end dams and seal watertight to adjacent construction and trim flush with exterior face of masonry.
 - 3. At masonry-veneer walls, provide through wall flashing with stainless steel drip edge. Continuously adhere drip edge to veneer and then adhere through wall flashing to drip edge. Extend flashing through veneer, across airspace behind veneer and over mortar wash, turned up not less than 16 inches onto backup substrate (sheathing, concrete, etc). Overlap through wall flashing to-air barrier, lapping at least 4 inches, unless otherwise indicated. Securely fasten top of flashing to backup substrate with continuous termination bars. Anchor termination bars to backup substrate and seal top of termination bar watertight.
 - a. Where through-wall flashing abuts vertical obstructions and becomes discontinuous, turn up not less than 2 inches to form end dams and seal watertight to adjacent construction and trim flush with exterior face of masonry.
 - 4. At lintels and shelf angles, extend flashing a minimum of 8 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams. Extend flashing up exterior face of backup substrate not less than 16 inches and terminate with terminations bars and sealant as previously specified. Trim flashing at end dams flush to exterior brick face.
 - 5. Drip Edges: Provide metal drip edges beneath flexible flashing (through wall flashing) at exterior face of wall at all locations where through-wall flashing extends to exterior. Extend 1/2 inch beyond exterior face of outer wythe and pre-bend to form a drip.
 - a. Adhered stainless steel drip edge to lintel and adhered to flexible through-wall flashing on top of drip edge, overlapping 1-1/2 inches, minimum. Through wall flashing shall be held back from exterior face of masonry 1/2 inch.
 - 6. Termination Drip Edging: Provide stainless steel termination drip edging over exposed exterior flanges of lintels.
 - 7. Cores: Fill cores in masonry below flexible through-wall flashing with mortar.
 - 8. Cut exposed vertical edges of flexible flashing end dams off flush with face of wall after mortar is set.
 - 9. Cut flexible flashing off flush with face of wall after masonry wall construction is completed.
- C. Install counterflashing receivers and nailers for flashing and other related construction where they are shown to be built into masonry.
 - 1. Fill cavity behind veneer with insulation as required to support mortar wash.
 - 2. Install receiver with back down leg tight to brick.
 - 3. Form mortar wash starting at back of brick and slope upward 1/2 inch at backup wall.
 - 4. Install windowsill receiver (pan) starting at back of window line.
- D. Install weep holes/cavity vents in exterior wythes and veneers at head joints of first course of masonry immediately above embedded flashing.
 - 1. Use specified weep/cavity vent products to form weep holes.

2. Use wicking material to form weep holes above flashing under brick sills. Turn wicking down at lip of sill to be as inconspicuous as possible.
 3. Space weep holes/cavity vents at 24 inches o.c. unless otherwise indicated.
 4. Space weep holes formed from wicking material 16 inches o.c.
 5. Trim wicking material flush with outside face of wall after mortar has set.
- E. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.
- F. Install cavity vents in head joints in exterior wythes at 24 inches on center. Use specified weep/cavity vent products to form cavity vents.

3.14 MOISTURE BARRIER

- A. Refer to Section 071326 "Self Adhered Sheet Waterproofing" for additional moisture barrier system installation requirements.
- B. Prepare masonry surface so they are smooth and free from projections that could puncture moisture barrier.
- C. Prime CMU wall surface then install moisture barrier.
- D. Roll entire surface then seal all lap seams with mastic.
- E. Schedule work so moisture barrier is not exposed to UV more than 30 days or protect from UV.

3.15 REINFORCED UNIT MASONRY INSTALLATION

- A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
 1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
 2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and that of other loads that may be placed on them during construction.
- B. Placing Reinforcement: Comply with requirements in TMS 602/ACI 530.1/ASCE 6.
- C. Grouting:
 1. Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
 2. Comply with requirements in TMS 602/ACI 530.1/ASCE 6 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
 3. Do not reconsolidate self-consolidating grout.
 4. Limit height of vertical grout pours to not more than 60 inches.

3.16 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.
- B. Inspections: Special inspections according to TMS 402/ACI 530/ASCE 5 as follows:
- C. Inspections: Special inspections according to TMS 402/602-16 as follows:
 1. Level "2" for all areas except High Wind Areas.
 2. Level "3" for High Wind Areas.
 3. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
 4. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
 5. Place grout only after inspectors have verified proportions of site-prepared grout.

- D. Testing Prior to Construction: One set of tests.
- E. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof. Reference the Statement of Special Inspections for additional requirements.
- F. Clay Masonry Unit Test: For each type of unit provided, according to ASTM C 67 for compressive strength.
- G. Mortar Aggregate Ratio Test (Proportion Specification): For site-mixed mortar, test each mix provided, according to ASTM C 780.
- H. Mortar Test (Property Specification): For each mix provided, according to ASTM C 780. Test mortar for mortar air content and compressive strength.
- I. Grout Test (Compressive Strength): For each mix provided, according to ASTM C 1019.

3.17 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.
- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 2. Test cleaning methods on mockup sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
 3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
 4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
 5. Initially, clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20. Where initial cleaning results are not satisfactory as judged by Architect from testing on mockup, proceed to cleaning with proprietary cleaners.
 6. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.
 7. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.

3.18 MASONRY WASTE DISPOSAL

- A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.
- B. Excess Masonry Waste: Remove excess clean masonry waste and other masonry waste, and legally dispose of off Owner's property.

3.19 SURFACE PREPARATION FOR FLUID APPLIED AIR BARRIERS

- A. General: This project will have fluid-applied Air Barrier material applied to the cavity side of the CMU. Special attention and care must be taken to provide a smooth, filled surface to receive the membrane. The care is necessary to insure the design performance of the selected materials. Concrete masonry unit (CMU) wall shall be prepared as follows to accept the air & vapor barrier:
 1. Surfaces shall be free of contaminants such as grease, oil and wax on surfaces to receive membrane.
 2. CMU surfaces shall be free from projections.
 3. Strike all mortar joints flush to the face of the masonry units.

4. Fill all voids and holes greater than 1/4 inch across at any point with mortar, sealant or other approved fill material.
5. Surface irregularities exceeding 1/4 inch in height or sharp to touch shall be ground flush or made smooth.
6. Fill around all penetrations with mortar, sealant or other approved fill material and strike flush.
7. Remove mortar droppings on brick ties, shelf angles, brick shelves or other horizontal obstructions.

3.20 CLEANING OF EXISTING BRICK MASONRY

A. General Cleaning of Masonry:

1. Proceed with cleaning in an orderly manner; work from top to bottom of each scaffold width and from one end of each elevation to the other.
2. Perform each cleaning method indicated in a manner which results in uniform coverage of all surfaces, including corners, moldings, interstices and which produces an even effect without streaking or damage to masonry surfaces.
3. Rinse off chemical residue and soil by working upwards from bottom to top of each treated area at each stage or scaffold setting.
4. Water Application Methods: Spray Applications: Spray-apply water to masonry surfaces to comply with requirements indicated for location, purpose, water temperature, pressure, volume and equipment. Unless otherwise indicated, hold spray nozzle not less than 6" from surface of masonry and apply water from side to side in overlapping bands to produce uniform coverage and an even effect.
 - a. Low Pressure Spray: 100-400 psi; 3-6 gallons per minute.
 - b. Medium Pressure Spray: 400-800 psi; 3-6 gallons per minute (only upon approval of Architect).
 - c. High Pressure Spray: Only allowed when approved by Architect and based upon field sample mockup testing results.
 - d. Steam Wash: Apply steam to masonry surfaces at pressures not exceeding 80 psi. Hold nozzle no less than 6" from surface of masonry and apply steam from side to side or in direction of tooling in overlapping bands to produce uniform coverage and an even effect.
5. Chemical Cleaner Application Methods: Use only when directed by Architect, after performing water only cleaning methods described above.
 - a. General: Apply chemical cleaners to masonry surfaces to comply with chemical manufacturer's recommendations using brush or spray application methods, at Contractor's option, unless otherwise indicated. Do not allow chemicals to remain on surface for periods longer than that indicated or recommended by manufacturer.
 - b. Spray Application: Apply to pressures not exceeding 50 psi, unless higher pressure is recommended by chemical cleaner manufacturer.
 - c. Reapplication of Chemical Cleaners: Do not apply chemical cleaners to same masonry surfaces more than twice.

B. Cleaning Brickwork:

1. Cold Water Wash: At locations indicated, clean brick masonry surface with cold water applied as follows:
 - a. Low pressure spray.
 - b. Medium pressure spray.
2. Warm Water Wash: At locations indicated, clean brick masonry surfaces with warm water applied as follows:
 - a. Low pressure spray
 - b. Medium pressure spray.
3. Chemical Cleaning: At locations indicated, clean brick masonry surfaces with chemical cleaner applied as follows:
 - a. Prewet masonry with cold water applied by low pressure spray.
 - b. Prewet masonry with warm water applied by low pressure spray.
 - c. Apply chemical cleaner to masonry. Let cleaner remain on surface for period determined from preconstruction testing, scrub and thoroughly rinsing away:
 - 1) As recommended by chemical cleaner manufacturer and preconstruction testing.
 - d. Rinse masonry with chemical afterwash to remove chemicals and soil, applied by medium pressure spray.
 - e. Repeat chemical cleaning procedure above where required to produce effect established by mock-up. Do not apply more than twice.
 - f. Do not clean brick work prior to seven (7) days after completion of the tuckpointing.

END OF SECTION 042000

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SECTION 051200 – STRUCTURAL STEEL FRAMING

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Structural steel (051200.A01), including, but not limited to the following:
 - a. W-Shapes (051200.A02)
 - b. Channels (051200.A03)
 - c. Angles (051200.A04)
 - d. Plate and Bar (051200.A05)
 - e. Hollow Structural Steel Shapes (051200.A06)
 - 2. Shrinkage-resistant grout (051200.A08).
- B. Related Requirements:
 - 1. Section 012300 "Alternates" for alternates effecting work of this Section.
 - 2. Section 014000 "Quality Requirements" for independent testing agency procedures and administrative requirements.
 - 3. Section 053100 "Steel Decking" for field installation of shear connectors through deck.
 - 4. Section 055000 "Metal Fabrications" for steel lintels and shelf angles not attached to structural-steel frame miscellaneous steel fabrications and other steel items not defined as structural steel.
 - 5. Section 099123 "Interior Painting"
 - 6. Section 099646 "Intumescent Coatings"

1.02 DEFINITIONS

- A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

1.03 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

1.04 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site at biweekly intervals.
 - 1. Before installation of structural steel framing, review procedures and tolerances for ensuring quality of structural steel framing materials. Require representatives of each entity directly concerned with structural steel framing to attend, including but not limited to the following:
 - a. Owner's representative
 - b. Architect and/or Structural Engineer.
 - c. Contractor's superintendent.
 - d. Structural Steel Framing subcontractor.
 - e. Manufacturer's representative for structural steel framing.
 - 2. Review field quality control measures for the following items:
 - a. Field dimensions and tolerances for structural steel framing installation.

1.05 ACTION SUBMITTALS

- A. Product Data: For each of the following:
 - 1. Structural-steel materials.
 - 2. High-strength, bolt-nut-washer assemblies.
 - 3. Anchor rods.
 - 4. Threaded rods.
 - 5. Shop primer.

6. Galvanized-steel primer.
 7. Etching cleaner.
 8. Galvanized repair paint.
 9. Shrinkage-resistant grout.
- B. Shop Drawings: Show fabrication of structural-steel components.
1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
 2. Include embedment Drawings.
 3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
 4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections.
 5. For structural-steel connections indicated to comply with design loads, include structural design data signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Delegated-Design Submittal: For structural-steel connections indicated to comply with design loads, include analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.06 INFORMATIONAL SUBMITTALS

- A. Qualification Data: Submit for each of the following.
1. Installer.
 2. Fabricator.
 3. Professional engineer
- B. Welding certificates.
- C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
- D. Mill test reports for structural steel, including chemical and physical properties.
- E. Product Test Reports: For the following:
1. Bolts, nuts, and washers including mechanical properties and chemical analysis.
 2. Direct-tension indicators.
 3. Tension-control, high-strength, bolt-nut-washer assemblies.
 4. Shop primers.
 5. Shrinkage-resistant grout.
- F. Survey of existing conditions.
- G. Source quality-control reports.
- H. Field quality-control and special inspection reports.

1.07 QUALITY ASSURANCE

- A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category BU or is accredited by the IAS Fabricator Inspection Program for Structural Steel (Acceptance Criteria 172).
1. Non-certified fabricators shall submit their qualifications with their bid. Qualifications shall be submitted on AIA Document A305 "Qualifications Statement", include the following for each project listed: references for at least 3 projects, identify engineer-of-record, tonnage of steel fabricated and type of steel fabricated (structural, miscellaneous, etc.).
 2. Shop must be certified for state of Kansas to meet local inspection requirements.
- B. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CSE, and as follows:
1. A firm with not less than ten (10) years of experience under the current name.
 2. Must have completed five (5) projects within the past 5 years of comparable size and scope.

3. Non-certified erectors shall submit their qualifications with their bid. Qualifications shall be submitted on AIA Document A305 "Qualifications Statement", include the following for each project listed: references for at least 3 projects, identify engineer-of-record, tonnage of steel erected and type of steel erected (structural, miscellaneous, etc.).
- C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- D. Comply with applicable provisions of the following specifications and documents:
 1. AISC 303.
 2. AISC 360.
 3. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

1.08 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with structural steel framing by field measurements before fabrication.

1.09 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
 1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.
- B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
 1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
 2. Clean and relubricate bolts and nuts that become dry or rusty before use.
 3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Comply with applicable provisions of the following specifications and documents:
 1. ANSI/AISC 303
- B. Connection Design Information:
 1. Connection designs have been complete and connections indicated on the drawings.
- C. Moment Connections: Type FR, fully restrained.
- D. Construction: Combined system of moment frames, braced frames, and shear walls

2.02 STRUCTURAL-STEEL MATERIALS

- A. W-Shapes (051200.A02): ASTM A 992/A 992M.
- B. Channels (051200.A03), Angles (051200.A04), M, S-Shapes: ASTM A 36/A 36M.
- C. Plate and Bar (051200.A05): ASTM A 36/A 36M.
- D. Cold-Formed Hollow Structural Sections (051200.A06): ASTM A 500/A 500M, Grade C, structural tubing.
- E. Welding Electrodes: Comply with AWS requirements.

2.03 BOLTS, CONNECTORS, AND ANCHORS

- A. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade C, heavy-hex carbon-steel nuts; and ASTM F 436, Type 1, hardened carbon-steel washers; all with plain finish.
- B. High-Strength Bolts, Nuts, and Washers: ASTM A 490, Type 1, heavy-hex steel structural bolts or tension-control, bolt-nut-washer assemblies with splined ends; ASTM A 563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F 436, Type 1, hardened carbon-steel washers with plain finish.
 - 1. Direct-Tension Indicators: ASTM F 959, Type 490, compressible-washer type with plain finish.
- C. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, heavy-hex head assemblies consisting of steel structural bolts with splined ends, heavy-hex carbon-steel nuts, and hardened carbon-steel washers.
 - 1. Finish: Plain.

2.04 RODS

- A. Unheaded Anchor Rods: ASTM F 1554, Grade 55, weldable.
 - 1. Configuration: Straight.
 - 2. Nuts: ASTM A 563 heavy-hex carbon steel.
 - 3. Plate Washers: ASTM A 36/A 36M carbon steel.
 - 4. Washers: ASTM F 436, Type 1, hardened carbon steel.
 - 5. Finish: Plain.
- B. Headed Anchor Rods: ASTM F 1554, Grade 55, weldable, straight.
 - 1. Nuts: ASTM A 563 heavy-hex carbon steel.
 - 2. Plate Washers: ASTM A 36/A 36M carbon steel.
 - 3. Washers: ASTM F 436, Type 1, hardened carbon steel.
 - 4. Finish: Plain.
- C. Threaded Rods: ASTM A 36/A 36M.
 - 1. Nuts: ASTM A 563 heavy-hex carbon steel.
 - 2. Washers: ASTM A 36/A 36M carbon steel.
 - 3. Finish: Plain.

2.05 PRIMER

- A. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer compatible with topcoat.
 - 1. Primer shall be compatible with intumescent coating.
- B. Galvanizing Repair Paint: ASTM A 780/A 780M.

2.06 FILLER

- A. Filler: Polyester filler intended for use in repairing dents in automobile bodies.

2.07 SHRINKAGE-RESISTANT GROUT (051200.A08)

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107/C 1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.08 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," and to AISC 360.
 - 1. Camber structural-steel members where indicated.
 - 2. Fabricate beams with rolling camber up.
 - 3. Identify high-strength structural steel according to ASTM A 6/A 6M and maintain markings until structural steel has been erected.
 - 4. Mark and match-mark materials for field assembly.

5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
- B. In addition to special care used to handle and fabricate structural steel exposed to view in final position, comply with the following:
 1. Fabricate with exposed surfaces smooth, square, and free of surface blemishes including pitting, rust, scale, and roughness.
 2. Grind sheared, punched, and flame-cut edges to remove burrs and provide smooth surfaces and edges.
 3. Fabricate with exposed surfaces free of mill marks, including rolled trade names and stamped or raised identification.
 4. Fabricate with exposed surfaces free of seams to maximum extent possible.
 5. Remove blemishes by filling or grinding or by welding and grinding, before cleaning, treating, and shop priming.
 6. Fabricate with piece marks fully hidden in the completed structure or made with media that permits full removal after erection.
 7. Seal-weld open ends of hollow structural sections with 3/8-inch closure plates.
 - C. Coping, Blocking, and Joint Gaps: Maintain uniform gaps of 1/8 inch with a tolerance of 1/32 inch.
 - D. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
 1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.
 2. Thermal Cutting is not allowed at the project site.
 - E. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.
 - F. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
 - G. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 1, "Solvent Cleaning." or SSPC-SP 2, "Hand Tool Cleaning."
 - H. Steel Wall-Opening Framing: Select true and straight members for fabricating steel wall-opening framing to be attached to structural-steel frame. Straighten as required to provide uniform, square, and true members in completed wall framing. Build up welded framing, weld exposed joints continuously, and grind smooth.
 - I. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel members.
 1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
 2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
 3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.09 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
 1. Joint Type: Snug tightened.
- B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
 1. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.
 2. Erection plates shall be removed after welding and prior to finishing.
 3. For structural steel exposed to view in final position with exposed welded connections lower than 25'-0" above finished floor shall be finished to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 1 welds; no evidence of a welded joint and as follows:
 - a. Use weld sizes, fabrication sequence, and equipment that limit distortions to allowable tolerances.
 - b. Provide continuous, sealed welds at angle to gusset-plate connections and similar locations where exposed to weather.
 - c. Provide continuous welds of uniform size and profile.
 - d. Grind butt and groove welds flush to adjacent surfaces within tolerance of plus 1/16 inch, minus zero inch. Do not grind unless required for clearances or for fitting other components, or unless directed to correct unacceptable work.
 - e. At locations where welding on the far side of an exposed connection occurs, grind distortions and marking of the steel to a smooth profile aligned with adjacent material.

- f. Make fillet welds of uniform size and profile with exposed face smooth and slightly concave. Do not grind unless directed to correct unacceptable work.

2.10 SHOP PRIMING

- A. Shop prime steel surfaces except the following:
 - 1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
 - 2. Surfaces to be field welded.
 - 3. Surfaces of high-strength bolted, slip-critical connections.
 - 4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
 - 5. Galvanized surfaces.
 - 6. Surfaces enclosed in interior construction (not exposed-to-view in final position).
- B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
 - 1. SSPC-SP 3, "Power Tool Cleaning."
- C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
 - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
 - 2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

2.11 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/A 123M.
 - 1. Fill vent and drain holes that are exposed in the finished Work unless they function as weep holes, by plugging with zinc solder and filing off smooth.
 - 2. Galvanize lintels, shelf angles and welded door frames attached to structural-steel frame and located in exterior walls.
 - 3. Galvanize all exterior exposed structural steel.

2.12 SOURCE QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform shop tests and inspections.
 - 1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
- B. Bolted Connections: Inspect shop-bolted connections according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- C. Welded Connections: Visually inspect shop-welded connections according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
 - 1. Liquid Penetrant Inspection: ASTM E 165.
 - 2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
 - 3. Ultrasonic Inspection: ASTM E 164.
 - 4. Radiographic Inspection: ASTM E 94.
- D. In addition to visual inspection, test and inspect shop-welded shear connectors according to requirements in AWS D1.1/D1.1M for stud welding and as follows:
 - 1. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
 - 2. Conduct tests according to requirements in AWS D1.1/D1.1M on additional shear connectors if weld fracture occurs on shear connectors already tested.
- E. Prepare test and inspection reports.

- F. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents
- G. Special Inspections: Owner will retain and pay for the services of a qualified independent inspection agency acceptable to the Architect to conduct special inspections of all structural welding and high-strength bolting in accordance with applicable requirements of Section 1704 of the International Building Code, latest edition, as adopted and amended by authority having jurisdiction. The inspection agency shall inspect the work, prepare and submit periodic reports and final reports to City Code Officials, Architect, and Owner in compliance with building code requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
 - 1. Prepare a certified survey of existing conditions. Include bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.
 - 1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

3.03 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.
- B. Baseplates Bearing Plates and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
 - 1. Set plates for structural members on wedges, shims, or setting nuts as required.
 - 2. Weld plate washers to top of baseplate.
 - 3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
 - 4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- C. Maintain erection tolerances of structural steel within AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."
- D. Maintain erection tolerances of structural steel within AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."
 - 1. At exterior masonry veneer comply with the following:
 - a. Veneer lintels attached to structural steel frames.
 - 1) Locate toe of angle by surveying face of veneer prior to veneer installation.
 - 2) Use full depth shims to adjust toe of angle horizontally outward when angle is more than 1 inch behind the face of brick.
 - 3) Saw cut off toe of shelf angle to adjust toe of angle horizontally where steel is less than 3/8 inch behind face of veneer.
 - (a) Apply three coats of cold galvanizing repair paint to repair galvanizing at sawn edges.
 - 4) Horizontal lines of alignment (elevation): Locate shelf angles so that the top of the angle is just below the bottom of the brick course directly above the angle.
 - 5) Tolerances:
 - (a) Vertical: Do not vary from plumb more than:
 - (1) 1/8 inch in 10 feet.
 - (2) 1/4 inch in 20 feet.

(b) Horizontal: Do not vary from elevation more than:

- (1) 1/8 inch in 10 feet.
- (2) 1/4 inch in 20 feet.

- E. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that are in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 1. Level and plumb individual members of structure.
 2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.
- F. Splice members only where indicated.
- G. Do not use thermal cutting during erection unless approved by Structural Engineer of Record. Finish thermally cut sections within smoothness limits in AWS D1.1/D1.1M.
- H. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

3.04 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
 1. Joint Type: Pretensioned or slip critical as indicated.
- B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
 1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
 2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
 3. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," for mill material.

3.05 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
 1. Verify structural-steel materials and inspect steel frame joint details.
 2. Verify weld materials and inspect welds.
 3. Verify connection materials and inspect high-strength bolted connections.
- B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
 1. Bolted Connections: Inspect and test bolted connections in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
 2. Welded Connections: Visually inspect field welds according to AWS D1.1/D1.1M.
 - a. In addition to visual inspection, test and inspect field welds according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
 - 1) Liquid Penetrant Inspection: ASTM E 165.
 - 2) Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
 - 3) Ultrasonic Inspection: ASTM E 164.
 - 4) Radiographic Inspection: ASTM E 94.
- C. In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1/D1.1M for stud welding and as follows:
 1. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
 2. Conduct tests according to requirements in AWS D1.1/D1.1M on additional shear connectors if weld fracture occurs on shear connectors already tested.

3.06 REPAIRS AND PROTECTION

- A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780/A 780M.
- B. Touchup Prime Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - 1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

END OF SECTION 051200

SECTION 052100 - STEEL JOIST FRAMING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Steel joist framing (052100.A01), including, but not limited to the following:
 - a. K-series steel joists (052100.A02).
 - b. KCS-type K-series steel joists (052100.A03).
 - c. K-series steel joist substitutes (052100.A04).
 - 2. Joist accessories.
- B. 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 014000 "Quality Requirements" for independent testing agency procedures and administrative requirements.
 - 4. Section 033000 "Cast-in-Place Concrete" for installing bearing plates in concrete.
 - 5. Section 042000 "Unit Masonry" for installing bearing plates in unit masonry.
 - 6. Section 051200 "Structural Steel Framing" for field-welded shear connectors.
 - 7. Section 053100 "Steel Decking" for structural steel decking.
 - 8. Section 055000 "Metal Fabrications" for bearing plates to be embedded in other construction.

1.2 DEFINITIONS

- A. SJI's "Specifications": Steel Joist Institute's "Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders."
- B. Special Joists: Steel joists or joist girders requiring modification by manufacturer to support nonuniform, unequal, or special loading conditions that invalidate load tables in SJI's "Specifications."

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of joist, accessory, and product.
- B. Shop Drawings:
 - 1. Include layout, designation, number, type, location, and spacing of joists.
 - 2. Include joining and anchorage details, bracing, bridging, and joist accessories; splice and connection locations and details; and attachments to other construction.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer and professional engineer.
- B. Welding certificates.
- C. Mill certificates for each type of bolt.
- D. Comprehensive engineering analysis of special joists signed and sealed by the qualified professional engineer responsible for its preparation.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A manufacturer certified by SJI to manufacture joists complying with applicable standard specifications and load tables in SJI's "Specifications."
 - 1. Manufacturer's responsibilities include providing professional engineering services for designing special joists to comply with performance requirements.

- B. Welding Qualifications: Qualify field-welding procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle joists as recommended in SJI's "Specifications."
- B. Protect joists from corrosion, deformation, and other damage during delivery, storage, and handling.

1.7 SEQUENCING

- A. Deliver steel bearing plates to be built into cast-in-place concrete and masonry construction.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide special joists and connections capable of withstanding design loads indicated.
 - 1. Use ASD; data are given at service-load level.
 - 2. Design special joists to withstand design loads with deflections no greater than the following:
 - a. Roof Joists: Vertical deflection of 1/360 total load of the span.

2.2 K-SERIES STEEL JOISTS (052100.A02 AND 052100.A03)

- A. Manufacture steel joists of type indicated according to "Standard Specifications for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle top- and bottom-chord members, underslung ends, and parallel top chord.
 - 1. Joist Type:
 - a. K-series steel joists (052100.A02)
 - b. KCS-type K-series steel joists (052100.A03)
- B. Steel Joist Substitutes: Manufacture according to "Standard Specifications for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle or -channel members.
- C. Provide holes in chord members for connecting and securing other construction to joists.
- D. Extended Ends: Extend bearing ends of joists with SJI's Type R extended ends where indicated, complying with SJI's "Specifications."
- E. Camber: Camber joists according to SJI's "Specifications"
- F. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches.

2.3 PRIMERS

- A. Primer: SSPC-Paint 15, or manufacturer's standard shop primer complying with performance requirements in SSPC-Paint 15.

2.4 JOIST ACCESSORIES

- A. Bridging: Provide bridging anchors and number of rows of horizontal bridging of material, size, and type required by SJI's "Specifications" for type of joist, chord size, spacing, and span. Furnish additional erection bridging if required for stability.
- B. Bridging: Fabricate as indicated and according to SJI's "Specifications." Furnish additional erection bridging if required for stability.
- C. Steel bearing plates with integral anchorages are specified in Section 055000 "Metal Fabrications."

- D. Furnish ceiling extensions, either extended bottom-chord elements or a separate extension unit of enough strength to support ceiling construction. Extend ends to within 1/2 inch of finished wall surface unless otherwise indicated.
 - 1. Finish: Plain.
- E. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy hex steel structural bolts; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers.
 - 1. Finish: Plain.
- F. Welding Electrodes: Comply with AWS standards.
- G. Galvanizing Repair Paint: or ASTM A 780.
- H. Furnish miscellaneous accessories including splice plates and bolts required by joist manufacturer to complete joist assembly.

2.5 CLEANING AND SHOP PAINTING

- A. Clean and remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories by hand-tool cleaning, SSPC-SP 2 or power-tool cleaning, SSPC-SP 3.
- B. Shop prime paint joists and accessories except the following:
 - 1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
 - 2. Surfaces to be field welded.
 - 3. Surfaces of high-strength bolted, slip-critical connections.
 - 4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
 - 5. Surfaces enclosed in interior construction (not exposed-to-view in final position).
 - 6. Galvanized surfaces.
- C. Apply one coat of shop primer to joists and joist accessories to be primed to provide a continuous, dry paint film not less than 1 mil thick.
- D. Shop priming of joists and joist accessories is specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine supporting substrates, embedded bearing plates, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Do not install joists until supporting construction is in place and secured.
- B. Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJL's "Specifications," joist manufacturer's written recommendations, and requirements in this Section.
 - 1. Before installation, splice joists delivered to Project site in more than one piece.
 - 2. Space, adjust, and align joists accurately in location before permanently fastening.
 - 3. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.
 - 4. Delay rigidly connecting bottom-chord extensions to columns or supports until dead loads are applied.
- C. Field weld joists to supporting steel bearing plates and framework. Coordinate welding sequence and procedure with placement of joists. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

- D. Bolt joists to supporting steel framework using high-strength structural bolts. Comply with Research Council on Structural Connection's "Specification for Structural Joints Using ASTM A 325 or ASTM A 490 Bolts" for high-strength structural bolt installation and tightening requirements.
- E. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and bolted connections and to perform field tests and inspections and prepare test and inspection reports.
- B. Visually inspect field welds according to AWS D1.1/D1.1M.
- C. Visually inspect bolted connections.
- D. Correct deficiencies in Work that test and inspection reports have indicated are not in compliance with specified requirements.
- E. Perform additional testing to determine compliance of corrected Work with specified requirements.

3.4 PROTECTION

- A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists, bearing plates, abutting structural steel, and accessories.
 - 1. Clean and prepare surfaces by hand-tool cleaning according to SSPC-SP 2, or power-tool cleaning according to SSPC-SP 3.
 - 2. Apply a compatible primer of same type as primer used on adjacent surfaces.
 - 3. Cleaning and touchup painting are specified in Section 099113 "Exterior Painting", Section 099123 "Interior Painting" and Section 099600 "High-Performance Coatings."
- C. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that joists and accessories are without damage or deterioration at time of Substantial Completion.

END OF SECTION 052100

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SECTION 053100 – STEEL DECKING

PART – 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Roof deck
 - 2. Non-composite Form Deck
- B. Related Requirements:
 - 1. Section 012300 "Alternates" for alternates effecting work of this Section.
 - 2. Section 014000 "Quality Requirements" for independent testing agency procedures and administrative requirements.
 - 3. Section 051200 "Structural Steel Framing" for shop- and field-welded shear connectors.
 - 4. Section 099123 "Interior Painting" for repair painting of primed deck and finish painting of deck.
 - 5. Section 099646 "Intumescent Coatings"

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of deck, accessory, and product indicated.
- B. Shop Drawings:
 - 1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

1.3 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Product Certificates: For each type of steel deck.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that each of the following complies with requirements:

1.4 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."
- B. FM Global Listing: Provide steel roof deck evaluated by FM Global and listed in its "Approval Guide, Building Materials" for Class 1 fire rating and Class 1-90 windstorm ratings.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

PART 2 – PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."
- B. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

2.2 ROOF DECK

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Canam United States; Canam Group Inc.
 - 2. Consolidated Systems, Inc.; Metal Dek Group.
 - 3. Epic Metals Corporation.
 - 4. New Millennium Building Systems, LLC.
 - 5. Nucor Corp; Vulcraft Group.
 - 6. Wheeling Corrugating Company; Div. of Wheeling-Pittsburgh Steel Corporation.
- B. Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:
 - 1. Galvanized and Shop-Primed Steel Sheet: Provide where specifically indicated. ASTM A 653/A 653M, Structural Steel (SS), Grade 33, G60 zinc coating; cleaned, pretreated, and primed with manufacturer's standard baked-on, rust-inhibitive primer.
 - a. Color: Manufacturer's standard.
 - 2. Deck Profile: As indicated.
 - 3. Profile Depth: As indicated.
 - 4. Design Uncoated-Steel Thickness: As indicated.
 - 5. Span Condition: Triple span or more.
 - 6. Side Laps: Overlapped.

2.3 NONCOMPOSITE FORM DECK

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Canam United States; Canam Group Inc.
 - 2. Consolidated Systems, Inc.; Metal Dek Group
 - 3. Epic Metals Corporation
 - 4. New Millennium Building Systems, LLC.
 - 5. Nucor Corp; Vulcraft Group
 - 6. Verco Manufacturing Co.
 - 7. Wheeling Corrugating Company; Div. of Wheeling-Pittsburgh Steel Corporation.
- B. Fabrication of Noncomposite Form Deck: Fabricate ribbed-steel sheet noncomposite deck panels used as a form to comply with SDI NC, with the minimum section properties indicated, and with the following:
 - 1. Galvanized-Steel Sheet: ASTM A653/A653M, Structural Steel (SS), Grade 33, G60 (Z180) zinc coating.
 - 2. Profile Depth: As indicated on drawings.
 - 3. Design Uncoated-Steel Thickness: As indicated on drawings.
 - 4. Span Condition: Triple span or more].
 - 5. Side Laps: Overlapped or interlocking seam at Contractor's option.
- C. ACCESSORIES
 - 1. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.
 - 2. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.
 - 3. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.
 - 4. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.
 - 5. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.
 - 6. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi, of same material and finish as deck, and of thickness and profile recommended by SDI Publication No. 31 for overhang and slab depth.
 - 7. Piercing Hanger Tabs: Piercing steel sheet hanger attachment devices for use with floor deck.
 - 8. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, 0.0747 inch thick, with factory-punched hole of 3/8-inch minimum diameter.
 - 9. Flat Sump Plates: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck. For drains, cut holes in the field.
 - 10. Galvanizing Repair Paint: ASTM A 780 or SSPC-Paint 20, with dry film containing a minimum of 94 percent zinc dust by weight.

11. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

2.4 ACCESSORIES

- A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.
- B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.
- C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.
- D. Flexible Flute Closure Strips: Vulcanized, closed cell foam rubber, 1 inch thick minimum; profiled to fit tight to the deck.
- E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.
- F. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi, of same material and finish as deck, and of thickness and profile recommended by SDI Publication No. 31 for overhang and slab depth.
- G. Flat Sump Plates: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck. For drains, cut holes in the field.
- H. Galvanizing Repair Paint: ASTM A 780 or SSPC-Paint 20, with dry film containing a minimum of 94 percent zinc dust by weight.
- I. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section.
- B. Locate deck bundles to prevent overloading of supporting members.
- C. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.
- D. Place deck panels flat and square and fasten to supporting frame without warp or deflection.
- E. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.
- F. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.
- G. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

3.3 ROOF-DECK INSTALLATION

- A. Fasten roof-deck panels to steel supporting members by welding or mechanically fastening as indicated on Drawings.
 - 1. Provide type and size of fasteners indicated on Drawing and recommended by fastener manufacturer to suit conditions involved and performance criteria specified.
 - 2. Fastener Spacing: Fasten edge and interior ribs of deck units at each support with number of fasteners as indicated on the Drawings not to exceed that recommended by mechanical fastener manufacturer and as based on roof-area definitions in FMG Loss Prevention Data Sheet 1-28.
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding 12 inches on center, and as follows:
 - 1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.
 - 2. Side Lap Fastening: As indicated on Drawings.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:
 - 1. End Joints: Lapped 2 inches minimum.
- D. Roof Sump Plates: Install over openings provided in roof deck and weld or mechanically fasten flanges to top of deck. Space welds or mechanical fasteners not more than 12 inches apart with at least one weld or fastener at each corner.
 - 1. Install reinforcing channels or zees in ribs to span between supports and weld or mechanically fasten.
- E. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld to substrate to provide a complete deck installation.
 - 1. Weld cover plates at changes in direction of roof-deck panels unless otherwise indicated.

3.4 FLOOR-DECK INSTALLATION

- A. Mechanically Fastened Floor Deck Installation:
 - 1. Fasten floor-deck panels to steel supporting members with approved mechanical fasteners, and as follows:
 - a. Provide type and size of fasteners recommended by fastener manufacturer to suit conditions involved and performance criteria specified.
 - b. Fastener Spacing: Fasten edge and interior ribs of deck units at each support with number of fasteners recommended by mechanical fastener manufacturer.
 - 2. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of new deck panels between supports, at intervals not exceeding 12 inches on center, and as follows:
 - a. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.
 - 3. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:
 - a. End Joints: Lapped 2 inches minimum.
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of half of the span or 36 inches, and as follows:
 - 1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:
 - 1. End Joints: Lapped.
- D. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations unless otherwise indicated.
- E. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

- B. Field welds will be subject to inspection.
- C. Testing agency will report inspection results promptly and in writing to Contractor and Architect.
- D. Remove and replace work that does not comply with specified requirements.
- E. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.6 PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Repair Painting: Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation, and apply repair paint.
 - 1. Apply repair paint, of same color as adjacent shop-primed deck, to bottom surfaces of deck exposed to view.
- C. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION 053100

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SECTION 054000 - COLD FORMED METAL FRAMING

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes the following applications of cold-formed metal framing (054000.A01):
 - 1. Exterior non-load-bearing wall framing (054000.A03).
 - 2. Interior non-load-bearing wall framing exceeding height limitations of standard, nonstructural metal framing.
 - 3. Ceiling joist framing (054000.A06).
 - 4. Soffit framing (054000.A06).
 - 5. Miscellaneous framing and furring members (054000.A07).
 - 6. Miscellaneous materials.
 - a. Isolation Strip (054000.A08)
 - b. Sealer Gaskets
 - c. Flat straps and backing plates (054000.A09).
- B. Related Requirements:
 - 1. Section 012300 "Alternates" for those alternates related to work of this Section.
 - 2. Section 055000 "Metal Fabrications" for miscellaneous steel shapes, masonry shelf angles, and connections used with cold-formed metal framing.
 - 3. Section 092116 "Non-Structural Metal Framing" for standard, interior non-load-bearing, metal-stud framing, with height limitations and ceiling-suspension assemblies.

1.02 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Before installation of cold formed metal framing, review procedures and tolerances for ensuring quality of metal framing materials. Require representatives of each entity directly concerned with cold-formed metal framing to attend, including but not limited to the following:
 - a. Owner's representative
 - b. Architect.
 - c. Contractor's superintendent.
 - d. Cold Formed Metal Framing subcontractor.
 - e. Manufacturer's representative for cold-formed metal framing.
 - 2. Review field quality control measures for the following items:
 - a. Field dimensions and tolerances for cold formed metal framing installation.
 - b. Coordination of items where blocking is required

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of cold-formed steel framing product and accessory.
- B. Shop Drawings:
 - 1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
 - 2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
 - 3. For cold-formed metal framing indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Delegated-Design Submittal: For cold-formed steel framing.

1.04 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency and professional engineer.
- B. Welding certificates.

- C. Product Test Reports: For each listed product, for tests performed by a qualified testing agency.
 - 1. Steel sheet.
 - 2. Power-actuated anchors.
 - 3. Mechanical fasteners.
 - 4. Vertical deflection clips.
 - 5. Horizontal drift deflection clips
 - 6. Miscellaneous structural clips and accessories.
- D. Evaluation Reports: For nonstandard cold-formed steel framing post-installed anchors and power-actuated fasteners, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

1.05 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
- B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of cold-formed metal framing that are similar to those indicated for this Project in material, design, and extent.
- C. Product Tests: Mill certificates or data from a qualified independent testing agency, indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.
- D. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Certified Steel Stud Association, the Steel Framing Industry Association or the Steel Stud Manufacturers Association.
- E. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - 2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."
- F. AISI Specifications: Comply with AISI's "Specification for the Design of Cold-Formed Steel Structural Members" for calculating structural characteristics of cold-formed metal framing:
 - 1. CCFSS Technical Bulletin: "AISI Specification Provisions for Screw Connections."

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Protect cold-formed steel framing from corrosion, moisture staining, deformation, and other damage during delivery, storage, and handling.
- B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide cold-formed metal framing by one of the following:
 - 1. All Steel and Gypsum Products.
 - 2. CEMCO; California Expanded Metal Products Company.
 - 3. Clark-Dietrich Building Systems.
 - 4. Custom Stud, Inc.
 - 5. Engineered Steel Products, Inc.
 - 6. MBA Building Supplies.
 - 7. MarinoWare; a division of Ware Industries.
 - 8. SCAFCO Corporation.
 - 9. Steel Construction Systems.
 - 10. Steel Network, Inc.
 - 11. Steel Structural Systems.

12. United Metal Products, Inc.

2.02 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide cold-formed steel framing capable of withstanding design loads within limits and under conditions indicated.
 - 1. Design Loads: As indicated in per Code and the Structural General Notes.
 - 2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
 - a. Exterior Non-Load-Bearing Framing: Horizontal deflection of 1/360 of wall height.
 - 1) Walls indicated to receive thin brick shall have a horizontal deflection of 1/600 of the wall height.
 - b. Interior Non-Load-Bearing Framing: Horizontal deflection of 1/360 of wall height, under a horizontal load of 5 lbf/sq. ft.
 - c. Ceiling Joist Framing: Vertical deflection of 1/360 of the span for live loads and 1/240 for total loads of the span.
 - d. Soffit Framing: Vertical deflection of 1/360 of the span for live loads and 1/240 for total loads of the span.
 - 3. Design framing systems to provide for movement of framing members located outside the insulated building envelope without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F.
 - 4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:
 - a. Upward and downward movement of 3/8 inch.
 - b. Upward and downward movement of 3/8 inch.
 - 5. Design interior non-load-bearing framing as required for structural performance, including but not limited to: windows systems, operable walls, soffits and ceilings.
 - 6. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.
 - 7. Headers: Design according to AISI's "Standard for Cold-Formed Steel Framing – Header Design."
- B. Cold-Formed Steel Framing Design Standards: Unless more stringent requirements are indicated, framing shall comply with AISI S100, AISI S200, and the following:
 - 1. Floor and Roof Systems: AISI S210.
 - 2. Wall Studs: AISI S211.
 - 3. Headers: AISI S212.
 - 4. Lateral Design: AISI S213.
- C. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.03 COLD-FORMED STEEL FRAMING, GENERAL (054000.A01)

- A. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
 - 1. Grade: As required by structural performance.
 - 2. Coating: G60.
- B. Steel Sheet for Vertical Deflection and Drift Clips: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:
 - 1. Grade: As required by structural performance.
 - 2. Coating: G60.

2.04 EXTERIOR NON-LOAD BEARING WALL FRAMING (054000.A03)

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: 0.0428 inch, minimum.

2. Flange Width: 1-5/8 inches.
 3. Section Properties: Per SSMA or as required by structural performance.
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: Matching steel studs.
 2. Flange Width: 1-1/4 inches.
- C. Steel Box or Back-to-Back Headers: Manufacturer's standard C-shapes used to form header beams, of web depths indicated, unpunched, with stiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: 0.0428 inch.
 2. Flange Width: 1-5/8 inches.
 3. Section Properties: As required by structural performance.
- D. Vertical Deflection Clips: Manufacturer's standard bypass and/or head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Clark/Dietrich Building Systems.
 - b. MarinoWARE.
 - c. SCAFCO Corporation.
 - d. Steel Network, Inc. (The).
- E. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.
1. Outer Track: Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:
 - a. Minimum Base-Metal Thickness: One gauge heavier than steel studs, and not less than 0.0538 inch.
 - b. Flange Width: 1 inch plus the design gap for one-story structures and 1 inch plus twice the design gap for other applications.
 2. Inner Track: Of web depth indicated, and as follows:
 - a. Minimum Base-Metal Thickness: Matching steel studs.
 - b. Flange Width: 3 inches.
- F. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure through positive mechanical attachment to stud web and structure.

2.05 INTERIOR NON-LOAD BEARING WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
1. Minimum Base-Metal Thickness:
 - a. For horizontal framing members: 0.0428 inch
 - b. For vertical framing members (where welding occurs): 0.0966 inch.
 2. Flange Width: 1-5/8 inches.
 3. Section Properties: Per SSMA or as required by structural performance.
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: Matching steel studs.
 2. Flange Width: 1-1/4 inches.
- C. Vertical Deflection Clips: Manufacturer's standard bypass or head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
- D. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.
1. Outer Track: Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:
 - a. Minimum Base-Metal Thickness: 0.0538 inch.

- b. Flange Width: 1 inch plus the design gap for one-story structures and 1 inch plus twice the design gap for other applications.
 - 2. Inner Track: Of web depth indicated, and as follows:
 - a. Minimum Base-Metal Thickness: 0.0428 inch.
 - b. Flange Width: 3 inches.
- E. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure through positive mechanical attachment to stud web and structure.

2.06 CEILING JOIST FRAMING (054000.A06)

- A. Steel Ceiling Joists: Manufacturer's standard C-shaped steel sections, of web depths indicated, punched with standard holes, with stiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: 0.0329 inch.
 - 2. Flange Width: 1-5/8 inches, minimum.
 - 3. Section Properties: In accordance with SSMA.
- B. Steel Joist Track: Manufacturer's standard U-shaped steel joist track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: Matching steel joists.
 - 2. Flange Width: 1-1/2 inches, minimum.

2.07 SOFFIT FRAMING (054000.A06)

- A. Exterior Soffit Frame: Manufacturer's standard C-shaped steel sections, of web depths indicated, with stiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: 0.0329 inch.
 - 2. Flange Width: 1-5/8 inches, minimum.
 - 3. Section Properties: In accordance with SSMA.

2.08 MISCELLANEOUS FRAMING (054000.A07)

- A. General: Manufacturer's standard Z-shaped and hat-shaped steel sections, of web depths indicated, and as follows:
 - 1. Minimum Uncoated Base-Metal Thickness: 0.0538 inch.
 - 2. Z-Furring: Manufacturer's standard slotted or non-slotted web, face flange of at least 1-1/4 inches and wall attachment flange of 7/8 inch.
 - 3. Hat Channels: Manufacturer's standard profile.
 - 4. Depth/Height:
 - a. For Z-furring: 3 inches, unless otherwise indicated.
 - b. For hat channels: 7/8 inch, unless otherwise indicated.

2.09 FRAMING ACCESSORIES

- A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.
- B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
 - 1. Supplementary framing.
 - 2. Bracing, bridging, and solid blocking.
 - 3. Web stiffeners.
 - 4. Anchor clips.
 - 5. End clips.
 - 6. Foundation clips.
 - 7. Gusset plates.
 - 8. Stud kickers and knee braces.
 - 9. Joist hangers and end closures.
 - 10. Hole-reinforcing plates.

11. Backer plates.

2.10 ANCHORS, CLIPS, AND FASTENERS

- A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.
- B. Anchor Bolts: ASTM F 1554, Grade 55, threaded carbon-steel headless bolts, with encased end threaded, and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C.
- C. Post-Installed Anchors: Fastener systems with bolts of same basic metal as fastened metal, if visible, unless otherwise indicated; with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC508 or ICC-ES AC308 as appropriate for the substrate.
 - 1. Uses: Securing cold-formed steel framing to structure.
 - 2. Type: Torque-controlled adhesive anchor or adhesive anchor.
 - 3. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.
 - 4. Material for Exterior or Interior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.
- D. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with allowable load capacities calculated according to ICC-ES AC70, greater than or equal to the design load, as determined by testing per ASTM E 1190 conducted by a qualified testing agency.
- E. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.
 - 1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.
- F. Welding Electrodes: Comply with AWS standards.

2.11 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: SSPC-Paint 20 or ASTM A 780.
- B. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107/C 1107M, with fluid consistency and 30-minute working time.
- C. Shims: Load bearing, high-density multimonomer plastic, and non-leaching; or of cold-formed steel of same grade and coating as framing members supported by shims.
- D. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members as required.

2.12 FABRICATION

- A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.
 - 1. Fabricate framing assemblies using jigs or templates.
 - 2. Cut framing members by sawing or shearing; do not torch cut.
 - 3. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
 - a. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by no fewer than three exposed screw threads.
 - 4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.
- B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.

- C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
 - 1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
 - 2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Grout bearing surfaces uniform and level to ensure full contact of bearing flanges or track webs on supporting concrete or masonry construction.
- B. Install sealer gaskets at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

3.03 INSTALLATION, GENERAL

- A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.
- B. Install cold-formed steel framing according to AISI S200, AISI S202, and manufacturer's written instructions unless more stringent requirements are indicated.
 - 1. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to manufacturer's written recommendations and requirements in this Section.
- C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.
 - 1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.
- D. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.
 - 1. Cut framing members by sawing or shearing; do not torch cut.
 - 2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetration.
- E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.
- F. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.
- G. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.
- H. Install insulation, specified in Section 07 21 00 "Thermal Insulation," in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

- I. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.
- J. Erection Tolerances: Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
 - 1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.04 EXTERIOR AND INTERIOR NON-LOAD BEARING WALL INSTALLATION

- A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.
- B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Space studs as follows:
 - 1. Do not fasten studs to outer track of double deflection tracks.
 - 2. Stud Spacing: 16 inches, maximum.
 - 3. Additional Studs: Space 8 inches from opening jambs and each side of veneer expansion joints. Coordinate stud spacing with other masonry anchor locations.
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.
- D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
 - 1. Do not fasten studs to outer track of double deflection tracks.
 - 2. Install single deep-leg deflection tracks and anchor to building structure.
 - 3. Install double deep-leg deflection tracks and anchor outer track to building structure.
 - 4. Connect vertical deflection clips to bypassing and infill studs and anchor to building structure.
 - 5. Connect drift clips to cold-formed metal framing and anchor to building structure.
- E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.
 - 1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
 - 2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
- F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.
 - 1. Strapping: Before installing sheathing, install continuous strapping at backup location for termination bar at the top of veneer base flashing and lintel flashing.
- G. Install horizontal strapping at center line of masonry flashing termination bar. Coordinate locations with mason.

3.05 CEILING AND SOFFIT FRAMING INSTALLATION

- A. Install perimeter joist track sized to match joists. Align and securely anchor or fasten track to supporting structure at corners, ends, and spacings indicated on Shop Drawings.
- B. Install joists level, straight, and plumb; adjust to final position, brace, and reinforce. Fasten joists to both flanges of joist track.
 - 1. Install joists over supporting frame or flange of joist track as occurs, with a minimum end bearing of 1-1/2 inches.
 - 2. Reinforce ends and bearing points of joists with web stiffeners, end clips, joist hangers, steel clip angles, or steel-stud sections.
- C. Space joists not more than 2 inches from abutting walls parallel with joists, and as follows:
 - 1. Joist Spacing: 16 inches.

- D. Frame openings with built-up joist headers, consisting of joist and joist track or another combination of connected joists if indicated.
- E. Install joist reinforcement at interior supports with single, short length of joist section located directly over interior support, with lapped joists of equal length to joist reinforcement.
 - 1. Install web stiffeners to transfer axial loads of walls above.
- F. Install bridging at intervals indicated on Shop Drawings. Fasten bridging at each joist intersection as follows:
 - 1. Combination Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and joist-track solid blocking of width and thickness indicated. Fasten flat straps to bottom flange of joists and secure solid blocking to joist webs.
- G. Secure joists to load-bearing interior walls to prevent lateral movement of bottom flange.
- H. Install miscellaneous joist framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold-down angles, anchors, and fasteners, to provide a complete and stable joist-framing assembly.

3.06 MISCELLANEOUS FRAMING INSTALLATION

- A. General:
 - 1. Where miscellaneous framing is installed parallel to stud framing in wall, align miscellaneous framing over studs. Securely anchor at corners and ends, and at spacings as follows:
 - a. Anchor Spacing: As shown on Shop Drawings.
 - 2. Where miscellaneous framing is installed perpendicular to stud framing in wall, secure over studs. Securely anchor at corners and ends, and at spacing as follows:
 - a. Anchor Spacing: As shown on Shop Drawings.
 - 3. Set miscellaneous framing plumb, level and true to plane.

3.07 ERECTION TOLERANCES

- A. Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
 - 1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.08 FIELD QUALITY CONTROL

- A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Field and shop welds will be subject to testing and inspecting.
- C. Testing agency will report test results promptly and in writing to Contractor and Architect.
- D. Remove and replace work where test results indicate that it does not comply with specified requirements.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.09 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 054000

SECTION 055000 - METAL FABRICATIONS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Miscellaneous Steel Framing and Supports (055000.A01) for:
 - a. Storefront and curtain wall.
 - b. Overhead doors.
 - c. Operable partitions.
 - d. Countertops.
 - e. Low Partitions.
 - f. Interior athletic equipment.
 - g. Mechanical and Electrical equipment.
 - h. Bracing of partition non-load bearing CMU walls.
 - i. Steel framing and supports for applications where framing and supports are not specified in other Sections.
 - 2. Trash Enclosure Supports and accessories (055000.A24).
 - a. Supports and framing for trash enclosure gates.
 - b. Supports and framing for trash enclosure.
 - c. Supports and framing for pipe gates.
 - 3. Shelf angles (055000.A05).
 - 4. Miscellaneous steel trim (055000.A13).
 - 5. Metal bollards (055000.A14).
 - 6. Loose bearing and leveling plates (055000.A21) for applications where they are not specified in other Sections.
 - 7. Slotted-channel inserts and ceiling assembly.
- B. Products furnished, but not installed, under this Section include the following:
 - 1. Loose steel lintels (055000.A22).
 - 2. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
 - 3. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.
- C. Related Requirements:
 - 1. Section 033000 "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, slotted-channel inserts, wedge-type inserts, and other items cast into concrete.
 - 2. Section 042000 "Unit Masonry" for installing loose lintels, anchor bolts, and other items built into unit masonry.
 - 3. Section 051200 "Structural Steel Framing" for steel framing, supports, elevator machine beams, hoist beams, divider beams, door frames, and other steel items attached to the structural-steel framing.
 - 4. Section 077200 "Roof Accessories" for manufactured metal roof walkways and metal roof stairs.

1.2 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.3 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Nonslip aggregates and nonslip-aggregate surface finishes.
 - 2. Metal nosings and treads.
 - 3. Paint products.
 - 4. Shrinkage-resisting grout.
 - 5. Slotted channel framing.
- B. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide Shop Drawings for the following:
 - 1. Miscellaneous steel framing and supports.
 - a. Steel framing and supports for operable partitions.
 - b. Steel framing and supports for overhead doors.
 - c. Steel framing and supports for countertops.
 - d. Steel tube reinforcement for low partitions.
 - e. Steel framing and supports for mechanical and electrical equipment.
 - f. Bracing of partition non-load bearing CMU walls.
 - g. Steel framing and supports for applications where framing and supports are not specified in other Sections.
 - 2. Shelf angles.
 - 3. Metal ladders.
 - 4. Metal ship's ladders.
 - 5. Metal bollards.
 - 6. Loose steel lintels.
- C. Samples for Verification: For each type and finish of extruded nosing and tread.
- D. Delegated-Design Submittal: For items indicated under Performance Requirements, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For professional engineer's experience with providing delegated-design engineering services of the kind indicated, including documentation that engineer is licensed in the jurisdiction in which Project is located.
- B. Mill Certificates: Signed by stainless-steel manufacturers, certifying that products furnished comply with requirements.
- C. Welding certificates.
- D. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
- E. Research/Evaluation Reports: For post-installed anchors, from ICC-ES.

1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - 2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
 - 3. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

1.6 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

1.7 SEQUENCING

- A. Deliver steel bearing plates to be built into cast-in-place concrete and masonry construction.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design the following.
 - 1. Metal ships ladders.
 - 2. Connections to Building Structure.
 - a. Delegated design engineer shall coordinate with structural engineer to design connections to building structure.
- B. Structural Performance of Aluminum Ladders: Ladders, including landings, shall withstand the effects of loads and stresses within limits and under conditions specified in ANSI A14.3.
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
- D. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

2.2 METALS

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- B. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- C. Steel Channels, Plates, Shapes, and Bars: ASTM A 36/A 36M.
- D. Stainless-Steel Sheet, Strip, and Plate: ASTM A 240/A 240M or ASTM A 666, Type 304.
- E. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304.
- F. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.
- G. Rolled-Stainless-Steel Floor Plate: ASTM A 793.
- H. Abrasive-Surface Floor Plate: Steel plate with abrasive material metallurgically bonded to steel.
- I. Steel Tubing: ASTM A 500/A 500M, cold-formed steel tubing.
- J. Steel Pipe: ASTM A 53/A 53M, Standard Weight (Schedule 40) unless otherwise indicated.
- K. Zinc-Coated Steel Wire Rope: ASTM A741.

1. Wire Rope Fittings: Hot-dip galvanized-steel connectors with capability to sustain, without failure, a load equal to minimum breaking strength of wire rope with which they are used.
- L. Stainless Steel Wire Rope: Wire rope manufactured from stainless steel wire complying with ASTM A492, Type 316.
 1. Wire Rope Fittings: Stainless steel connectors, Type 316, with capability to sustain, without failure, a load equal to minimum breaking strength of wire rope with which they are used.
- M. Steel Prestressing Strand: ASTM A416/A416M, Grade 270 (Grade 1860), low-relaxation, seven-wire, with 0.9-lb/sq. ft. (4.39-kg/sq. m) zinc coating.
 1. Steel Prestressing Strand Fittings: Hot-dip galvanized-steel anchors and connectors with capability to sustain, without failure, a load equal to minimum breaking strength of steel prestressing strand with which they are used.
- N. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4, and as follows:
 1. Size of Channels: 1-5/8 by 1-5/8 inches.
 2. Material: Galvanized steel, ASTM A 653/A 653M, with G90 (Z275) coating.
- O. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.
- P. Aluminum Plate and Sheet: ASTM B 209, Alloy 6061-T6.
- Q. Aluminum Extrusions: ASTM B 221, Alloy 6063-T6.
- R. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, Alloy 6061-T6.
- S. Aluminum Castings: ASTM B 26/B 26M, Alloy 443.0-F.
- T. Bronze Extrusions: ASTM B455, Alloy UNS No. C38500 (extruded architectural bronze).
- U. Bronze Castings: ASTM B584, Alloy UNS No. C83600 (lead red brass) or UNS No. C84400 (lead semired brass).
- V. Nickel Silver Extrusions: ASTM B151/B151M, Alloy UNS No. C74500.
- W. Nickel Silver Castings: ASTM B584, Alloy UNS No. C97600 (20 percent lead nickel bronze).

2.3 FASTENERS

- A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
 1. Provide stainless-steel fasteners for fastening aluminum.
 2. Provide stainless-steel fasteners for fastening stainless steel.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.
- C. High-Strength Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325 (Grade A325M), Type 3, heavy-hex steel structural bolts; ASTM A563, Grade DH3, (ASTM A563M, Class 10S3) heavy-hex carbon-steel nuts; and where indicated, flat washers.
- D. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, ASTM F 593; with hex nuts, ASTM F 594; and, where indicated, flat washers; Alloy Group 1.
- E. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.
 1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.
- F. Anchors, General: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.

- G. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.
- H. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.
 - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.
 - 2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.
- I. Slotted-Channel Inserts and Ceiling Assembly: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 1-5/8 inches by length indicated with anchor straps or studs not less than 3 inches long at not more than 8 inches o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B 633, Class Fe/Zn 5, as needed for fastening to inserts.
 - 1. Refer to Reflected Ceiling Plans on drawings for locations using this product.

2.4 MISCELLANEOUS MATERIALS

- A. Shop Primers: Provide primers that comply with Section 099113 "Exterior Painting," Section 099123 Interior Painting," and Section 099600 "High-Performance Coatings."
- B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
 - 1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- C. Water-Based Primer: Emulsion type, anticorrosive primer for mildly corrosive environments that is resistant to flash rusting when applied to cleaned steel, complying with MPI#107 and compatible with topcoat.
- D. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.
- E. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.
- F. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- G. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.
- H. Shrinkage-Resistant Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- I. Concrete: Comply with requirements in Section 033000 "Cast-in-Place Concrete",
- J. Neoprene Pads: High-strength, multipurpose neoprene rubber pads, smooth texture, thickness as indicated on drawings (ENGINEER SHOW THICKNESS), complying with ASTM D2000 BC, with a durometer rating of 50A and minimum tensile strength of 1,400 psi.
 - 1. Basis of Design: McMaster-Carr Product No. 1290N36 (12" x 12" sheet).

2.5 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

- D. Form exposed work with accurate angles and surfaces and straight edges.
- E. Weld corners and seams continuously to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.
- G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
- J. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS (055000.A01)

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
 - 1. Fabricate units from slotted channel framing where indicated.
 - 2. Furnish inserts for units installed after concrete is placed.
 - 3. Galvanize miscellaneous framing and supports for exterior application and where indicated for interior applications.
- C. Fabricate supports for operable partitions from continuous steel beams of sizes indicated with attached bearing plates, anchors, and braces as indicated. Drill or punch bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition Shop Drawings.
- D. Galvanize miscellaneous framing and supports where indicated.
- E. Prime miscellaneous framing and supports with zinc-rich primer, if not exposed to view; or primer specified in Section 099600 "High-Performance Coatings" where exposed to view or painted.

2.7 SHELF ANGLES (055000.A05)

- A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and 24 inches o.c., unless otherwise indicated.
 - 1. Provide mitered and welded units at corners.
 - 2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches larger than expansion or control joint.
- B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.
- C. Galvanize shelf angles located in exterior walls.
- D. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.8 METAL LADDERS (055000.A06)

- A. General:
 - 1. Comply with ANSI A14.3, except for elevator pit ladders.
 - 2. For elevator pit ladders, comply with ASME A17.1/CSA B44.
- B. Steel Ladders:
 - 1. Space siderails 16 inches apart unless otherwise indicated.
 - 2. Siderails: Continuous, 3/8-by-2-1/2-inch steel flat bars, with eased edges.
 - 3. Rungs - Exterior: 3/4-inch-diameter bars.
 - a. At Contractor's option, "Small Hole Traction Tread" plank ladder rungs as manufactured by McNichols Co. may be utilized in lieu of bar rungs. Traction treads shall be 3-row type, 1-5/8 inches wide by 1-1/8 inches high having a weight of at least 1.3 lbs/lf.
 - 4. Rungs – Interior: "Small Hole Traction Tread" plank ladder rungs as manufactured by McNichols Co. Traction treads shall be 3-row type, 1-5/8 inches wide by 1-1/8 inches high having a weight of at least 1.3 lbs/lf. Provide nonslip surfaces on top of each rung by coating with abrasive material metallically bonded to rung.
 - 5. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
 - 6. Provide nonslip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.
 - 7. Provide nonslip surfaces on top of each rung by coating with abrasive material metallically bonded to rung.
 - 8. Provide platforms as indicated fabricated from welded or pressure-locked steel bar grating, supported by steel angles. Limit openings in gratings to no more than 1/2 inch in least dimension.
 - 9. Support each ladder at top and bottom and not more than 60 inches o.c. with welded or bolted steel brackets.
 - 10. Galvanize exterior ladders and ladder in elevator pit, including brackets.
 - 11. Prime ladders, including brackets and fasteners, with zinc-rich primer specified in Section 099600 "High-Performance Coatings."

2.9 SHIPS LADDER WITH WALK-THRU AND PLATFORM RETURN (055000.A10)

- A. Provide metal ladders where indicated. Fabricate of open-type construction with channel or plate stringers and pipe and tube railings unless otherwise indicated. Refer to drawings and as specified below. Provide with manufacturer's standard floor-mounting brackets. Provide brackets and fittings for installation. Provide precast pavers 24" X 24" X 4" for ladder attachment at roof.
 - 1. Basis-of-Design Products: Subject to compliance with requirements, provide the following ship's ladders as manufactured by Precision Ladders, LLC.
 - a. Model SL-04.
 - 1) Size: Per drawings, field verify.
 - b. Comply with applicable railing requirements in Section 055213 "Pipe and Tube Railings."
 - 2. Fabricate ladders including railings from aluminum.
 - a. Where ladder provides access to roof hatch, fabricate railing to accommodate roof hatch access.
 - 3. Fabricate treads and platforms from extruded-aluminum plank grating or from pressure-locked aluminum bar grating. Provide ladder manufacturer's standard aluminum railing secured to ship's ladder.
 - a. Limit openings in gratings to no more than 3/4 inch in least dimension.
 - 4. Treads shall be not less than 5 inches exclusive of nosing or less than 8-1/2 inches including the nosing, and riser height shall be not more than 9-1/2 inches.
 - 5. Rest platform: provide as required.
- B. Structural Performance: Ladder shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated.
 - 1. Load: 1000 lb total.
 - 2. Uniform and concentrated loads need not be assumed to act concurrently.
 - 3. Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
- C. Clear Anodic Finish: AA-M10C22A41 Mechanical finish as fabricated. Architectural Class I, clear coating 0.018 mm or thicker.

2.10 CROSSOVER SHIPS LADDER (055000.A11)

- A. Provide metal ladders where indicated. Fabricate of open-type construction with channel or plate stringers and pipe and tube railings unless otherwise indicated. Refer to drawings and as specified below. Provide with manufacturer's standard floor-mounting brackets. Provide brackets and fittings for installation. Provide precast pavers 24" X 24" X 4" for ladder attachment at roof.
 - 1. Basis-of-Design Products: Subject to compliance with requirements, provide the following ship's ladders as manufactured by Precision Ladders, LLC.
 - a. Model SL-03.
 - 1) Size: Per drawings, field verify.
 - b. Comply with applicable railing requirements in Section 055213 "Pipe and Tube Railings."
 - 2. Fabricate ladders including railings from aluminum.
 - a. Where ladder provides access to roof hatch, fabricate railing to accommodate roof hatch access.
 - 3. Fabricate treads and platforms from extruded-aluminum plank grating or from pressure-locked aluminum bar grating. Provide ladder manufacturer's standard aluminum railing secured to ship's ladder.
 - a. Limit openings in gratings to no more than 3/4 inch in least dimension.
 - 4. Treads shall be not less than 5 inches exclusive of nosing or less than 8-1/2 inches including the nosing, and riser height shall be not more than 9-1/2 inches.
 - 5. Rest platform: provide as required.
- B. Structural Performance: Ladder shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated.
 - 1. Load: 1000 lb total.
 - 2. Uniform and concentrated loads need not be assumed to act concurrently.
 - 3. Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
- C. Clear Anodic Finish: AA-M10C22A41 Mechanical finish as fabricated. Architectural Class I, clear coating 0.018 mm or thicker.

2.11 MISCELLANEOUS STEEL TRIM (055000.A13)

- A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.
- B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
 - 1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.
- C. Galvanize exterior miscellaneous steel trim.
- D. Prime miscellaneous steel trim with zinc-rich primer, if not exposed to view; or primer specified in Section 099600 "High-Performance Coatings" where exposed to view or painted.

2.12 METAL BOLLARDS (055000.A14)

- A. Fabricate metal bollards from Schedule 40 steel pipe.
 - 1. Where bollards are indicated to receive controls for door operators, provide cutouts for controls and holes for wire.
 - 2. Where bollards are indicated to receive light fixtures, provide cutouts for fixtures and holes for wire.
- B. Fabricate bollards with 6 inch outside diameter and 3/8-inch-thick steel baseplates for bolting to concrete slab. Drill baseplates at all four corners for 3/4-inch anchor bolts.
 - 1. Where bollards are to be anchored to sloping concrete slabs, angle baseplates for plumb alignment of bollards.
- C. Fabricate sleeves for bollard anchorage from steel pipe or tubing with 1/4-inch-thick steel plate welded to bottom of sleeve. Make sleeves not less than 8 inches deep and 3/4 inch larger than OD of bollard.
- D. Prime bollards with zinc rich primer.

2.13 LOOSE BEARING AND LEVELING PLATES (055000.A21)

- A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.
- B. Galvanize plates.
- C. Prime plates with zinc-rich primer.

2.14 LOOSE STEEL LINTELS (055000.A22)

- A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.
- B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span, but not less than 8 inches unless otherwise indicated.
- C. Galvanize loose steel lintels located in exterior walls.
- D. Prime loose steel lintels located in exterior walls with zinc-rich primer, if not exposed to view; or primer specified in Section 099600 "High-Performance Coatings" where exposed to view or painted.

2.15 STEEL WELD PLATES AND ANGLES

- A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.16 FINISHES, GENERAL

- A. Finish metal fabrications after assembly.
- B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.17 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.
 - 1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
- B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.
- C. Shop prime iron and steel items unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
 - 1. Shop prime with universal shop primer unless zinc-rich primer is indicated.
- D. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:
 - 1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 3. Items Indicated to Receive Primers Specified in Section 099600 "High-Performance Coatings": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 4. Other Items: SSPC-SP 3, "Power Tool Cleaning."
- E. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

2.18 ALUMINUM FINISHES

- A. As-Fabricated Finish: AA-M12.
- B. Clear Anodic Finish: AAMA 611, Class I, AA-M12C22A41.

PART 3 EXECUTION

3.1 INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. Field Welding: Comply with the following requirements:
 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.
 3. Remove welding flux immediately.
 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.
- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- F. Corrosion Protection: Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:
 1. Cast Aluminum: Heavy coat of bituminous paint.
 2. Extruded Aluminum: Two coats of clear lacquer.
- G. Connect downspout boots to downspouts and to subdrainage system vertical risers as recommended by boot manufacturer.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.
- B. Anchor supports for operable partitions and overhead doors securely to, and rigidly brace from, building structure.

3.3 INSTALLING METAL BOLLARDS

- A. Anchor bollards to existing construction with expansion anchors. Provide four 3/4-inch bolts at each bollard unless otherwise indicated.
 1. Embed anchor bolts at least 4 inches in concrete.

- B. Anchor bollards in place with concrete footings. Center and align bollards in holes 3 inches above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.
- C. Fill bollards solidly with concrete, mounding top surface to shed water.
 - 1. Do not fill removable bollards with concrete.
 - 2. At Contractor's Option: Provide precast concrete tops. Class "A" form finish with 5000 psi concrete reinforced with microfibers.
 - a. Basis of Design Product: Subject to compliance with requirements provide "Top Gard Pipe Bollard Cap" by TopGard Construction Products.
 - b. Size: To accommodate bollard diameter. Coordinate with Drawings.
 - c. Bolts: Provide quantity by manufacturer's written specifications according to precast top size.

3.4 INSTALLING BEARING AND LEVELING PLATES

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.
- B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with nonshrink grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.5 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - 1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
- C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780/A 780M.

END OF SECTION 055000

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SECTION 055100 - METAL STAIRS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Pre-assembled Steel stairs with steel-grating treads (055100.A01)
 - a. Industrial Class stairs.
 - 2. Steel tube railings attached to metal stairs (055100.A08).
 - a. Refer to Section 055213 for additional requirements.
 - 3. Steel tube handrails attached to walls adjacent to metal stairs (055100.A10).
 - a. Refer to Section 055213 for additional requirements.
- B. Related Sections:
 - 1. Section 033000 "Cast-in-Place Concrete" for concrete fill for stair treads and landings.
 - 2. Section 051200 "Structural Metal Framing" for additional structural member incorporated in the use of this section.
 - 3. Section 055213 "Pipe and Tube Railings" for steel pipe and tube railings.
 - 4. Section 099600 "High Performance Coatings" for touch-up priming and finish painting of stairs.

1.2 ACTION SUBMITTALS

- A. Product Data: For metal stairs.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
- C. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation. See also Paragraph 1.2 B above for additional requirements.
- D. Samples for Verification: For exposed structural steel and stainless steel railing connections, provide a welded sample indicating workmanship and finish requirements.
 - 1. Sample shall include a 12 inch long finished section of the stringer and 6 inch tall section of stainless steel railing post with post welded to stringer.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified professional engineer.
- B. Welding certificates.

1.4 QUALITY ASSURANCE

- A. Fabricator Qualifications: A firm experienced in producing metal pan stairs and railings similar to that indicated for this Project and with a 10-year record of successful in-service performance, as well as sufficient production capacity to produce required units.
- B. Installer Qualifications: Fabricator of products.
- C. High-Performance-Coating Applicator Qualifications: A firm experienced in successfully applying high-performance coatings, of type indicated, to steel fabrications and employing competent control personnel to conduct continuing, effective quality-control program to ensure compliance with requirements.
- D. NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM AMP 510, "Metal Stairs Manual," for class of stair designated, unless more stringent requirements are indicated.

1. Industrial-Type Stairs – Non-Public Stairs: Industrial class.
- E. Welding Qualifications: Qualify procedures and personnel according to the following:
1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 2. AWS D1.3, "Structural Welding Code - Sheet Steel."

1.5 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages for metal stairs. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- C. Coordinate locations of hanger rods and struts with other work so that they will not encroach on required stair width.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Refer to Section 051200 "Structural Steel Framing" for performance requirements regarding connections and materials to be included in the work of this Section.
- B. Delegated Design Requirements:
 1. General:
 - a. For steel connections and metal pan stair treads, design is shown schematically.
 - b. Design metal connections and concrete filled metal tread pans, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
 - c. Refer to Section 014000 "Quality Requirements" for additional requirements regarding delegated designs.
 2. Provide steel stairs with concrete filled treads.
 3. Provide connections of stairs to building construction.
 4. Provide for railings and connections of railings to stairs.
- C. Structural Performance of Stairs: Metal stairs shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 1. Uniform Load: 100 lbf/sq. ft.
 2. Concentrated Load: 300 lbf applied on an area of 4 sq. in.
 3. Uniform and concentrated loads need not be assumed to act concurrently.
 4. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
 5. Limit deflection of treads, platforms, and framing members as follows:
 - a. For stairs and landings indicated to receive precast concrete: $L/720$ or $1/8"$, whichever is less.
 - b. For all other stairs: $L/360$ or $1/4$ inch, whichever is less.
- D. Structural Performance of Railings: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 1. Handrails and Top Rails of Guards:
 - a. Uniform load of 50 lbf/ft. applied in any direction.
 - b. Concentrated load of 200 lbf applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
 2. Infill of Guards:
 - a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft..
 - b. Infill load and other loads need not be assumed to act concurrently.
 3. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 - a. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

- E. Seismic Performance of Stairs: Metal stairs shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. Component Importance Factor: 1.5.

2.2 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- C. Steel Tubing for Railings: ASTM A 500/A 500M (cold formed) or ASTM A 513/A 513M.
 - 1. Provide galvanized finish for exterior installations and where indicated.
- D. Steel Pipe for Railings: ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.
 - 1. Provide galvanized finish for exterior installations and where indicated.
- E. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/a 283M, Grade C or D.
- F. Uncoated, Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, either commercial steel, Type B, or structural steel, Grade 25, unless another grade is required by design loads; exposed.
- G. Uncoated, Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, either commercial steel, Type B, or structural steel, Grade 30, unless another grade is required by design loads.
- H. Galvanized-Steel Sheet: ASTM A 653/A 653M, G90 coating, either commercial steel, Type B, or structural steel, Grade 33, unless another grade is required by design loads.

2.3 FASTENERS

- A. General: Provide zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 12 for exterior use, and Class Fe/Zn 5 where built into exterior walls. Select fasteners for type, grade, and class required.
- B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.
- C. Anchor Bolts: ASTM F 1554, Grade 55, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.
- D. Machine Screws: ASME B18.6.3.
- E. Lag Screws: ASME B18.2.1.
- F. Plain Washers: Round, ASME B18.22.1.
- G. Lock Washers: Helical, spring type, ASME B18.21.1.
- H. Post-Installed Anchors: Torque-controlled expansion anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
 - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.

2.4 MISCELLANEOUS MATERIALS

- A. Welding Electrodes: Comply with AWS requirements.
- B. Shop Primers: Provide primers that comply with Section 099600 "High-Performance Coatings."
- C. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish system indicated.
- D. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.
- F. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107/C 1107M, factory-packaged, nonmetallic aggregate grout; recommended by manufacturer for exterior use; noncorrosive and nonstaining; mixed with water to consistency suitable for application and a 30-minute working time.
- G. Prefilled Concrete Treads:
 - 1. Concrete Materials and Properties: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with minimum 28-day compressive strength of 3000 psi and maximum aggregate size of 1/2 inch unless otherwise indicated.
 - 2. Plain Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, galvanized steel, 6 by 6 inches, W1.4 by W1.4, unless otherwise indicated on Drawings.
 - 3. Reinforcement Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening welded-wire reinforcement in place.
 - a. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete.
- H. For galvanized reinforcement, use galvanized wire or dielectric-polymer-coated wire bar supports.

2.5 FABRICATION, GENERAL

- A. Provide complete stair assemblies, including metal framing, hangers, struts, railings, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.
 - 1. Join components by welding unless otherwise indicated.
 - 2. Use connections that maintain structural value of joined pieces.
- B. Preassembled Stairs: Assemble stairs in shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- E. Form exposed work with accurate angles and surfaces and straight edges.
- F. Weld connections to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. Weld exposed corners and seams continuously unless otherwise indicated.
 - 5. At exposed connections in stairs, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 1 welds: no evidence of a welded joint.
 - 6. Avoid discoloration of stainless steel at welded connections.
- G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise

indicated. Locate joints where least conspicuous.

2.6 STEEL-FRAMED STAIRS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Alfab, Inc.
 - 2. American Stair, Inc.
 - 3. Sharon Companies Ltd. (The).
 - 4. Approved local fabricator.
- B. Stair Framing:
 - 1. Industrial Class Stair: Fabricate stringers of steel channel stringers.
 - a. Provide closures for exposed ends of stringers.
 - b. Construct platforms of steel channels and miscellaneous framing members as needed to comply with performance requirements.
 - 2. Use Commercial Class for metal pan stairs.
 - 3. Weld or bolt stringers to headers; weld or bolt framing members to stringers and headers. If using bolts, fabricate and join so bolts are not exposed on finished surfaces. Refer to paragraphs below.
 - a. Weld and grind smooth structural connections per requirements at surfaces exposed to view.
 - 4. Where masonry walls support metal stairs, provide temporary supporting struts designed for erecting steel stair components before installing masonry.
- C. Metal-Pan Stairs: Form risers, subreads pans, and subplatforms to configurations shown from steel sheet of thickness needed to comply with performance requirements, but not less than 0.067 inch.
 - 1. Steel Sheet: Uncoated cold-rolled steel sheet.
 - 2. Directly weld metal pans to stringers; locate welds on top of subreads where they will be concealed by precast concrete treads. Do not weld risers to stringers.
 - 3. Attach risers and subreads to stringers with brackets made of steel angles or bars. Weld brackets to stringers and attach metal pans to brackets by welding, riveting, or bolting.
 - 4. Shape metal pans to include nosing integral with riser.
 - 5. Provide subplatforms of configuration indicated or, if not indicated, the same as subreads. Weld subplatforms to platform framing.
 - 6. Risers shall be fabricated from perforated cold-rolled steel sheets.
 - a. Basis of Design: Subject to compliance with requirements provide products by McNichols, or another manufacturers submitted to and accepted by Architect prior to bidding, with the following product characteristics.
 - b. Thickness: 20 gauge (0.0359 inches) minimum.
 - c. Perforations: 1/4 inch round holes on 3/8 inch staggered centers (40 percent open area).
 - 7. In addition to special care used to handle and fabricate steel for architectural class stairs, comply with the following:
 - a. Fabricate with exposed surfaces smooth, square, and free of surface blemishes including pitting, rust, scale, and roughness.
 - b. Grind sheared, punched, and flame-cut edges of to remove burrs and provide smooth surfaces and edges.
 - c. Fabricate with exposed surfaces free of mill marks, including rolled trade names and stamped or raised identification.
 - d. Fabricate with exposed surfaces free of seams to maximum extent possible.
 - e. Remove blemishes by filling or grinding or by welding and grinding, before cleaning, treating, and shop priming.
- D. Special Finishing Requirements for Stairs:
 - 1. Use special care in handling and shipping of stair steel both before and after shop painting minimize damage to any shop finish. Use Nylon type slings or softeners when using chains or wire rope slings.
 - 2. Fabricate and assemble steel in the shop to the greatest extent possible. Locate field joints in steel assemblies at concealed locations or as approved by the Architect. Detail steel assemblies to minimize field handling and expedite erection.
 - 3. Remove blemishes or unsightly surfaces resulting from temporary braces or fixtures.
 - 4. Remove all backing and run out tabs.
 - 5. Grind all sharp edges smooth, including all sheared, punched or fame cut edges.
 - 6. Appearance and quality of welds shall be consistent.
 - 7. Remove all weld spatter, slivers and similar surface discontinuities.

8. Grind off projections larger than 1/16 in. at butt and plug welds.
9. Seal weld open ends of round and rectangular hollow structural Section with 3/8 in. closure plates.

2.7 FABRICATION OF STAIR RAILINGS

- A. Fabricate railings to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of member, post spacings, wall bracket spacing, and anchorage, but not less than that needed to withstand indicated loads.
 1. Guard Rails and Posts: 1-1/2-inch-square top and bottom rails and 1-1/2-inch-square posts unless otherwise detailed.
 2. Hand Rails: 1-1/2 inch round unless otherwise detailed.
 3. Picket Infill: 1/2-inch-square pickets spaced less than 4 inches clear.
 4. Intermediate Rails Infill: 1-1/2-inch-square.
 5. Safety Swing Gate: Universal self-closing safety gate, extra wide. Swing gate to open a full 90 degree angle with a heavy duty stainless steel spring that locks the gate to prevent unnecessary mishaps.
 - a. Basis of Design Product: Subject to compliance with requirements provide "EGASCG-X-S Universal Self Closing Swing Gate" by Global Industrial.
 - 1) Material: Stainless steel tube. 1-1/4 inches maximum diameter.
 - 2) Opening Width: 40 to 48 inches.
 - 3) Adjustable Width: 2 inches.
 - 4) Length: 48 to 56 inches.
 - 5) Weight: 46 pounds.
 - 6) Mounting Style: Bolt on.
 - 7) Certified and in compliance with OSHA (Occupational Safety and Health Administration).
- B. Welded Connections: Fabricate railings with welded connections.
 1. Fabricate connections that are exposed to weather in a manner that excludes water.
 - a. Provide weep holes where water may accumulate internally.
 2. Cope components at connections to provide close fit, or use fittings designed for this purpose.
 3. Weld all around at connections, including at fittings.
 4. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 5. Obtain fusion without undercut or overlap.
 6. Remove flux immediately.
 7. Finish welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #1 - No evidence of a welded joint as shown in NAAMM AMP 521.
 8. At exposed connections in Industrial Class stairs, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 3 welds; all welding spatter removed.
- C. Form changes in direction of railings as follows:
 1. As detailed.
- D. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- E. Close exposed ends of railing members with fully welded end fittings.
- F. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated.
 1. Close ends of returns.
- G. Connect posts to stair framing by direct welding unless otherwise indicated.
- H. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnecting components and for attaching to other work.
 1. Furnish inserts and other anchorage devices for connecting to adjacent construction.
 2. For galvanized railings, provide galvanized fittings, brackets, fasteners, sleeves, and other ferrous-metal components.
 3. For nongalvanized railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors embedded in exterior masonry and concrete construction.
 4. Provide type of bracket indicated and that provides 1-1/2-inch clearance from inside face of handrail to finished wall surface.

- I. Fillers: Provide fillers made from steel plate, or other suitably crush-resistant material, where needed to transfer wall bracket loads through wall finishes to structural supports.
 - 1. Size fillers to suit wall finish thicknesses and to produce adequate bearing area to prevent bracket rotation and overstressing of substrate.
- J. Special Finishing Requirements for Stair Railings:
 - 1. Use special care in handling and shipping of stair steel both before and after shop painting minimize damage to any shop finish. Use Nylon type slings or softeners when using chains or wire rope slings.
 - 2. Fabricate and assemble steel in the shop to the greatest extent possible. Locate field joints in steel assemblies at concealed locations or as approved by the Architect. Detail steel assemblies to minimize field handling and expedite erection.
 - 3. Remove blemishes or unsightly surfaces resulting from temporary braces or fixtures.
 - 4. Remove all backing and run out tabs.
 - 5. Grind all sharp edges smooth, including all sheared, punched or flame cut edges.
 - 6. Appearance and quality of welds shall be consistent.
 - 7. Remove all weld spatter, slivers and similar surface discontinuities.
 - 8. Grind off projections larger than 1/16 in. at butt and plug welds.
 - 9. Seal weld open ends of round and rectangular hollow structural Section with 3/8 in. closure plates.

2.8 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish metal stairs after assembly.
- C. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 3, "Power Tool Cleaning."
- D. Apply shop primer to uncoated surfaces of metal stair components, except those with galvanized finishes and those to be embedded in concrete or masonry unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
 - 1. Prime paint corners, crevices, bolts, welds, and sharp edges.
 - 2. Apply primers to comply with Section 099600 "High Performance Coatings."
- E. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.
 - 1. Do not quench or apply post-galvanizing treatments that might interfere with paint adhesion.
 - 2. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

PART 3 EXECUTION

3.1 INSTALLATION, GENERAL

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.
- C. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete unless otherwise indicated.
 - 1. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- D. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field

connections.

E. Field Welding: Comply with requirements for welding in "Fabrication, General" Article.

3.2 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0 mil dry film thickness.

END OF SECTION 055100

SECTION 055213 - PIPE AND TUBE RAILINGS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Steel pipe and tube railings and handrails (055213.A01).
 - 2. Stainless steel railing system (055213.A03).
 - 3. Handrails:
 - a. Wall-mounted stainless steel (055213.A03).
- B. Related Requirements:
 - 1. Section 055100 "Metal Stairs" for steel tube railings associated with metal pan stairs.
 - 2. Section 057113 "Fabricated Metal Spiral Stairs" for steel railings associated with fabricated metal spiral stairs.
 - 3. Section 061000 "Rough Carpentry" for wood blocking for anchoring railings.
 - 4. Section 092116 "Non-Structural Metal Framing" for metal backing for anchoring railings.
 - 5. Section 099600 "High-Performance Coatings" for painting railings.

1.2 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- C. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

1.3 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Railing brackets.
 - 2. Grout, anchoring cement, and paint products.
- B. Shop Drawings: For each railing and handrail type, including plans, elevations, sections, details, and attachments to other work.
- C. Samples: For each type of exposed finish required.
 - 1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters. Sample shall be of a fully-assembled unit not less than 2 feet in height and 2 feet in length.
 - 2. Fittings and brackets.
 - 3. Welded connections.
 - 4. Assembled Sample of railing system, made from full-size components, including top rail, post, handrail, and infill. Sample does not need to be full height.
 - a. Show method of connecting and finishing members at intersections.
- D. Delegated-Design Submittal: For railings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.

- B. Welding certificates.
- C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.
- D. Product Test Reports: For pipe and tube railings, for tests performed by a qualified testing agency, according to ASTM E 894 and ASTM E 935.
- E. Evaluation Reports: For post-installed anchors, from ICC-ES.

1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 2. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

1.7 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

1.8 COORDINATION AND SCHEDULING

- A. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- B. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not suit structural performance requirements.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design railings, including attachment to building construction.
- B. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 1. Handrails and Top Rails of Guards:
 - a. Uniform load of 50 lbf/ ft. applied in any direction.
 - b. Concentrated load of 200 lbf applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
- D. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

2.2 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
- B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.
 - 1. Provide type of bracket with flange tapped for concealed anchorage to threaded hanger bolt and that provides 1-1/2-inch clearance from inside face of handrail to finished wall surface.
 - a. At enclosed egress stairs provide type of bracket with predrilled hole for exposed bolt anchorage and that provides 1-1/2-inch clearance from inside face of handrail to finished wall surface.
 - b. Wall mounted handrail bracket for stainless steel handrails, Basis of Design: Morse Industries, Part R13-0111-000-12.

2.3 STEEL AND IRON

- A. General: Provide tube or pipe as determined from fabricator's engineering design.
- B. Tubing: ASTM A 500 (cold formed) or ASTM A 513.
 - 1. Provide galvanized finish for exterior installations and where indicated.
- C. Pipe: ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.
 - 1. Provide galvanized finish for exterior installations and where indicated.
- D. Plates, Shapes, and Bars: ASTM A 36/A 36M.
- E. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.

2.4 STAINLESS STEEL

- A. General: Sizes and profiles of components are indicated on Drawings.
- B. Tubing: ASTM A 554, Grade MT 304.
- C. Pipe: ASTM A 312/A 312M, Grade TP 304.
- D. Castings: ASTM A 743/A 743M, Grade CF 8 or CF 20.
- E. Sheet, Strip, Plate, and Flat Bar: ASTM A 666, Type 304.
- F. Bars and Shapes: ASTM A 276, Type 304.
 - 1. Sizes as shown on the drawings.

2.5 FASTENERS

- A. General: Provide the following:
 - 1. Hot-Dip Galvanized Railings: Type 304 stainless-steel or hot-dip zinc-coated steel fasteners complying with ASTM A 153/A 153M or ASTM F 2329 for zinc coating.
 - 2. Stainless-Steel Railings: Type 304 stainless-steel fasteners.
 - 3. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.
- B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.
- C. Fasteners for Interconnecting Railing Components:

1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless exposed fasteners are unavoidable or are the standard fastening method for railings indicated.
 2. Provide tamper-resistant flat-head machine screws for exposed fasteners unless otherwise indicated.
- D. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to 6 times the load imposed when installed in unit masonry and 4 times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.
1. Material for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.
 2. Material for Exterior Locations: Alloy Group 1 (A1) stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).

2.6 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
1. For stainless steel railings, provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.
- B. Etching Cleaner for Galvanized Metal: Complying with MPI#25.
- C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.
- D. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- E. Shop Primers: Provide primers that comply with Section 099600 "High-Performance Coatings."
- F. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer compatible with topcoat.
1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- G. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.
- H. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.
- I. Non-shrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- J. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.
1. Water-Resistant Product: At exterior locations provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

2.7 FABRICATION

- A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.
- B. Shop assemble railings to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.
- C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
1. Provide smooth surfaces and edges.
 2. Provide exposed surfaces free of seams to maximum extent possible.
 3. Remove blemishes by filling or grinding or by welding and grinding, before cleaning, treating, and shop priming.

- D. Form work true to line and level with accurate angles and surfaces.
- E. Fabricate connections that are exposed to weather in a manner that excludes water. Provide weep holes where water may accumulate.
- F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
- G. Connections: Fabricate railings with welded connections unless otherwise indicated.
- H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove flux immediately.
 - 4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours, color and finish of adjoining surfaces.
 - 5. Welding for all stainless steel shall be in accordance with Category 1 AESS and as follows:
 - a. Provide continuous welds of uniform size and profile.
 - b. Welds flush to adjacent surfaces within tolerance of plus 1/16 inch, minus zero inch.
 - c. Make fillet welds for of uniform size and profile with exposed face smooth and slightly concave. Do not grind unless directed to correct unacceptable work.
- I. Non-welded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
 - 1. Fabricate splice joints for field connection using an epoxy structural adhesive if this is manufacturer's standard splicing method.
- J. Form Changes in Direction as Follows:
 - 1. For steel railings: As detailed on Drawings.
 - 2. For stainless steel railings: Mitered, unless detailed otherwise.
- K. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- L. Close exposed ends of railing members with prefabricated end fittings.
- M. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.
- N. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.
 - 1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers or other means to transfer loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.
- O. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.
- P. For railing posts set in concrete, provide stainless-steel sleeves not less than 6 inches long with inside dimensions not less than 1/2 inch greater than outside dimensions of post, with metal plate forming bottom closure.
- Q. Toe Boards: Where indicated, provide toe boards at railings around openings and at edge of open-sided floors and platforms. Fabricate to dimensions and details indicated.

2.8 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

- B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- C. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

2.9 STEEL AND IRON FINISHES

- A. Galvanized Railings:
 - 1. Hot-dip galvanize exterior steel railings, including hardware, after fabrication.
 - 2. Comply with ASTM A 123/A 123M for hot-dip galvanized railings.
 - 3. Comply with ASTM A 153/A 153M for hot-dip galvanized hardware.
 - 4. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
 - 5. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
- B. For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.
- C. Preparing Galvanized Railings for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner.
- D. For nongalvanized-steel railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves; however, galvanize anchors to be embedded in exterior concrete or masonry.
- E. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with requirements indicated below:
 - 1. Exterior Railings: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 2. Railings Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 3. Railings Indicated to Receive Primers Specified in Section 099600 "High-Performance Coatings": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 4. Other Railings: SSPC-SP 3, "Power Tool Cleaning."
- F. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Shop, Field, and Maintenance Painting of Steel," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.
 - 1. Shop prime uncoated railings with primers specified in Section 099600 "High-Performance Coatings" are indicated.
 - 2. Do not apply primer to galvanized surfaces.
- G. Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

2.10 STAINLESS-STEEL FINISHES

- A. Remove tool and die marks and stretch lines, or blend into finish.
- B. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.
- C. 180-Grit Polished Finish: Oil-ground, uniform, directionally textured finish.
- D. Directional Satin Finish: No. 4.
- E. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements are clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.2 INSTALLATION, GENERAL

- A. Fit exposed connections together to form tight, hairline joints.
- B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
 - 1. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
 - 2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
 - 3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.
- C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
- D. Adjust railings before anchoring to ensure matching alignment at abutting joints.
- E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.3 RAILING CONNECTIONS

- A. Non-welded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of railings.
- B. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.
- C. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches beyond joint on either side, fasten internal sleeve securely to one side, and locate joint within 6 inches of post.

3.4 ANCHORING POSTS

- A. Use metal sleeves preset and anchored into concrete for installing posts. After posts are inserted into sleeves, fill annular space between post and sleeve with non-shrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.
- B. Form or core-drill holes not less than 5 inches deep and 3/4 inch larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with non-shrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.
 - 1. At exterior locations, hold grout/anchoring material down from adjacent concrete 1/2 inch to allow for sealant. Provide bond break to inhibit 3-sided adhesion of sealant and fill joint with sealant, building up 1/8 inch and sloping away from post.
 - 2. At interior installations, tool anchoring material flush with adjacent surface.
 - a. Interior installations of posts at concrete slabs shall not include exposed flanges or fasteners.
 - b. Coordinate installation of posts with installation requirements for polished concrete slabs.

- C. Anchor posts to metal surfaces with oval flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:
 - 1. For stainless-steel pipe railings, weld flanges to post and bolt to supporting surfaces.
 - 2. For steel pipe railings, weld flanges to post and bolt to metal supporting surfaces.

3.5 ATTACHING RAILINGS

- A. Attach railings to wall with wall brackets. Provide brackets with 1-1/2-inch clearance from inside face of handrail and finished wall surface. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
- B. Secure wall brackets and railing end flanges to building construction as follows:
 - 1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
 - 2. For hollow masonry anchorage, use toggle bolts.
 - 3. For steel-framed partitions, use hanger or lag bolts set into fire-retardant-treated wood backing between studs. Coordinate with stud installation to locate backing members.
 - 4. For steel-framed partitions, use self-tapping screws fastened to steel framing or to concealed steel reinforcements.
 - 5. For steel-framed partitions, use toggle bolts installed through flanges of steel framing or through concealed steel reinforcements.

3.6 ADJUSTING AND CLEANING

- A. Clean stainless steel by washing thoroughly with clean water and soap and rinsing with clean water.
- B. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 requirements for touching up shop-painted surfaces.
 - 1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
- C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas, and repair galvanizing to comply with ASTM A 780/A 780M.

3.7 PROTECTION

- A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

END OF SECTION 055213

SECTION 061000 - ROUGH CARPENTRY

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Miscellaneous framing with dimension lumber (061000.A01).
 - 2. Rooftop support curbs (061000.A14, 061000.A17).
 - 3. Wood blocking, cants, and nailers (061000.A13)
 - 4. Preservative-treated wood blocking, cants and nailers (061000.A12).
 - 5. Fire-Retardant-Treated Wood blocking and nailers (061000.A16).
 - 6. Wood furring and grounds (061000.A15, 061000.A18).
 - 7. Plywood blocking panels (061000.A19).
 - 8. Fire retardant treated plywood blocking and backing panels (061000.A20).
 - 9. Preservative-treated plywood blocking panels (061000.A22)
 - 10. Sill-Sealer Gaskets (061000.A11).
 - 11. Flexible Strip Flashing (061000.A24).
- B. Related Requirements:
 - 1. Section 061600 "Sheathing" for sheathing, subflooring, and underlayment.
 - 2. Section 313116 "Termite Control" for site application of borate treatment to wood framing.

1.2 DEFINITIONS

- A. Boards or Strips: Lumber of less than 2 inches nominal size in least dimension.
- B. Dimension Lumber: Lumber of 2 inches nominal size or greater but less than 5 inches nominal size in least dimension.
- C. Lumber grading agencies, and the abbreviations used to reference them, include the following:
 - 1. NLGA: National Lumber Grades Authority.
 - 2. SPIB: The Southern Pine Inspection Bureau.
 - 3. WCLIB: West Coast Lumber Inspection Bureau.
 - 4. WWPA: Western Wood Products Association.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
 - 1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
 - 2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
 - 3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.
 - 4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
 - 5. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

1.4 INFORMATIONAL SUBMITTALS

- A. Evaluation Reports: For the following, from ICC-ES:
 - 1. Wood-preservative-treated wood.

2. Fire-retardant-treated wood.
3. Power-driven fasteners.
4. Post-installed anchors.
5. Expansion anchors and metal framing anchors.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Stack wood products flat with spacers beneath and between each bundle to provide air circulation. Protect wood products from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
 1. Factory mark each piece of lumber with grade stamp of grading agency.
 2. Dress lumber, S4S, unless otherwise indicated.
- B. Maximum Moisture Content of Lumber: 19 percent for 2-inch nominal thickness or less; no limit for more than 2-inch nominal thickness unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

- A. Preservative Treatment by Pressure Process: AWP A U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.
 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
 2. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
 1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by inspection agency.
- D. Application: Treat items indicated on Drawings, and the following:
 1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
 2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
 3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
 4. Wood floor plates that are installed over concrete slabs-on-grade.

2.3 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Where fire-retardant-treated materials are indicated, materials shall comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
- B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
 - 1. Treatment shall not promote corrosion of metal fasteners.
 - 2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
 - 3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.
 - 4. Design Value Adjustment Factors: Treated lumber shall be tested according to ASTM D 5664 and design value adjustment factors shall be calculated according to ASTM D 6841. For enclosed roof framing, framing in attic spaces, and where high temperature fire-retardant treatment is indicated, provide material with adjustment factors of not less than 0.85 modulus of elasticity and 0.75 for extreme fiber in bending for Project's climatological zone.
- C. Kiln-dry lumber after treatment to maximum moisture content of 19 percent. Kiln-dry plywood after treatment to maximum moisture content of 15 percent.
- D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.
- E. Application: Treat items indicated on Drawings, and the following:
 - 1. Framing for raised platforms and stages.
 - 2. Plywood blocking and backing panels.
 - 3. Roof construction.

2.4 DIMENSION LUMBER FRAMING

- A. Miscellaneous Framing (061000.A01): No. 2 grade.
 - 1. Species:
 - a. Hem-fir (north); NLGA.
 - b. Mixed southern pine; SPIB.
 - c. Douglas fir-larch; WCLIB or WWPA.
 - 2. Refer to Article 2.2 and Article 2.3 for locations of preservative treated wood and fire retardant treated wood.

2.5 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
 - 1. Preservative-treated blocking, grounds and nailers (061000.A12).
 - 2. Blocking, grounds and nailers (061000.A13).
 - a. Blocking for wall-mounted cabinets and casework shall be 2x6, minimum.
 - 3. Curbs and cants (061000.A14).
 - 4. Furring (061000.A15).
 - 5. Fire-retardant treated wood blocking and nailers (061000.A16).
 - 6. Fire-retardant treated wood curbs and cants (061000.A17).
 - a. Rooftop equipment bases and support curbs.
 - 7. Fire-retardant treated wood furring: (061000.A18).
- B. Dimension Lumber Items: Construction or No. 2 grade lumber of any of the following species:
 - 1. Mixed southern pine or southern pine; SPIB.

2. Spruce-pine-fir; NLGA.
 3. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
 4. Western woods; WCLIB or WWPA.
- C. Concealed Boards: 19 percent maximum moisture content and any of the following species and grades:
1. Mixed southern pine or southern pine; No. 2 grade; SPIB.
 2. Spruce-pine-fir (south) or spruce-pine-fir; Construction or No. 2 Common grade; NeLMA, NLGA, WCLIB, or WWPA.
 3. Western woods; WCLIB or WWPA.
- D. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.
- E. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.
1. Nailers shall be anchored to resist a pull of 175 lbs. / foot in any direction. **[[LEES SUMMIT NOTE]]**
 2. Nailers shall be fastened according to Factory Mutual Data Sheet 1-49. **[[LEES SUMMIT NOTE]]**
- F. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.6 MISCELLANEOUS PLYWOOD PANELS

- A. General: DOC PS 1, Exposure 1, CD, non-fire-retardant treated and fire-retardant treated as noted below, in thickness indicated or, if not indicated, not less than 5/8-inch nominal thickness.
1. Plywood shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
 2. Plywood blocking and backing panels, non-fire-retardant treated (061000.A19).
 3. Fire-Retardant-Treated Plywood blocking and backing panels (061000.A20).
 - a. Note that plywood equipment backing panels are specified in Article below.
 4. Preservative Treated Plywood blocking and backing panels, non-fire-retardant treated (061000.A22).

2.7 PLYWOOD BACKING PANELS

- A. Equipment Backing Panels (061000.A20): Plywood, DOC PS 1, Exterior, A-C, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch nominal thickness.
1. Plywood shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.8 FASTENERS

- A. General: Fasteners shall be of size and type indicated and shall comply with requirements specified in this article for material and manufacture.
1. Where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
 2. Where rough carpentry is preservative treated or fire-retardant-treated wood materials, provide Type 304 stainless steel fasteners or fasteners with corrosion-protective coating have a salt-spray resistance of more than 800 hours according to ASTM B117.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- D. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC58 or ICC-ES AC308 as appropriate for the substrate.
1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.

2. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2.

2.9 METAL FRAMING ANCHORS (061000.A10)

- A. Allowable design loads, as published by manufacturer, shall meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency. Framing anchors shall be punched for fasteners adequate to withstand same loads as framing anchors.
- B. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 coating designation.
 1. Use for interior locations unless otherwise indicated.
- C. Hot-Dip, Heavy-Galvanized Steel Sheet: ASTM A 653/A 653M; structural steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 coating designation; and not less than 0.036 inch thick.
 1. Use for wood-preserved-treated lumber and where indicated.
- D. Stainless-Steel Sheet: ASTM A 666, Type 304 or Type 316.
 1. Use for exterior locations and where indicated.
- E. Joist Hangers: U-shaped joist hangers with 2-inch-long seat and 1-1/4-inch-wide nailing flanges at least 85 percent of joist depth.
 1. Thickness: 0.062 inch.
- F. I-Joist Hangers: U-shaped joist hangers with 2-inch-long seat and 1-1/4-inch-wide nailing flanges full depth of joist. Nailing flanges provide lateral support at joist top chord.
 1. Thickness: 0.062 inch.
- G. Top Flange Hangers: U-shaped joist hangers, full depth of joist, formed from metal strap with tabs bent to extend over and be fastened to supporting member.
 1. Strap Width: 2 inches.
 2. Thickness: 0.062 inch.
- H. Bridging: Rigid, V-section, nailless type, 0.050 inch thick, length to suit joist size and spacing.
- I. Joist Ties: Flat straps, with holes for fasteners, for tying joists together over supports.
 1. Width: 1-1/4 inches.
 2. Thickness: 0.062 inch.
 3. Length: 24 inches.
- J. Wall Bracing: T-shaped bracing made for letting into studs in saw kerf, 1-1/8 inches wide by 9/16 inch deep by 0.034 inch thick with hemmed edges.
- K. Wall Bracing: Angle bracing made for letting into studs in saw kerf, 15/16 by 15/16 by 0.040 inch thick with hemmed edges.

2.10 MISCELLANEOUS MATERIALS

- A. Flexible Strip Flashing (061000.A24): Provide self-adhering, membrane, 40 mils thick.
 1. Available Products: Subject to compliance with requirements, products that may be incorporated in the work included, but are not limited to, the following:
 - a. Air-Shield by W. R. Meadows, Inc.
 - b. Blueskin by Henry Corp.
 - c. CCW 705 by Carlisle Coatings & Waterproofing.
 - d. Hyload S/A Through Wall Flashing by Hyload, Inc.
- B. Adhesives for Gluing Furring and Sleepers to Concrete or Masonry: Formulation complying with ASTM D 3498 that is approved for use indicated by adhesive manufacturer.
 1. Adhesives shall have a VOC content of 70 g/L or less.

2. Adhesive shall comply with the testing and product 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."
- C. Water-Repellent Preservative: NWWDA-tested and -accepted formulation containing 3-iodo-2-propynyl butyl carbamate, combined with an insecticide containing chlorpyrifos as its active ingredient.

PART 3 EXECUTION

3.1 INSTALLATION, GENERAL

- A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- B. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.
- C. Install plywood blocking and backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.
- D. Do not splice structural members between supports unless otherwise indicated.
- E. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
 1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.
- F. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:
 1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
- G. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- H. Comply with AWPAC M4 for applying field treatment to cut surfaces of preservative-treated lumber.
 1. Use inorganic boron for items that are continuously protected from liquid water.
 2. Use copper naphthenate for items not continuously protected from liquid water.
- I. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- J. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 1. NES NER-272 for power-driven fasteners.
 2. Table 2304.10.1, "Fastening Schedule," in ICC's International Building Code.
 3. ICC-ES evaluation report for fastener.
- K. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.
- L. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced, and with adjacent rows staggered.
 1. Comply with approved fastener patterns where applicable. Before fastening, mark fastener locations, using a template made of sheet metal, plastic, or cardboard.
 2. Use finishing nails unless otherwise indicated. Countersink nail heads and fill holes with wood filler.

3.2 WOOD BLOCKING, AND NAILER INSTALLATION

- A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.
- C. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.3 WOOD FURRING INSTALLATION

- A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.
- B. Furring to Receive Plywood: Install 1-by-3-inch nominal-size furring vertically at 16 inches o.c.
- C. Furring to Receive Gypsum Board: Install 1-by-2-inch nominal-size furring vertically at 16 inches o.c.

3.4 WALL AND PARTITION FRAMING INSTALLATION

- A. General: Provide single bottom plate and double top plates using members of 2-inch nominal thickness whose widths equal that of studs, except single top plate may be used for non-load-bearing partitions and for load-bearing partitions where framing members bearing on partition are located directly over studs. Fasten plates to supporting construction unless otherwise indicated.
 - 1. For exterior walls, provide 2-by-6-inch nominal- size wood studs spaced 16 inches o.c. unless otherwise indicated.
 - 2. For interior partitions and walls, provide 2-by-4-inch nominal- size wood studs spaced 16 inches o.c. unless otherwise indicated.
 - 3. Provide continuous horizontal blocking at midheight of partitions more than 96 inches high, using members of 2-inch nominal thickness and of same width as wall or partitions.
- B. Construct corners and intersections with three or more studs[, except that two studs may be used for interior non-load-bearing partitions].
- C. Frame openings with multiple studs and headers. Provide nailed header members of thickness equal to width of studs. Support headers on jamb studs.
 - 1. For non-load-bearing partitions, provide double-jamb studs and headers not less than 4-inch nominal depth for openings 48 inches and less in width, 6-inch nominal depth for openings 48 to 72 inches in width, 8-inch nominal depth for openings 72 to 120 inches in width, and not less than 10-inch nominal depth for openings 10 to 12 feet in width.
 - 2. For load-bearing walls, provide double-jamb studs for openings 60 inches and less in width, and triple-jamb studs for wider openings. Provide headers of depth indicated.
- D. Provide diagonal bracing in walls, at locations indicated, at 45-degree angle, full-story height unless otherwise indicated. Use metal wall bracing, let into studs in saw kerf.

3.5 FLOOR JOIST FRAMING INSTALLATION

- A. General: Install floor joists with crown edge up and support ends of each member with not less than 1-1/2 inches of bearing on wood or metal, or 3 inches on masonry. Attach floor joists as follows:
 - 1. Where supported on wood members, by using metal framing anchors.
 - 2. Where framed into wood supporting members, by using wood ledgers as indicated or, if not indicated, by using metal joist hangers.
- B. Fire Cuts: At joists built into masonry, bevel cut ends 3 inches and do not embed more than 4 inches.

- C. Frame openings with headers and trimmers supported by metal joist hangers; double headers and trimmers where span of header exceeds 48 inches.
- D. Do not notch in middle third of joists; limit notches to one-sixth depth of joist, one-third at ends. Do not bore holes larger than one-third depth of joist; do not locate closer than 2 inches from top or bottom.
- E. Provide solid blocking of 2-inch nominal thickness by depth of joist at ends of joists unless nailed to header or band.
- F. Lap members framing from opposite sides of beams, girders, or partitions not less than 4 inches or securely tie opposing members together. Provide solid blocking of 2-inch nominal thickness by depth of joist over supports.
- G. Anchor members paralleling masonry with 1/4-by-1-1/4-inch metal strap anchors spaced not more than 96 inches o.c., extending over and fastening to three joists. Embed anchors at least 4 inches into grouted masonry with ends bent at right angles and extending 4 inches beyond bend.
- H. Provide solid blocking between joists under jamb studs for openings.
- I. Under non-load-bearing partitions, provide double joists separated by solid blocking equal to depth of studs above.
 - 1. Provide triple joists separated as above, under partitions receiving ceramic tile and similar heavy finishes or fixtures.
- J. Provide bridging of type indicated below, at intervals of 96 inches o.c., between joists.
 - 1. Diagonal wood bridging formed from bevel-cut, 1-by-3-inch nominal-size lumber, double-crossed and nailed at both ends to joists.
 - 2. Steel bridging installed to comply with bridging manufacturer's written instructions.

3.6 CEILING JOIST AND RAFTER FRAMING INSTALLATION

- A. Ceiling Joists: Install with crown edge up and complying with requirements specified above for floor joists. Face nail to ends of parallel rafters.
 - 1. Where ceiling joists are at right angles to rafters, provide additional short joists parallel to rafters from wall plate to first joist; nail to ends of rafters and to top plate, and nail to first joist or anchor with framing anchors or metal straps. Provide 1-by-8-inch nominal-size or 2-by-4-inch nominal-size stringers spaced 48 inches o.c. crosswise over main ceiling joists.
- B. Rafters: Notch to fit exterior wall plates and use metal framing anchors. Double rafters to form headers and trimmers at openings in roof framing, if any, and support with metal hangers. Where rafters abut at ridge, place directly opposite each other and nail to ridge member or use metal ridge hangers.
 - 1. At valleys, provide double-valley rafters of size indicated or, if not indicated, of same thickness as regular rafters and 2 inches deeper. Bevel ends of jack rafters for full bearing against valley rafters.
 - 2. At hips, provide hip rafter of size indicated or, if not indicated, of same thickness as regular rafters and 2 inches deeper. Bevel ends of jack rafters for full bearing against hip rafter.
- C. Provide collar beams (ties) as indicated or, if not indicated, provide 1-by-6-inch nominal-size boards between every third pair of rafters, but not more than 48 inches o.c. Locate below ridge member, at third point of rafter span. Cut ends to fit roof slope and nail to rafters.
- D. Provide special framing as indicated for eaves, overhangs, dormers, and similar conditions if any.

3.7 PROTECTION

- A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.
- B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061000

SECTION 061600 - SHEATHING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Preservative-treated plywood sheathing (061600.A01).
2. Fire Rated plywood sheathing (061600.A02).
3. Plywood wall sheathing (061600.A03).
4. Type X glass-mat gypsum wall sheathing. (061600.A04).
5. Cementitious wall sheathing (061600.A05).
6. Air-Barrier and water-resistant glass-mat gypsum wall sheathing (061600.A14).
7. Roof Sheathing (061600.A06).
8. Plywood Ceiling Sheathing (061600.A07).
9. Composite Insulated Wall Sheathing (061600.A08).
10. Composite Insulated Roof Sheathing (061600.A09).
11. Subflooring (061600.A11).
12. Underlayment (061600.A12).
13. Mass Loaded Acoustical Vinyl (061600.A13).
14. Structural Concrete Panel (061600.A20).
15. Miscellaneous sheathing as indicated for backup to sheet metal flashing, coping, and other applications indicated.
16. Sheathing joint and penetration treatment.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for plywood backing panels.
2. Section 072500 "Weather Barriers" for water-resistive barrier applied over wall sheathing.
3. Section 072726 "Air-Barrier Coatings" for air barrier applied over wall sheathing.

1.2 PREINSTALLATION MEETINGS

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

1.3 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Indicate type of preservative used and net amount of preservative retained.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Include physical properties of treated materials.
3. For fire-retardant treatments, include physical properties of treated plywood both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5516.
 - a. Include copies of warranties from chemical treatment manufacturers for each type of treatment.
4. For products receiving waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
5. Include data for Structural Concrete Panel including fasteners and panel layout.

1.4 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For the following, from ICC-ES:

1. Wood-preservative-treated plywood.
2. Fire-retardant-treated plywood.

1.5 QUALITY ASSURANCE

- A. Mockups: Build mockups to set quality standards for materials and execution and for preconstruction testing.
 - 1. Build integrated mockups of exterior wall assembly as indicated on Drawings, incorporating backup wall construction, window, storefront, door frame and sill, ties and other penetrations, and flashing to demonstrate crack and joint treatment and sealing of gaps, terminations, and penetrations of air-barrier sheathing assembly.
 - a. Coordinate construction of mockups to permit inspection and testing of sheathing before external insulation and cladding are installed.
 - b. Include junction with roofing membrane, building corner condition, and foundation wall intersection.
 - c. If Architect determines mockups do not comply with requirements, reconstruct mockups until mockups are approved.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- B. Testing Agency Qualifications:
 - 1. For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.
 - 1. Panels must be stored over stable soil or other surface. Soil or surface must be able to carry the load of the stored pallet(s). Each 20-piece pallet weighs 3,500 lbs. It is recommended that the load carrying capacity of the floor or surfaces be verified before storing panels.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance Ratings: As tested according to ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.2 WOOD PANEL PRODUCTS - GENERAL

- A. Plywood: DOC PS1.
 - 1. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.
 - 2. Factory mark panels to indicate compliance with applicable standard.

2.3 WOOD-PRESERVATIVE-TREATED PLYWOOD

- A. Preservative Treatment by Pressure Process: AWP A U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.
 - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
 - 2. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.

- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
 - 1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by inspection agency.
- D. Application: Treat items indicated on Drawings and plywood in contact with masonry or concrete, plywood used with roofing, coping, flashing, vapor barriers, and waterproofing.

2.4 FIRE-RETARDANT-TREATED PLYWOOD

- A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
- B. Fire-Retardant-Treated Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
 - 1. Use treatment that does not promote corrosion of metal fasteners.
 - 2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
 - 3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D3201/D3201M at 92 percent relative humidity. Use where exterior type is not indicated.
 - 4. Design Value Adjustment Factors: Treated lumber plywood shall be tested according to ASTM D5516 and design value adjustment factors shall be calculated according to ASTM D6305. Span ratings after treatment shall be not less than span ratings specified. For roof sheathing and where high-temperature fire-retardant treatment is indicated, span ratings for temperatures up to 170 deg F (76 deg C) shall be not less than span ratings specified.
- C. Kiln-dry material after treatment to a maximum moisture content of 15 percent. Do not use material that is warped or does not comply with requirements for untreated material.
- D. Identify fire-retardant-treated plywood with appropriate classification marking of qualified testing agency.
- E. Application: Treat plywood indicated on Drawings, and the following:
 - 1. Roof and wall sheathing within 48 inches (1220 mm) of fire party walls.
 - 2. Wall sheathing.
 - 3. Roof sheathing.
 - 4. Subflooring and underlayment for raised platforms.
 - 5. Back side of parapets where indicated.

2.5 WALL SHEATHING

- A. Preservative-treated plywood sheathing (061600.A01).
 - 1. Span Rating: Not less than 16/0.
 - 2. Nominal Thickness: Unless specifically indicated otherwise, not less than 5/8 inch.
 - 3. Size: 48 by 96 inches or as required for vertical installation without butt joints.
- B. Fire Retardant Treated Plywood Wall Sheathing: (061600.A02)
 - 1. Span Rating: Not less than 16/0.
 - 2. Nominal Thickness: Unless specifically indicated otherwise, not less than 5/8 inch, except 3/4 inch at back sides of parapets.
 - 3. Size: 48 by 96 inches or as required for vertical installation without butt joints.
- C. Plywood Wall Sheathing: (061600.A03)
 - 1. Span Rating: Not less than 16/0.

2. Nominal Thickness: Not less than 5/8 inch.
 3. Size: 48 by 96 inches or as required for vertical installation without butt joints.
 4. Locations: Where specifically indicated.
- D. Glass-Mat Gypsum Wall Sheathing: (061600.A04)
1. Products: Subject to compliance with requirements provide one of the following:
 - a. CertainTeed Corporation; GlasRoc Sheathing Type X.
 - b. G-P Gypsum Corporation; DensGlass Fireguard.
 - c. National Gypsum Company; Gold Bond eXP Fire-Shield.
 - d. United States Gypsum Co.; Securock.
 2. Type and Thickness: Type X, 5/8 inch thick.
 3. Size: 48 by 96 inches or as required for vertical installation without butt joints.
- E. Cementitious Wall Sheathing (061600.A05): ASTM C1325, Type A.
1. Products: Subject to compliance with requirements provide one of the following:
 - a. National Gypsum; PermaBase Cement Board.
 2. Thickness: 5/8 inch (15.9 mm).

2.6 COMPOSITE NAIL BASE INSULATED WALL SHEATHING

- A. Plywood-Surfaced, Polyisocyanurate-Foam Wall Sheathing (061600.A08):
1. Basis of Design Products: Subject to compliance with requirements, provide one of the following.
 - a. "Hunter Xci Ply" by Hunter Panels.
 - b. Comparable products, with the following product characteristics, shall be considered when submitted to and accepted by Architect prior to bidding.
 2. Product Characteristics:
 - a. Description: Plywood sheathing with foam insulation board factory adhered to one side.
 - b. Plywood Surfacing: DOC PS 2, Exposure 1, fire-retardant treated plywood.
 - 1) Thickness: 3/4 inches minimum.
 - c. Foam Insulation Board: ASTM C 1289, Type II, Class 1, polyisocyanurate foam insulation board.
 - 1) Thickness:
 - (a) 2 inches at precast concrete and CMU walls.
 - (b) 3 inches at cold formed metal framed walls.
 - d. Adhesive: For areas where polyisocyanurate foam insulation board is attached to precast concrete or CMU walls, provide manufactureres recommended adhesive products.

2.7 COMPOSITE NAIL BASE INSULATED ROOF SHEATHING

- A. Plywood-Surfaced, Polyisocyanurate-Foam Sheathing (061600.A09): ASTM C 1289, Type II, Class 1, with DOC PS 2, Exposure 1, fire-retardant treated plywood adhered to one face.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Hunter
 - b. Atlas Roofing Corporation
 - c. GAF Cornell Corporation
 - d. Rmax, Inc.
 2. Polyisocyanurate Insulation shall be installed in two layers.
 - a. Base layer shall be polyisocyanurate board mechanically fastened to structural roof sheathing substrate.
 - 1) Thickness: 2 inches.
 - 2) Thermal Resistance: R-11 minimum.
 - b. Top layer shall be composite insulated roof sheathing mechanically fastened through base layer and to structural roof sheathing substrate.
 - 1) Basis of Design Product: "H-Shield NB" by Hunter Panels or a comparable product submitted to and accepted by Architect.
 - 2) Thickness: 3 inches minimum, including 5/8 inch fire retardant treated Plywood panels.
 - 3) Thermal Resistance: R-15 minimum.

2.8 SOFFIT SHEATHING

- A. Glass-Mat-Faced Gypsum Sheathing (061600.A04): ASTM C 1177/1177M.
 - 1. Type and Thickness: Type X, 5/8 inch thick.
 - 2. Size: 48 by 96 inches for vertical installation.

2.9 STRUCTURAL CONCRETE PANEL (061600.A20)

- A. Basis of Design: Provide "STRUCTO-CRETE® Structural Panels" by United States Gypsum Company (USG),
 - 1. Comparable products, with the following product characteristics, shall be considered when submitted to and accepted by Architect prior to bidding.
- B. Product Characteristics:
 - 1. Thickness: 3/4" (19 mm).
 - 2. Width: 4' (1220 mm).
 - 3. Long Edges: Tongue and Groove.
- C. Panel Properties:
 - 1. Density: 75 lb/ft³ (1200 kg/m³) tested in accordance with ASTM C1185.
 - 2. Weight: 5.0 lbs/ft² (24.4 kg/m²) tested in accordance with ASTM D1037 at a thickness of 3/4" (19 mm).
 - 3. Noncombustibility: Pass tested in accordance with ASTM E136.
 - 4. Surface Burning Characteristics: 0 Flame Spread / 0 Smoke Developed tested in accordance with ASTM E84.
- D. Fasteners: Provide panel fasteners as recommended by the structural concrete panel manufacturer,

2.10 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
 - 1. For roof and parapet sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
 - 2. For wall sheathing, provide fasteners with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- D. Screws for Fastening Sheathing to Wood Framing: ASTM C 1002.
- E. Screws for Fastening Wood Structural Panels to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.
- F. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.
 - 1. For steel framing less than 0.0329 inch thick, use screws that comply with ASTM C 1002.
 - 2. For steel framing from 0.033 to 0.112 inch thick, use screws that comply with ASTM C 954.
- G. Screws for Fastening Composite Nail Base Insulated Wall Sheathing to Cold-Formed Metal Framing: Steel drill screws, in type and length recommended by sheathing manufacturer for thickness of sheathing to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B117. Provide washers or plates if recommended by sheathing manufacturer.

2.11 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

- A. **[ONLY FOR AIR BARRIER COMBO SHEATHING - SHOULD BE IN SECTION 072729]**
- B. Sealant for Glass-Mat Gypsum Sheathing: Silicone emulsion sealant complying with ASTM C834, compatible with sheathing tape and sheathing and recommended by tape and sheathing manufacturers for use with glass-fiber sheathing tape and for covering exposed fasteners.
 - 1. Sheathing Tape: Self-adhering glass-fiber tape, minimum 2 inches (50 mm) wide, 10 by 10 or 10 by 20 threads/inch (390 by 390 or 390 by 780 threads/m), of type recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass-mat gypsum sheathing and with a history of successful in-service use.
- C. Sheathing Tape for Foam-Plastic Sheathing: Pressure-sensitive plastic tape recommended by sheathing manufacturer for sealing joints and penetrations in sheathing.

PART 3 EXECUTION

3.1 INSTALLATION, GENERAL

- A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.
- B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.
- C. Securely attach to substrate by fastening as indicated, complying with the following:
 - 1. Table 2304.9.1, "Fastening Schedule," in the ICC's International Building Code.
 - 2. ICC-ES evaluation report for fastener.
- D. Coordinate sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.
- E. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
- F. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 GYPSUM SHEATHING INSTALLATION

- A. Comply with GA-253 and with manufacturer's written instructions.
 - 1. Fasten gypsum sheathing to wood framing with screws.
 - 2. Fasten gypsum sheathing to cold-formed metal framing with screws.
 - 3. Install panels with a 3/8-inch gap where non-load-bearing construction abuts structural elements.
 - 4. Install panels with a 1/4-inch gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.
- B. Apply fasteners so heads bear tightly against face of sheathing, but do not cut into facing.
 - 1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of boards.
- C. Horizontal Installation: Install sheathing with V-grooved edge down and tongue edge up. Interlock tongue with groove to bring long edges in contact with edges of adjacent panels without forcing. Abut ends over centers of studs, and stagger end joints of adjacent panels not less than one stud spacing. Attach at perimeter and within field of panel to each stud.
 - 1. Space fasteners approximately 8 inches (200 mm) o.c. and set back a minimum of 3/8 inch (9.5 mm) from edges and ends of panels.

2. For sheathing under stucco cladding, panels may be initially tacked in place with screws if overlying self-furring metal lath is screw-attached through sheathing to studs immediately after sheathing is installed.
- D. Vertical Installation: Install vertical edges centered over studs. Abut ends and edges with those of adjacent panels. Attach at perimeter and within field of panel to each stud.
1. Space fasteners approximately 8 inches (200 mm) o.c. and set back a minimum of 3/8 inch (9.5 mm) from edges and ends of panels.
 2. For sheathing under stucco cladding, panels may be initially tacked in place with screws if overlying self-furring metal lath is screw-attached through sheathing to studs immediately after sheathing is installed.

3.3 CEMENTITIOUS WALL SHEATHING INSTALLATION

- A. Install panels and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated.

3.4 STRUCTURAL CONCRETE PANEL

- A. When mechanically fastened do not install when ambient or conditioned temperature is below 0 °F (-18 °C).
- B. When applying finished flooring structural panels must be conditioned at the same temperature as required for the finished flooring for at least 48 hours.

END OF SECTION 061600

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SECTION 064023 - INTERIOR ARCHITECTURAL WOODWORK

PART 1 GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Flush Wood Paneling (064023.A05 - CLG6).
 - 2. Interior plastic laminated clad panels (064023.A08 – WP1, WP2, WP3).
 - 3. Metal Edge Trim (064023.A24 - TR1, TR2, MTL1).
 - 4. Swinging Display Case Door System (064023.A25).
 - 5. Sliding Display Case Door System (064023.A26).
 - 6. Display case shelving systems (064023.A27).
 - 7. Concealed Countertop Bracket (064023.A32).
 - 8. Exposed Countertop Bracket (064023.A33).
- B. Related Sections include the following:
 - 1. Section 055000 "Metal Fabrications" for decorative metal finished components.
 - 2. Section 061000 "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing woodwork and concealed within other construction before woodwork installation.
 - 3. Section 062023 "Interior Finish Carpentry" for premanufactured wood trim and shelving.
 - 4. Section 092900 "Gypsum Board" for decorative metal reveals.
 - 5. Section 101400 "Signage" for fabricated signage items.
 - 6. Section 123200 "Manufactured Wood Casework" for premanufactured casework.
 - 7. Section 123666 "Solid Surfacing Countertops" for solid surfacing countertops.

1.2 DEFINITIONS

- A. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips for installing woodwork items unless concealed within other construction before woodwork installation.
- B. Balanced Construction: Where exposed face of a panel is surfaced with high pressure plastic laminate and the opposite (back) surface shall receive a cabinet liner or backer sheet when that surface is not exposed to view.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated, including hardware, accessories and solid-surfacing material.
- B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
 - 1. Show details full size.
 - 2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
 - 3. Show locations and sizes of cutouts and holes for items installed in architectural woodwork.
- C. Samples for Initial Selection: For each type of product involving selection of colors, profiles, or textures.
- D. Samples for Verification:
 - 1. For each species and cut of lumber and wood trim with non-factory-applied finish, with 1/2 of exposed surface finished, 50 sq. in. for lumber and 10-inch-long for trim.
 - 2. Veneer-faced panel products with transparent finish, with 1/2 of exposed surface finished, 8 by 10 inches for each species and cut of veneered panel. Include at least one face-veneer seam and finish as specified.
 - 3. Plastic laminate-faced panel products, 8 by 10 inches for each color of plastic laminate panel. Include at two edges with specified edging.
 - 4. Plastic laminates, 8 by 10 inches, for each color, pattern, and surface finish, with one sample applied to core material and specified edge material applied to one edge.
 - 5. Thermoset decorative panels, 8 by 10 inches, for each color, pattern, and surface finish, with edge banding on one edge.

6. Exposed cabinet hardware and accessories, one unit for each type.
7. Solid-surfacing materials, 6 inches square.
8. Display case door rail finish, 4 inches long.
9. Display case brackets and standards, not less than 4 inches long.
10. Perforated Hardboard (Pegboard): 2'-0" long x 12" board width, complete with accessories.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of product, signed by product manufacturer.
- B. Qualification Data: For Installer.

1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance of not less than seven years under the current company name.
- B. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- C. Source Limitations: Engage a qualified woodworking firm to assume undivided responsibility for production of interior architectural woodwork with sequence-matched wood veneers and plastic laminate finishes.
- D. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards" for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.
 1. Comply with "Premium" grading requirements, unless specifically specified otherwise.
- E. Fire-Test-Response Characteristics: Where fire-retardant materials or products are indicated, provide materials and products with specified fire-test-response characteristics as determined by testing identical products per test method indicated by UL, ITS, or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify with appropriate markings of applicable testing and inspecting agency in the form of separable paper label or, where required by authorities having jurisdiction, imprint on surfaces of materials that will be concealed from view after installation.
- F. Preinstallation Conference: Conduct conference at Project site.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver woodwork until painting and similar operations that could damage woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Project Conditions" Article.
- B. Stack lumber, trim, plywood, and other panels flat with spacers between each bundle to provide air circulation. Protect materials from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Do not install interior architectural woodwork materials that are wet, moisture damaged, or mold damaged.
 1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

- C. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 - 1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed, and indicate measurements on Shop Drawings.
 - 2. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating woodwork without field measurements. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.8 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.

1.9 WARRANTY

- A. Special Warranty for Hardware: Manufacturer's standard from in which manufacturer agrees to repair or replace components that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Failure of operating hardware.
 - b. Deterioration of finishes.
 - 2. Warranty period: Three years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 MATERIALS

- A. General: Provide materials that comply with requirements of AWI's quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.
- B. Wood Species and Cut for Transparent Finish: Red Oak, plain sliced/plain sawn. Refer to Material Finish Legend and Drawings for addition information and locations.
- C. Wood Products: Comply with the following:
 - 1. Hardboard: AHA A135.4.
 - 2. Medium-Density Fiberboard: ANSI A208.2, Grade MD, made with binder containing no urea formaldehyde.
 - a. Where Fire Retardant MDF or FRT MDF is indicated, MDF must meet class A requirements per ASTM E 84.
 - 3. Particleboard: ANSI A208.1, Grade M-2-Exterior Glue.
 - 4. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1, made with adhesive containing no urea formaldehyde.
- D. Perforated Hardboard (Pegboard): Manufactured from hardboard as defined by AHA A135.4.
 - 1. Thickness: 3/16 inches.
 - 2. Color: White as selected by Architect.
- E. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by woodwork quality standard.
 - 1. Basis of Design Products: Subject to compliance with requirements, provide "Formica" and "Wilsonart" or comparable product submitted to and accepted by Architect prior to bidding.
 - 2. Colors and Patterns: Refer to Material Finish Legend designations: PL1, PL2.
- F. Thermoset Decorative Panels: Particleboard or medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper complying with LMA SAT-1.
 - 1. Provide PVC or polyester edge banding complying with LMA EDG-1 on components with exposed or semiexposed edges.

- G. Plastic-Laminate-Clad Panels: Particleboard or medium-density fiberboard core, ¾ inch thick, finished with plastic laminate, grade VGS in color as selected by Architect. Each panel shall be self-edged. Back panel face (non-exposed) to receive grade BKL backing sheet.
 - 1. Markerboard Panels (PL#) shall have markerboard edgebanding to match adjacent laminate in color and ability to erase markers. Basis of Design shall be by Rehau or a comparable manufacturer submitted to and accepted by Architect.
- H. Tempered Float Glass for Display Case Doors and Shelves: Refer to Section 088000 for requirements.
- I. Sealant for Countertops: Manufacturer's standard sealant of characteristics indicated below that complies with applicable requirements in Section 079200 "Joint Sealants."
 - 1. Mildew-Resistant Joint Sealant: Mildew resistant, single component, nonsag, neutral curing, silicone.
 - 2. Color: Clear.

2.2 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this Article, acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified.
 - 1. Do not use treated materials that do not comply with requirements of referenced woodworking standard or that are warped, discolored, or otherwise defective.
 - 2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
 - 3. Identify fire-retardant-treated materials with appropriate classification marking of UL, U.S. Testing, Timber Products Inspection, or another testing and inspecting agency acceptable to authorities having jurisdiction.
- B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Comply with performance requirements of AWPA C20 (lumber) and AWPA C27 (plywood). Use the following treatment type:
 - 1. Interior Type A: Low-hygroscopic formulation.
 - 2. Kiln-dry materials before and after treatment to levels required for untreated materials.

2.3 FLUSH WOOD PANELING (064023.A05 - CLG6).

- A. Medium-Density Fiberboard: ANSI A208.2, Grade MD, made with binder containing no urea formaldehyde.
- B. Fire Resistance: Class A per ASTM E 84.
- C. Face Surface: Surfaced (smooth).
- D. Profiles: Refer to Drawings for configurations and profiles required.
- E. Mitre all corners, use 064023.A24 - "MTL1"

2.4 PLASTIC LAMINATE CLAD PANELS (064023.A08 – WP1, WP2, WP3)

- A. General: Plastic-laminate-clad panels shall be fabricated with a particleboard or medium-density fiberboard core, ¾ inch thick, finished with plastic laminate, grade VGS in color as selected by Architect. Each panel shall be self-edged. Back panel face (non-exposed) shall receive grade BKL backing sheet.
 - 1. Fabricate to sizes and configurations indicated.

2.5 METAL EDGE TRIM (064023.A24)

- A. Millwork channel with return keys (064023.A24 - TR1): Subject to compliance with requirements, provide "MWC10050" by Fry Reglet Corporation or comparable product with the following product characteristics, submitted to and accepted by Architect prior to bidding:
 - 1. Material: 6063-T5 Aluminum.
 - 2. Finish: Clear anodized.
 - 3. Projection from Substrate: 1/4 inch.
 - 4. Installed with 1 inch millwork panels at 90 degree outside corners.

5. Provide clips in lengths as required to meet performance requirements.
 6. Installation: Mechanically fastened using manufacturer's recommended fasteners.
- B. Millwork channel "L" angle with return key (064023.A24 - TR2): Subject to compliance with requirements, provide "MWCL100" by Fry Reglet Corporation or comparable product with the following product characteristics, submitted to and accepted by Architect prior to bidding:
1. Material: 6063-T5 Aluminum.
 2. Finish: Black.
 - a. Black to match storefront.
 3. Projection from Substrate: 1/4 inch.
 4. Installed with 1 inch millwork panels at 90 degree outside corners.
 5. Provide clips in lengths as required to meet performance requirements.
 6. Installation: Mechanically fastened using manufacturer's recommended fasteners.
- C. Metal trim (064023.A24 - MTL1): Provide aluminum metal trim to be fastened and painted to match adjacent panels "CLG6".
1. Material: 6063-T5 Aluminum.
 2. Installation: Mechanically fastened using manufacturer's recommended fasteners.
- D. Z-cleats for Mechanically Fastened Interior Panels: Subject to compliance with requirements, provide comparable product with the following product characteristics, submitted to and accepted by Architect prior to bidding:
1. Material: 6063-T6 Aluminum.
 2. Depth: 1/4 inch.
 3. Length of Cleat: 2 inch minimum to 72 inches maximum.
 - a. Provide cleats in lengths as required to meet performance requirements.
 4. Installation: Mechanically fastened using manufacturer's recommended fasteners.

2.6 SWINGING DISPLAY CASE DOOR SYSTEM (064023.A25)

- A. Display Case Doors - Basis-of-Design Product: Subject to compliance with requirements, provide Blumcraft of Pittsburgh / C.R. Laurence Co, Inc.; "Series 1301-SM" Display Case Door System or comparable product from other manufacturers submitted to and accepted by Architect prior to bidding.
1. System Description: System shall include, but not be limited to: manual-swinging display case doors with top and bottom rails: Rail types shall be square type with top and bottom trim. Furnish as complete units with: locks, strike plate and other accessories necessary for complete and fully-functional installation.
 - a. Refer to Section 088000 for glass requirements; glass to be provided by display case door hardware installer.
 - 1) 3/8" thick
 - b. Exposed aluminum surfaces shall have a clear satin anodized finish.
 - c. Aluminum
 - 1) Satin clear anodized

2.7 SLIDING DISPLAY CASE DOOR SYSTEM (064023.A26)

- A. Sliding Display Case Doors and Lock: Basis-of-Design; provide dual track model #P1092 with 984 NP lock as manufactured by Knape & Vogt (K & V). Key all locks for display cases alike.

2.8 DISPLAY CASE SHELVING SYSTEM (064023.A27)

- A. Display Case Shelf Standards and Brackets: Subject to compliance with requirements, provide the following display case shelving, including all accessories and fasteners, or comparable products from other manufacturers, submitted to and accepted by Architect prior to bidding.
1. Display Case Shelving for EPiC:
 - a. Basis-of-Design Product: Arakawa Hanging Systems.
 - b. Top Receiver: Arakawa; Model MF35S. Receiver shall accommodate 1/8 inch cable. Load carrying capacity shall be 200 lbs, maximum. Furnish with 1-1/2-inch long, #10, stainless steel wood screws.
 - c. Bottom Tensioner/Receiver: Arakawa; Model MF23BSET. Receiver/tensioner shall accommodate 1/8 inch cable.

- d. Glass shelf supports: Model MF35SR. Support to accommodate ½-inch thick glass shelving. Provide 4 per shelf. Support shall include clear rubber pads.
 - e. Cable: Provide manufacturer's standard 1/8 inch diameter, stainless steel air craft cable.
 - f. Glass Shelves: Refer to Section 088000 for requirements.
2. Display Case Shelving for Discovery Middle School and South Valley Middle School:
- a. Basis-of-Design Product: Doug Mockett & Company, Inc.; "SH15 Series", Model SH15C.
 - b. Standards/Track: Architect will select from any of the two track (standard) styles. Tracks shall be single slotted type, fabricated from aluminum. Factory finish in satin finish.
 - c. Brackets: Brackets shall be rectangular shape, ¼ inch wide and 1-1/4 inch high, similar to EZ Shelf Support Bracket. Bracket lengths shall be 11-11/16 inch, unless another length is indicated on Drawings. Brackets shall be fabricated from aluminum and shall be clear satin finished to match standards/tracks. Provide bracket lengths to suit shelving depths indicated.
 - d. Accessories include, but are not limited to: Manufacturer's standard hold-down brackets, clear rubber bumper supports for glass shelves and fasteners to suit supporting substrate. Fasteners shall be finished to match standards/tracks.
 - e. Glass Shelves: Refer to Section 088000 for requirements.

2.9 MISCELLANEOUS MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.
- B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.
- C. Adhesives: Use adhesives that meet the testing and product 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."
- D. Installation Adhesive: Product recommended by fabricator for each substrate for secure anchorage.
 - 1. Adhesives shall have a VOC content of 70 g/L or less.
 - 2. Adhesive shall comply with the testing and product 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."

2.10 FABRICATION, GENERAL

- A. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.
- B. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:
 - 1. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members 3/4 Inch Thick or Less: 1/16 inch.
 - 2. Edges of Rails and Similar Members More Than 3/4 Inch Thick: 1/8 inch.
- C. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
 - 1. Notify Architect seven days in advance of the dates and times woodwork fabrication will be complete.
 - 2. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements indicated on Shop Drawings before disassembling for shipment.
- D. Shop-cut openings to maximum extent possible to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
- E. Install glass to comply with applicable requirements in Division 08 Section "Glazing" and in GANA's "Glazing Manual." For glass in wood frames, secure glass with removable stops.

- F. Install glass in display case doors in accordance with door manufacturer's instructions.
- G. Apply marker board laminate to flush wood doors on the non-primed face, in strict accordance with laminate manufacturer's written recommendations.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine all areas and conditions where solid surfacing fabrications will be installed. Notify Architect of any conditions that would adversely affect the installation. Do not proceed with installation until unsatisfactory conditions are corrected.
 - 1. Commencement of installation is construed as acceptance of the adjacent surfaces and conditions.

3.2 PREPARATION

- A. Before installation, condition woodwork to average prevailing humidity conditions in installation areas.
- B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and back priming.

3.3 INSTALLATION

- A. Grade: Install woodwork to comply with requirements for the same grade specified in Part 2 for fabrication of type of woodwork involved.
- B. Assemble woodwork and complete fabrication at Project site to comply with requirements for fabrication in Part 2, to extent that it was not completed in the shop.
- C. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches.
- D. Scribe and cut woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- E. Preservative-Treated Wood: Where cut or drilled in field, treat cut ends and drilled holes according to AWPA M4.
- F. Fire-Retardant-Treated Wood: Handle, store, and install fire-retardant-treated wood to comply with chemical treatment manufacturer's written instructions, including those for adhesives used to install woodwork.
- G. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.
- H. Display Case Doors and Shelving: Install units plumb and level in strict accordance with manufacturer's written instructions. Check doors for proper operation and adjust as necessary. Install shelf hanging systems to configurations indicated and in accordance with manufacturer's written instructions.

3.4 ADJUSTING AND CLEANING

- A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.
- B. Clean, lubricate, and adjust hardware.
- C. Clean woodwork on exposed and semi-exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

- D. Stainless Steel Protection: Provide 6-mil plastic or other suitable water-resistant covering over the countertop surfaces. Tape to underside of countertop at a minimum of 48 inches o.c. Remove protection at Substantial Completion.

END OF SECTION 064023

SECTION 071326 - SELF-ADHERING SHEET WATERPROOFING

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes self-adhering modified bituminous sheet waterproofing system as follows:
 - 1. Modified bituminous sheet waterproofing (071326.A01).
 - 2. Metal termination bars (071326.A02).
 - 3. Perimeter insulation / protection course.
 - 4. Insulation Drainage Panels.
- B. Related Requirements:
 - 1. Section 012300 "Alternates" for those alternates related to work of this Section.
 - 2. Section 033000 "Cast-In-Place Concrete" for perimeter insulation installed with the work of this Section.
 - 3. Section 042000 "Unit Masonry" for installation of moisture barriers in unit masonry.
 - 4. Section 071416 "Cold Fluid-Applied Waterproofing" for cold fluid applied waterproofing.
 - 5. Section 334600 "Subdrainage" for drainage tile, fabric, gravel, and subdrainage system.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference for Waterproofing Sy: Conduct conference at Project site.
 - 1. Review waterproofing requirements including, but not limited to, the following:
 - a. Surface preparation specified in other Sections.
 - b. Substrate condition and pretreatment.
 - c. Minimum curing period.
 - d. Forecasted weather conditions.
 - e. Special details and sheet flashings.
 - f. Installation procedures.
 - g. Testing and inspection procedures.
 - h. Field quality control.
 - i. Protection.
 - j. Repairs.
- B. Preinstallation Conference for Moisture Barrier: Conduct conference at Project site in conjunction with unit masonry preinstallation conference.
 - 1. Review moisture barrier requirements including, but not limited to, the following:
 - a. Surface preparation specified in other Sections.
 - b. Substrate condition, pretreatment and priming.
 - c. Forecasted weather conditions.
 - d. Special details and terminations.
 - e. Installation procedures.
 - f. Protection and repairs.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, and tested physical and performance properties of waterproofing.
 - 2. Include construction details, material descriptions, and tested physical and performance properties of moisture barrier.
 - 3. Include manufacturer's written instructions for evaluating, preparing, and treating substrate.
- B. Shop Drawings:
 - 1. Show locations and extent of waterproofing and moisture barrier.
 - 2. Include details for substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.

3. Include details for substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining moisture barrier, membrane air barrier, and other termination conditions.
- C. Samples: For each exposed product and for each color and texture specified, including the following products:
1. Self adhering sheet waterproofing, 8 by 8 inches.
 2. Moisture barrier, 8 inches by 8 inches.
 3. Molded-sheet drainage panels, 6 by 6 inches.
 4. Insulation drainage panels, 8 by 8 inches.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Field quality-control reports.
- C. Sample Warranties: For special warranties.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by waterproofing manufacturer.
- B. Installer Qualifications: An entity that employs installers and supervisors who are trained and acceptable or approved by moisture barrier manufacturer.

1.6 FIELD CONDITIONS

- A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended in writing by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate.
1. Do not apply in snow, rain, fog, or mist.
- B. Environmental Limitations: Apply moisture barrier within the range of ambient and substrate temperatures recommended in writing by moisture barrier manufacturer. Do not apply to a damp or wet substrate.
1. Do not apply moisture barrier in snow, rain, fog, or mist.
- C. Maintain adequate ventilation during preparation and application of waterproofing and moisture barrier materials.

1.7 WARRANTY

- A. Waterproofing Manufacturer's Warranty: Manufacturer's standard materials-only warranty in which manufacturer agrees to furnish replacement waterproofing material for waterproofing that does not comply with requirements or that fails to remain watertight within specified warranty period.
1. Warranty Period: Three years from date of Substantial Completion.
- B. Moisture Barrier Manufacturer's Warranty: Manufacturer's standard materials-only warranty in which manufacturer agrees to furnish replacement moisture barrier material for moisture barrier that does not comply with requirements or that fails to remain watertight within specified warranty period.
1. Warranty Period: Two years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations for Waterproofing System: Obtain waterproofing materials and molded-sheet drainage panels from single source from single manufacturer.
1. Insulation drainage panels may be used in place of a separate molded-sheet drainage panels and perimeter insulation when approved by waterproofing system manufacturer.

- B. Source Limitations for Moisture Barrier: Obtain moisture barrier materials from single source and single manufacturer.

2.2 MODIFIED BITUMINOUS SHEET WATERPROOFING (071326.A01)

- A. Modified Bituminous Sheet: Minimum 60-mil nominal thickness, self-adhering sheet consisting of 56 mils of rubberized asphalt laminated on one side to a 4-mil- thick, polyethylene-film reinforcement, and with release liner on adhesive side; formulated for application with primer or surface conditioner that complies with VOC limits of authorities having jurisdiction.
 - 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. Carlisle Coatings & Waterproofing Inc; CCW MiraDRI 860/861.
 - b. Grace Construction Products; W.R. Grace & Co. -- Conn; Bituthene 3000/Low Temperature or Bituthene 4000.
 - c. Polyguard Products, Inc; Polyguard 650.
 - d. Tamko Building Products, Inc; TW-60.
 - e. WR Meadows; Mel-Rol.
 - 2. Physical Properties:
 - a. Tensile Strength, Membrane: 250 psi minimum; ASTM D 412, Die C, modified.
 - b. Ultimate Elongation: 300 percent minimum; ASTM D 412, Die C, modified.
 - c. Low-Temperature Flexibility: Pass at minus 20 deg F; ASTM D 1970.
 - d. Crack Cycling: Unaffected after 100 cycles of 1/8-inch movement; ASTM C 836.
 - e. Puncture Resistance: 40 lbf minimum; ASTM E 154.
 - f. Water Absorption: 0.2 percent weight-gain maximum after 48-hour immersion at 70 deg F; ASTM D 570.
 - g. Water Vapor Permeance: 0.05 perms maximum; ASTM E 96/E 96M, Water Method.
 - h. Hydrostatic-Head Resistance: 200 feet minimum; ASTM D 5385.
 - 3. Sheet Strips: Self-adhering, rubberized-asphalt strips of same material and thickness as sheet waterproofing.

2.3 AUXILIARY MATERIALS

- A. General: Furnish auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with sheet waterproofing.
 - 1. Furnish liquid-type auxiliary materials that comply with VOC limits of authorities having jurisdiction.
- B. Primer and Surface Conditioner: Liquid waterborne primers and surface conditioners recommended for substrate by sheet-waterproofing material manufacturer.
- C. Surface Conditioner: Liquid, waterborne surface conditioner recommended for substrate by sheet-waterproofing material manufacturer.
- D. Liquid Membrane: Elastomeric, two-component liquid, cold fluid applied, of trowel grade or low viscosity.
- E. Substrate Patching Membrane: Low-viscosity, two-component, modified asphalt coating.
- F. Metal Termination Bars (071326.A02): Aluminum bars, approximately 1 by 1/8 inch thick, predrilled at 6 to 9-inch centers.
 - 1. Termination bars for moisture barrier shall be flat, without a bent edge to receive sealant.

2.4 PROTECTION COURSE

- A. Perimeter Insulation or Protection Course (071326.A03): Refer to 072100.A01 in Section 033000 "Cast-In-Place Concrete" for additional requirements regarding perimeter insulation.
 - 1. Compressive strength of not less than 8 psi according to ASTM D1621
 - 2. Maximum water absorption by volume of 0.6 percent according to ASTM C272.

2.5 MOLDED-SHEET DRAINAGE PANELS (071326.A04)

- A. Woven-Geotextile-Faced, Molded-Sheet Drainage Panel: Manufactured composite subsurface drainage panels consisting of a woven-geotextile facing with an apparent opening size not exceeding No. 40 sieve, laminated to one side of the three dimensional, nonbiodegradable, high density polyethylene "geonet-type" drainage core, with a horizontal flow rate not less than 8.5 gpm/ft. Thickness shall be ¼ inch. Compressive strength shall not be less than 40,000 psi.
1. Basis-of-Design Product: Subject to compliance with requirements, provide American hydrotech, Inc.; Hydrodrain 300.

2.6 INSULATION DRAINAGE PANELS

- A. Insulation Drainage Panels: Provide extruded polystyrene board, meeting ASTM C 578, Type IV, 25-psi minimum compressive strength; maximum flame-spread and smoke-developed indexes of 25 and 450, respectively, per ASTM E 84. Panels shall have drainage grooves on one side that are faced with geotextile filtration fabric. Panels shall have the following characteristics:
1. Thickness: 2-1/4 inches.
 2. Drainage Capacity: Not less than 12 gal/min/ft per ASTM D 4716.

2.7 MOISTURE BARRIER (071326.A08)

- A. Rubberized-Asphalt Moisture Barrier: Composite product consisting of a pliable, adhesive 32 mil rubberized-asphalt compound, bonded to a high-density, 8 mil cross-laminated polyethylene film to produce an overall thickness of not less than 0.040 inch.
1. Basis-of-Design Products: Subject to compliance with requirements, provide one of the following:
 - a. Carlisle Coatings & Waterproofing; CCW-705-TWF Thru-Wall Flashing.
 - b. Grace Construction Products, W.R. Grace & Co. – Conn.; Perm-A-Barrier wall flashing.
 2. Application: Unless otherwise indicated, use the following:
 - a. Moisture barrier at base of wall from footing to 8 inches above horizontal leg of through wall flashing elevation.
 3. Primers and Mastic: Manufacturer's standard products or product recommended by moisture barrier flashing manufacturer for bonding sheets to substrates and as follows:
 - a. Solvent based primer for bonding flexible moisture barrier to substrates.
 - 1) Liquid applied with roller or brush.
 - 2) Spray adhesive recommended by manufacturer.
 - (a) Basis of Design: Carlisle Coatings and Waterproofing: Travel-Tack and Cav-Grip.
 4. Metal Termination Bars (071326.A02): Flat, aluminum bars, 1 tall by not less than 14 gage thick, predrilled at 6 to 9-inch centers.
 - a. Basis-of-Design Products: Subject to compliance with requirements, provide one of the following:
 - 1) Hechman Building Products; Model 1050A140.
 - 2) Hohmann and Barnard; Model T1 Term Bar.
 - 3) Wire-Bond; Model #4200 Term Bar.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of work of this Section.
1. Verify that concrete has cured and aged for minimum time period recommended in writing by waterproofing and moisture barrier manufacturer.
 2. Verify that substrate is visibly dry and within the moisture limits recommended in writing by manufacturer. Test for capillary moisture by plastic sheet method according to ASTM D4263.
 3. Verify that compacted subgrade is dry, smooth, sound, and ready to receive waterproofing sheet.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Refer to Section 334600 "Subdrainage" for additional coordination information with subdrainage system to provide waterproofing behind all locations indicated to receive subdrainage.
- B. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing and moisture barrier application.
- C. Mask off adjoining surfaces not receiving waterproofing and moisture barrier to prevent spillage and overspray affecting other construction.
- D. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
- E. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids.
- F. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks according to ASTM D4258.
 - 1. Install sheet strips of width according to manufacturer's written instructions and center over treated construction and contraction joints and cracks exceeding a width of 1/16 inch.
- G. Bridge and cover isolation joints, expansion joints, and discontinuous deck-to-wall and deck-to-deck joints with overlapping sheet strips of widths according to manufacturer's written instructions.
 - 1. Invert and loosely lay first sheet strip over center of joint. Firmly adhere second sheet strip to first and overlap to substrate.
- H. Corners: Prepare, prime, and treat inside and outside corners according to ASTM D6135.
 - 1. Install membrane strips centered over vertical inside corners. Install 3/4-inch fillets of liquid membrane on horizontal inside corners and as follows:
 - a. At footing-to-wall intersections, extend liquid membrane in each direction from corner or install membrane strip centered over corner.
- I. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through waterproofing and at drains and protrusions according to ASTM D6135.

3.3 INSTALLATION OF MODIFIED BITUMINOUS SHEET-WATERPROOFING APPLICATION

- A. Prepare surfaces and install modified bituminous sheets according to waterproofing manufacturer's written instructions and recommendations in ASTM D 6135.
- B. Apply surface conditioner and primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by sheet waterproofing in same day. Reprime areas exposed for more than 24 hours.
- C. Apply and firmly adhere sheets over area to receive waterproofing. Accurately align sheets and maintain uniform 2-1/2-inch- minimum lap widths and end laps. Overlap and seal seams, and stagger end laps to ensure watertight installation.
 - 1. When ambient and substrate temperatures range between 25 and 40 deg F, install self-adhering, modified bituminous sheets produced for low-temperature application. Do not use low-temperature sheets if ambient or substrate temperature is higher than 60 deg F.
 - 2. Apply continuous sheets over already-installed sheet strips, bridging substrate cracks, construction, and contraction joints.
 - a. Seal edges of sheet-waterproofing terminations with mastic.
 - 3. Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Slit and flatten fishmouths and blisters. Patch with sheet waterproofing extending 6 inches beyond repaired areas in all directions.
- D. Install sheet-waterproofing and auxiliary materials to tie into adjacent waterproofing.
- E. Install sheet-waterproofing and auxiliary materials to lap and seal to adjacent air barrier coating as occurs, to provide continuous building envelope barrier.

- F. Immediately install molded-sheet drainage panels and perimeter insulation with butted joints over waterproofing membrane.
 - 1. Insulation drainage panels may be used in place of a separate molded-sheet drainage panels and perimeter insulation to vertical applications when approved by waterproofing manufacturer and installed immediately.

3.4 INSTALLATION OF MOISTURE BARRIER

- A. General: Comply with manufacturer's recommendations for preparation of surfaces and installation of moisture barrier and as follows:
 - 1. Prepare surfaces so they are smooth and free from projections that could puncture moisture barrier.
 - 2. Prime CMU wall surface then install moisture barrier.
 - 3. Install moisture barrier horizontally in longest lengths practical to minimize lap joints.
 - 4. Roll entire surface then seal all lap seams with mastic.
 - 5. Anchor top of moisture barrier to wall substrate with flat termination bar securely fastened to wall substrate.
 - 6. Schedule work so moisture barrier is not exposed to UV more than 30 days or protect from UV.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests.
- B. Manufacturer's Field Service: Engage a site representative qualified by waterproofing membrane manufacturer to inspect substrate conditions, surface preparation, membrane application, flashings, protection, and drainage components; and to furnish daily reports to Architect.
- C. Waterproofing will be considered defective if it does not pass tests and inspections.

3.6 PROTECTION, REPAIR, AND CLEANING

- A. Protect waterproofing and moisture barrier from damage and wear during remainder of construction period.
- B. Protect installed perimeter insulation and insulation drainage panels from damage due to UV light, harmful weather exposures, physical abuse, and other causes. Provide temporary coverings where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.
- C. Correct deficiencies in or remove waterproofing and moisture barrier that does not comply with requirements; repair substrates, reapply waterproofing and moisture barrier, and repair sheet flashings.
- D. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 071326

SECTION 071416 - COLD FLUID-APPLIED WATERPROOFING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes water-based, polymer-modified liquid waterproofing membrane system as follows:
 - 1. Water-based, polymer-modified liquid waterproofing membrane system (071416.A01)
 - 2. Reinforcing fabric (071416.A03)
 - 3. Concrete repair material / Waterproofing Filler (071416.A04)
 - 4. Perimeter insulation / protection course (071416.A05)
 - 5. Molded-Sheet Drainage Panels (071416.A06)
 - 6. Insulation Drainage Panels (071416.A07)
- B. Related Requirements:
 - 1. Section 033000 "Cast-In-Place Concrete" for perimeter insulation installed with the work of this Section.
 - 2. Section 034100 "Precast Structural Concrete" for mockup requirements related to this Section
 - 3. Section 071326 "Self-Adhering Sheet Waterproofing" for self adhering sheet waterproofing.
 - 4. Section 334600 "Subdrainage" for drainage tile, fabric, gravel, and subdrainage system.

1.2 PREINSTALLATION REQUIREMENTS

- A. Preinstallation Conference: Conduct conference at Project site..
 - 1. Review waterproofing requirements including, but not limited to, the following:
 - a. Surface preparation specified in other Sections.
 - b. Substrate condition and pretreatment.
 - c. Minimum curing period.
 - d. Forecasted weather conditions.
 - e. Special details and sheet flashings.
 - f. Installation procedures.
 - g. Testing and inspection procedures.
 - h. Field quality control.
 - i. Protection.
 - j. Repairs.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, and tested physical and performance properties of waterproofing.
 - 2. Include manufacturer's written instructions for evaluating, preparing, and treating substrate.
 - 3. Include installation instructions for insulation drainage panels.
- B. Shop Drawings:
 - 1. Show locations and extent of waterproofing.
 - 2. Include details for substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.
 - 3. Include details for connections and terminations of insulation drainage panels.
- C. Samples: For each exposed product and for each color and texture specified, including the following products:
 - 1. Flashing sheet, 8 by 8 inches.
 - 2. Membrane-reinforcing fabric, 8 by 8 inches.
 - 3. Protection board, 6 by 6 inches.
 - 4. Insulation drainage panels, 8 by 8 inches.

1.4 INFORMATIONAL SUBMITTALS

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by waterproofing manufacturer.
- B. Single Source Responsibility: Obtain waterproofing materials from a single manufacturer regularly engaged in manufacturing the product.
- C. Field quality-control reports.
- D. Sample Warranties: For special warranties.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by waterproofing manufacturer.
- B. Refer to Section 034100 "Precast Structural Concrete" for mockup requirements related to this Section.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
- B. Store materials in a clean, dry area in accordance with manufacturer's instructions.
- C. Store at temperatures between 40° - 70° F (4° - 21° C).
- D. Protect materials during handling and application to prevent damage or contamination.

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended in writing by waterproofing manufacturer.
 - 1. Do not apply waterproofing to a damp or wet substrate, when relative humidity exceeds 85 percent, or when temperatures are less than 5 deg F above dew point.
 - 2. Do not apply membrane when air, material, or surface temperatures are expected to fall below 30 deg F within four hours of completed application.
 - 3. Do not apply waterproofing in snow, rain, fog or mist, or when such weather conditions are imminent during application and curing period.
- B. Maintain adequate ventilation during application and curing of waterproofing materials.
- C. Consult manufacturer for applications to green concrete.

1.8 WARRANTY

- A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace waterproofing that fails in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.
- B. Installer's Special Warranty: Specified form, signed by Installer, covering Work of this Section, for warranty period of two years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations for Waterproofing System: Obtain waterproofing materials, filler material, molded sheet drainage panels, protection course (perimeter insulating panels), from single source from single manufacturer.
 - 1. Basis of Design Product manufacturers:
 - a. W. R. MEADOWS.
 - b. TREMCO Comparable Product.
 - c. Comparable products from other manufacturers, meeting specified requirements, will be considered when submitted to and accepted by Architect prior to bidding.

2.2 SINGLE-COMPONENT, FLUID-APPLIED ELASTOMERIC WATERPROOFING MEMBRANE (071416.A01)

- A. Single-Component, rapid curing, high-solids, VOC-compliant modified polyurethane waterproofing membrane compose of a one-part moisture-curing elastomer. Available in three viscosity: Self-Leveling (SL), Roller (R) and Trowel (trowel intended for detailing work only).
- B. Basis-of-Design Products:
 - 1. W. R. MEADOWS Comparable Product.
 - 2. TREMCO; "TREMproof 250GC".
- C. Product Characteristics:
 - 1. Waterproofing shall be capable being applied to "green" concrete.
 - 2. Solids Content: Not less than 84 percent.
 - 3. Cure Time: 16 to 24 hours at 75 °F (24 °C), 50% RH.
 - 4. Thickness 60 mils.
 - 5. Stability: Exceeds ASTM C836.
 - 6. Elongation: Not less than 600 percent according to ASTM D412.
 - 7. Tensile Strength: Not less than 200 psi according to ASTM D412.
 - 8. Water Vapor Transmission: 0.03 perms according to ASTM E96, Method B.

2.3 SINGLE-COMPONENT WATER-BASED, POLYMER-MODIFIED WATERPROOFING (071416.A01)

- A. Basis-of-Design Product:
 - 1. W. R. MEADOWS; "MEL-ROL LM".
 - 2. TREMCO; "TREMproof 250GC."
- B. Product Characteristics:
 - 1. Waterproofing shall be capable being applied to "green" concrete.
 - 2. Solids Content: Not less than 70 percent.
 - 3. VOC Content: 0 grams/liter.
 - 4. Cure Time: 16 to 24 hours.
 - 5. Service Temperature: -20 to 140 degrees F.
 - 6. Stability: Exceeds ASTM C836.
 - 7. Elongation: Not less than 900 percent according to ASTM D412.
 - 8. Water Absorption: 0.7 percent according to ASTM D1970.
 - 9. Water Vapor Transmission: 0.03 perms according to ASTM E96, Method B.
 - 10. Resistance to Hydrostatic Head: 48 psi according to ASTM D751.
 - 11. Puncture Resistance: 22 lbf according to ASTM D4833.

2.4 PROTECTION COURSE (071416.A05)

- A. Perimeter Insulation or Protection Course: Refer to 072100.A01 in Section 033000 "Cast-In-Place Concrete" for additional requirements regarding perimeter insulation.
 - 1. Compressive strength of not less than 8 psi according to ASTM D1621

2. Maximum water absorption by volume of 0.6 percent according to ASTM C272.
- B. Protective Waterproofing Course: Composed from a blend of EPDM and SBR thermostat elastomers. This sheet is reinforced with a high-strength, polyester-woven scrim.
 1. Basis-of-Design Products:
 - a. W.R. Meadows comparable product.
 - b. TREMCO; "TREMProof, TRA Sheeting."

2.5 MOLDED-SHEET DRAINAGE PANELS (071416.A06)

- A. Provide two-part, prefabricated geocomposite drain consisting of a formed 24" high HIPS core covered on one side with a non-woven, needle-punched polypropylene filter fabric. The top section is 12" of 7/16" core for water collection. The bottom section is 12" of 1" thick for water collection and horizontal water flow to designated exits.
 1. Basis-of-Design Products:
 - a. W.R. Meadows; "MEL-DRAIN TOTAL-DRAIN."
 - b. TREMCO; "TREMDrain NW."

2.6 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials recommended in writing by waterproofing manufacturer for intended use and compatible with one another and with waterproofing.
 1. Furnish liquid-type auxiliary materials that comply with VOC limits of authorities having jurisdiction.
- B. Primer: Manufacturer's standard primer, sealer, or surface conditioner; factory-formulated.
 1. Basis-of-Design Product:
 - a. W. R. MEADOWS; "Rezi-Weld LV" or "Rezi-Weld LV State."
 - b. TREMCO Comparable Product.
- C. Joint Tape: 6" wide reinforcing fabric for corners, crack, and joint treatment.
- D. Reinforcing Fabric for High Build Applications (071416.A03):
 1. Basis-of-Design Products:
 - a. W. R. MEADOWS; "Reinforcing Fabric HCR."
 - b. TREMCO Comparable Product.
- E. Reinforced Joint Tape for outside corners subject to backfill.
 1. Basis-of-Design Products:
 - a. W.R. MEADOWS; "Precon Fabric Tape."
 - b. TREMCO Comparable Product.
- F. Sheet Flashing: When required by waterproofing manufacturer
 1. Basis-of-Design Products:
 - a. W. R. MEADOWSs; "Perminator 10 mil."
 - b. TREMOC comparable product..
- G. Membrane-Reinforcing Fabric: Manufacturer's recommended fiberglass mesh or polyester fabric, manufacturer's standard weight.
- H. Joint Reinforcing Strip:
 1. Basis-of-Design Products:
 - a. W. R. MEADOWS; "Detail Strip."
 - b. TREMCO Comparable Product.
- I. Detailing Membrane: One-component, cold-applied, non-slump membrane, high quality moisture-curing elastomeric sealing material.
 1. Basis-of-Design Products:
 - a. W. R. MEADOWS;" BEM."
 - b. TREMCO Comparable Product.
- J. Concrete Repair Materials/Waterproofing Filler (071416.A04): Provide hydraulic cementitious waterstop mortar acceptance to waterproofing manufacturer.

1. Basis-of-Design Products:
 - a. W.R. MEADOWS; "Meadow-Patch 5."
 - b. TREMCO Comparable Product.
- K. Waterproofing Filler/ Sealant (071416.A04): Single-component, high movement, high performance, medium-modulus, non-sag polyurethane sealant.
 1. Basis-of-Design Products:
 - a. W.R. MEADOWS; Comparable Product.
 - b. TREMCO; "DYMONIC100."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
 1. Verify that concrete has cured and aged for minimum time period recommended in writing by waterproofing manufacturer.
 2. Verify that substrate is visibly dry and within the moisture limits recommended in writing by manufacturer. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Refer to Section 334600 "Subdrainage" for additional coordination information with subdrainage system to provide waterproofing behind all locations indicated to receive subdrainage.
- B. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.
- C. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.
- D. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, acid residues, and other penetrating contaminants or film-forming coatings from concrete.
- E. Remove fins, ridges, and other projections, and fill honeycomb, aggregate pockets, holes, and other voids.

3.3 PREPARATION AT TERMINATIONS, PENETRATIONS, AND CORNERS

- A. Prepare surfaces at terminations and penetrations through waterproofing and at expansion joints, drains, sleeves, and corners according to waterproofing manufacturer's written instructions.
- B. Apply waterproofing in two separate applications, and embed a joint reinforcing strip in the first preparation coat when recommended by waterproofing manufacturer.

3.4 JOINT AND CRACK TREATMENT

- A. Prepare, treat, rout, and fill joints and cracks in substrate according to waterproofing manufacturer's written instructions. Before coating surfaces, remove dust and dirt from joints and cracks according to ASTM D 4258.
 1. Prime substrate along each side of joint and apply a single thickness of preparation strip at least 6 inches wide along each side of joint. Apply waterproofing in two separate applications and embed a joint reinforcing strip in the first preparation coat.
- B. Fill voids at base and vertical joints in precast concrete where waterproofing is to be applied with specified waterproofing joint filler. Tool flush with adjacent surfaces.

- C. Install sheet flashing and bond to wall substrates where required according to waterproofing manufacturer's written instructions.

3.5 WATERPROOFING APPLICATION

- A. Apply waterproofing according to manufacturer's written instructions and to recommendations in ASTM C 1471/C 1471M.
- B. Start installing waterproofing in presence of manufacturer's technical representative.
- C. Apply primer over prepared substrate unless otherwise instructed in writing by waterproofing manufacturer.
- D. Vertical Unreinforced Waterproofing Applications: Mix materials and apply waterproofing by spray, roller, notched squeegee, trowel, or other application method suitable to slope of substrate.
 - 1. Apply one or more coats of waterproofing to obtain a seamless membrane free of entrapped gases and pinholes, with a dry film thickness of not less than 60 mils.
 - 2. Apply waterproofing to prepared wall terminations and vertical surfaces.
 - 3. Verify manufacturer's recommended wet film thickness of waterproofing every 100 sq. ft.
- E. Cure waterproofing, taking care to prevent contamination and damage during application and curing.
- F. Immediately install molded-sheet drainage panels and perimeter insulation (protection course) with butted joints over waterproofing membrane.
 - 1. Insulation drainage panels may be used in place of a separate molded-sheet drainage panels and perimeter insulation to vertical applications when approved by waterproofing manufacturer and installed immediately.
 - 2. For vertical applications, set molded sheet drainage panels and protection course in nominally cured membrane, which will act as an adhesive. If membrane cures before application of protection course, use adhesive.
 - 3. At locations where foundation insulation is indicated, omit protection course specified in this section, as foundation insulation will serve as protection course.
- G. Install insulation drainage panels in strict accordance with panel manufacturer's written instructions. Install before starting subsequent construction operations. Panels shall be oriented with drainage slots vertically, with tongue and grooved edges interlocked. Geotextile filtration fabric shall be located away from wall.
 - 1. For vertical applications, set insulation drainage panels in nominally cured membrane, which will act as an adhesive. If membrane cures before application of protection course, use adhesive.
 - 2. Provide at all locations where foundation drainage systems are indicated.

3.6 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests.
- B. Manufacturer's Field Service: Engage a site representative qualified by waterproofing membrane manufacturer to inspect substrate conditions, surface preparation, membrane application, flashings, protection, and drainage components and to furnish weekly reports to Architect.
- C. Waterproofing will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

3.7 PROTECTION, REPAIR, AND CLEANING

- A. Protect waterproofing from damage and wear during remainder of construction period.
- B. Protect installed perimeter insulation and insulation drainage panels from damage due to UV light, harmful weather exposures, physical abuse, and other causes. Provide temporary coverings where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

- C. Correct deficiencies in or remove waterproofing that does not comply with requirements; repair substrates, reapply waterproofing, and repair sheet flashings.
- D. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 071416

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SECTION 072100 - THERMAL INSULATION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Extruded polystyrene rigid insulation board (072100.A01)
 - a. Foundation perimeter insulation.
 - 1) Refer to Section 033000 for installation and product information.
 - b. Cavity wall insulation below base flashing (through wall flashing).
 - 1) Refer to Section 042000 for installation requirements.
2. Polyisocyanurate foam-plastic board (072100.A04).
3. Glass-fiber board (072100.A05).
4. Glass-fiber blanket (072100.A08).
5. Spray polyurethane foam insulation (072100.A12).
6. Mineral-wool blanket (072100.A17).

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for foundation insulation and foam void fill.
2. Section 034100 "Precast Structural Concrete" for insulation contained within precast structural concrete assemblies.
3. Section 042000 "Unit Masonry" for foamed-in-place masonry cell foam insulation.
4. Section 061600 "Sheathing" for composite nail-base insulated roof sheathing.
5. Section 071326 "Self-Adhering Sheet Waterproofing" for insulating protection board/drainage panels.
6. Section 071416 "Cold-Fluid Applied Waterproofing" for insulating protection board/drainage panels.
7. Section 074800 "Rainscreen Furring System" for insulation included in rainscreen furring system assemblies.
8. Section 075216 "Modified Bituminous Membrane Roofing" for roof insulation.
9. Section 075423 "Thermoplastic Polyolefin (TPO) Roofing" for roof insulation.
10. Section 078446 "Fire-Resistive Joint Systems" for insulation installed as part of a perimeter fire-resistive joint system.
11. Section 092900 "Gypsum Board" for sound attenuation blanket used as acoustic insulation.

C. Products Furnished but not Installed Under Work of this Section:

1. Cavity-wall insulation.

1.2 PREINSTALLATION MEETINGS

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

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each product, for tests performed by a qualified testing agency.
- B. Evaluation Reports: For foam-plastic insulation, from ICC-ES.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing,

and protecting during installation.

- B. Protect foam-plastic board insulation as follows:
 - 1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
 - 2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.
 - 3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 PRODUCTS

2.1 EXTRUDED POLYSTYRENE FOUNDATION PERIMETER INSULATION (072100.A01)

- A. Refer to Section 033000 "Cast-in-Place Concrete" for product information and installation.

2.2 POLYISOCYANURATE FOAM-PLASTIC BOARD (072100.A04)

- A. Polyisocyanurate Board, Glass-Fiber-Mat Faced: ASTM C 1289, glass-fiber-mat faced, Type II, Class 2, Grade 2. Facers shall be coated.
 - 1. Locations:
 - a. Cavity wall insulation.
 - b. At Kitchen refrigerator/freezer beneath slab.
 - 2. Thicknesses: As indicated on Drawings
 - 3. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
 - 4. Insulation, associated components and adhesives shall be compatible with fluid-applied air barrier coating specified in Section 072726.
 - 5. Manufacturers and Products: Subject to compliance with requirements, provide one of the following products:
 - a. Carlisle Coatings and Waterproofing; "R2+ Matte."
 - b. Firestone Building Products; "Enverge CI."
 - c. Hunter; "Xci CG".
 - d. Atlas; comparable product submitted to and accepted by Architect prior to bidding.

2.3 GLASS-FIBER BLANKET

- A. Glass-Fiber Blanket, Unfaced (072100.A08): ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.
 - 1. Thickness: As indicated on Drawings.

2.4 MINERAL-WOOL INSULATION

- A. Mineral-Wool Blanket, Unfaced (072100.A17): ASTM C 665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.
 - 1. Thickness: As indicated on Drawings.
- B. Pre-manufactured Head-of-Wall Mineral Wool Insulation: Meeting same criteria as specified above; manufactured into various shapes and sizes to fill voids between top-of-wall and metal decking.

2.5 SPRAY POLYURETHANE FOAM INSULATION

- A. Closed-Cell Polyurethane Foam Insulation (072100.A12): ASTM C1029, Type II, with maximum flame-spread and smoke-developed indexes of 75 and 450 respectively, per ASTM E84.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. BASF Corporation

- b. Dow Chemical Company (The)
 - c. NCFI; Division of Barnhardt Mfg. Co.
 - d. Icynene "ProSeal".
 - e. Demilec; "Heatlok XT High Lift".
2. Minimum density of 1.5 lb/cu. ft., thermal resistivity of 6.2 deg F x h x sq. ft./Btu x in. at 75 deg. F.

2.6 ACCESSORIES

- A. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.
- 1. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
 - 2. Adhesives shall be compatible with fluid-applied air barrier coating specified in Section 072729.
 - 3. Adhesives shall have a VOC content of 70 g/L or less.
 - 4. Adhesive shall comply with the testing and product 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."

PART 3 EXECUTION

3.1 PREPARATION

- A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and applications.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
- C. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. Water-Piping Coordination: If water piping is located within insulated exterior walls, coordinate location of piping to ensure that it is placed on warm side of insulation and insulation encapsulates piping.
- E. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

3.3 INSTALLATION OF SLAB INSULATION

- A. On horizontal surfaces, loosely lay insulation units in two layers, according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

3.4 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

- A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.
- B. Foam-Plastic Board Insulation: Seal joints between units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by insulation manufacturer
- C. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:

1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
 2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
 3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
 4. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
- D. Mineral-Wool Blanket Insulation: Install at tops of non-rated interior walls to fill cavities between top of wall and underside of deck/structure above. Install in parapet walls over runner track as shown. Provide lengths that will produce a snug fit between ends.
- E. Spray-Applied Insulation at Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
1. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.
 2. Do not apply insulation until installation of pipes, ducts, conduits, wiring, and electrical outlets in walls is completed and windows, electrical boxes, and other items not indicated to receive insulation are masked. After insulation is applied, make flush with face of CMU by using method recommended by insulation manufacturer.
 3. Fill voids of joist bearing pockets in exterior walls.
 4. Fill voids between double studs at openings in exterior walls.
 5. Fill voids between framing members of boxed headers, including header.
 6. Fill voids at tops of exterior walls or provide pre-manufactured head-of-wall mineral wool insulation.
 7. At raised Platform between framing members for sound deadening.

3.5 INSTALLATION OF CAVITY-WALL INSULATION

- A. Refer to Section 042000 "Unit Masonry" for additional installation requirements.

3.6 PROTECTION

- A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 072100

SECTION 072726 - FLUID APPLIED AIR BARRIER COATINGS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Vapor-retarding, fluid-applied air barriers (072726.A01).
- B. Related Requirements:
 - 1. Section 042000 "Unit Masonry" for masonry to receive air barriers.
 - 2. Section 061600 "Sheathing" for wall sheathing to receive air barriers.
 - 3. Section 074213 "Formed Metal Wall and Soffit Panels" for testing.
 - 4. Section 076200 "Sheet Metal Flashing and Trim" for flexible membrane closures installed with air barriers.

1.2 DEFINITIONS

- A. Air-Barrier Material: A primary element that provides a continuous barrier to the movement of air.
- B. Air-Barrier Accessory: A transitional component of the air barrier that provides continuity.
- C. Air-Barrier Assembly: The collection of air-barrier materials and accessory materials applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

1.3 PREINSTALLATION MEETINGS

- A. Pre-Installation Conference: Conduct conference at Project site.
 - 1. Contractor to organize and convene conference a minimum of two weeks prior to commencing Work of this Section.
 - 2. Agenda shall include, at a minimum, the following:
 - a. Construction and visual inspection of mock-up.
 - b. Sequence of construction.
 - c. Coordination with substrate preparation.
 - d. Materials approved for use.
 - e. Compatibility of materials.
 - f. Coordination with installation of adjacent and covering materials.
 - g. Details of construction.
 - h. Review of inspection, testing, protection and repair procedures
 - i. Construction site safety will be discussed to review hazards or fire risks during application.
 - 3. Attendance is required by air barrier coating manufacturer's representative, air barrier coating installer, representatives of related trades including covering materials, substrate materials and adjacent materials.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include manufacturer's written instructions for evaluating, preparing, and treating substrate; technical data; tested physical and performance properties of products.
 - 2. Include verification data, including graphic illustrations, listing each component of the assembly passing NFPA 285 testing.
 - 3. Submit product data for air barrier coatings concurrently with product data for polyisocyanurate insulation.
- B. Shop Drawings: For air-barrier assemblies.
 - 1. Show locations and extent of air barrier. Include details for each type of substrate showing: substrate joints and cracks, through-wall flashing, counterflashing, each type of penetration, inside and outside corners, terminations, expansion joints, air barrier flashing system at openings and tie-ins with adjoining construction.

2. Include details of interfaces with other materials that form part of air barrier.
3. Show and list each component of the assembly.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer. Include list of manufacturer-certified installers and supervisors employed by the Installer, who work on Project, in addition to the following:
 1. Submit in writing, evidence of experience.
- B. Product Certificates: From air-barrier manufacturer, certifying compatibility of air barriers and accessory materials with Project materials that connect to or that come in contact with the barrier.
- C. Product test reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for air barriers, submit certified test report showing compliance with requirements specified for ASTM E2178.

1.6 QUALITY ASSURANCE

- A. Manufacturer: Air barrier systems shall be manufactured and marketed by a firm with a minimum of 20 years experience in the production and sales of waterproofing. Manufacturers proposed for use, but not named in these specifications shall submit evidence of ability to meet all requirements specified, and include a list of projects of similar design and complexity completed within the past five years.
- B. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer, in addition to the following:
 1. Installer shall have not less than 5 years successful experience, under the current company name, in installing fluid-applied membrane air barriers of similar type, size and complexity as those specified for this Project.
 2. Installer shall submit a reference list, complete with Owner, Architect, General Contractor or Construction Manager; phone number of each, of at least seven (7) completed projects in the states of Missouri and Kansas similar in size and specification.
 - a. List shall include square footage installed on each project.
 - b. List shall include type of air barrier installed, name of product installed and name of manufacturer.
 3. Installer shall assign experienced mechanics from previous applications, including lead mechanic/supervisor, for this Project.
- C. Field Mockups: Build mockups to set quality standards for materials and execution.
 1. Apply air barrier coating to mockup panels specified in Section 042000 "Unit Masonry", to demonstrate surface preparation, crack and joint treatment, application of air barriers and associated flashing and transitions, and sealing of gaps, terminations, ties-ins and terminations at openings, and penetrations of air-barrier assembly.
 2. Coordinate application to mockups to permit inspection by Architect and air barrier coating manufacturer's representative of air barrier before external insulation and cladding are installed.
 - a. Include junction building corner condition, building expansion joint and sheet metal flashing.
 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
- D. Testing Agency: Contractor shall engage an independent testing agency to perform testing as indicated in the work of this Section.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Remove and replace liquid materials that cannot be applied within their stated shelf life.
- B. Protect stored materials from direct sunlight.
- C. Deliver materials and products in labeled packages. Store and handle in strict compliance with manufacturer's instructions, recommendations and material safety data sheets. Protect from damage from sunlight, weather, excessive temperatures and construction operations. Remove damaged material from the site and dispose of in accordance with applicable regulations.

- D. Do not double-stack pallets of fluid applied membrane components on the job site. Provide cover on top and all sides, allowing for adequate ventilation.
- E. Protect fluid-applied membrane components from freezing and extreme heat.
- F. Sequence deliveries to avoid delays but minimize on-site storage.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended by air-barrier manufacturer.
 - 1. Protect substrates from environmental conditions that affect air-barrier performance.
 - 2. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.
 - 3. Do not apply product or accessories over incompatible materials.

1.9 WARRANTY

- A. Material Warranty: Manufacturer's standard form in which manufacturer agrees to replace fluid-applied air barrier membrane materials that fail within specified warranty period when installed and used in strict conformance with written manufacturer's instructions.
 - 1. Failures for non-permeable air barrier system include, but are not limited to, the following:
 - a. Failure to maintain air permeance rating not to exceed 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E 2178, within specified warranty period.
 - b. Failure to maintain a vapor permeance rating no greater than 1 perms when tested in accordance with ATM E96, Method B.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 MATERIALS – GENERAL

- A. Source Limitations: Obtain primary air-barrier materials and air-barrier accessories from single source from single manufacturer.
 - 1. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
- B. VOC Content: 100 g/L or less.
- C. Low-Emitting Materials: Products shall comply with the testing and product 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."

2.2 PERFORMANCE REQUIREMENTS

- A. Vapor Retarding Fluid-Applied Air Barrier - General: Air barrier shall be capable of performing as a continuous vapor-retarding air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air-barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.
- B. Air-Barrier Assembly Air Leakage: Maximum 0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft., when tested according to ASTM E 2357.
- C. Exterior wall assemblies incorporating the product and accessories shall be tested in accordance with and comply with the acceptance criteria of NFPA 285.
- D. Air barrier system shall be tested for various fastener attached penetrations including, but not limited to, veneer anchors.

- E. The air barrier shall be joined in an airtight and flexible manner to the air barrier material of adjacent systems, allowing for the relative movement of systems due to thermal and moisture variations and creep. Connection shall be made between:
 - 1. Foundation and walls.
 - 2. Walls and windows or doors.
 - 3. Different wall systems.
 - 4. Wall and roof.
 - 5. Wall and roof over unconditioned space.
 - 6. Walls, floor and roof across construction, control and expansion joints.
 - 7. Walls, floors and roof to utility, pipe and duct penetrations.
- F. All penetrations of the air barrier and paths of air infiltration/exfiltration shall be made airtight.

2.3 VAPOR-RETARDING FLUID-APPLIED AIR BARRIER

- A. Fluid-Applied, Vapor-Retarding Membrane Air Barrier (072726.A01): Fire-resistant, synthetic polymer membrane.
 - 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. Carlisle Coatings and Waterproofing (CCW); "Fire-Resist BarriTech NP."
 - b. Henry Corporation; "Air-Bloc 32 MR."
 - c. W. R. Meadows; "Air-Shield LSR."
 - d. Tremco; "ExoAir 130."
 - e. Comparable products from other manufacturers meeting specified requirements, and that are submitted to and accepted by Architect prior to bidding.
 - 2. Physical and Performance Properties:
 - a. Air Permeance: Maximum 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E 2178.
 - b. Water Vapor Permeance: Maximum 1 perm; ASTM E 96/E 96M (Method B).
 - c. Ultimate Elongation: Minimum 346 percent; ASTM D412, Die C.
 - d. Surface Burning Characteristics:
 - 1) Flame Spread Index of 25 or less; ASTM E 84.
 - 2) Smoke Generation Index of 450 or less; ASTM E 84.
 - e. Low Temperature Flexibility: No cracking at minus 20 degrees F, 180 degree bend over 1-inch mandrel.
 - f. Fastener Sealability: No water leaking through nail penetration after 24 hours; ASTM D 1970.
 - 1) System shall be coordinated and tested with installation requirements of veneer anchors and other attachments over air barrier system.
 - g. UV Exposure Rating: Coating may be exposed up to 180 days (6 months) without effecting warranty.
 - h. Multi-Story Fire Tests: Air barrier coating shall pass NFPA 285.

2.4 ACCESSORY MATERIALS

- A. General: Accessory materials recommended by air-barrier manufacturer to produce a complete fire-resistant air-barrier assembly and compatible with primary air-barrier material.
- B. Transition Membrane and Flashing (072726.A03): Provide self-adhering sheet or reinforced liquid flashing as recommended by air-barrier material manufacturer. Approved with air barrier membrane in NFPA 285 wall assemblies.
 - 1. Basis-of-Design Products for Transition Membrane: Subject to compliance with requirements, provide one of the following:
 - a. Carlisle Coatings and Waterproofing; "CCW Sure-Seal Pressure-Sensitive Elastoform".
 - b. Henry Corporation; "Air-Bloc 16 MR".
 - c. W. R. Meadows; "Air-Shield".
 - d. Tremco; "Proglaze ETA".
 - e. Comparable products from other manufacturers listed.
 - f. Comparable products from other manufacturers not listed, meeting specified requirements, submitted to and accepted by Architect prior to bidding.

2. Basis-of-Design Products for Detail Flashing: Subject to compliance with requirements, provide one of the following:
 - a. Carlisle Coatings and Waterproofing; "Fire-Resist 705 FR-A."
 - b. Comparable products from other manufacturers listed.
 - c. Comparable products from other manufacturers not listed, meeting specified requirements, submitted to and accepted by Architect prior to bidding.
- C. Contact Adhesive: As approved by air-barrier manufacturer.
- D. Primer: Liquid primer as approved by air-barrier manufacturer for substrates involved.
- E. Detail Mastic: As approved by air-barrier manufacturer.
- F. Joint Reinforcing Fabric: Air-barrier manufacturer's woven, synthetic polymer reinforcement fabric.
- G. Joint Reinforcing Strip: Air-barrier manufacturer's self-adhering glass-fiber-mesh tape.
- H. Glass Mat: Randomly-oriented glass strands held in binder soluble in wet air barrier membrane.
 1. As approved by air-barrier manufacturer.
- I. Substrate-Patching Membrane: Manufacturer's standard trowel-grade substrate filler.
- J. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, 0.0187 inch thick, and Series 300 stainless-steel fasteners.
- K. Sprayed Polyurethane Foam Sealant: Class 1, one- or two-component, disposable, closed-cell, low-pressure spray foam insulation/sealant kits. Spray foam shall be flame retardant and have a nominal 2.0-lb/cu. ft density; 95 percent minimum closed cell content and shall meet ASTM E 84 requirements flame-spread index of 25 or less and a smoke developed rating of 300 or less based on 2 inch thickness. Provide insulation manufacturer's recommended primer and noncorrosive substrate cleaner recommended by foam sealant manufacturer.
- L. Joint Sealant:
 1. Dow 790, 791, 795.
 2. Pecora 890, 891, 895.
 3. GE Silpruf, Silpruf LM.
 4. Other product approved by air barrier membrane manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
 1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
 2. Verify that concrete has cured and aged for minimum time period recommended by air-barrier manufacturer.
 3. Verify that concrete is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263. Honeycomb and holes/cracks exceeding ¼ inch across shall be filled with grout or mortar.
 4. Verify that masonry joints are flush and completely filled with mortar.
 5. Verify that wall assemblies are dried in, such that water intrusion will not occur from above, behind or around the air barrier installation.
 6. Surfaces shall be supported and flush at joints without large voids or sharp protrusions.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

- A. Refer to manufacturer's literature for requirements for preparation of substrates. Surfaces shall be sound and free of voids, spalled areas, loose aggregate and sharp protrusions. Remove contaminants such as grease, oil and wax from exposed surfaces. Remove dust, dirt, loose stone and debris. Use repair materials and methods that

are acceptable to manufacturer of the fluid-applied air barrier system.

- B. Exterior sheathing panels: Ensure that the boards are sufficiently stabilized with corners and edges fastened with appropriate screws. Pre-treat all screws with liquid flash to ensure recessed screws holes are filled. Gaps greater than 6mm (1/4 in.) should be filled with mastic or caulk, allowing sufficient time to fully cure before application of the tape and fluid applied air barrier system.
- C. Related Materials: Treat construction joints and install flashing as recommended by manufacturer.
- D. Clean, prepare, treat, and seal substrate and substrate joints according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for air-barrier application.
- E. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.
- F. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
- G. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching membrane.
- H. Remove excess mortar from masonry ties, shelf angles, and other obstructions.
- I. Fill cracks, gaps and joints exceeding 1/4 inch width with fill compound or sealant approved by air barrier manufacturer. Fill rough gaps around pipe, conduit and similar penetrations with mortar, non-shrink grout, fill compound or polyurethane foam sealant shaved flush.
- J. At changes in substrate plane, apply sealant or termination mastic beads to create a cant at sharp corners and edges to form a smooth transition from one plane to another.
- K. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.

3.3 JOINT TREATMENT

- A. Concrete and Masonry: Prepare, treat, rout, and fill joints and cracks in substrate according to ASTM C 1193 and air-barrier manufacturer's written instructions. Remove dust and dirt from joints and cracks complying with ASTM D 4258 before coating surfaces.
 - 1. Prime substrate and apply a single thickness of air-barrier manufacturer's recommended preparation coat extending a minimum of 3 inches along each side of joints and cracks. Apply a double thickness of air-barrier coating material and embed joint reinforcing in preparation coat.
- B. Gypsum Sheathing: Fill joints greater than 1/4 inch with sealant according to ASTM C 1193 and air-barrier manufacturer's written instructions. Apply first layer of air-barrier coating material at joints. Tape joints with joint reinforcing after first layer is dry. Apply a second layer of air-barrier coating material over joint reinforcing.
- C. Plywood Sheathing: Fill joints and apply air-barrier coating in strict accordance with air-barrier coating manufacturer's written instructions to suit substrate involved.

3.4 TRANSITION STRIP AND FLASHING INSTALLATION

- A. General: Install strips, transition strips, flashing, and accessory materials according to air-barrier manufacturer's written instructions to form a seal with adjacent construction and maintain a continuous air barrier.
 - 1. Coordinate the installation of air barrier with installation of sheet metal flashing and embedded masonry through-wall flashing to ensure continuity of air barrier and drainage to exterior.
 - 2. Install transition strip between changes in substrates and base flashing so that a minimum of 3 inches of coverage is achieved over each substrate.
 - 3. Vertical legs of metal flashings installed over fluid applied air barrier coatings shall receive transition strips and fluid applied flashings, installed as recommended by manufacturers written recommendations.
- B. Apply primer to substrates, when required by air barrier coating manufacturer, at required rate and allow it to dry. Limit priming to areas that will be covered by air-barrier coating material on same day. Re-prime areas exposed

for more than 24 hours.

1. Prime glass-fiber-surfaced gypsum and plywood sheathing with number of prime coats needed to achieve required bond, with adequate drying time between coats.
 2. Where required by air barrier coating manufacturer to achieve performance specified, apply manufacturer's recommended filler coat over CMU and similar substrates.
- C. Connect and seal exterior wall air-barrier material continuously to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials. Extend flashing/transition membrane into window and other openings to completely cover wood blocking and nailers in accordance with air barrier coating manufacturer's recommendations and approved shop drawings.
- D. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air-barrier material with foam sealant.
- E. At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.
- F. Apply joint sealants forming part of air-barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- G. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.
- H. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches beyond repaired areas in strip direction.

3.5 INSTALLATION

- A. General: Install fluid-applied membrane air-barriers and accessory materials according to air-barrier manufacturer's written instructions to form a seal with adjacent construction and maintain a continuous air barrier/moisture barrier. Apply air-barrier coating within manufacturer's recommended application temperature ranges.
1. Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier.
 2. Coordinate the installation of air barrier with installation of weather barrier and jamb closure membranes to ensure compatibility and continuation of barriers to allow water to drain to exterior.
- B. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by fluid air-barrier material on same day. Reprime areas exposed for more than 24 hours.
1. Prime glass-fiber-surfaced gypsum sheathing with number of prime coats needed to achieve required bond, with adequate drying time between coats.
- C. Vapor Retarding Fluid-Applied Membrane Material: Apply a continuous unbroken air-barrier membrane to substrates according to the following thickness. Apply air-barrier membrane in full contact around protrusions such as masonry ties.
1. Vapor-Retarding Membrane Air Barrier: Total dry film thickness as recommended in writing by air barrier manufacturer to meet performance requirements specified and as listed in Air Barrier Association of America (ABAA) for air permeance and water vapor permeance (desiccant method), but not less than 40-mil dry film thickness.
 - a. Apply additional coats as needed to achieve void- and pinhole-free surface.
 2. Extend system into window and door openings of metal-stud-framed walls.
- D. Apply strip and transition strip a minimum of 1 inch onto cured air-barrier material or strip and transition strip over cured air-barrier material overlapping 3 inches onto each surface according to air-barrier manufacturer's written instructions.
- E. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.
- F. Repair punctures, voids, and deficient lapped seams. Slit and flatten fishmouths and blisters. Extend patches 6 inches beyond repaired areas, unless otherwise recommended by air barrier manufacturer.

- G. Do not cover air barrier until it has been inspected by air barrier coating manufacturer's representative and installation has been reviewed and accepted by Architect.
- H. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

3.6 FIELD QUALITY CONTROL

- A. Testing Agency: Air barrier coating manufacturer shall perform tests and inspections.
- B. Inspections: Air-barrier materials, accessories, and installation are subject to inspection for compliance with requirements. Inspections may include, and is not limited to, the following:
 - 1. Continuity of air-barrier system has been achieved with no gaps or holes.
 - 2. Continuous support of air-barrier system has been provided.
 - 3. Masonry and concrete surfaces are smooth, clean, and free of cavities, protrusions, and mortar droppings.
 - 4. Maximum exposure time of materials to UV deterioration has not been exceeded.
 - 5. Surfaces have been primed, if applicable.
 - 6. Laps in strips and transition strips have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fishmouths.
 - 7. Termination mastic has been applied on cut edges.
 - 8. Flashing strips, transition strips and liquid flashing have been firmly adhered to substrate.
 - 9. Compatible materials have been used.
 - 10. Transitions at changes in direction and structural support at gaps have been provided.
 - 11. Connections between assemblies (air-barrier and sealants) have complied with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.
 - 12. All penetrations have been sealed.
- C. Tests:
 - 1. Adhesion Testing: Air-barrier assemblies will be tested for minimum air-barrier adhesion of 30 lbf/sq. in. according to ASTM D 4541 for each 1000 sq. ft. of installed air barrier or part thereof.
 - 2. Refer to Section 074213 "Formed Metal Wall and Soffit Panels" for water spray test,
- D. Air barriers will be considered defective if they do not pass tests and inspections.
 - 1. Apply additional air-barrier material, according to manufacturer's written instructions, where inspection results indicate insufficient thickness.
 - 2. Remove and replace deficient air-barrier components for retesting as specified above.
- E. Repair damage to air barriers caused by testing; follow manufacturer's written instructions.
- F. Prepare test and inspection reports.

3.7 CLEANING AND PROTECTION

- A. Protect air-barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.
 - 1. Protect air barrier from exposure to UV light and harmful weather exposure as required by manufacturer. If exposed to these conditions for more than 30 days, remove and replace air barrier or install additional, full-thickness, air-barrier application after repairing and preparing the overexposed membrane according to air-barrier manufacturer's written instructions.
 - 2. Protect air barrier from contact with incompatible materials and sealants not approved by air-barrier manufacturer.
- B. Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended by manufacturer of affected construction.
- C. Remove masking materials after installation.

END OF SECTION 072726

SECTION 074213 - FORMED METAL WALL AND SOFFIT PANELS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Concealed-fastener, lap-seam metal wall panels (074213.A03).
- B. Related Sections:
 - 1. Section 054000 "Cold-Formed Metal Framing" for miscellaneous support framing.
 - 2. Section 074800 "Rainscreen Furring Systems" for premanufactured rainscreen furring.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Meet with Owner, Architect, Owner's insurer if applicable, metal panel Installer, metal panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal panels, including installers of doors, windows, and louvers.
 - 2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 3. Review methods and procedures related to metal panel installation, including manufacturer's written instructions.
 - 4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
 - 5. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that affect metal panels.
 - 6. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
 - 7. Review temporary protection requirements for metal panel assembly during and after installation.
 - 8. Review of procedures for repair of metal panels damaged after installation.
 - 9. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.
- B. Shop Drawings:
 - 1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, locations and types of sealants, and accessories; and special details. Show locations of all cutouts.
 - 2. Accessories: Include details of the flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches.
 - a. Indicate flashing and trim to be provided under work of this Section and to be provided by others.
 - b. Indicate shape and method of attachment.
 - c. Anchorage systems. Show locations for any exposed fasteners.
 - d. Sealants: Indicate locations and types for factory-applied and field-installed sealants.
 - e. Where panels are indicated to receive custom perforated artwork, manufacturer shall provide elevations indicating location and extent of artwork proposed.
- C. Samples for Initial Selection: For each type of metal panel indicated with factory-applied finishes.
 - 1. Include Samples of trim and accessories involving color selection.
- D. Samples for Verification: For each type of exposed finish and panel type required, prepared on Samples of size indicated below.

1. Metal Wall Panels: 6 to 12 inches long by actual panel width for each color. Include fasteners, closures, and other metal wall panel accessories.
 - a. Where panels are indicated to receive custom perforated artwork, provide a full size sample of area containing artwork. Architect shall select region of artwork to be provided on sample.
2. Trim and Closures: 6 to 12 inches in length for each trim profile. Include fasteners and other exposed accessories.
3. Accessories: 6 to 12-inch-long Samples for each type of accessory.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For metal panels to include in maintenance manuals.
- B. Sample Warranties: For special warranties.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturer shall have a minimum of five (5) years of experience in production of metal panels similar in design to those specified.
- B. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer, with not less than seven (7) years of successful experience under the current company name installing metal panels similar to those required for this Project.
- C. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
 1. Water-Spray Test: Conduct water-spray test of metal panel assembly mockup, testing for water penetration according to AAMA 501.2.
 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.
- B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.
- D. Retain strippable protective covering on metal panels during installation.

1.8 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

- B. Field Measurements: Verify locations of structural members and opening dimensions by field measurements before metal panel fabrication, and indicate measurements on Shop Drawings.

1.9 COORDINATION

- A. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.10 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including rupturing, cracking, or puncturing.
 - b. Deterioration of metals and other materials beyond normal weathering.
 - 2. Warranty Period: Two years from date of Substantial Completion.
- B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General Performance: Metal wall panel assemblies shall comply with performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction.
- B. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 1592:
 - 1. Wind Loads: Determine loads based on the following minimum design wind pressures:
 - a. Uniform pressure as indicated on Drawings.
 - 2. Deflection Limits: Metal wall panel assemblies shall withstand wind loads with horizontal deflections no greater than 1/240 of the span.
- C. Air Infiltration: Air leakage through assembly of not more than 0.06 cfm/sq. ft. of wall area when tested according to ASTM E 283 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 1.57 lbf/sq. ft.
- D. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 331 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 2.86 lbf/sq. ft.
- E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

2.2 CONCEALED-FASTENER, LAP-SEAM METAL WALL PANELS (074213.A03 - MP2)

- A. General: Provide factory-formed metal panels designed to be field assembled by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners[and factory-applied sealant] in side laps. Include accessories required for weathertight installation.
- B. Asymmetrical-Groove Profile, Concealed-Fastener Metal Wall Panels (074213.A03): Formed with projecting asymmetrical-shaped ribs with flat recesses between ribs symmetrically spaced between panel edges; with narrow reveal joint between panels.
1. Basis-of-Design Product: Subject to compliance with requirements, provide one of the following:
 - a. Berridge Manufacturing Company; "HR-16 Panel".
 - b. Centria; "CS-660" Concept Series Panel.
 - c. Dimensional Metals, Inc.; "HWP16 Panel".
 - d. Fabral; "Silhouette HCF Series", profile 16-4C.
 - e. Firestone Building Products Company / Una-Clad; "Delta CFP-16F".
 - f. MBCI; a division of NCI Building Systems, L.P; "Masterline 16".
 - g. Morin; a Kingspan Group Company; "Integrity Series", profile X-16.
 - h. Comparable products from other manufacturers, meeting specified requirements, will be considered when submitted to and accepted by Architect prior to bidding.
 2. Material: Zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet.
 - a. Nominal Thickness: 0.028 inch (22 gauge).
 - b. Face Texture: Smooth.
 - c. Exterior Finish: Two-coat fluoropolymer.
 - d. Color: As selected by Architect from manufacturer's full range of standard and custom colors as indicated on drawings.
 3. Panel Coverage: 16 inches with 4 raised ribs.
 4. Panel Thickness: 3/4 inch to 1 inch.
- C. Concealed-Fastener Metal Wall Panels (074213.A03 – MP21, MP22, MP23): Factory-formed, prefinished panels with flush profile, fastened to supports with concealed fasteners.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Morin; "Matrix Panel", or comparable product from other manufacturers, meeting specified requirements, submitted to and accepted by Architect prior to bidding.
 2. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A 653/A 653M, G90 coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A 792/A 792M, Class AZ50 coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
 - a. Nominal Thickness: 22 gage.
 - b. Exterior Finish: Two-coat fluoropolymer or Three-coat fluoropolymer as necessary for color selected.
 - c. Color: As selected by Architect from manufacturer's full range.
 - d. Profile Selections:
 - 1) Type 1: MX 1.0 Matrix Profile.
 - 2) Type 2, 3 MX 10.0 Matrix Profile.
 3. Panel Coverage: 12 inches, minimum.
 4. Panel Depth: 1.5 inches.

2.3 MISCELLANEOUS MATERIALS

- A. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.
1. Closures: Provide closures at eaves and rakes, fabricated of same metal as metal panels.
 2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
 3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch-thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

- B. Flashing and Trim (074213.A07): Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.
- C. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.
- D. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.
 - 1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
 - 2. Joint Sealant: ASTM C 920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.
 - 3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.
- E. Weep Strips (074213.A08): Mesh Weep/Vent: Free-draining mesh; made from polyethylene strands, 1/4 -inch thick by 2-inch high strips and continuous for entire width of panel installation; in grey color. Weep strips shall be custom cut to height specified.
 - 1. Products: Subject to compliance with requirements, provide the following:
 - a. Mortar Net USA, Ltd.

2.4 FABRICATION

- A. General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
- B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
- C. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.
- D. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
 - 1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
 - 2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
 - 3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
 - 4. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
 - 5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
 - 6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
 - a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

2.5 FINISHES

- A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable.

Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Steel Panels and Accessories:

1. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
2. Three-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
3. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.
 1. Verify that prefinished metal flashing "by others" has been installed and weather-lapped to drain moisture to exterior.
 2. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal wall panel manufacturer.
 3. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal wall panel manufacturer.
 - a. Verify that self-adhering water-resistive barriers have been installed over sheathing or backing substrate to prevent water penetration.
- B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action as recommended by metal panel manufacturer.
- B. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal panel manufacturer's written recommendations.
- C. Weep Strip Installation: Prior to installing panel trim moldings, install weep strips between weather-resistive barrier and panel trim moldings at tops and bottoms of panels. Temporarily hold strips in place with manufacturer's recommended adhesive. Adhesive shall be applied in 3/4-inch diameter dots spaced at 12-inch centers. Bottom of weep strips shall align with top and bottom of wall panel system.

3.3 METAL PANEL INSTALLATION

- A. General: Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
 1. Commence metal wall panel installation and install minimum of 200 sq. ft. in presence of factory-authorized representative.
 2. Shim or otherwise plumb substrates receiving metal panels.
 3. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
 4. Install screw fasteners in predrilled holes.

5. Locate and space fastenings in uniform vertical and horizontal alignment.
 6. Install flashing and trim as metal panel work proceeds.
 7. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
 8. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
 9. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.
- B. Fasteners:
1. Steel Panels: Use stainless-steel fasteners for surfaces exposed to the exterior; use galvanized-steel fasteners for surfaces exposed to the interior.
- C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.
- D. Lap-Seam Metal Panels: Fasten metal panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.
1. Apply panels to avoid "panel creep" or application not true to line.
 2. Lap ribbed or fluted sheets one full rib. Apply panels and associated items true to line for neat and weathertight enclosure.
 3. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal panels.
 4. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
 5. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
 6. Flash and seal panels with weather closures at perimeter of all openings.
 7. Apply a continuous ribbon of sealant tape to weather-side surface of fastenings on end laps; on side laps of nesting-type panels; on side laps of corrugated nesting-type, ribbed, or fluted panels; and elsewhere as needed to make panels weathertight.
 8. At panel splices, nest panels with minimum 6-inch end lap, sealed with butyl-rubber sealant and fastened together by interlocking clamping plates.
 9. Soffit panels shall be fastened to supports with concealed fasteners in according to manufacturer's instructions. Provide perforated (vented) soffit panels for every fourth panel where indicated.
- E. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal wall panel manufacturer; or, if not indicated, provide types recommended by metal panel manufacturer.
- F. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.
1. Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and achieve waterproof performance.
 2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Water-Spray Test: After installation, test area of assembly as directed by Architect for water penetration according to AAMA 501.2.
- C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect completed metal wall panel installation, including accessories.

- D. Remove and replace metal wall panels where tests and inspections indicate that they do not comply with specified requirements.
- E. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.
- F. Prepare test and inspection reports.

3.5 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.
- B. After metal panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.
- C. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 074213

SECTION 074243 - METAL COMPOSITE MATERIAL WALL PANELS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes metal composite material wall and soffit panels (074243.A01 - MP1).
- B. Related Sections:
 - 1. Section 042000 "Unit Masonry" for masonry to receive air barriers.
 - 2. Section 054000 "Cold-Formed Metal Framing" for miscellaneous support framing.
 - 3. Section 061600 "Sheathing" for wall sheathing to receive air barriers.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Meet with Owner, Architect, Owner's insurer if applicable, metal composite material panel Installer, metal composite material panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal composite material panels, including installers of doors, windows, and louvers.
 - 2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 3. Review methods and procedures related to metal composite material panel installation, including manufacturer's written instructions.
 - 4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
 - 5. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that affect metal composite material panels and sequencing of adjacent construction.
 - 6. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
 - 7. Review temporary protection requirements for metal composite material panel assembly during and after installation.
 - 8. Review procedures for repair of panels damaged after installation.
 - 9. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.
- B. Shop Drawings:
 - 1. Include fabrication and installation layouts of metal composite material panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment assembly, trim, flashings, closures, and accessories; and special details.
 - 2. Accessories: Include details of the flashing, trim and anchorage, at a scale of not less than 1-1/2 inches per 12 inches.
- C. Samples for Initial Selection: For each type of metal composite material panel indicated with factory-applied color finishes.
 - 1. Include similar Samples of each trim profile and accessories involving color selection. Trim samples shall be 4 to 6-inches in length.
- D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
 - 1. Metal Composite Material Panels: 12 inches square. Include fasteners, closures, and other metal composite material panel accessories.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Field quality-control reports.
- C. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For metal composite material panels to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer. Installer shall have not less than seven (7) years of successful experience under the current company name installing metal panels similar to those required for this Project.
- B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
 - 1. Build mockup of typical metal composite material panel assembly as shown on Drawings, including corner, supports, attachments, and accessories.
 - 2. Water-Spray Test: Conduct water-spray test of mockup of metal composite material panel assembly, testing for water penetration according to AAMA 501.2.
 - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion. Where mockups are separate from building, when Substantial Completion is reached demolish mockup and legally dispose of off site.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, metal composite material panels, and other manufactured items so as not to be damaged or deformed. Package metal composite material panels for protection during transportation and handling.
- B. Unload, store, and erect metal composite material panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack metal composite material panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal composite material panels to ensure dryness, with positive slope for drainage of water. Do not store metal composite material panels in contact with other materials that might cause staining, denting, or other surface damage.
- D. Retain strippable protective covering on metal composite material panels during installation.

1.8 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal composite material panels to be performed according to manufacturers' written instructions and warranty requirements.

1.9 COORDINATION

- A. Coordinate metal composite material panel installation with rain drainage work, air barriers, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.10 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal composite material panel systems that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including rupturing, cracking, or puncturing.
 - b. Deterioration of metals and other materials beyond normal weathering.
 - 2. Warranty Period: Two years from date of Substantial Completion.
- B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal composite material panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide metal composite material panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 330:
 - 1. Wind Loads: As indicated on Drawings.
 - 2. Other Design Loads: As indicated on Drawings.
 - 3. Deflection Limits: For wind loads, no greater than 1/240 of the span.
- B. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E 283 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 1.57 lbf/sq. ft.
- C. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 331 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 6.24 lbf/sq. ft.
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
- E. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.
 - 2. Fire Performance: Comply with ASTM E 84 for Class A.
 - a. Flame Spread Index must be less than 25.
 - b. Smoke Developed Index must be less than 450.
- F. Fire Propagation Characteristics: Metal composite material wall panel system passes NFPA 285 testing.

2.2 METAL COMPOSITE MATERIAL WALL PANELS (074243.A01 – MP1)

- A. Metal Composite Material Wall Panel Systems: Provide factory-formed and -assembled, metal composite material wall panels fabricated from two metal facings that are bonded to a solid, extruded thermoplastic core; formed into profile for installation method indicated. Include attachment assembly components, panel stiffeners, and accessories required for wall panel "barrier" system.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Citadel Architectural Products, Inc.; Envelope 2000 RV - Reveal or comparable product, meeting specified requirements, submitted to and accepted by Architect prior to bidding by one of the following:
 - a. Alcotex.
 - b. Arconic Architectural Products, LLC.
 - c. Firestone Metal Products, LLC.
- B. System Description: System shall be a "barrier system"; consisting of premanufactured and prefinished, smooth-faced panels, all single-piece aluminum trim, secondary support/attachment system, connectors, gaskets, sealant and flashing for a complete system. System shall utilize concealed fasteners.
- C. Aluminum-Faced Composite Wall Panels: Panels shall be formed with a 0.024-inch- thick, coil-coated aluminum exposed facing sheet and 0.010-inch-thick, aluminum backing sheet. Or panels shall be formed with 0.020-inch thick aluminum face sheets.
 1. Panel Thickness: 4mm.
 2. Core: Solid, thermoset phenolic resin core or fire resistant extruded thermoplastic.
 3. Exterior Finishes:
 - a. Provide the three-coat fluoropolymer finish for bright colors, such as the red and yellow selected.
 4. Colors: As selected by Architect from manufacturer's full range of standard and custom colors, refer to Exterior Material Legend.
- D. Panel Characteristics:
 1. Panel weight: 1.27 psf, minimum.
 2. R-Value: Not less than 0.051.
 3. Stiffness (EI): 22,400 lb-in² per foot.
 4. Ultimate Tensile Strength: 26,000 psi per ASTM D 638.
 5. Ultimate Flexural Strength: 31,650 psi per ASTM D 790.
 6. Bond Strength: Not less than 22.6 lb-in/in per ASTM D 1781.
 7. Water Absorption: 0 percent.
 8. Flame Resistance: Class A per ASTM E 84.
 9. Tolerances: 0.6 percent for lengthwise bow and crosswise bow.
- E. Attachment Assembly Components: Formed from extruded aluminum.
- F. Attachment Assembly: Barrier principle system.

2.3 MISCELLANEOUS MATERIALS

- A. Miscellaneous Metal Subframing and Furring: Provide supplemental subframing and furring as necessary. Framing shall comply with ASTM C 645, cold-formed, metallic-coated steel sheet ASTM A 653/A 653M, G90 coating designation or ASTM A 792/A 792M, Class AZ50 aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal composite material panel system.
- B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal composite material panels unless otherwise indicated.
 1. Trim Moldings: Provide one-piece, extruded aluminum shapes in finish to match panel faces. Trim moldings shall completely capture panel edges and allow for concealed attachment to backup substrate.
 - a. Trim mouldings shall be the "reveal" type.
- C. Flashing and Trim (074243.A05): Provide flashing and trim formed from same material as metal composite material as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal composite material panels.
- D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal composite material panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.
- E. Panel Sealants: ASTM C 920; elastomeric non-staining silicone sealant; of type, grade, class, and use classifications required to seal joints in metal composite material panels and remain weathertight; and as

recommended in writing by metal composite material panel manufacturer.

2.4 FABRICATION

- A. General: Fabricate and finish metal composite material panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
- B. Fabricate metal composite material panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.
- C. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
 - 1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
 - 2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
 - 3. Sealed Joints: Form non-expansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
 - 4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
 - 5. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
 - a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

2.5 FINISHES

- A. Panels and Accessories:
 - 1. Three-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 2. Colors: As selected by Architect from manufacturer's full range of standard and custom colors, refer to Exterior Material Legend.
 - a. Refer to Drawings for color matching requirements for sheet metal flashing and trim installed adjacent to metal wall panels, storefront and curtain wall.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal composite material panel supports, and other conditions affecting performance of the Work.
 - 1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal composite material wall panel manufacturer.
 - 2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal composite material wall panel manufacturer.
 - a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Examine roughing-in for components and assemblies penetrating metal composite material panels to verify actual locations of penetrations relative to seam locations of metal composite material panels before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal composite material panel manufacturer's written recommendations.

3.3 METAL COMPOSITE MATERIAL PANEL INSTALLATION

- A. General: Install metal composite material panels according to manufacturer's written instructions in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to supports unless otherwise indicated. Anchor metal composite material panels and other components of the Work securely in place, with provisions for thermal and structural movement.
 - 1. Shim or otherwise plumb substrates receiving metal composite material panels.
 - 2. Flash and seal metal composite material panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal composite material panels are installed.
 - 3. Install screw fasteners in predrilled holes.
 - 4. Locate and space fastenings in uniform vertical and horizontal alignment.
 - 5. Install flashing and trim as metal composite material panel work proceeds.
 - 6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
 - 7. Align bottoms of metal composite material panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
 - 8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.
- B. Fasteners:
 - 1. Aluminum Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized-steel fasteners for surfaces exposed to the interior.
- C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal composite material panel manufacturer.
- D. Attachment Assembly, General: Install attachment assembly required to support metal composite material wall panels and to provide a complete weathertight wall system, including subgirts, perimeter extrusions, tracks, drainage channels, panel clips, and anchor channels.
 - 1. Include attachment to supports, panel-to-panel joinery, panel-to-dissimilar-material joinery, and panel-system joint seals.
- E. Barrier-Principle Installation: Install panels, fasteners, trim, flashing and related items in accordance with dimensions and procedures indicated on approved Shop Drawings.
 - 1. Joints between panels and between panels and adjacent construction shall be uniform and true to line.
 - 2. Panels shall be shimmed when necessary to maintain flush vertical and horizontal planes. Panel corners shall align to within 1/16 inch.
 - 3. Sealants shall be installed where indicated and in accordance with approved Shop Drawings to assure air and water infiltration performance specified.
 - 4. Work shall be coordinated with related trades as required to ensure proper flashing and seals to intersecting construction and penetrations.
 - 5. Damaged caused by manufacturer or installation contractor shall be repaired or replaced to "as new" condition as acceptable to Architect.
- F. Rainscreen-Principle Installation: Install using manufacturer's standard assembly with vertical channel that provides support and secondary drainage assembly, draining at base of wall. Notch vertical channel to receive support pins. Install vertical channels supported by channel brackets or adjuster angles and at locations, spacings, and with fasteners recommended by manufacturer. Attach metal composite material wall panels by inserting horizontal support pins into notches in vertical channels and into flanges of panels. Leave horizontal and vertical joints with open reveal.
 - 1. Install wall panels to allow individual panels to be installed and removed without disturbing adjacent panels.
 - 2. Do not apply sealants to joints unless otherwise indicated.

- G. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
 - 1. Install components required for a complete metal composite material panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal composite material panel manufacturer; or, if not indicated, provide types recommended in writing by metal composite material panel manufacturer.
- H. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.
 - 1. Install exposed flashing and trim that is without buckling and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof performance.
 - 2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

3.4 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align metal composite material wall panel units within installed tolerance of 1/4 inch in 20 feet, non-accumulative, on level, plumb, and location lines as indicated, and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified independent testing agency to perform field tests and inspections.
- B. Water-Spray Test: After installation, test area of assembly as directed by Architect for water penetration according to AAMA 501.2.
- C. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect completed metal composite material wall panel installation, including accessories.
- D. Metal composite material wall panels will be considered defective if they do not pass test and inspections.
- E. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.
- F. Prepare test and inspection reports.

3.6 CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as metal composite material panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal composite material panel installation, clean finished surfaces as recommended by metal composite material panel manufacturer. Maintain in a clean condition during construction.

END OF SECTION 074243

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SECTION 074400 - CONCRETE FACED RIGID INSULATION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Concrete faced insulated perimeter wall panels (074400.A01).
- B. Related Requirements:
 - 1. Section 033000 "Cast-in-Place Concrete" for foundation insulation and foam void fill.
 - 2. Section 042000 "Unit Masonry" for foamed-in-place masonry cell foam insulation.
 - 3. Section 071416 "Cold Fluid-Applied Waterproofing" for insulating protection board/drainage panels.

1.2 ACTION SUBMITTALS

- A. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
- B. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.
- C. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square, representing actual product, color, and patterns.

1.3 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each product, for tests performed by a qualified testing agency.
- B. Evaluation Reports: For foam-plastic insulation, from ICC-ES.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Provides design, engineering, fabrications and testing of all required components and assemblies for a complete system.
- B. Mock-Up/Field Sample: Provide a mock-up/field sample for evaluation of surface preparation techniques and application workmanship.
 - 1. Finish areas designated by Architect.
 - 2. Do not proceed with remaining work until workmanship is approved by Architect.
 - 3. Refinish mock-up area as required to produce acceptable work.
 - 4. Subject to compliance with requirements, mock-up/field samples may remain as a part of the completed work, if acceptable to Architect and Owner.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
- B. Protect foam-plastic board insulation as follows:
 - 1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
 - 2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.

3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.
 4. Store panels laying flat
 5. Do not drop panels.
- C. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.6 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

PART 2 PRODUCTS

2.1 CONCRETE FACED INSULATED PERIMETER WALL PANELS (074400.A01)

- A. Basis of Design Product: Subject to compliance with requirements, provide "WallGUARD Concrete Faced Insulated Perimeter Panels" by T-Clear / FinPan or a comparable product, the following product characteristics, submitted to and accepted by Architect prior to bidding.
1. Construction: Perimeter Foundation Insulation: Extruded polystyrene board to ASTM C 578 (CAN/ULC-S701) Type IV, rigid, closed cell, with integral high-density skin, c/w integral 5/16 inch (8 mm) thick latex-modified concrete facing.
 - a. Board Size: 2 feet by 4 feet by 2-5/16 inches and 3-5/16 inches thick.
 - b. Edges: Tongue and groove sides, square edge ends.
 - c. Maximum Use Temperature: 165-degree F.
 - d. Thermal Resistance (ASTM C 518): Long term aged R-value of 5 per inch.
 - e. Foam Compressive Strength, ASTM D 1621, minimum: 35 psi.
 - f. Compressive Strength: to ASTM D 1621, minimum 40 psi.
 - g. Water Absorption (ASTM D 2842): < 0.1 (0.7% by volume maximum).
 - h. Water Vapor Permeance (ASTM E 96): 0.8 perms.
 - i. Coefficient of Lineal Thermal Expansion (ASTM D 696, in/in x degree F (mm/m x degree C)): 3.5 x 10-5 (6.3 x 10-2).
 2. Accessories:
 - a. Metal Cap Flashing: 24 ga (0.61mm) galvanized steel J-channel; 2-1/4 inches wide, 4 inches long leg and 2-1/4 inches short leg; prefinished in color as selected.
 - b. Clips and Fasteners: corrosion-resistant type, sized to suit application as supplied by insulation manufacturer.
 3. Wall Panel System Fire Test:
 - a. Meets Uniform Building Code (UBC) 17-5 - Room Fire Test Standard for Interior of Foam Plastic Systems. Criteria are to maintain coverage of foam substrate up to 8 feet (2438 mm) from interior corner, over the duration on the test.
 - b. Equivalent to current UL 17-15 and UBC 97 revised.

2.2 ACCESSORIES

- A. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.
1. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
 2. Adhesives shall be compatible with fluid-applied air barrier coating specified in Section 072726.
 3. Adhesives shall have a VOC content of 70 g/L or less.
 4. Adhesive shall comply with the testing and product 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."

PART 3 EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

- A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and applications.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
- C. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

3.4 INSTALLATION OF CONCRETE FACED INSULATED PERIMETER WALL PANELS

- A. Perimeter Insulation Substrate Examination (Poured Concrete or Concrete Block Only):
 - 1. Verify that the insulation boards and adjacent materials are compatible.
 - 2. Verify that the substrate is flat, sound, clean and remove any masonry irregularities or jagged surfaces on the foundation wall.
- B. Perimeter Insulation Installation:
 - 1. Layout concrete-faced insulation boards to maximize board sizes. Do not use boards less than 6 inches wide.
 - 2. Install concrete-faced insulation board system in orientation as indicated or to maximize full sheets. Complete with fastening clips and cap flashing in accordance with manufacturer's installation guidelines.

3.5 PROTECTION

- A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 074400

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SECTION 074800 - RAINSCREEN FURRING SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes providing continuous insulation and composite framing support (rainscreen furring) system integrated with exterior wall cladding.
- B. Related Sections:
 - 1. Section 072726 "Fluid Applied Air Barrier Coatings" for performance testing.
 - 2. Section 074213 "Formed Metal Wall and Soffit Panels" for exterior wall cladding over rainscreen furring.
 - 3. Section 074219 "Insulated Metal Wall Panels" for exterior wall cladding over rainscreen furring.
 - 4. Section 074243 "Metal Composite Material Wall Panels" for exterior wall cladding over rainscreen furring.

1.2 REFERENCE STANDARDS

- A. ASTM International (American Society for Testing and Materials; www.astm.org).
 - 1. ASTM A 653/A653M – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by Hot-Dip Process; 2015.
 - 2. ASTM C 518 – Standard Test Method for Steady-State Thermal Transmission Properties by Means of Heat Flow Meter Apparatus; 2015.
 - 3. ASTM C754 – Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2015.
 - 4. ASTM C 1289 – Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2015.
 - 5. ASTM E 84 – Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.
 - 6. ASTM E 96/E96M – Standard Test Methods for Water Vapor Transmission of Materials; 2015.
- B. ASHRAE (American Society of Heating, Refrigerating, and Air-Conditioning Engineers; ashrae.org).
 - 1. ASHRAE 90.1 – Energy Standard for Buildings Except Low-Rise Residential Buildings; 2013. For rain screen furring attachment system performance with continuous insulation.
- C. NFPA – National Fire Protection Association (www.nfpa.org)
 - 1. NFPA 285 – Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components; 2012.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Meet with Owner, Architect, Owner's insurer if applicable, metal panel Installer, metal panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects rainscreen furring.
 - 2. Coordinate installation of rainscreen furring system over substrate indicated for proper drainage, flashing, trim, back-up support framing, soffits and other related work.
 - 3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 4. Review methods and procedures related to rainscreen furring installation, including manufacturer's written instructions.
 - 5. Review layout for rain screen furring system, supplemental furring and backing strips.
 - 6. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
 - 7. Review closures and flashings, special wall cladding details, wall penetrations, openings, and condition of other construction that affect rainscreen furring.
 - 8. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
 - 9. Review temporary protection requirements for rainscreen furring assembly during and after installation.
 - 10. Review procedures for repair of rainscreen furring damaged after installation.

11. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of rainscreen furring system and accessory.
- B. Shop Drawings: For each type of rainscreen furring system specified, submit the following:
 1. Show layout and attachment of rainscreen furring.
 - a. Include details of edge conditions, corners, anchorages, attachment system, weep system, trim, flashings, closures, locations and types accessories; and special details.
 2. Shop drawings for rainscreen furring system shall be signed and sealed by professional engineer licensed in jurisdiction where project is located.
 - a. Include comprehensive structural design analysis and calculations.
- C. Samples: For each type of rainscreen furring system component indicated. Samples shall not be less than 8 inches in length.
 1. Include similar Samples of each type of trim, shims and accessories.
- D. Coordination Drawings: Submit exterior elevations, drawn to scale, that have the following items shown and coordinated with each other, using input from installers of these items as follows:
 1. Rain screen furring system and continuous insulation.
 2. Wall-mounted items including doors, windows, louvers, and lighting fixtures.
 3. Penetrations of wall by pipes and utilities.
 4. Submit connection details to cladding manufacturers, showing interface of rainscreen furring to substrate and each type of exterior wall cladding. Coordinate layouts and details with adjacent construction.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Manufacturer and Installer.
- B. Product Test Reports: For each product, tests performed by a qualified testing agency.
- C. Test and Inspection Reports: Submit test and inspection reports on each type of wall cladding system based on evaluation of comprehensive tests performed by nationally recognized testing agency.
- D. Sample Warranties: For special warranties.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing rainscreen furring systems similar to that specified in this section and with at least three years of documented experience.
- B. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer, with not less than three years of successful and documented experience under the current company name installing rainscreen furring similar to those systems required for this Project.
 1. Installer shall have completed at least seven (7) projects of equivalent scope.
- C. Source Limitations: Obtain each type of rainscreen furring system and continuous insulation from single source and from single manufacturer.
- D. Integrated Field Sample: Build field sample of rainscreen furring system coordinated with exterior cladding types to demonstrate aesthetic effects and set quality standards for fabrication and installation.
 1. Refer to exterior cladding sections:
 - a. Section 074213 "Formed Metal Wall and Soffit Panels."
 - b. Section 074219 "Insulated Metal Wall Panels."
 - c. Section 074243 "Metal Composite Material Wall Panels."
 2. Build integrated field sample of typical wall panel area as shown on Drawings.

- a. Field sample area shall be at least 70 sq ft. Locate as directed by Architect.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials and components in manufacturer's original, unopened and undamaged containers or bundles. Containers and/or bundles shall be clearly labeled identifying product and manufacturer. Exercise care to avoid damage during unloading, storing and installation.
- B. Store, protect and handle materials and components in accordance with manufacturer's recommendations to prevent damage, contamination and deterioration. Keep materials and components clean, dry and free of dirt and other foreign matter, and protect from damage to weather and construction activities.
 1. Handle components in a manner to prevent bending, warping, twisting and; surface, edge and corner damage.

1.8 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit installation of rainscreen furring to be performed according to manufacturers' written instructions and warranty requirements.
- B. Field Measurements: Verify locations of rainscreen furring system components, structural members and opening dimensions by field measurements before metal panel fabrication, indicate measurements on Shop Drawings.
 1. Where field measurements cannot be made without delaying work, guarantee dimensions and proceed with fabrication of rainscreen furring corresponding to established dimensions.

1.9 COORDINATION

- A. Coordinate work of this section with exterior cladding, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.
- B. Coordinate construction to ensure that assemblies fit properly to supporting and adjoining construction; coordinate schedule with construction in progress to avoid delaying the Work.

1.10 WARRANTY

- A. Continuous Insulation and Rainscreen Furring System Warranty: Manufacturer's standard limited warranty form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.
 1. Failures include, but are not limited to, the following:
 - a. Components of the rainscreen furring system, including failure of components when all materials and components are supplied and installed according to furring manufacturer's requirements.
 2. Includes labor and material for removal and replacement of defective material and components.
 3. Includes labor to remove and reinstall exterior cladding, finish closures, flashing and cladding accessories necessary to access defective material.
 4. Warranty Period: Five (5) years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General: Rainscreen furring system shall be capable of withstanding effects of loads and stresses from dead loads, wind loads, ice loads (as applicable) as set forth in the Structural General Notes and normal thermal movement without evidence of permanent defects of assemblies and components.

- B. System Thermal Design: Ensure installed continuous insulation and rainscreen furring system, sub-framing, clips and cladding attachment does not have thermal bridging of fasteners or framing that creates a continuous metal path from exterior surface of insulation to interior face of insulation.
 - 1. System thermal design shall meet or exceed thermal design requirements in compliance with ANSI/ASHRAE 90.1-2010.
 - 2. Thermal Resistance of Wall Assembly: Not less than an R-Value of 18.4.
- C. Temperature: Comply with structural loading requirements within temperature range of minus 55 degrees F to 180 degrees F.
- D. Fire Test Response Characteristics: Provide rainscreen furring system with fire test results indicated as determined by test standard indicated and applied by UL or other testing and inspection agency acceptable to authorities having jurisdiction.
 - 1. Surface Burning Characteristics: in compliance with ASTM E 84, for foam insulation, fiber reinforced polymer (FRP) and interior surface as follows:
 - a. Flame Spread Index: 25 or less.
 - b. Smoke Developed Index: 450 or less.
 - 2. Intermediate Scale Multistory Test: Comply with NFPA 285 and/or International Building Code (IBC) acceptance criteria for wall height above grade and fire separation distances.
- E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

2.2 CONTINUOUS INSULATION AND PREMANUFACTURED RAINSCREEN FURRING SYSTEM (074800.A01)

- A. General: Manufacturer of rainscreen furring system shall be responsible for engineering and design of the furring system, including anchorage to the structural system and necessary modifications to meet specified requirements and to maintain visual design concepts.
 - 1. Manufacturer shall employ a registered professional engineer, licensed to practice engineering in jurisdiction where the project is located, to engineer each component of rainscreen furring system.
- B. Manufacturer and Product for Continuous Insulation and Subframing/Rainscreen Furring System:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide continuous insulation and rainscreen furring system "SMARTci 2-in-1 System" as manufactured by Advanced Architectural Products (A2P). Include all necessary inside and outside corner components and accessories for complete system to properly support exterior wall cladding.
 - a. Comparable products from other manufacturers, meeting specified requirements, will be considered when submitted to and accepted by Architect prior to bidding.
- C. General – System Description for Rainscreen Furring System:
 - 1. Rainscreen system components shall be anchored through exterior sheathing to metal stud framing. Continuous insulation and rainscreen furring system shall be installed with shims as indicated on approved shop drawings and in compliance with specified requirements.
- D. Rainscreen Furring System: Provide rainscreen furring system consisting of polyester and vinyl ester bioresin matrix (FRP) with recycled materials, fire retardant additives and integral continuous metal inserts the length of the profile.. Reinforce rainscreen furring system with glass rovings used internally for longitudinal (lengthwise) strength and continuous strand glass mats or stitched reinforcements used internally for traverse (crosswise) strength.
 - 1. Depth of Furring members: 2-inch or 3-inch as indicated in the Wall Types..
 - 2. Spacing: 16 inches on center.
 - 3. Orientation: Vertically or Horizontally as indicated in the Wall Types.
 - 4. Provide continuous non-corrosive steel insert for engagement of fasteners, 16 gage, minimum thickness, with G90 galvanized coating designation in compliance with ASTM A 653/A653M.
 - a. Fully engage steel insert with adjacent rainscreen furring system at ends.
 - b. Anchor sub-girts and other wall cladding support accessories to steel insert set into part of rainscreen furring system.
 - 5. Provide 3-point compression seal in rainscreen furring sections to ensure insulation panel will not dislodge.
 - 6. Provide integral anti-siphon grooves on interior and exterior flanges of rainscreen furring.

7. Provide force distribution zones integrally designed into profile of rainscreen furring.
 8. Surface Burning Characteristics:
 - a. Flame Spread Index: 25 or less, when tested in accordance with ASTM E 84.
 - b. Smoke Developed Index: 450 or less, tested in accordance with ASTM E 84.
 9. Self-Extinguishing: Comply with ASTM D 625.
 10. Adjustable CMH Sub-Framing System: Provide adjustable "GreenGirt Delta Z-Bracket" with integral insulation and rail retention - Dual-Grip.
 - a. Depth: 5 inches.
 - b. Adjustability Range: 5.25 inches to 9.5 inches.
- E. Continuous Insulation (074800.A02): Provide factory-formed edges on insulation panels that interlock with rainscreen furring system components and as specified hereinafter.
1. Polyisocyanurate Panel Insulation: Rigid closed cell foam, complying with ASTM C 1289; Type II, Class 1, cellulose felt or glass fiber mat both faces; Grade 3 having a 25 psi compressive strength.
 - a. Flame Spread Index: 25 or less, when tested in accordance with ASTM E 84.
 - b. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E 84.
 - c. Thermal Resistance: R-value of not less than 5 long-term per inch, thermal resistance (LTTR).
 - d. Comply with fire-resistance requirements, as indicated as specified herein, and as part of an exterior non-load-bearing exterior wall assembly when tested in accordance with NFPA 285.
 - e. Board edges shall be square.
 - f. Dimensional Stability: Less than 2 percent linear change after 7 days, according to ASTM D 2126.
 - g. Moisture Vapor Permeance: Less than 1 perm, according to ASTM E 96/E96M.
 - h. Water Absorption: Less than 0.05 percent by volume, according to ASTM C 209.
 2. Acceptable Products:
 - a. Atlas Roof Insulation.
 - b. Hunter Panels, LLC.
 - c. RMAX Operating, LLC.
- F. Accessories:
1. General: Provide all accessories necessary for a complete continuous insulation and rainscreen furring system, including metal closure trim, tie-in brackets, shims and similar items.
 2. Fasteners: Corrosion-resistant, self-tapping and self-drilling screws, bolts, nuts and other fasteners as recommended by manufacturer of rainscreen furring system to suit installation indicated.
 - a. Cladding to Rainscreen Furring: Self-tapping as recommended by cladding manufacturer, refer to Section 074213.
 - b. Rainscreen Furring to Metal Stud Wall Framing: Use standard, non-corrosive self-tapping metal screws.
 - c. Rainscreen Furring to Concrete and Concrete Unit Masonry: Use standard, non-corrosive screws anchors in pre-drilled holes.
 3. Shims: Provide high impact plastic horseshoe shims as recommended by rainscreen furring system manufacturer as follows:
 - a. Thickness: Behind anchoring flanges of rainscreen furring adjacent to air barrier coating system 1/4 inch. Provide other shim thicknesses as required to suit conditions involved.
 - b. Length and Width: 3 inches long by 2-5/16 inches wide.
 - c. Slot Opening: 7/8 inch.
 4. Sealants: Provide sealants as recommended by rainscreen furring system manufacturer for openings within rainscreen furring system and perimeter conditions, and to seal fasteners required for rainscreen furring system to properly seal penetrations in the air barrier.
 5. Masonry Anchors for Rainscreen Furring System.
 - a. Basis of Design Product: Subject to compliance with requirements, provide one of the following masonry veneer anchoring systems:
 - b. Masonry anchor products shall be approved in writing by rainscreen furring system manufacturer's technical representative prior to use on this project.
 - c. Masonry anchor products shall be installed as indicated on rainscreen furring system manufacturer's written recommendations and requirements.

2.3 MISCELLANEOUS MATERIALS

- A. Miscellaneous Metal Subframing and Furring: ASTM C 645, cold-formed, metallic-coated steel sheet, ASTM A 653/A 653M, G90 (Z275 hot-dip galvanized) coating designation or ASTM A 792/A 792M, Class AZ50 (Class AZM150) aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's

standard sections as required for support and alignment of metal panel system.

- B. Panel Sealants: ASTM C 920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer. Provide sealant types that are compatible with panel materials, are non-staining, and do not damage panel finish.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrates, exterior cladding supports, and other conditions affecting performance of the Work.
 - 1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal wall panel manufacturer.
 - 2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal wall panel manufacturer.
 - a. Verify that air/moisture barrier coating has been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Verify that mechanical and electrical services for exterior walls have been installed and tested. When appropriate, verify that adjacent materials and finishes are dry and ready to receive insulation.
- C. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to rainscreen furring system installation.
- B. Prepare surfaces using methods recommended by rainscreen furring system manufacturer for achieving best results for substrate under project conditions.
- C. Prepare sub-framing, base angles, sills, furring and other rainscreen furring system members to provide anchorage in accordance with ASTM C 754 for substrate type and exterior wall cladding type indicated in accordance with rainscreen furring system manufacturer's instructions.

3.3 INSTALLATION

- A. Assembly: Assemble continuous insulation and rainscreen furring as a system using manufacturer's procedures and processes identical to tested units, and as necessary to comply with performance requirements indicated and manufacturer's engineering design.
 - 1. Erect rainscreen furring system in sequence according to system manufacturer's installation procedures.
 - 2. Provide spray foam sealant on backside of cantilevered fasteners or actuated fastening tools that completely puncture continuous insulation layer.
- B. Install continuous insulation and rainscreen furring system in accordance with system manufacturer's written installation instructions and approved shop drawings.
 - 1. Install system to fill exterior spaces without gaps and voids, and do not compress insulation panels.
 - 2. Trim insulation neatly to fit spaces and insulate miscellaneous gaps and voids.
 - 3. Fit insulation tight in spaces and tight to exterior side of Mechanical/Electrical services within plane of insulation.
 - 4. Seal gaps, voids and penetrations completely with approved expandable foam sealant on exterior and interior (if visible) before enclosing wall.
 - 5. Seal gaps, voids and penetrations completely with approved sealant that occur within exterior sheathing before enclosing wall.

6. Provide spray foam to seal metal penetrations, including cantilevered fasteners, to prevent interstitial space condensation.
7. Exposed insulation shall be kept dry and shall be protected from open flame. Insulation panels shall not be left exposed to UV in excess of 60 days.
8. Shim and align system to comply with tolerances specified.
 - a. Provide ¼ inch gap between back face of insulation and air/moisture barrier coating.

3.4 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align metal plate wall panel units within installed tolerance of 1/4 inch in 20 feet, non-accumulative, on level, plumb, and location lines as indicated, and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.5 PROTECTION

- A. Protect installed products from damage during subsequent construction until date of Substantial Completion.
- B. Ensure that insulation panels are not exposed to moisture.
 1. Remove wet insulation panels or allow insulation panels to completely dry prior to installation of rainscreen furring system.
- C. Replace damaged insulation panels prior to date of Substantial Completion.

END OF SECTION 074800

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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.
 - 6. Liquid flashing.
 - 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:
1. Performance Requirement Certificate: Signed by roof membrane manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
 - 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 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 37-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.
 - c. Performance Roofing Systems: PRS Vented Base Sheet.
 - d. Soprema.
 - e. Tremco.
 - f. Comparable product submitted to and accepted by Architect and roofing material manufacturer prior to bidding.
- B. Adhesives: Single-component, moisture cured, silyl-terminated polyether (STPE), membrane adhesive.
 - 1. Basis-of-Design Product: Provide Colply EF Adhesive by Soprema.

2.4 VAPOR RETARDER

- A. Self-Adhered Sheet Vapor Barrier (075216.A16): ASTM D1970/D1970M, polyethylene film laminated to layer of rubberized asphalt adhesive: cold applied, with slip-resisting surface and release paper backing. Provide primer when recommended by vapor retarder manufacturer.
 - 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).
1. Basis of Design Product: Provide "Duotack 365" by Soprema.
 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.
1. Granule Material: Mineral.
 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.
1. Granule Material: Mineral.
 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.
1. Granule Material: Mineral.
 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.
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 Warranty 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 manufacturer'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/repared 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

SECTION 075423 - THERMOPLASTIC POLYOLEFIN (TPO) ROOFING

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).
 - 4. Coverboard (075423.A25).
 - 5. Walkways (075423.A41).
 - 6. Liquid Flashing (075423.A44).
 - 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.
- B. Roofing Terminology: See ASTM D 1079 and glossary in NRCA's "The NRCA Roofing Manual: Membrane Roofing Systems" for definitions of terms related to roofing work in this Section.

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 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:
 1. Performance Requirement Certificate: Signed by roof membrane manufacturer, certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
 - 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 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).
 - 3. Johns Manville.
 - 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.**
 - 2. **Hail Resistance Rating: FM Global Property Loss Prevention Data Sheet 1-34 VSH (very severe hail).**

2.3 TPO MEMBRANE ROOFING

- A. Fabric-Reinforced Thermoplastic Polyolefin Sheet: ASTM D 6878, internally fabric or scrim reinforced, uniform, flexible TPO sheet.
 - 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.
- B. ~~Fabric-Backed Thermoplastic Polyolefin Sheet: ASTM D 6878, internally fabric or scrim reinforced, uniform, flexible fabric-backed TPO sheet.~~
 - 1. ~~Source Limitations: Obtain components for roofing system from roof membrane manufacturer or manufacturers approved by roof membrane manufacturer.~~
 - 2. ~~Thickness: 60 mils, with 55 mil fabric backing. Total thickness of 115 mils, minimum.~~
 - 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.
- C. Vertical Wall Flashing (075423.A11): Match roof ply.
- 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 1/2 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.
- D. Cover Board (075423.A25): ASTM C 1177/C 1177M, Type X, glass-mat, water-resistant gypsum substrate, 5/8 inch thick, factory primed. Coverboard shall be listed by roofing manufacturer for hail resistance rating specified.
 1. Basis-of-Design Product: Provide "Dens-Deck StormX Prime" as manufactured by G-P Gypsum corporation.

2.8 ASPHALT MATERIALS

- A. Asphalt Primer: ASTM D 41.

2.9 WALKWAYS

- A. Flexible Walkways (075423.A41): Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway pads, approximately 3/16 inch thick and acceptable to roofing system manufacturer.
 - 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 substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
 - d. Verify that concrete curing compounds that will impair adhesion of roofing components to roof deck have been removed.
 - e. 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 butted 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.

- 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.
 - 1) Trim insulation so that water flow is unrestricted.
- f. Fill gaps exceeding 1/4 inch with insulation.
- g. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
- h. Adhere each layer of insulation to substrate using adhesive according 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.

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 076200 - SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Formed Products:
 - a. Formed roof drainage sheet metal fabrications.
 - b. Formed low-slope roof sheet metal fabrications.
 - c. Formed wall sheet metal fabrications.
 - d. Formed equipment support flashings.
 - e. Premanufactured pitch pockets.
 - f. Roof drains.
- B. Related Sections:
 - 1. Section 042000 "Unit Masonry" for masonry through wall flashing.
 - 2. Section 061000 "Rough Carpentry " for wood nailers, curbs, and blocking.
 - 3. Section 072100 "Thermal Insulation"
 - 4. Section 074213 "Formed Metal Wall and Soffit Panels" for sheet metal flashing and trim integral with metal coping and prefinished sheet metal flashing.
 - 5. Section 075216 "Modified Bituminous Membrane Roofing" for installing sheet metal flashing and trim integral with roofing.
 - 6. Section 075423 "TPO Roofing" for installing sheet metal flashing and trim integral with roofing.

1.2 COORDINATION

- A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.
- B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints and seams to provide leakproof, secure and non-corrosive installation.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct Conference at Project Site.
 - 1. Review construction schedule. Verify availability of materials, Installer's personnel, equipment and facilities needed to make progress and avoid delays.
 - 2. Review special roof details, roof drainage, roof-penetration flashing, equipment curbs and condition of other construction that affects sheet metal flashing and trim.
 - 3. Review requirements for insurance and certificates, if applicable.
 - 4. Review sheet metal flashing observation and repair procedures – post flashing installation.
 - 5. Meet with Owner, Architect, Installer and other Installers whose work interfaces with or affects sheet metal flashing and trim – including installers of roofing materials, roof accessories and roof-mounted equipment.
 - 6. Review methods and procedures related to sheet metal flashing and trim.
 - 7. Review special roof details, roof drainage, roof penetrations, equipment curbs and condition of other construction that will affect sheet metal flashing.
 - 8. Review sequencing of sheet metal flashing installation with other related trades to coordinate installation.
 - 9. Document proceedings, including corrective measures and actions required, and furnish copy of records to each participant.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.

- B. Shop Drawings: Show fabrication and installation layouts of sheet metal flashing and trim, including plans, elevations, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work. Include the following:
1. Identification of material, thickness, weight, and finish for each item and location in Project.
 2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
 3. Details for joining, supporting, and securing sheet metal flashing and trim, including layout of fasteners, cleats, clips, and other attachments. Include pattern of seams.
 4. Details of termination points and assemblies, including fixed points.
 5. Details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counterflashing as applicable.
 6. Details of special conditions and of connections to adjoining work.
 7. Detail formed flashing and trim at a scale of not less than 3 inches per 12 inches.
 8. Include details of roof-penetration flashing.
 9. Include details of expansion joints and expansion-joint covers – show direction of expansion and contraction joints from fixed points.
 10. Shop drawings for Section 076200 "Sheet Metal Flashing and Trim" shall be reviewed concurrently with shop drawings for the following sections:
 - a. Section 075216 "Modified Bituminous Membrane Roofing"
- C. Samples for Verification: For each type of exposed finish required, prepared on 6 inch square samples of actual metal to be used in the work.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified fabricator.
- B. Maintenance Data: For sheet metal flashing, trim, and accessories to include in maintenance manuals.
- C. Warranty: Sample of special warranty.

1.6 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.
1. For copings and roof edge flashings that are SPRI ES-1 compliant, shop shall be SPRI ES-1 certified and listed as able to fabricate required details as tested and approved.
- B. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual", Sixth Edition, unless more stringent requirements are specified or shown on Drawings.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
- B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to the extent necessary for the period of sheet metal flashing and trim installation.

1.8 WARRANTY

- A. Special Warranty on Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.
1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.

- c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
- 2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.
 - 1. *SPRI Wind Design Standard: Manufacture and install copings and roof edge flashings tested in accordance with ANSI/SPRI/FM 4435/ES-1 and capable of resisting the following design pressure:*
 - a. *Design Pressure: As indicated on Drawings.*
 - 2. Sheet metal flashings shall be installed in accordance with ANSI/SPRI/FM 4435/ES-1 "Wind Design Standard for Edge Systems used with Low Slope Roofing Systems" as applicable for locations and configurations indicated on Drawings.
- B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.
- C. Recycled Content: Postconsumer recycled content plus one-half of pre-consumer recycled content not less than 25 percent.
- D. Fabricate and install roof edge flashing capable of resisting the following forces according to recommendations in FMG Loss Prevention Data Sheet 1-49.
 - 1. Refer to structural drawings.
- E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 SHEET METALS

- A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying a strippable, temporary protective film before shipping.
 - 1. Contractor shall use gauges or thicknesses specified or as prescribed in the referenced standards for specific girths, whichever is greater.
- B. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304, dead soft, fully annealed.
 - 1. Finish: 2D (dull, cold rolled).
 - 2. Surface: Smooth, flat.
- C. Metallic-Coated Steel Sheet: Restricted flatness steel sheet, metallic coated by the hot-dip process and pre-painted by the coil-coating process to comply with ASTM A 755/A 755M.
 - 1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation; structural quality.
 - 2. Surface: Smooth, flat.
 - 3. Exposed Coil-Coated Finish:
 - a. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 4. Colors: As selected by Architect from manufacturer's full range. Refer to Exterior Finish Legend for color matching requirements for sheet metal flashing and trim installed adjacent to metal wall panels, storefront and curtain wall.
 - 5. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

2.3 UNDERLAYMENT MATERIALS

- A. Self-Adhering, High-Temperature Sheet (076200.A01): Minimum 30 to 40 mils () thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer and compatible with self-adhering air barrier transition membrane.
 - 1. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F.
 - 2. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F.
 - 3. Products: Subject to compliance with requirements, provide one of the following:
 - a. Carlisle Coatings & Waterproofing Inc.; CCW WIP 300HT.
 - b. Grace Construction Products, a unit of W. R. Grace & Co.; Ultra.
 - c. Henry Company; Blueskin PE200 HT.
- B. Slip Sheet: Building paper, 3-lb/100 sq. ft. minimum, rosin sized.
- C. Flexible Membrane Closure (076200.A04): EPDM Sheet membrane; at roof expansion joints provide non-reinforced flexible, black EPDM synthetic rubber sheet flashing of 45 to 60 mils thickness. EPDM sheet shall have a tensile strength of not less than 1200 psi, a tear resistance of at least 20 lbs per inch and an ultimate elongation of at least 250 percent. Provide with seam and splice tape, adhesives and all other accessories required for proper and watertight installation.

2.4 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and recommended by manufacturer of primary sheet metal unless otherwise indicated.
- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal.
 - 1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
 - a. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
 - 2. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.
 - 3. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329 or Series 300 stainless steel.
- C. Solder:
 - 1. For Stainless Steel: ASTM B 32, Grade Sn60, with an acid flux of type recommended by stainless-steel sheet manufacturer.
- D. Sealant Tape (076200.A02): Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, non-sag, nontoxic, non-staining tape 1/2 inch wide and 1/8 inch thick.
- E. Elastomeric Sealant (076200.A03): ASTM C 920, elastomeric silicone polymer sealant; low modulus; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- F. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.
- G. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.
- H. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.
- I. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.
- J. Pre-Manufactured Pourable Sealer Pockets: Use only on non-structural penetrations that are flexible and those that are closely spaced. Provide pre-fabricated pourable sealer pocket system filled with fast-setting, solvent-free, multi-use waterproof sealer. Pre-fabricated pourable sealer pocket components shall connect together by means of tongue-and-groove joints, and shall be manufactured from a high-strength, flexible polyurethane elastomer.

Pocket components shall join together to create pockets of varying sizes.

1. Basis-of-Design Product: Subject to compliance with requirements, provide "Lockin Pocket interlocking Pitch Pocket System" as manufactured by Weather-Tite, or comparable product submitted to and accepted by Architect prior to bidding.
2. Product Characteristics:
 - a. Pourable sealer pocket components and sealer color shall be black.
 - b. Height: Not less than 4 inches above field of roof.
 - c. Warranty: Not less than 2 years.

2.5 FABRICATION, GENERAL

- A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, geometry, metal thickness, and other characteristics of item indicated. Fabricate items at the shop to greatest extent possible.
 1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
 2. Obtain field measurements for accurate fit before shop fabrication.
 3. Form sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
 4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces exposed to view.
- B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch () offset of adjoining faces and of alignment of matching profiles.
- C. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant.
- D. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.
 1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
 2. Use lapped expansion joints only where indicated on Drawings.
- E. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.
- F. Cleats (076200.A36): Fabricate cleats and attachment devices of sizes as recommended by SMACNA's "Architectural Sheet Metal Manual" and by FMG Loss Prevention Data Sheet 1-49 for application, but not less than thickness of metal being secured.
 1. Cleats for coping, gravel stop edges and fascia caps shall be fabricated from not less than 0.040 inch thick (20 gauge) galvanized steel and shall be continuous 10 foot lengths with 1/4 inch gap between sections.
- G. Seams: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.
- H. Do not use graphite pencils to mark metal surfaces.

2.6 ROOF DRAINAGE SHEET METAL FABRICATIONS

- A. Downspouts (076200.A07): Fabricate rectangular 4 x 6 inch downspouts complete with mitered elbows. Furnish with metal hangers, from same material as downspouts, and anchors.
 1. Fabricate downspouts similar to SMACNA (Sixth Edition), Figure 1-32B.
 2. Fabricated Hanger Style: SMACNA figure designation 1-35I.
 - a. Hangers shall be spaced evenly not greater than 10 feet on center between eave and finished grade.
 3. Fabricate from the following materials:
 - a. Coil-Coated Galvanized Steel: 0.034 inch thick.
- B. Parapet Scuppers (076200.A08): Fabricate scuppers of dimensions required with closure flange trim to exterior, 4-inch- wide wall flanges to interior, and base extending 4 inches beyond cant or tapered strip into field of roof. Fabricate from the following materials:
 1. Fabricate scupper similar to SMACNA (Sixth Edition), Figures 1-26A, 1-26B and 1-27A.
 2. Coil-Coated Galvanized Steel: 0.034 inch thick.

- C. Conductor Heads (076200.A09): Fabricate conductor heads to configurations and sizes indicated, similar to those shown in SMACNA (Sixth Edition), Figures 1-25F, 1-26A and 1-27A. Fabricate leading edge of scupper into conductor head similar to Figure 1-28, Section A-A with locked drip edge.
 - 1. Fabricate from the following materials:
 - a. Coil-Coated Galvanized Steel: 0.034 inch thick.
- D. Splash Pans (076200.A10): Fabricate from the following materials:
 - 1. Galvanized Steel: 0.034 inch thick.
 - 2. Fabricate similar to SMACNA (Sixth Edition), Figure 1-36. Fabricate with 2 to 3 corrugations.
- E. Splash Block (076200.A10):
 - 1. Materials: Fabricate from UV-resistant precast 5,000 p.s.i. concrete 28 days reinforcement with grade 60 steel. Basis of Design: Century Group.
 - 2. Minimum dimension: 4"H x 12"W x 30"L.
 - 3. Weight: 48 lbs.

2.7 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

- A. Roof Edge Flashing (Gravel Stop 076200.A11) and Fascia (076200.A12): Fabricate in minimum 96-inch- long, but not exceeding 12-foot- long sections. Furnish with 6 inch wide cover plates. Shop fabricate interior and exterior corners.
 - 1. Joint Style: Butted with expansion space and 12-inch-wide, concealed backup plate.
 - 2. Fabricate edging similar to SMACNA (Sixth Edition), Figures 2-1B and 2-5C.
 - 3. Fabricate fascia similar to SMACNA (Sixth Edition), Figures 2-7A and 2-7B.
 - a. Coil-Coated Galvanized Steel: 0.034 inch thick.
- B. Copings and Caps (076200.A13): Fabricate in minimum 96-inch- long, but not exceeding 10-foot- long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and drill elongated holes for fasteners on interior leg. Miter corners, seal, and solder or weld watertight.
 - 1. Coping Profile: Similar to SMACNA figures designation 3-1A, 3-4A and 3-8D.
 - 2. Cap Profile: Similar to SMACNA figure designation 4-5C, with 4inch high flange.
 - 3. Joint Style:
 - a. At coping: Similar to SMACNA, Figure 3-1, Detail 2, with drive cleat over top and "J1" 3-inch lap joint on vertical faces.
 - b. At caps: Similar to SMACNA, Table 3-1, joint "J2" with butt and backup plate.
 - 4. Fabricate from the following materials:
 - a. Coil-Coated Galvanized Steel: 0.034 inch thick.
- C. Roof-to- Roof Expansion-Joint Cover (076200.A14): Fabricate from the following materials:
 - 1. Coil-Coated Galvanized Steel: 0.034 inch thick.
 - 2. Fabricate roof-to-roof expansion joint similar to SMACNA (Sixth Edition), Figure 5-5A.
 - 3. Where expansion joint occurs beneath metal wall panels, vertical legs of receiver shall be 4 inches tall and extend up behind rigid insulation.
- D. Roof to Wall Transition Expansion-Joint Cover (076200.A15): Fabricate from the following materials:
 - 1. Coil-Coated Galvanized Steel: 0.034 inch thick.
 - 2. Fabricate roof-to-wall expansion joint similar to SMACNA (Sixth Edition), Figures 5-1 and 5-6B.
 - 3. Where expansion joint occurs beneath metal wall panels, vertical legs of receiver shall be 4 inches tall and extend up behind weather resistive barrier/air barrier transition flashing.
- E. Counterflashing (076200.A18): Fabricate from the following materials:
 - 1. Coil Coated Galvanized Steel: 0.034 inch thick.
 - 2. Fabricate similar to SMACNA (Sixth Edition), Figure 4-4D, spring action and two piece (with receiver).
 - 3. Where indicated, fabricate counterflashing with integral reglet flange similar to SMACNA (Sixth Edition), Figure 4-4B.
- F. Flashing Receivers (076200.A19): Fabricate from the following materials:
 - 1. Stainless Steel: 0.019 inch thick.
 - 2. Where receivers are indicated to project through exterior wythe, horizontal leg of receiver shall be 3 to 3-1/2 inches long.

3. Where receivers are cut-in to masonry joint or partially embedded in masonry joint, fabricate similar to SMACNA (Sixth Edition), Figure 4-4C.
 4. Where receivers are mechanically fastened to vertical surface, vertical leg of receiver shall be at least 4 inches tall, similar to SMACNA, Figure 4-5C with receiver formed similar to Figure 4-4D.
- G. Roof-Penetration Flashing (076200.A20): Fabricate from the following materials:
1. Coil-Coated Galvanized Steel: 0.034 inch thick.

2.8 WALL SHEET METAL FABRICATIONS

- A. Opening Flashings in Frame Construction: Fabricate head, sill, and similar flashings to extend 4 inches beyond wall openings. Form head and sill flashing with 2-inch-high, end dams. Fabricate from the following materials:
1. Coil-Coated Galvanized Steel: 0.034 inch thick.

2.9 MISCELLANEOUS SHEET METAL FABRICATIONS

- A. Equipment Support Flashing (076200.A33): Fabricate from the following materials:
1. Galvanized Steel: 0.034 inch thick.
- B. Pre-Finished Miscellaneous Metal Flashing and Trim (076200.A35): Fabricated from the following materials:
1. Coil-Coated Galvanized Steel: 0.034 inch thick.
 2. Stainless Steel: 0.031 inch thick.
 3. At metal wall panels, fabricate to configurations indicated, with vertical leg not less than 4 inches tall to extend up and behind rigid insulation. Fabricate ends of flashing with end dams not less than 2 inches tall, and extending out to face of wall panel.
 4. At pan flashing for windows, storefront and curtain wall; fabricate to configurations indicated, with horizontal leg to extend 2 inches beneath window, storefront or curtain wall sill as occurs.
 5. Fabricate trim to configurations indicated.
 6. Fabricate pre-finished miscellaneous metal flashing in lengths of 8 to 10 feet. Overlap adjoining pieces 4 inches and seal joint watertight.
- C. Premanufactured Pitch Pockets: A pre-fabricated interlocking pitch 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 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 above field of roof.
 - c. Warranty: Not less than 2 years.
 3. Prepare Substrates and install pitch pockets in accordance with manufacturer's printed instructions to accommodate substrates involved.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of the Work.
1. Verify compliance with requirements for installation tolerances of substrates.
 2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
 3. Verify that air or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 UNDERLAYMENT INSTALLATION

- A. General: Install underlayment as indicated on Drawings.
- B. Self-Adhering High Temperature Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free. Apply primer if required by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer rather than nails for installing underlayment at low temperatures. Apply in shingle fashion to shed water, with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps with roller. Cover underlayment within 14 days.
- C. Flexible Membrane Closure EPDM Underlayment: Install EPDM underlayment wrinkle free and continuously sealed between sheets and all laps for watertight installation at roof expansion joints to form a bellows. Install an additional sheet over the top of coping, wall caps, and expansion joint bellows securely attached to wall substrate and adhered to over top of blocking/curb and turned down 1-1/2 inches.
- D. Apply slip sheet, wrinkle free, over underlayment before installing sheet metal flashing and trim.

3.3 INSTALLATION, GENERAL

- A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
 - 1. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
 - 2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
 - 3. Space cleats not more than 12 inches apart. Anchor individual cleats with two fasteners and bend tabs over fasteners. At continuous cleats, interlock bottom edge of roof edge flashing with continuous cleat. Anchor continuous cleat to substrate at 2 inches in from each end and then at not greater than 12-inch centers. Bend tabs over fasteners.
 - 4. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
 - 5. Install sealant tape where indicated.
 - 6. All lap joints in pre-finished miscellaneous metal flashing shall be sealed watertight.
 - 7. Torch cutting of sheet metal flashing and trim is not permitted.
 - 8. Do not use graphite pencils to mark metal surfaces.
- B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by SMACNA.
 - 1. Coat back side of stainless-steel sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.
 - 2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of EPDM underlayment and cover with a slip sheet or install a course of polyethylene sheet.
- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection.
 - 1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
 - 2. Use lapped expansion joints only where indicated on Drawings.
- D. Fastener Sizes: Use fasteners of sizes that will penetrate wood sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.
- E. Seal joints as shown and as required for watertight construction.
 - 1. Use sealant-filled joints unless otherwise indicated. Embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.
 - 2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."

- F. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches, except reduce pre-tinning where pre-tinned surface would show in completed Work.
 - 1. Do not solder metallic-coated steel sheet.
 - 2. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.
 - 3. Stainless-Steel Soldering: Tin edges of uncoated sheets using solder recommended for stainless steel and acid flux. Promptly remove acid flux residue from metal after tinning and soldering. Comply with solder manufacturer's recommended methods for cleaning and neutralization.
- G. Expansion-Joint Covers: Install expansion-joint covers at locations and of configuration indicated. Lap joints a minimum of 4 inch in direction of water flow. Provide EPDM bellows and EPDM cap flashing beneath expansion joint cover as specified.

3.4 ROOF DRAINAGE SYSTEM INSTALLATION

- A. General: Install sheet metal roof drainage items to produce complete roof drainage system according to SMACNA recommendations and as indicated. Coordinate installation of roof perimeter flashing with installation of roof drainage system.
- B. Hanging Gutters: Join sections with joints sealed with sealant. Provide for thermal expansion. Attach gutters at eave or fascia to firmly anchor them in position. Provide end closures and seal watertight with sealant. Slope to downspouts.
 - 1. Fasten gutter spacers to front and back of gutter.
 - 2. Anchor and loosely lock back edge of gutter to continuous cleat.
 - 3. Anchor back of gutter that extends onto roof deck with cleats spaced not more than 24 inches apart.
 - 4. Anchor gutter with gutter brackets spaced not more than 36 inches apart to roof deck, unless otherwise indicated, and loosely lock to front gutter bead.
 - 5. Install gutter with expansion joints at locations indicated, but not exceeding, 50 feet apart. Install expansion-joint caps.
- C. Downspouts: Join sections with 1-1/2-inch telescoping joints.
 - 1. Provide hangers with fasteners designed to hold downspouts securely to walls. Locate hangers at top and bottom and at approximately 60 inches o.c. in between.
 - 2. Provide elbows at base of downspout to direct water away from building.
 - 3. Connect downspouts to underground drainage system indicated.
- D. Splash Pans: Install where downspouts discharge on low-slope roofs. Set on slip sheet strip cut from extra cap sheet.
- E. Parapet Scuppers: Install scuppers where indicated through parapet. Continuously support scupper, set to correct elevation, and seal flanges to interior wall face, over cants or tapered edge strips, and under roofing membrane.
 - 1. Anchor scupper closure trim flange to exterior wall and seal with elastomeric sealant to scupper.
 - 2. Loosely lock front edge of scupper with adjacent flashing.
- F. Conductor Heads: Anchor securely to wall, with elevation of conductor head rim at minimum of 1 inch below scupper or gutter discharge.

3.5 ROOF FLASHING INSTALLATION

- A. General: Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
- B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in FMG Loss Prevention Data Sheet 1-49 for specified wind zone and as indicated.
 - 1. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at 2 inches in from each end and then at not greater than 12-inch centers.

- C. Copings: Anchor to resist uplift and outward forces according to recommendations in FMG Loss Prevention Data Sheet 1-49 for specified wind zone and as indicated.
 - 1. Interlock exterior bottom edge of coping with continuous cleat anchored to substrate at 2 inches in from each end and then at not greater than 12-inch centers.
 - 2. Anchor interior leg of coping with screw fasteners and washers at 16 inch centers.
- D. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending a minimum of 4 inches over base flashing. Install stainless-steel draw band and tighten.
- E. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches over base flashing. Lap counterflashing joints a minimum of 4 inches and bed with sealant. Secure in a waterproof manner.
- F. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric sealant and clamp flashing to pipes that penetrate roof.
- G. Pourable Sealer Pocket Installation: Prepare substrates and install pockets in strict accordance with pocket manufacturer's written instructions to accommodate substrates involved.

3.6 WALL FLASHING INSTALLATION

- A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to SMACNA recommendations and as indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.
- B. Through-Wall Flashing: Installation of through-wall flashing is specified in Section 042000 "Unit Masonry."
- C. Opening Flashings in Frame Construction: Install continuous head, sill, and similar flashings to extend ()4 inches beyond wall openings.

3.7 MISCELLANEOUS FLASHING INSTALLATION

- A. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with elastomeric sealant to equipment support member.
- B. Pre-Finished Miscellaneous Metal Flashing: Coordinate installation of flashing with adjoining construction and air barrier coating. Seal lap joints watertight.

3.8 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
- B. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

3.9 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder.
- C. Clean off excess sealants.
- D. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturers' written installation instructions. On completion of installation, remove

unused materials and clean finished surfaces. Maintain in a clean condition during construction.

- E. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 076200

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SECTION 077200 - ROOF ACCESSORIES

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Roof hatches (077200.A03).
 - 2. ~~Hatch type heat and smoke vents (077200.A04).~~
- B. Related Sections:
 - 1. Section 055000 "Metal Fabrications" for metal vertical ladders, ships' ladders, and stairs for access to roof hatches.
 - 2. Section 076200 "Sheet Metal Flashing and Trim" for shop- and field-formed metal flashing, roof-drainage systems, roof expansion-joint covers, and miscellaneous sheet metal trim and accessories.

1.2 PERFORMANCE REQUIREMENTS

- A. General Performance: Roof accessories shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of roof accessory indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: Include plans, sections, details, attachments to other work, and terminations to adjacent construction.
 - 1. For rooftop fall protection include but not limited to indication of profiles, sizes, connections, sizes and types of fasteners and accessories; showing fabrication and installation of handrails and guardrails including but not limited to plans, elevations, sections, details of components, anchor details, and attachment to adjoining units of work.
 - 2. For roof hatch include but not limited to indication of profiles, sizes, connections, sizes and types of fasteners and accessories; showing fabrication and installation but not limited to plans, elevations, sections, details of components, anchor details, and attachment to adjoining units of work..

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Roof plans, drawn to scale, and coordinating penetrations and roof-mounted items. Show the following:
 - 1. Size and location of roof accessories specified in this Section.
 - 2. Method of attaching roof accessories to roof or building structure and required clearances.
- B. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For roof accessories to include in operation and maintenance manuals.

1.6 COORDINATION

- A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.

- B. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.
- C. Field Measurements: Where handrails and railings are indicated to fit to other construction, check actual dimensions of other construction by accurate field measurements before fabrication; show recorded measurements on final shop drawings.
 - 1. Coordinate fabrication and delivery schedule of handrails with construction progress and sequence to avoid delay of railing installation.

1.7 WARRANTY

- A. Manufacturer's Warranty: Provide manufacturer's standard warranty. Materials shall be free of defects in material and workmanship for a period of five years from the date of purchase. Should a part fail to function in normal use within this period, manufacturer shall furnish a new part at no charge.

PART 2 PRODUCTS

2.1 METAL MATERIALS

- A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation.
 - 1. Factory Prime Coating: Where field painting is indicated, apply pretreatment and white or light-colored, factory-applied, baked-on epoxy primer coat, with a minimum dry film thickness of 0.2 mil.
 - 2. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester-backer finish consisting of prime coat and wash coat, with a minimum total dry film thickness of 0.5 mil.
- B. Stainless-Steel Sheet and Shapes: ASTM A 240/A 240M or ASTM A 666, Type 304.
- C. Steel Shapes: ASTM A 36/A 36M, hot-dip galvanized according to ASTM A 123/A 123M unless otherwise indicated.
- D. Galvanized-Steel Tube: ASTM A 500, round tube, hot-dip galvanized according to ASTM A 123/A 123M.
- E. Steel Pipe: ASTM A 53/A 53M, galvanized.
- F. Aluminum Sheet: ASTM B 209, manufacturer's standard alloy for finish required, with temper to suit forming operations and performance required.
 - 1. Mill Finish: As manufactured.

2.2 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.
- B. Polyisocyanurate Board Insulation: ASTM C 1289, thickness as indicated.
- C. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, acceptable to authorities having jurisdiction, containing no arsenic or chromium, and complying with AWPA C2; not less than 1-1/2 inches thick.
- D. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.
- E. Underlayment:
 - 1. Felt: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.
 - 2. Polyethylene Sheet: 6-mil- thick polyethylene sheet complying with ASTM D 4397.
 - 3. Slip Sheet: Building paper, 3-lb/100 sq. ft. minimum, rosin sized.
- F. Fasteners: Roof accessory manufacturer's recommended fasteners suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners. Furnish the following unless otherwise indicated:
 - 1. Fasteners for Aluminum and Stainless-Steel Sheet: Series 300 stainless steel.

2. Fasteners for Zinc-Coated or Aluminum-Zinc Alloy-Coated Steel: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A 153/A 153M or ASTM F 2329.
- G. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, PVC, or silicone.
- H. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane or silicone polymer sealant as recommended by roof accessory manufacturer for installation indicated; low modulus; of type, grade, class, and use classifications required to seal joints and remain watertight.
- I. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for expansion joints with limited movement.
- J. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.3 ROOF HATCH

- A. Roof Hatches (077200.A03): Thermally broken, metal roof-hatch units with R-20 insulated lids and insulated double-walled curbs, welded or mechanically fastened and sealed corner joints, continuous lid-to-curb counterflashing and weathertight perimeter gasketing, and integrally formed deck-mounting flange at perimeter bottom.
 1. Basis-of-Design Product: Subject to compliance with requirements, provide Bilco Company; "Type NB-50-TB" of hatch for ship's ladder/alternating tread device access, or comparable product by one of the following:
 - a. Babcock-Davis.
 - b. Dur-Red Products.
 - c. Hi Pro International, Inc.
 - d. J. L. Industries, Inc.
 - e. Milcor Inc.; Commercial Products Group of Hart & Cooley, Inc.
 - f. Naturalite Skylight Systems; Vistawall Group (The).
 - g. Nystrom.
 - h. O'Keeffe's Inc.
 - i. Precision Ladders, LLC.
 2. Type and Size: Single-leaf lid, 30 by 54 inches.
 3. Loads: Minimum 40-lbf/sq. ft. external live load and 20-lbf/sq. ft. internal uplift load.
 4. Hatch Material: Aluminum sheet, 11 gauge, mill finished.
 5. Construction:
 - a. Insulation: Polyisocyanurate board.
 - b. Hatch Lid: Opaque, insulated, and double walled, with manufacturer's standard metal liner of same material and finish as outer metal lid. Lid corners shall be fully welded. Lid shall be internally reinforced. Overlapping flange of lid shall not be less than 5 inches. Insulation thickness shall be 3 inches.
 - c. Curb: Opaque, insulated, and double walled, with manufacturer's standard metal liner of same material and finish as outer metal curb. Curb corners shall be fully welded. Curb shall be 12 inches high. Insulation thickness shall be 3 inches. Curb shall have a 5-1/2 inch mounting flange.
 - d. Sloping Roofs: Where slope or roof deck exceeds 1:48, fabricate curb with perimeter curb height that is constant. Equip hatch with water diverter or cricket on side that obstructs water flow.
 6. Hardware: Galvanized-steel spring latch with turn handles, butt- or pintle-type hinge system, and padlock hasps inside and outside.
 7. Hinge pins shall be made of Type 316 stainless steel.
 8. Latch shall be an enclosed two-point spring latch.
 9. Lift Assistance: Provide compression spring operators enclosed in telescopic tubes. Furnish with automatic hold-open arm and grip handle release.
- B. Ladder-Assist Post: Roof-hatch manufacturer's standard device for attachment to roof-access ladder.
 1. Basis-of-Design Product: Subject to compliance with requirements, provide Bilco Company; "LadderUP Safety Post", Model LU-1 or comparable product from other roof hatch manufacturers meeting specified requirements.
 2. Operation: Post locks in place on full extension; release mechanism returns post to closed position.
 3. Height: 42 inches above finished roof deck.
 4. Material: Steel tube.
 5. Post: Not less than 1-5/8-inch- diameter pipe.

6. Mounting: Unit shall be equipped with adjustable mounting hardware to accommodate various ladder rungs sizes and spacing.
 7. Finish: Manufacturer's standard baked enamel or powder coat.
 - a. Color: Yellow.
- C. Safety Railing System: Roof-hatch manufacturer's standard system including rails, clamps, fasteners, safety barrier at railing opening, and accessories required for a complete installation; attached to roof hatch and complying with 29 CFR 1910.23 requirements and authorities having jurisdiction.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Bilco Company; "Bil-Guard Hatch Rail System – Model RL-L" or comparable product by one of the roof hatch manufacturers listed above.
 2. Height: 42 inches above finished roof deck.
 3. Posts and Rails: Pultruded and fire-retardant fiberglass reinforced polymer (FRP) or galvanized-steel pipe, 1-1/4 inches in diameter or galvanized-steel tube, 1-5/8 inches in diameter.
 4. Maximum Opening Size: System constructed to prevent passage of a sphere 21 inches in diameter.
 5. Self-Latching Gate: Fabricated of same materials and rail spacing as safety railing system. Provide manufacturer's standard hinges and self-latching mechanism.
 6. Post and Rail Tops and Ends: Weather resistant, closed or plugged with prefabricated end fittings.
 7. Provide weep holes or another means to drain entrapped water in hollow sections of handrail and railing members.
 8. Fabricate joints exposed to weather to be watertight.
 9. Fasteners: Manufacturer's standard, finished to match railing system.
 10. Finish: Manufacturer's standard in color as selected by Architect from manufacturer's full range.

2.4 ACOUSTICAL HEAT AND SMOKE VENTS (077200.A04)

- A. ~~Hatch Type Heat and Smoke Vents (077200.A04): Manufacturer's standard, with double walled insulated curbs, welded or mechanically fastened and sealed corner joints, integral condensation gutter, and cap flashing. Fabricate with insulated double walled lid and continuous weathertight perimeter lid gaskets, and equip with automatic self lifting mechanisms, UL listed fusible links rated at 165 deg F and remote controlled motorized operation.~~
1. ~~Basis of Design Product: Subject to compliance with requirements, provide Bilco Company; "Type ACDSH – Double Leaf Acoustical" heat and smoke vent, Model ACDSH66144 or comparable product by one of the following:~~
 - a. ~~Babcock-Davis.~~
 - b. ~~Dur-Red Products.~~
 - c. ~~Hi-Pro International, Inc.~~
 - d. ~~J. L. Industries, Inc.~~
 - e. ~~Milcor Inc.; Commercial Products Group of Hart & Cooley, Inc.~~
 - f. ~~Naturalite Skylight Systems; Vistawall Group (The).~~
 - g. ~~Nystrom.~~
 - h. ~~O'Keeffe's Inc.~~
 - i. ~~Pate Company (The).~~
 2. ~~Type and Size: Double leaf lid, 66 by 144 inches.~~
 3. ~~Loads: Minimum 40 lbf/sq. ft. external live load and 90 lbf/sq. ft. internal uplift load.~~
 - a. ~~When release is actuated, lid shall open against 10 lbf/sq. ft. snow or wind load and lock in position.~~
 4. ~~Heat and Smoke Vent Standard: Provide units that have been tested and listed to comply with UL 793.~~
 5. ~~Curb, Framing, and Lid Material: Zinc coated (G-90 galvanized) steel sheet, 0.079 inch (14 gauge) thick.~~
 - a. ~~Finish: Factory prime coating.~~
 6. ~~Construction:~~
 - a. ~~Insulation: Glass fiber board.~~
 - b. ~~Gasketing: Provide extruded PVC or EPDM gasket permanently adhered to underside of hatch lid and top of curb.~~
 - c. ~~Hatch Lid: Opaque, insulated, and double walled, with manufacturer's standard metal liner of same material and finish as outer metal lid. Lid corners shall be fully welded. Lid shall be internally reinforced. Overlapping flange of lid shall not be less than 5 inches.~~
 - d. ~~Exterior Curb Liner: Manufacturer's standard, of same material and finish as metal curb.~~
 - e. ~~Fabricate curbs to minimum height of 12 inches unless otherwise indicated. Curbs shall be fully welded at corners and have a 5 inch mounting flange.~~
 - f. ~~Sloping Roofs: Where slope of roof deck exceeds 1:48, fabricate curb with perimeter curb height that is constant. Equip hatch with water diverter or cricket on side that obstructs water flow.~~

- g. ~~Remote Operation: Provide remote operation at floor level. Operation shall be by means of electric motor operator and 3 push button control (open/close/stop). Locate control station as indicated, where not specifically indicated, locate as directed by Architect.~~
- 7. ~~Hardware: Manufacturer's standard, corrosion resistant or hot dip galvanized; with hinges, hold open devices, and independent manual release devices for inside operation of lids.~~
 - a. ~~Provide separate latching for each cover.~~
 - b. ~~Latch shall be designed to hold covers (hatch lids) closed against 90 PSF uplift force.~~
 - c. ~~Corrosion resistant gas springs shall have built-in dampers to control rate of hatch lid opening and shall automatically lock hatch lids in the full "open" position.~~

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.
- B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
- C. Verify dimensions of roof openings for roof accessories.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install roof accessories according to manufacturer's written instructions.
 - 1. Install roof accessories level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil canning, buckling, or tool marks.
 - 2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.
 - 3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
 - 4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.
- B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
 - 1. Coat concealed side of uncoated aluminum roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
 - 2. Underlayment: Where installing roof accessories directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet, or install a course of polyethylene sheet.
 - 3. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof accessories for waterproof performance.
- C. Roof-Hatch Installation:
 - 1. Install roof hatch so top surface of hatch curb is level.
 - 2. Verify that roof hatch operates properly. Clean, lubricate, and adjust operating mechanism and hardware.
 - 3. Attach safety railing system according to manufacturer's written instructions.
 - 4. Attach ladder-assist post according to manufacturer's written instructions.
- D. ~~Heat and Smoke Vent Installation:~~
 - 1. ~~Install heat and smoke vent so top perimeter surfaces are level.~~
 - 2. ~~Install and test heat and smoke vents and their components for proper operation according to NFPA 204.~~
- E. Pipe Support Installation: Install pipe supports so top surfaces are in contact with and provide equally distributed support along length of supported item.
- F. Seal joints with elastomeric sealant as required by roof accessory manufacturer.

3.3 REPAIR AND CLEANING

- A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing according to ASTM A 780.
- B. Touch up factory-primed surfaces with compatible primer ready for field painting according to Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
- C. Clean exposed surfaces according to manufacturer's written instructions.
- D. Clean off excess sealants.
- E. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 077200

SECTION 078100 - APPLIED FIREPROOFING

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes sprayed fire-resistive materials.

1.2 DEFINITIONS

- A. SFRM: Sprayed fire-resistive materials.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review products, design ratings, restrained and unrestrained conditions, densities, thicknesses, bond strengths, and other performance requirements.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Framing plans or schedules, or both, indicating the following:
 - 1. Extent of fireproofing for each construction and fire-resistance rating.
 - 2. Applicable fire-resistance design designations of a qualified testing and inspecting agency acceptable to authorities having jurisdiction.
 - 3. Minimum fireproofing thicknesses needed to achieve required fire-resistance rating of each structural component and assembly.
 - 4. Treatment of fireproofing after application.
- C. Samples: For each exposed product and for each color and texture specified, 4 inches square in size.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and testing agency.
- B. Product Certificates: For each type of fireproofing.
- C. Evaluation Reports: For fireproofing, from ICC-ES.
- D. Field quality-control reports.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A firm or individual certified, licensed, or otherwise qualified by fireproofing manufacturer as experienced and with sufficient trained staff to install manufacturer's products according to specified requirements.
- B. Field Sample: Apply field sample to verify selections made under Sample submittals and to demonstrate aesthetic effects to set quality standards for materials and execution and for preconstruction testing.
 - 1. Apply field sample to an area not less than 36 square feet in location as directed by Architect of each type of fireproofing and different substrate and each required finish.
 - 2. Approval of field sample does not constitute approval of deviations from the Contract Documents contained in field sample unless Architect specifically approves such deviations in writing.

3. Subject to compliance with requirements, approved field sample may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on field sample of fireproofing.
 1. Provide test specimens and assemblies representative of proposed materials and construction.
- B. Preconstruction Adhesion and Compatibility Testing: Test for compliance with requirements for specified performance and test methods.
 1. Bond Strength: Test for cohesive and adhesive strength according to ASTM E 736. Provide bond strength indicated in referenced fire-resistance design, but not less than minimum specified in Part 2.
 2. Density: Test for density according to ASTM E 605. Provide density indicated in referenced fire-resistance design, but not less than minimum specified in Part 2.
 3. Verify that manufacturer, through its own laboratory testing or field experience, attests that primers or coatings are compatible with fireproofing.
 4. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
 5. For materials failing tests, obtain applied-fireproofing manufacturer's written instructions for corrective measures including the use of specially formulated bonding agents or primers.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not apply fireproofing when ambient or substrate temperature is 44 deg F or lower unless temporary protection and heat are provided to maintain temperature at or above this level for 24 hours before, during, and for 24 hours after product application.
- B. Ventilation: Ventilate building spaces during and after application of fireproofing, providing complete air exchanges according to manufacturer's written instructions. Use natural means or, if they are inadequate, forced-air circulation until fireproofing dries thoroughly.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Assemblies: Provide fireproofing, including auxiliary materials, according to requirements of each fire-resistance design and manufacturer's written instructions.
- B. Source Limitations: Obtain fireproofing for each fire-resistance design from single source.
- C. Fire-Resistance Design: Indicated on Drawings, tested according to ASTM E 119 or UL 263; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 1. Steel members are to be considered unrestrained unless specifically noted otherwise.
- D. Asbestos: Provide products containing no detectable asbestos.

2.2 SPRAYED FIRE-RESISTIVE MATERIALS

- A. Sprayed Fire-Resistive Material (078100.A01): Manufacturer's standard, factory-mixed, lightweight, dry formulation, complying with indicated fire-resistance design, and mixed with water at Project site to form a slurry or mortar before conveyance and application.
 1. Application: Designated for exterior use by a qualified testing agency acceptable to authorities having jurisdiction.
 2. Bond Strength: Minimum 150-lbf/sq. ft. cohesive and adhesive strength based on field testing according to ASTM E 736.
 3. Density: Not less than density specified in the approved fire-resistance design, according to ASTM E 605.
 4. Thickness: As required for fire-resistance design indicated, measured according to requirements of fire-resistance design or ASTM E 605, whichever is thicker, but not less than 0.375 inch.

5. Combustion Characteristics: ASTM E 136.
6. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 10 or less.
 - b. Smoke-Developed Index: 10 or less.
7. Compressive Strength: Minimum 10 lbf/sq. in. according to ASTM E 761.
8. Corrosion Resistance: No evidence of corrosion according to ASTM E 937.
9. Deflection: No cracking, spalling, or delamination according to ASTM E 759.
10. Effect of Impact on Bonding: No cracking, spalling, or delamination according to ASTM E 760.
11. Air Erosion: Maximum weight loss of 0.025 g/sq. ft. in 24 hours according to ASTM E 859.
12. Fungal Resistance: Treat products with manufacturer's standard antimicrobial formulation to result in no growth on specimens per ASTM G 21 or rating of 10 according to ASTM D 3274 when tested according to ASTM D 3273.
13. Finish: As selected by Architect from manufacturer's standard finishes. Where fireproofing is exposed to view in final position, apply separate, colored topcoat after finishing.
 - a. Color: As selected by Architect from manufacturer's full range.

2.3 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that are compatible with fireproofing and substrates and are approved by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-resistance designs indicated.
- B. Substrate Primers: Primers approved by fireproofing manufacturer and complying with one or both of the following requirements:
 1. Primer and substrate are identical to those tested in required fire-resistance design by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
 2. Primer's bond strength in required fire-resistance design complies with specified bond strength for fireproofing and with requirements in UL's "Fire Resistance Directory" or in the listings of another qualified testing agency acceptable to authorities having jurisdiction, based on a series of bond tests according to ASTM E 736.
- C. Bonding Agent: Product approved by fireproofing manufacturer and complying with requirements in UL's "Fire Resistance Directory" or in the listings of another qualified testing agency acceptable to authorities having jurisdiction.
- D. Reinforcing Fabric: Glass- or carbon-fiber fabric of type, weight, and form required to comply with fire-resistance designs indicated; approved and provided by fireproofing manufacturer.
- E. Reinforcing Mesh: Metallic mesh reinforcement of type, weight, and form required to comply with fire-resistance design indicated; approved and provided by fireproofing manufacturer. Include pins and attachment.
- F. Sealer: Transparent-drying, water-dispersible, tinted protective coating recommended in writing by fireproofing manufacturer for each fire-resistance design.
- G. Topcoat: Suitable for application over applied fireproofing; of type recommended in writing by fireproofing manufacturer for each fire-resistance design.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrates and other conditions affecting performance of the Work and according to each fire-resistance design.
 1. Verify that substrates are free of dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, incompatible primers, paints, and encapsulants, or other foreign substances capable of impairing bond of fireproofing with substrates under conditions of normal use or fire exposure.
 2. Verify that objects penetrating fireproofing, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.
 3. Verify that substrates receiving fireproofing are not obstructed by ducts, piping, equipment, or other suspended construction that will interfere with fireproofing application.

- B. Verify that concrete work on steel deck is complete before beginning fireproofing work.
- C. Verify that roof construction, installation of rooftop HVAC equipment, and other related work are complete before beginning fireproofing work.
- D. Conduct tests according to fireproofing manufacturer's written instructions to verify that substrates are free of substances capable of interfering with bond.
- E. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Cover other work subject to damage from fallout or overspray of fireproofing materials during application.
- B. Clean substrates of substances that could impair bond of fireproofing.
- C. Prime substrates where included in fire-resistance design and where recommended in writing by fireproofing manufacturer unless compatible shop primer has been applied and is in satisfactory condition to receive fireproofing.
- D. For applications visible on completion of Project, repair substrates to remove surface imperfections that could affect uniformity of texture and thickness in finished surface of fireproofing. Remove minor projections and fill voids that would telegraph through fire-resistive products after application.

3.3 APPLICATION

- A. Construct fireproofing assemblies that are identical to fire-resistance design indicated and products as specified, tested, and substantiated by test reports; for thickness, primers, sealers, topcoats, finishing, and other materials and procedures affecting fireproofing work.
- B. Comply with fireproofing manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey, and apply fireproofing; as applicable to particular conditions of installation and as required to achieve fire-resistance ratings indicated.
- C. Coordinate application of fireproofing with other construction to minimize need to cut or remove fireproofing.
 - 1. Do not begin applying fireproofing until clips, hangers, supports, sleeves, and other items penetrating fireproofing are in place.
 - 2. Defer installing ducts, piping, and other items that would interfere with applying fireproofing until application of fireproofing is completed.
- D. Metal Decks:
 - 1. Do not apply fireproofing to underside of metal deck substrates until concrete topping, if any, is completed.
 - 2. Do not apply fireproofing to underside of metal roof deck until roofing is completed; prohibit roof traffic during application and drying of fireproofing.
- E. Install auxiliary materials as required, as detailed, and according to fire-resistance design and fireproofing manufacturer's written instructions for conditions of exposure and intended use. For auxiliary materials, use attachment and anchorage devices of type recommended in writing by fireproofing manufacturer.
- F. Spray apply fireproofing to maximum extent possible. After the spraying operation in each area, complete the coverage by trowel application or other placement method recommended in writing by fireproofing manufacturer.
- G. Extend fireproofing in full thickness over entire area of each substrate to be protected.
- H. Install body of fireproofing in a single course unless otherwise recommended in writing by fireproofing manufacturer.
- I. Where sealers are used, apply products that are tinted to differentiate them from fireproofing over which they are applied.

- J. Provide a uniform finish complying with description indicated for each type of fireproofing material and matching finish approved for required mockups.
- K. Cure fireproofing according to fireproofing manufacturer's written instructions.
- L. Do not install enclosing or concealing construction until after fireproofing has been applied, inspected, and tested and corrections have been made to deficient applications.
- M. Finishes: Where indicated, apply fireproofing to produce the following finishes:
 - 1. Manufacturer's Standard Finishes: Finish according to manufacturer's written instructions for each finish selected, as accepted by Architect from sample submittal approvals.
 - a. Spray-Textured Finish: Finish left as spray applied with no further treatment.
 - b. Rolled, Spray-Textured Finish: Even finish produced by rolling spray-applied finish with a damp paint roller to remove drippings and excessive roughness.
 - c. Skip-Troweled Finish: Even leveled surface produced by troweling spray-applied finish to smooth out the texture and neaten edges.

3.4 FIELD QUALITY CONTROL

- A. Special Inspections: Engage a qualified special inspector to perform the following special inspections:
 - 1. Test and inspect as required by the IBC, Subsection 1705.13, "Sprayed Fire-Resistant Materials."
- B. Perform the tests and inspections of completed Work in successive stages. Do not proceed with application of fireproofing for the next area until test results for previously completed applications of fireproofing show compliance with requirements. Tested values must equal or exceed values as specified and as indicated and required for approved fire-resistance design.
- C. Fireproofing will be considered defective if it does not pass tests and inspections.
 - 1. Remove and replace fireproofing that does not pass tests and inspections, and retest.
 - 2. Apply additional fireproofing, per manufacturer's written instructions, where test results indicate insufficient thickness, and retest.
- D. Prepare test and inspection reports.

3.5 CLEANING, PROTECTING, AND REPAIRING

- A. Cleaning: Immediately after completing spraying operations in each containable area of Project, remove material overspray and fallout from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.
- B. Protect fireproofing, according to advice of manufacturer and Installer, from damage resulting from construction operations or other causes, so fireproofing is without damage or deterioration at time of Substantial Completion.
- C. As installation of other construction proceeds, inspect fireproofing and repair damaged areas and fireproofing removed due to work of other trades.
- D. Repair fireproofing damaged by other work before concealing it with other construction.
- E. Repair fireproofing by reapplying it using same method as original installation or using manufacturer's recommended trowel-applied product.

END OF SECTION 078100

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SECTION 078413 - PENETRATION FIRESTOPPING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Penetrations in fire-resistance-rated walls.
- B. Related Sections:
 - 1. Division 07 Section "Fire-Resistive Joint Systems" for joints in or between fire-resistance-rated construction, at exterior curtain-wall/floor intersections, and in smoke barriers.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Product Schedule: For each penetration firestopping system. Include location and design designation of qualified testing and inspecting agency.
 - 1. Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping condition, submit illustration, with modifications marked, approved by penetration firestopping manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Installer Certificates: From Installer indicating penetration firestopping has been installed in compliance with requirements and manufacturer's written recommendations.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: A firm experienced in installing penetration firestopping similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its penetration firestopping products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.
- B. Fire-Test-Response Characteristics: Penetration firestopping shall comply with the following requirements:
 - 1. Penetration firestopping tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.
 - 2. Penetration firestopping is identical to those tested per testing standard referenced in "Penetration Firestopping" Article. Provide rated systems complying with the following requirements:
 - a. Penetration firestopping products bear classification marking of qualified testing and inspecting agency.
 - b. Classification markings on penetration firestopping correspond to designations listed by the following:
 - 1) UL in its "Fire Resistance Directory."
- C. Preinstallation Conference: Conduct conference at Project site.

1.5 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install penetration firestopping when ambient or substrate temperatures are outside limits permitted by penetration firestopping manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.

- B. Install and cure penetration firestopping per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.6 COORDINATION

- A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping is installed according to specified requirements.
- B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Grace Construction Products.
 - 2. Hilti, Inc.
 - 3. Johns Manville.
 - 4. Specified Technologies Inc.
 - 5. 3M Fire Protection Products.
 - 6. Tremco, Inc.; Tremco Fire Protection Systems Group.
 - 7. USG Corporation.
- B. Single Source Responsibility: All firestopping insulation, sealants, and related firestopping accessories required to prevent the passage of fire and smoke through fire rated penetrations, smoke rated penetrations and joints shall be furnished and installed by (or installed under direct supervision of) one contractor for the entire project. All products used for this work shall be furnished by one manufacturer for the entire project.

2.2 PENETRATION FIRESTOPPING (078413.A01)

- A. Provide penetration firestopping that is produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.
- B. Penetrations in Fire-Resistance-Rated Walls: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
 - 1. Fire-resistance-rated walls include fire walls fire-barrier walls and fire partitions.
 - 2. F-Rating: Not less than the fire-resistance rating of constructions penetrated.
- C. Exposed Penetration Firestopping: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.
- D. VOC Content: Provide penetration firestopping that complies with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - 1. Architectural Sealants: 250 g/L.
 - 2. Sealant Primers for Nonporous Substrates: 250 g/L.
 - 3. Sealant Primers for Porous Substrates: 775 g/L.
- E. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping manufacturer and approved by qualified testing and inspecting agency for firestopping indicated.
 - 1. Permanent forming/damming/backing materials, including the following:
 - a. Slag-wool-fiber or rock-wool-fiber insulation.
 - b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
 - c. Fillers for sealants.

2. Substrate primers.
 3. Collars.
- F. Firestopping compounds shall be paintable or capable of receiving finish materials in areas which are exposed to view and scheduled to receive finishes.

2.3 FILL MATERIALS

- A. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.
- B. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.
- C. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.
- D. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.
- E. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives. Where exposed, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed.
- F. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:
 1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces, and nonsag formulation for openings in vertical and sloped surfaces, unless indicated firestopping limits use of nonsag grade for both opening conditions.

2.4 MIXING

- A. For those products requiring mixing before application, comply with penetration firestopping manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

- A. Surface Cleaning: Clean out openings immediately before installing penetration firestopping to comply with manufacturer's written instructions and with the following requirements:
 1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping.
 2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping. Remove loose particles remaining from cleaning operation.
 3. Remove laitance and form-release agents from concrete.
- B. Priming: Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

- C. Masking Tape: Use masking tape to prevent penetration firestopping from contacting adjoining surfaces that will remain exposed on completion of the Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove stains. Remove tape as soon as possible without disturbing firestopping's seal with substrates.

3.3 INSTALLATION

- A. General: Install penetration firestopping to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.
- B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
 - 1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestopping.
- C. Install fill materials for firestopping by proven techniques to produce the following results:
 - 1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
 - 2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
 - 3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

- A. Identify penetration firestopping with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of firestopping edge so labels will be visible to anyone seeking to remove penetrating items or firestopping. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
 - 1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
 - 2. Contractor's name, address, and phone number.
 - 3. Designation of applicable testing and inspecting agency.
 - 4. Date of installation.
 - 5. Manufacturer's name.
 - 6. Installer's name.

3.5 FIELD QUALITY CONTROL

- A. Firestopping Manufacturer's representative shall perform and inspections of penetration firestopping. Contractor shall notify Architect and manufacturer's representative no later than seven days after penetration firestopping is complete to schedule inspection.
 - 1. Where deficiencies are found or penetration firestopping is damaged or removed because of testing, repair or replace penetration firestopping to comply with requirements.
 - 2. Proceed with enclosing penetration firestopping with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTION

- A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping manufacturers and that do not damage materials in which openings occur.
- B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping is without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping and install new materials to produce systems complying with specified requirements.

3.7 PENETRATION FIRESTOPPING SYSTEM SCHEDULE

- A. Where UL-classified systems are indicated, they refer to system numbers in UL's "Fire Resistance Directory" under product Category XHEZ.

END OF SECTION 078413

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SECTION 078446 - FIRE RESISTIVE JOINT SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Joints in or between fire-resistance-rated constructions. (078446.A01).
- B. Related Sections:
 - 1. Division 07 Section "Penetration Firestopping" for penetrations in fire-resistance-rated walls, horizontal assemblies, and smoke barriers.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Product Schedule: For each fire-resistive joint system. Include location and design designation of qualified testing agency.
 - 1. Where Project conditions require modification to a qualified testing agency's illustration for a particular fire-resistive joint system condition, submit illustration, with modifications marked, approved by fire-resistive joint system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for fire-resistive joint systems.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Installer Certificates: From Installer indicating fire-resistive joint systems have been installed in compliance with requirements and manufacturer's written recommendations.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with UL's "Qualified Firestop Contractor Program Requirements." Firm shall be experienced in installing fire-resistive joint systems similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its fire-resistive joint system products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.
- B. Fire-Test-Response Characteristics: Fire-resistive joint systems shall comply with the following requirements:
 - 1. Fire-resistive joint system tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.
 - 2. Fire-resistive joint systems are identical to those tested per testing standard referenced in "Fire-Resistive Joint Systems" Article. Provide rated systems complying with the following requirements:
 - a. Fire-resistive joint system products bear classification marking of qualified testing agency.
 - b. Fire-resistive joint systems correspond to those indicated by reference to designations listed by the following:
 - 1) UL in its "Fire Resistance Directory."

1.5 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install fire-resistive joint systems when ambient or substrate temperatures are outside limits permitted by fire-resistive joint system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
- B. Install and cure fire-resistive joint systems per manufacturer's written instructions using natural means of ventilation or, where this is inadequate, forced-air circulation.

1.6 COORDINATION

- A. Coordinate construction of joints to ensure that fire-resistive joint systems are installed according to specified requirements.
- B. Coordinate sizing of joints to accommodate fire-resistive joint systems.

PART 2 PRODUCTS

2.1 FIRE-RESISTIVE JOINT SYSTEMS (078446.A01)

- A. Where required, provide fire-resistive joint systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which fire-resistive joint systems are installed. Fire-resistive joint systems shall accommodate building movements without impairing their ability to resist the passage of fire and hot gases.
- B. Joints in or between Fire-Resistance-Rated Construction: Provide fire-resistive joint systems with ratings determined per ASTM E 1966 or UL 2079:
 - 1. Joints include those installed in or between fire-resistance-rated walls floor or floor/ceiling assemblies and roofs or roof/ceiling assemblies.
 - 2. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of construction they will join.
 - 3. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Grace Construction Products.
 - b. Hilti, Inc.
 - c. Johns Manville.
 - d. Specified Technologies Inc.
 - e. 3M Fire Protection Products.
 - f. Tremco, Inc.; Tremco Fire Protection Systems Group.
 - g. USG Corporation.
- C. Exposed Fire-Resistive Joint Systems: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.
 - 1. Sealant shall have a VOC content of 250 g/L or less.
- D. Accessories: Provide components of fire-resistive joint systems, including primers and forming materials, that are needed to install fill materials and to maintain ratings required. Use only components specified by fire-resistive joint system manufacturer and approved by the qualified testing agency for systems indicated.
- E. Firestopping compounds shall be paintable or capable of receiving finish materials in areas which are exposed to view and scheduled to receive finishes.

PART 3 EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

- A. Surface Cleaning: Clean joints immediately before installing fire-resistive joint systems to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:
 - 1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of fill materials.
 - 2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with fill materials. Remove loose particles remaining from cleaning operation.
 - 3. Remove laitance and form-release agents from concrete.
- B. Priming: Prime substrates where recommended in writing by fire-resistive joint system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.
- C. Masking Tape: Use masking tape to prevent fill materials of fire-resistive joint system from contacting adjoining surfaces that will remain exposed on completion of the Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove stains. Remove tape as soon as possible without disturbing fire-resistive joint system's seal with substrates.

3.3 INSTALLATION

- A. General: Install fire-resistive joint systems to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.
- B. Install forming materials and other accessories of types required to support fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
 - 1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of fire-resistive joint system.
- C. Install fill materials for fire-resistive joint systems by proven techniques to produce the following results:
 - 1. Fill voids and cavities formed by joints and forming materials as required to achieve fire-resistance ratings indicated.
 - 2. Apply fill materials so they contact and adhere to substrates formed by joints.
 - 3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

- A. Identify fire-resistive joint systems with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of joint edge so labels will be visible to anyone seeking to remove or penetrate joint system. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
 - 1. The words "Warning - Fire-Resistive Joint System - Do Not Disturb. Notify Building Management of Any Damage."
 - 2. Contractor's name, address, and phone number.
 - 3. Designation of applicable testing agency.
 - 4. Date of installation.
 - 5. Manufacturer's name.

6. Installer's name.

3.5 FIELD QUALITY CONTROL

- A. Inspecting Agency: Fire-Resistive Joint System manufacturer's representative will perform inspections of completed installation of work of this Section. Contractor shall notify Architect and manufacturer's representative not later than seven days after completion of fire-resistive joint system installation to schedule inspection.
- B. Where deficiencies are found or fire-resistive joint systems are damaged or removed due to testing, repair or replace fire-resistive joint systems so they comply with requirements.
- C. Proceed with enclosing fire-resistive joint systems with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTING

- A. Clean off excess fill materials adjacent to joints as the Work progresses by methods and with cleaning materials that are approved in writing by fire-resistive joint system manufacturers and that do not damage materials in which joints occur.
- B. Provide final protection and maintain conditions during and after installation that ensure fire-resistive joint systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated fire-resistive joint systems immediately and install new materials to produce fire-resistive joint systems complying with specified requirements.

3.7 FIRE-RESISTIVE JOINT SYSTEM SCHEDULE

- A. Where UL-classified systems are indicated, they refer to system numbers in UL's "Fire Resistance Directory" under product Category XHBN or Category XHDG.
- B. Wall-to-Wall, Fire-Resistive Joint Systems:
 1. UL-Classified Systems: WW-S-0000-0999.
 2. Assembly Rating: 2 hours.
 3. Nominal Joint Width: As indicated.
 4. Movement Capabilities: Class II - 25 percent compression or extension.
 5. L-Rating at Ambient: As selected by Contractor to suit project conditions.
- C. Wall-to-Wall (Precast Concrete Joints), Fire-Resistive Joint Systems:
 1. UL-Classified Systems: WW-D-0082.
 - a. Basis of Design Sealant Product: "CP 606 Sealant" by Hilti.
 - b. Basis of Design Mineral Wool Product: "CP 767 Speed Strips" by Hilti.
 2. Assembly Rating: 2 hours.
 3. Nominal Joint Width: As indicated.
 4. Movement Capabilities: Class II - 17 percent compression or extension.
 5. L-Rating at Ambient: As selected by Contractor to suit project conditions.
- D. Floor-to-Wall, Fire-Resistive Joint Systems:
 1. UL-Classified Systems: FW-S-0000-0999.
 2. Assembly Rating: 2 hours.
 3. Nominal Joint Width: As indicated.
 4. Movement Capabilities: Class II - 25 percent compression, extension, or horizontal shear.
 5. L-Rating at Ambient: As selected by Contractor to suit project conditions.
- E. Head-of-Wall, Fire-Resistive Joint Systems (for Fire-Resistive Roof Systems):
 1. UL-Classified Systems: HW-S-0000-0999.
 2. Assembly Rating: 2 hours.
 3. Nominal Joint Width: As indicated.
 4. Movement Capabilities: Class II - 25 percent compression or extension.
 5. L-Rating at Ambient: As selected by Contractor to suit project conditions.

- F. Head-of-Wall, Fire-Resistive Joint Systems (for Non-Fire-Resistive Roof Systems):
 - 1. UL-Classified Systems: CJ-S-0000-0999.
 - 2. Assembly Rating: 2 hours.
 - 3. Nominal Joint Width: As indicated.
 - 4. Movement Capabilities: Class II - 25 percent compression or extension.
 - 5. L-Rating at Ambient: As selected by Contractor to suit project conditions.
- G. Perimeter Fire-Resistive Joint Systems:
 - 1. UL-Classified Perimeter Fire-Containment Systems: CW-S-0000-0999.
 - 2. Integrity Rating: 2 hours.
 - 3. Insulation Rating: 1 hour.
 - 4. Linear Opening Width: As indicated.
 - 5. Movement Capabilities: Class II - 25 percent compression or extension.
 - 6. L-Rating at Ambient Temperature: As selected by Contractor to suit project conditions.

END OF SECTION 078446

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SECTION 079200 - JOINT SEALANTS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Silicone joint sealants.
 - 2. Urethane joint sealants.
 - 3. Latex joint sealants.
 - 4. Polyurea joint sealants.
 - 5. Hybrid silicone sealants.
- B. Related Sections:
 - 1. Section 078413 "Penetration Firestopping" for sealing penetrations in fire-resistance-rated construction.
 - 2. Section 078446 "Fire-Resistive Joint Systems" for sealing joints in fire-resistance-rated construction.
 - 3. Section 088000 "Glazing" for glazing sealants.
 - 4. Section 092900 "Gypsum Board" for acoustical sealant and sealing acoustical joints.
 - 5. Division 32 Section "Concrete Paving Joint Sealants" for sealing joints in pavements, walkways, and curbing.

1.2 PRECONSTRUCTION TESTING

- A. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates as follows:
 - 1. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.
 - 2. Conduct field tests for each application indicated below:
 - a. Each kind of sealant and joint substrate in exterior walls.
 - b. Sealant around perimeter of exterior windows/storefront.
 - 3. Notify Architect seven days in advance of dates and times when test joints will be erected.
 - 4. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.
 - a. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
 - 1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
 - 5. Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
 - 6. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

1.3 ACTION SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- C. Joint-Sealant Schedule: Include the following information:
 - 1. Joint-sealant application, joint location, and designation.
 - 2. Joint-sealant manufacturer and product name.
 - 3. Joint-sealant formulation.
 - 4. Joint-sealant color.
- D. Product Certificates: For each kind of joint sealant and accessory, from manufacturer.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Preconstruction Field-Adhesion Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified in "Preconstruction Testing" Article.
- C. Field-Adhesion Test Reports: For each sealant application tested.
- D. Warranties: Sample of special warranties.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Source Limitations: Obtain each kind of joint sealant from single source from single manufacturer.
- C. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.
 - 1. Refer to Section 034100 "Structural Precast Concrete" for 2-Stage weeping sealant joint in precast concrete mockups.
 - 2. Refer to Section 042000 "Unit Masonry" for sealant joint in masonry mockups.
- D. Preinstallation Conference: Conduct conference at Project site.

1.6 PROJECT CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
 - 1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
 - 2. When joint substrates are wet.
 - 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
 - 4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.7 WARRANTY

- A. Special Installer's Warranty: Manufacturer's standard form in which Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer's standard form in which joint-sealant manufacturer agrees to furnish joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.
- C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
 - 1. Movement of the structure caused by structural settlement or errors attributable to design or construction resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
 - 2. Disintegration of joint substrates from natural causes exceeding design specifications.
 - 3. Mechanical damage caused by individuals, tools, or other outside agents.
 - 4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 PRODUCTS

2.1 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- B. VOC Content: Sealants and sealant primers shall comply with the following:
 - 1. Architectural sealants shall have a VOC content of 250 g/L or less.
 - 2. Sealants and sealant primers for nonporous substrates shall have a VOC content of 250 g/L or less.
 - 3. Sealants and sealant primers for porous substrates shall have a VOC content of 775 g/L or less.
- C. Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
- D. Stain-Test-Response Characteristics: Where sealants are specified to be non-staining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.
- E. Suitability for Contact with Food: Where sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.
- F. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.
- G. Keynote Designations: Refer to schedule at end of this Section for types and applicable substrates.
 - 1. Sealant: (079200.A01).
 - 2. Sealant with backer rod: (079200.A02).
 - 3. Acoustical sealant: (079200.A04): Refer to Section 092900.
 - 4. Tape Sealant (079200.A05).

2.2 SILICONE JOINT SEALANTS

- A. Single-Component, Non-Staining, Non-sag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 50 minimum, for Use NT.
 - 1. Products:
 - a. Tremco Incorporated; Spectrem 2.
 - b. Sika Products; Sikasil WS-295 FPS.
 - c. Dow; Dowsil 756 SMS Building Sealant.
 - d. Pecora; 890NST.
- B. Single-Component, Non-sag, Traffic-Grade, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 100/50, for Use T.
 - 1. Products:
 - a. Dow; Dowsil 790 Silicone Building Sealant.
 - b. Sika Products; Sikasil 728 NS.
 - c. Pecora Corporation; 311 NS.
- C. Mildew-Resistant, Single-Component, Non-sag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25 minimum, for Use NT.
 - 1. Products:
 - a. Tremco Incorporated; Spectrem 2.
 - b. Sika Products; Sikasil GP.

2.3 URETHANE JOINT SEALANTS

- A. Multicomponent, Non-sag, Urethane Joint Sealant: ASTM C 920, Type M, Grade NS, Class 25 minimum, for Use NT.
 - 1. Products:
 - a. BASF Building Systems; Master Seal NP 2.
 - b. Tremco Incorporated; Dymeric 240FC.
 - c. Sika Products; Sikaflex; 2c NS EZ Mix.
 - d. Pecora Corporation; Dynatrol II.
- B. Multicomponent, Non-sag, Traffic-Grade, Urethane Joint Sealant: ASTM C 920, Type M, Grade NS, Class 25 minimum, for Use T.
 - 1. Products:
 - a. BASF Building Systems; Master Seal NP 2.
 - b. Tremco Incorporated; Dymeric 240FC.
 - c. Sika Products; Sikaflex; 2c NS EZ Mix.
 - d. Pecora Corporation; Dynatrol II.
- C. Multicomponent, Pourable, Traffic-Grade, Urethane Joint Sealant: ASTM C 920, Type M, Grade P, Class 25 minimum, for Use T.
 - 1. Products:
 - a. BASF Building Systems; Master Seal SL 2.
 - b. Sika Products; Sikaflex; 2c SL.
 - c. Pecora Corporation; Dynatrol II SG.

2.4 LATEX JOINT SEALANTS

- A. Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. BASF Building Systems; Sonolac.
 - b. May National Associates, Inc.; Bondaflex Sil-A 700.
 - c. Pecora Corporation; AC-20+.
 - d. Tremco Incorporated; Tremflex 834.

2.5 POLYUREA SEALANTS

- A. Polyurea Sealant: Semi-rigid, self-leveling, 2-part type. Shore D hardness of 85 when tested in accordance with ASTM D 2240. Tensile strength of 1160 pounds per square inch when tested in accordance with ASTM D 412.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Curecrete Distribution Company, Inc.; Ashford Crete-Fill.
 - b. L&M Construction Chemical, Inc. Joint Tite 750.
 - c. Adhesives Technologies Corp.; Crackbond JF311.

2.6 HYBRID SILICONE SEALANTS FOR RESINOUS WALL TREATMENTS

- A. Basis of Design: Subject to compliance with requirements, provide one of products listed below or a comparable product, with the following product characteristics, submitted to and accepted by Architect.
 - 1. Products:
 - a. BASF; MasterSeal NP 100.
 - 2. Product Characteristics:
 - a. Classification: ASTM C920, Type S, Grade NS, Class 50, Use T.
 - b. Movement Capacity: +/- 50 percent.
 - c. Shore A Hardness: 17 to 23 per ASTM C 661.
 - d. Tensile Strength: 160-200 psi per ASTM D 412.
 - e. Tear Strength 22 lbs per inch per ASTM 1004.
 - f. Color: As selected by Architect from manufacturer's full range of custom options.

2.7 JOINT SEALANT BACKING

- A. General: Provide sealant backings of material that are non-staining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings (079200.A04): ASTM C 1330, Type C (closed-cell material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
- C. Bond-Breaker Tape (079200.A05): Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.8 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Non-staining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
 - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
 - 2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
 - a. Concrete.
 - b. Masonry.
 - 3. Remove laitance and form-release agents from concrete.
 - 4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
 - a. Metal.
 - b. Glass.

- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - 1. Do not leave gaps between ends of sealant backings.
 - 2. Do not stretch, twist, puncture, or tear sealant backings.
 - 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
 - 4. As sealant work progresses, install tube weeps at 24 inches on center along base of metal wall panels and where indicated.
- D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 - 1. Place sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses in each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- E. Tooling of Non-sag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
 - 1. Remove excess sealant from surfaces adjacent to joints.
 - 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 - 3. Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.
 - 4. Provide flush joint profile where indicated per Figure 8B in ASTM C 1193.

3.4 FIELD QUALITY CONTROL

- A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
 - 1. Extent of Testing: Test completed and cured sealant joints as follows:
 - a. Perform one test for the first 1000 feet (300 m) of joint length for each kind of sealant and joint substrate.
 - 2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.
 - a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
 - 3. Inspect tested joints and report on the following:
 - a. Whether sealants filled joint cavities and are free of voids.
 - b. Whether sealant dimensions and configurations comply with specified requirements.
 - c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion complies with sealant manufacturer's field-adhesion hand-pull test criteria.

4. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant material, sealant configuration, and sealant dimensions.
 5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.
- B. Evaluation of Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.5 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.6 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.7 JOINT-SEALANT SCHEDULE (079200.A01)

- A. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces.
1. Joint Locations:
 - a. Isolation and contraction joints in cast-in-place concrete slabs.
 - b. Joints between different materials listed above.
 2. Urethane Joint Sealant: Multicomponent, pourable/non-sag, traffic grade, Class 25.
 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- B. Joint-Sealant Application: Exterior horizontal joints between precast structural concrete.
1. Joint Locations:
 - a. Joints at flanges between precast structural concrete units at roof.
 - b. Joints between precast structural concrete units at roof and abutting vertical walls/structure.
 2. Urethane Joint Sealant: Multicomponent, nonsag, traffic grade, Class 25.
 3. Joint-Sealant Color: Grey.
- C. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.
1. Joint Locations:
 - a. Construction joints in cast-in-place concrete.
 - b. Control and expansion joints in unit masonry.
 - c. Joints above finished grade between plant-precast concrete units, unless otherwise indicated.
 - 1) Joints below grade shall be urethane.
 - d. Joints in formed metal wall panels.
 - e. Joints within and at perimeter of storefront and curtain wall assemblies.
 - f. Control and expansion joints.
 - g. Joints between different materials listed above.
 - h. Perimeter joints between materials listed above and frames of doors, windows and louvers.
 - i. Control and expansion joints in ceilings and other overhead surfaces.
 2. Silicone Joint Sealant: Single component, non-staining, non-sag, neutral curing, Class 50.
 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- D. Joint-Sealant Application: Interior joints in horizontal traffic surfaces.
1. Joint Locations:
 - a. Isolation joints in cast-in-place concrete slabs.
 - b. Other joints as indicated, except for expansion and control joints.

2. Urethane Joint Sealant: Multicomponent, non-sag, traffic grade, Class 25.
 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- E. Joint-Sealant Application: Interior joints in horizontal traffic surfaces.
1. Joint Locations:
 - a. Expansion joints in tile and resinous flooring.
 2. Silicone Joint Sealant: Single component, non-sag, traffic grade, neutral curing, Class 100/50.
 3. Joint Sealant Color: As selected by Architect from manufacturer's full range of colors.
- F. Joint-Sealant Application: Interior control/contraction joints in horizontal traffic surfaces.
1. Joint Locations:
 - a. Control/contraction joints in concrete slabs indicated to receive sealed finish, polished concrete finish, resinous flooring and joints in slabs on grade extending to building exterior, seal watertight.
 2. Polyurea Joint Sealant: Polyurea, multi component, self-leveling, traffic grade.
 3. Joint Sealant Color: As selected by Architect from manufacturer's full range of colors.
- G. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.
1. Joint Locations:
 - a. Control and expansion joints on exposed interior surfaces of exterior walls.
 - b. Perimeter joints of exterior openings where indicated.
 - c. Vertical joints on exposed surfaces of interior unit masonry and concrete.
 2. Joint Sealant: Urethane, multicomponent, non-sag, Class 25, paintable.
 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- H. Joint Sealant Application: Interior joints in vertical surfaces.
1. Joint Locations:
 - a. Vertical joints in exposed surfaces of gypsum drywall partitions.
 - b. Perimeter joints between interior wall surfaces and frames of interior doors and windows.
 2. Joint Sealant: Acrylic based, paintable.
 3. Joint Sealant Color: As selected by Architect from manufacturer's full range of colors.
- I. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.
1. Joint Sealant Location:
 - a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
 - b. Tile control and expansion joints where indicated.
 2. Joint Sealant: Single component, non-sag, mildew resistant, acid curing, Silicone.
 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- J. Joint-Sealant Application: Interior control/contraction joints in vertical surfaces (Resinous Wall treatments)
1. Joint Locations:
 - a. Control and expansion joints in CMU, cement board, or gypsum board indicated to receive resinous wall treatment.
 2. Joint Sealant: Hybrid Silicone, single component, non-sag, Class 50, traffic grade.
 3. Joint Sealant Color: As selected by Architect from manufacturer's full range of custom colors.

END OF SECTION 079200

SECTION 079500 - EXPANSION CONTROL

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Exterior wall expansion control systems.
 - 2. Interior expansion control systems.
- B. Related Requirements:
 - 1. Section 034100 "Precast Structural Concrete" for panels receiving thermal control.
 - 2. Section 078446 "Fire-Resistive Joint Systems" for liquid-applied joint sealants in fire-resistive building joints.
 - 3. Section 079200 "Joint Sealants" for liquid-applied joint sealants and for elastomeric sealants without metal frames.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for expansion joint cover assemblies.
- B. Shop Drawings: For each expansion control system specified. Include plans, elevations, sections, details, splices, attachments to other work, and line diagrams showing entire route of each expansion control system. Where expansion control systems change planes, provide isometric or clearly detailed drawing depicting how components interconnect.
- C. Samples for Initial Selection: For each type of expansion control system indicated.
 - 1. Include manufacturer's color charts showing the full range of colors and finishes available for each exposed metal and elastomeric seal material.
- D. Product Schedule: Prepared by or under the supervision of the supplier. Include the following information in tabular form:
 - 1. Manufacturer and model number for each expansion control system.
 - 2. Expansion control system location cross-referenced to Drawings.
 - 3. Nominal joint width.
 - 4. Movement capability.
 - 5. Materials, colors, and finishes.
 - 6. Product options.
 - 7. Fire-resistance ratings.
- E. Samples for Initial Selection: For each type of exposed finish.
 - 1. Include manufacturer's color charts showing the full range of colors and finishes available for each exposed metal and elastomeric-seal material.
- F. Samples for Verification: For each type of expansion joint cover assembly, full width by 6 inches long in size.

1.3 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each fire barrier provided as part of an expansion control system, for tests performed by a qualified testing agency.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

- A. General: Provide expansion control systems of design, basic profile, materials, and operation indicated. Provide units with capability to accommodate variations in adjacent surfaces.
 - 1. Furnish units in longest practicable lengths to minimize field splicing. Install with hairline mitered corners where expansion control systems change direction or abut other materials.
 - 2. Include factory-fabricated closure materials and transition pieces, T-joints, corners, curbs, cross-connections, and other accessories as required to provide continuous expansion control systems.
- B. Coordination: Coordinate installation of exterior wall expansion control systems with roof expansion control systems to ensure that wall transitions are watertight. Roof expansion joint assemblies are specified elsewhere.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance Ratings: Where indicated, provide expansion control systems with fire barriers identical to those of systems tested for fire resistance per UL 2079 or ASTM E 1966 by a testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. Hose Stream Test: Wall-to-wall and wall-to-ceiling systems shall be subjected to hose stream testing.

2.3 EXTERIOR WALL EXPANSION CONTROL SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, provide specified product or products by one of the following:
 - 1. Balco, Inc.
 - 2. Watson Bowman Acme Corp.; a BASF Construction Chemicals business.
 - 3. Comparable products from other manufacturers submitted to and accepted by Architect prior to bidding.
- B. Source Limitations: Obtain expansion control systems from single source from single manufacturer.
- C. Wall-to-Wall: Exterior Preformed Cellular Foam (079500.A20):
 - 1. Basis-of-Design Product: EMSEAL Corporation; "Colorseal".
 - 2. Design Criteria:
 - a. Nominal Joint Width: 1-1/2 or 2 inches, unless otherwise indicated.
 - b. Movement Capability: -25 percent/+25 percent.
 - c. Type of Movement: Thermal.
 - 3. Type: Preformed cellular foam with factory pre-coated face.
 - a. Foam Material: Manufacturer's standard.
 - 4. Face Seal Material: Manufacturer's standard, factory pre-coated.
 - a. Color: As selected by Architect from manufacturer's full range.
- D. Exterior Below Grade Waterproof Expansion Joint:
 - 1. Basis of Design: Subject to compliance with requirements, provide "RedLINE 100" by Situra or a comparable product with the following product characteristics by another manufacturer submitted to and accepted by Architect prior to bidding.
 - 2. Product Characteristics:
 - a. Thickness: 0.118 inches (3 mm)
 - b. Expansion Joint Gland Width: 4.75 inches.
 - c. Movement Range:
 - 1) Horizontal Movement (parallel to installation): 4 inches
 - 2) Vertical Movement (perpendicular to installation): 2 inches
 - 3) Shear Movement: 2 inches
 - d. Tear Resistance: 215 lbs/inch per ASTM D 624, Die C.
 - e. Puncture Resistance: 15 lbs per CGSB 37.56 M96.
 - f. UV Exposure: No cracks or crazing after 5000 hrs per ASTM G 53.
- E. Pre-Formed Cellular Foam Secondary Seals (079500.A23):

1. Basis-of-Design Product: EMSEAL Corporation; "Backerseal".
2. Design Criteria:
 - a. Nominal Joint Width: As indicated on Drawings.
 - b. Movement Capability: -25 percent/+25 percent.
 - c. Type of Movement: Thermal.
3. Type: Preformed cellular foam.
 - a. Foam Material: Manufacturer's standard.
4. Materials:
 - a. Cellular Foam Seals: Extruded, compressible foam designed to function under compression.
5. Accessories: Manufacturer's standard adhesives, and other accessories compatible with material in contact, as indicated or required for complete installations.

2.4 INTERIOR EXPANSION CONTROL SYSTEMS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated or a comparable product by one of the following:
 1. Balco, Inc.
 2. Construction Specialties, Inc.
 3. JointMaster/InPro Corporation.
 4. InPro Architectural Products.
 5. MM Systems Corporation.
 6. Nystrom, Inc.
 7. Watson Bowman Acme Corp.; a BASF Construction Chemicals business.
- B. Source Limitations: Obtain expansion control systems from single source from single manufacturer.
- C. Expansion Cover Plate (079500.A01): Provide aluminum, door expansion void cover plate. Provide where indicated. Plate shall be 1/4 inch thick and in 23-1/4 inches width. Finish shall be silver P/S.
 1. Basis-of Design Product: Subject to compliance with requirements, provide Construction Specialties; Model PC-1400. Comparable products from manufacturers listed below will be considered when submitted to and accepted by Architect.
 - a. National Guard Products.
 - b. Pemko.
 - c. Reese.
- D. Wall-to-Wall (079500.A06) :
 1. Basis-of-Design Product: Balco, Inc.; Model WD-1 and WD-2.
 2. Design Criteria:
 - a. Nominal Joint Width: As indicated on Drawings.
 - b. Movement Capability: -50 percent/+50 percent, minimum.
 - c. Type of Movement: Thermal.
 3. Type: Flat Seal .
 - a. Metal Retainer: Aluminum.
 - 1) Finish: Manufacturer's standard.
 - b. Seal Material: Aluminum.
 - 1) Color: Clear Anodized finish.
- E. Wall-to-Wall (079500.A07):
 1. Basis-of-Design Product: Balco, Inc.; Model 2HWD-2.
 2. Design Criteria:
 - a. Nominal Joint Width: As indicated on Drawings.
 - b. Movement Capability: -50 percent/+50 percent, minimum.
 - c. Type of Movement: Thermal.
 - d. Fire-Rated Assemblies: Where expansion joints occur in fire-rated wall, provide Pyro-Seal as recommended by manufacturer to suit rating and joint design. System shall be UL listed and tested.
 3. Type: Flat Seal .
 - a. Metal Retainer: Aluminum.
 - 1) Finish: Manufacturer's standard.
 - b. Seal Material: Aluminum.
 - 1) Color: Clear Anodized finish.

- F. Wall to Corner (079500.A08):
 - 1. Basis-of-Design Product: Balco, Inc.; Model WDC-1.
 - 2. Design Criteria:
 - a. Nominal Joint Width: As indicated on Drawings.
 - b. Movement Capability: -25 percent/+25 percent, minimum.
 - c. Type of Movement: Thermal.
 - 3. Type: Flat Seal.
 - a. Metal Retainer: Aluminum.
 - 1) Finish: Manufacturer's standard.
 - b. Seal Material: Aluminum.
 - 1) Color: Clear Anodized finish.
- G. Ceiling-to-Wall (079500.A12):
 - 1. Basis-of-Design Product: Balco, Inc.; Model WDC-2.
 - 2. Design Criteria:
 - a. Nominal Joint Width: As indicated on Drawings.
 - b. Movement Capability: -50 percent/+50 percent, minimum.
 - c. Type of Movement: Thermal.
 - 3. Type: Flat Seal.
 - a. Metal Retainer: Aluminum.
 - 1) Finish: Manufacturer's standard.
 - b. Seal Material: Aluminum.
 - 1) Color: Clear Anodized finish.
- H. Preformed Cellular Foam (079500.A20):
 - 1. Basis-of-Design Product: EMSEAL Corporation; "Colorseal".
 - 2. Design Criteria:
 - a. Nominal Joint Width: 2 inches, unless otherwise indicated.
 - b. Movement Capability: -25 percent/+25 percent.
 - c. Type of Movement: Thermal.
 - 3. Type: Preformed cellular foam with factory pre-coated face.
 - a. Foam Material: Manufacturer's standard.
 - 4. Face Seal Material: Manufacturer's standard, factory pre-coated.
 - a. Color: As selected by Architect from manufacturer's full range.
- I. Pre-Formed Cellular Foam Secondary Seals (079500.A23):
 - 1. Basis-of-Design Product: EMSEAL Corporation; "Backerseal".
 - 2. Design Criteria:
 - a. Nominal Joint Width: 2 inches, unless otherwise indicated.
 - b. Movement Capability: -25 percent/+25 percent.
 - c. Type of Movement: Thermal.
 - 3. Type: Preformed cellular foam.
 - a. Foam Material: Manufacturer's standard.

2.5 MATERIALS

- A. Aluminum: ASTM B221, Alloy 6063-T5 for extrusions; ASTM B209, Alloy 6061-T6 for sheet and plate.
 - 1. Apply manufacturer's standard protective coating on aluminum surfaces to be placed in contact with cementitious materials.
- B. Elastomeric Seals: Manufacturer's standard preformed elastomeric membranes or extrusions to be installed in metal frames.
- C. Cellular Foam Seals: Extruded, compressible foam designed to function under compression.
- D. Accessories: Manufacturer's standard adhesives, and other accessories compatible with material in contact, as indicated or required for complete installations.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine surfaces where expansion control systems will be installed for installation tolerances and other conditions affecting performance of work.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

- A. Prepare substrates according to expansion joint cover assembly manufacturer's written instructions.
- B. Coordinate and furnish anchorages, setting drawings, and instructions for installing expansion joint cover assemblies. Provide fasteners of metal, type, and size to suit type of construction indicated and to provide for secure attachment of expansion joint cover assemblies.

3.3 INSTALLATION

- A. Comply with manufacturer's written instructions for storing, handling, and installing expansion control systems and materials unless more stringent requirements are indicated.
- B. Metal Frames: Perform cutting, drilling, and fitting required to install expansion joint cover assemblies.
 - 1. Install frames in continuous contact with adjacent surfaces.
 - a. Shimming is not permitted.
 - 2. Install in true alignment and proper relationship to joints and adjoining finished surfaces measured from established lines and levels.
 - 3. Adjust for differences between actual structural gap and nominal design gap due to ambient temperature at time of installation.
 - 4. Cut and fit ends to accommodate thermal expansion and contraction of metal without buckling of frames.
 - 5. Locate anchors at interval recommended by manufacturer, but not less than 3 inches from each end and not more than 24 inches o.c.
- C. Seals: Install elastomeric seals and membranes in frames to comply with manufacturer's written instructions. Install with minimum number of end joints.
 - 1. Provide in continuous lengths for straight sections.
 - 2. Seal transitions. Vulcanize or heat-weld field-spliced joints as recommended by manufacturer.
 - 3. Installation: Mechanically lock seals into frames or adhere to frames with adhesive or pressure-sensitive tape as recommended by manufacturer.
- D. Install with hairline mitered corners where expansion joint cover assemblies change direction or abut other materials.
- E. Foam Seals: Install with adhesive recommended by manufacturer.
- F. Terminate exposed ends of expansion control systems with field- or factory-fabricated termination devices.

3.4 INSTALLATION OF BELOW GRADE WATERPROOF EXPANSION JOINTS

- A. Apply hot rubberized asphalt at manufacturer's recommended minimum thickness, immediately embed waterproof expansion joint to allow bottom polyester fleece to receive full contact with the hot rubberized asphalt.
- B. Do not install waterproof expansion joint in cold asphalt.
- C. Spread an even coat of hot rubberized asphalt on top surface of waterproof expansion joint to cover all polyester fleece surfaces. Embed a reinforcing fabric mesh overlapping the edge of the waterproof expansion joint and ensure full contact with the hot rubberized asphalt. Apply an additional coat of hot rubberized asphalt over top reinforcing fabric mesh at the manufacturer's minimum recommended thickness.

- D. Refer to Section 071413 for additional requirement regarding hot fluid applied water proofing installed adjacent to and over waterproof expansion joint systems.

3.5 PROTECTION

- A. Do not remove protective covering until finish work in adjacent areas is complete. When protective covering is removed, clean exposed metal surfaces to comply with manufacturer's written instructions.
- B. Protect the installation from damage by work of other Sections. Where necessary due to heavy construction traffic, remove and properly store cover plates or seals and install temporary protection over expansion control systems. Reinstall cover plates or seals prior to Substantial Completion of the Work.

END OF SECTION 079500

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes hollow-metal work.
 - 1. Interior heavy-duty hollow-metal door (081113.A01 - A3).
 - 2. Insulated extra-heavy-duty hollow-metal door (081113.A12).
 - 3. High wind door assembly (081113.A21 - F1).
 - 4. Hollow-metal frame (081113.A31).
- B. Related Requirements:
 - 1. Section 042000 "Unit Masonry" for embedding anchors for hollow-metal work into masonry.
 - 2. Section 087100 "Door Hardware" for door hardware for hollow-metal doors.
 - 3. Section 099123 "Interior Painting" for field painting of hollow-metal work.
 - 4. Section 099600 "High Performance Coatings" for field painting of hollow metal work.
 - 5. Division 26 Sections for electrical connections including conduit and wiring for door controls and operators.

1.2 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.
- B. High Wind Area Assemblies: High performance commercial steel door and frames assemblies designed, tested and certified to meet extreme environmental application levels as follows:
 - 1. High Wind Area Applications: Door and frame assemblies that meet tornado shelter construction guidelines developed by the Federal Emergency Management Agency (FEMA) and meet the regulatory requirements specified.

1.3 COORDINATION

- A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.4 PREINSTALLATION MEETINGS

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

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, temperature-rise ratings, and finishes.
- B. Shop Drawings: Include the following:
 - 1. Furnish a schedule of doors and frames using same reference numbers for details and openings as those on Drawings.
 - 2. Elevations of each door type.
 - 3. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
 - 4. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 - 5. Locations of reinforcement and preparations for hardware.
 - 6. Details of each different wall opening condition.
 - 7. Details of anchorages, joints, field splices, and connections.

8. Details of accessories.
9. Details of moldings, removable stops, and glazing.
10. Details of conduit and preparations for power, signal, and control systems.
11. Details for high wind area door and frame assemblies

C. Samples for Verification:

1. For each type of exposed finish required, prepared on Samples of not less than 6 by 8 inches.

D. Schedule: Provide a schedule of hollow-metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final Door Hardware Schedule.

1.6 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each type of hollow-metal door and frame assembly, for tests performed by a qualified testing agency.
- B. Oversize Construction Certification: For assemblies required to be fire rated and exceeding limitations of labeled assemblies.
- C. Certifications for High Wind Area Door and Frame Assemblies: Submit written certification confirming tornado resistant door and frame assemblies comply with FEMA 361 and ICC 500-2014.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow-metal work palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use non-vented plastic.
 1. Provide additional protection to prevent damage to factory-finished units.
 2. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- B. Store hollow-metal work vertically under cover at Project site with head up. Place on minimum 4-inch-high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

1.8 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Ceco Door Products; an Assa Abloy Group company.
 2. Curries Company; an Assa Abloy Group company.
 3. Republic Doors and Frames.
 4. Steelcraft; an Allegion company.
- B. Basis-of-Design Product for High Wind Area Door and Frame Assemblies: Subject to compliance with requirements, provide Steelcraft, an Allegion Company (formerly Ingersoll-Rand); "Paladin" PW14 Series doors and FP14 associated frame assemblies for tornado resistant applications, as specified hereinafter. Comparable products from manufacturers listed below will also be considered:
 1. Ceco Door Products; an Assa Abloy Group company.
 2. Curries Company; an Assa Abloy Group company.
 3. Republic Doors and Frames.
- C. Source Limitations:
 1. Obtain hollow-metal work from single source from single manufacturer.

2.2 REGULATORY REQUIREMENTS

- A. Fire-Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings and temperature-rise limits indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
 - 1. Smoke- and Draft-Control Assemblies: Provide an assembly with gaskets listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.
 - 2. For areas required to receive a fire rating greater than 45 minutes, fire testing shall be based on fire resistive criteria according to NFPA 251 or ASTM E119.
- B. High Wind Area assemblies shall comply with FEMA P-361 and ANSI ICC 500-2014 standards.
 - 1. Door and frames must be furnished and installed as a system.
 - 2. Door and frame assembly shall be designed and tested to withstand windborne debris impact of a 15 pound missile traveling at 100 mph and a 250 mph design wind speed per FEMA for tornado resistant applications.

2.3 INTERIOR DOORS AND FRAMES

- A. Construct interior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Heavy-Duty Doors and Frames: SDI A250.8, Level 2.
 - 1. Physical Performance: Level B according to SDI A250.4.
 - 2. Doors (081113.A01):
 - a. Type: As indicated in the Door and Frame Schedule.
 - b. Thickness: 1-3/4 inches.
 - c. Face: Uncoated, cold-rolled steel sheet, minimum thickness of 0.042 inch (18 gauge).
 - 1) Provide metallic-coated cold rolled steel in areas exposed to moisture and as indicated on Drawings.
 - d. Edge Construction: Model 1, Full Flush.
 - e. Core: Manufacturer's standard kraft-paper honeycomb for non-fire-rated doors and mineral-board for fire-rated doors.
 - f. Openings in door for vision lites shall be reinforced with manufacturer's recommended steel reinforcement channels at perimeter of vision lite opening.
 - 3. Frames (081113.A31):
 - a. Materials: Uncoated, steel sheet, minimum thickness of 0.067 inch (14 gauge).
 - 1) Provide metallic-coated cold rolled steel in areas exposed to moisture and as indicated on Drawings.
 - b. Sidelite and Transom Frames: Fabricated from same thickness material as adjacent door frame.
 - c. Construction: Face welded.
 - d. Construction: Fully welded.
 - e. Reinforcement: Provide high frequency hinge reinforcement at top hinge location.
 - 4. Vision Lites:
 - a. For non-fire-rated glass, provide the following:
 - 1) Manufacturer's "flush" type vision lights.
 - b. For fire-rated security glass, provide vision light kit specified.
 - 5. Exposed Finish: Prime.

2.4 HIGH WIND AREA DOOR AND FRAME ASSEMBLIES (081113.A21)

- A. General: Provide High Wind Area compliant hollow metal door and frame assemblies of types and styles indicated.
 - 1. Application: Tornado resistant.
- B. High wind area door and frame assemblies shall comply with requirements of FEMA P-361 and ANSI ICC 500-2014 standards for high wind area applications. Provide approved hardware and accessories under Section 087100 "Door Hardware" as part of the complete prescriptive door assembly opening by Intertek or UL public

listing for the labeled tornado resistant assembly.

- C. High wind area doors shall be seamless and shall be FEMA labeled for tornado resistant applications. Doors shall be 1-3/4" thick, manufactured from 0.067-inch steel sheets. Cores and stiffeners (if any) shall be as standard from door manufacturer to meet windstorm resistant criteria for tornado resistance. All exterior doors and frames shall be fabricated from metallic-coated or galvanealed steel sheets. Doors shall have mechanically interlocked vertical edges, flush face sheets and seamed and fully welded edges. Top and bottom rails shall have flush closures channels and reinforcements as standard from door manufacturer to meet specified performance requirements. Hardware preparation and reinforcements shall meet windstorm resistance requirements and ANSI A250.6.
- D. High wind area frames shall match metal thickness and coating of door faces. Frames shall comply with specified performance requirements and ANSI A250.8. Frames shall be provided in configurations indicated for type and profile.
- E. Opening Sizes: Sizes shall not exceed the smallest and largest sizes tested and approved per ICC 500-2014. Available sizes shall be publicly available on Intertek or UL listing websites.
- F. Lite Kits: Where specified provide approved high wind area trim and glazing. Trim and glazing shall be pre-installed from the factory. Lite kit must conform with ADA requirements.
 - 1. For fire rated assemblies with glass, a UL classified fire rated sealant must be used.

2.5 FRAME ANCHORS

- A. General: Anchors for High Wind Area door, frame assemblies shall meet FEMA/ICC 500-2014 requirements. Provide anchoring approved by UL or Intertek Testing Services / Warnock Hershey (ITS/WHI), supported by testing and third party professional engineering reports. Follow installation instructions to meet specified regulatory requirements.
- B. Jamb Anchors:
 - 1. General: Anchors for severe storm-resistant door and frame assemblies shall be of sufficient length to provide not less than 5 inches of embedment into adjacent wall construction at jamb.
 - 2. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
 - 3. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.
 - 4. Compression Type for Drywall Slip-on Frames: Adjustable compression anchors.
 - 5. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch-diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.
- C. Floor Anchors: Formed from same material as frames, minimum thickness of 0.042 inch, and as follows:
 - 1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

2.6 MATERIALS

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- B. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B.
- D. Frame Anchors: ASTM A 879/A 879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.
 - 1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.
- E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
- F. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type

indicated.

- G. Grout: ASTM C 476, except with a maximum slump of 4 inches, as measured according to ASTM C 143/C 143M.
- H. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.
- I. Glazing: Comply with requirements in Section 088000 "Glazing."
- J. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.7 FABRICATION

- A. Fabricate hollow-metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
- B. Hollow-Metal Doors:
 - 1. Fire Door Cores: As required to provide fire-protection and temperature-rise ratings indicated.
 - 2. Vertical Edges for Single-Acting Doors: Bevel edges 1/8 inch in 2 inches.
 - 3. Top Edge Closures: Close top edges of doors with inverted closures, except provide flush closures at exterior doors of same material as face sheets.
 - 4. Bottom Edge Closures: Close bottom edges of doors where required for attachment of weather stripping with end closures or channels of same material as face sheets.
 - 5. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.
- C. Hollow-Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
 - 1. Anchors for High Wind Area Door, Frame Assemblies: Provide anchoring approved by UL or Intertek Testing Services / Warnock Hershey (ITS/WHI), supported by testing and third party professional engineering reports.
 - 2. Sidelite and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
 - 3. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 - 4. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
 - 5. Floor Anchors: Weld anchors to bottoms of jambs with at least four spot welds per anchor; however, for slip-on drywall frames, provide anchor clips or countersunk holes at bottoms of jambs.
 - 6. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Masonry Type: Locate anchors not more than 16 inches from top and bottom of frame. Space anchors not more than 32 inches o.c., to match coursing, and as follows:
 - 1) Two anchors per jamb up to 60 inches high.
 - 2) Three anchors per jamb from 60 to 90 inches high.
 - 3) Four anchors per jamb from 90 to 120 inches high.
 - 4) Four anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.
 - b. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Three anchors per jamb up to 60 inches high.
 - 2) Four anchors per jamb from 60 to 90 inches high.
 - 3) Five anchors per jamb from 90 to 96 inches high.
 - 4) Five anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
 - c. Compression Type: Not less than two anchors in each frame.
 - d. Postinstalled Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.
 - 7. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.

- a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
 - b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
- D. Fabricate concealed stiffeners and edge channels from either cold- or hot-rolled steel sheet.
- E. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.
 - 1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
 - 2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.
 - 3. Provide high frequency hinge reinforcement on top hinge only (two additional 10 gauge reinforcements are welded at 3 places each) on all door frames.
- F. Stops and Moldings: Provide stops and moldings around glazed lites and louvers where indicated. Form corners of stops and moldings with butted hairline joints.
 - 1. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
 - 2. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
 - 3. Provide loose stops and moldings on inside of hollow-metal work.
 - 4. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.

2.8 STEEL FINISHES

- A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
 - 1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

2.9 ACCESSORIES

- A. Louvers (081113.A35): Provide louvers for interior doors, where indicated, which comply with SDI 111C, with blades or baffles formed of 0.020-inch-thick, cold-rolled steel sheet set into 0.032-inch-thick steel frame.
 - 1. Sightproof Louver: Stationary louvers constructed with inverted-V or inverted-Y blades.
 - 2. Fire-Rated Automatic Louvers: Louvers constructed with movable blades closed by actuating fusible link, and listed and labeled for use in fire-rated door assemblies of type and fire-resistance rating indicated by same qualified testing and inspecting agency that established fire-resistance rating of door assembly.
- B. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.
- C. Grout Guards: Formed from same material as frames, not less than 0.016 inch thick.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.
- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General – High Wind Area Door and Frame Assemblies: Assemblies shall not be unduly modified. Consult with door manufacturer or the Authority having Jurisdiction (AHJ) as needed to maintain the labeled approval of the tornado resistant assembly, complying with ICC 500-2014.
- B. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- C. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
- D. Provide high frequency hinge reinforcement on top hinge only (two additional 10 gauge reinforcements are welded at 3 places each) on all door frames.
- E. Reinforce doors and frames to receive continuous hinges where scheduled.

3.3 INSTALLATION

- A. General: Install hollow-metal work plumb, rigid, properly aligned, and securely fastened in place. Comply with Drawings and manufacturer's written instructions.
- B. Hollow-Metal Frames: Install hollow-metal frames for doors, transoms, sidelites, borrowed lites, and other openings, of size and profile indicated. Comply with SDI A250.11 or NAAMM-HMMA 840 as required by standards specified.
 - 1. High Wind Area Door Assemblies: Follow tornado resistant door/frame manufacturer's installation instructions to meet specified regulatory requirements.
 - a. Assemblies shall not be unduly modified prior to, during and after installation. Consult with door manufacturer or the Authority having Jurisdiction (AHJ) as needed to maintain the labeled approval of the tornado resistant assembly, complying with ICC 500-2014.
 - 2. Set frames accurately in position; plumb, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
 - a. At fire-rated openings, install frames according to NFPA 80.
 - b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
 - c. Install frames with removable stops located on secure side of opening.
 - d. Install door silencers in frames before grouting.
 - 1) Provide mortar guards for hinge and strike plate cutouts and any electrical components attached to frames.
 - e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
 - f. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
 - g. Field apply bituminous coating to backs of frames that will be filled with grout containing antifreezing agents.
 - 3. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
 - a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
 - 4. Metal-Stud Partitions: Solidly pack mineral-fiber insulation inside frames.
 - 5. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
 - 6. Concrete Walls: Solidly fill space between frames and concrete with mineral-fiber insulation.
 - 7. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
 - 8. Installation Tolerances: Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.

- c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.
- C. Hollow-Metal Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.
 - 1. Non-Fire-Rated Steel Doors:
 - a. Between Door and Frame Jambs and Head: 1/8 inch plus or minus 1/32 inch.
 - b. Between Edges of Pairs of Doors: 1/8 inch to 1/4 inch plus or minus 1/32 inch.
 - c. At Bottom of Door: 5/8 inch plus or minus 1/32 inch.
 - d. Between Door Face and Stop: 1/16 inch to 1/8 inch plus or minus 1/32 inch.
 - 2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
 - 3. Smoke-Control Doors: Install doors and gaskets according to NFPA 105.
 - 4. High Wind Area Door Assemblies: Follow severe storm-resistant door/frame manufacturer's installation instructions to meet specified regulatory requirements
- D. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with hollow-metal manufacturer's written instructions.
 - 1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

3.4 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow-metal work that is warped, bowed, or otherwise unacceptable.
- B. Remove grout and other bonding material from hollow-metal work immediately after installation.
- C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
- D. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.
- E. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION 081113

SECTION 081416 - FLUSH WOOD DOORS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Solid-core doors with wood-veneer faces (081416.A01 – A1, B1).
 - 2. Factory finishing flush wood doors.
 - 3. Factory fitting flush wood doors to frames and factory machining for hardware.
- B. Related Requirements:
 - 1. Section 064023 "Interior Architectural Woodwork" for application of markerboard laminate and edge banding to wood doors.
 - 2. Section 081113 "Hollow Metal Doors and Frames" for hollow metal frames.
 - 3. Section 087100 "Door Hardware" for hardware in flush wood doors.
 - 4. Section 088000 "Glazing" for glass view panels in flush wood doors.

1.2 PREINSTALLATION MEETINGS

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

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of door. Include details of core and edge construction and trim for openings. Include factory-finishing specifications.
- B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; and the following:
 - 1. Dimensions and locations of blocking.
 - 2. Dimensions and locations of mortises and holes for hardware.
 - 3. Dimensions and locations of cutouts.
 - 4. Undercuts.
 - 5. Requirements for veneer matching.
 - 6. Doors to be factory finished and finish requirements.
- C. Samples for Initial Selection: For
 - 1. Factory finished doors.
- D. Samples for Verification:
 - 1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches, for each material and finish.
 - a. For each wood species and transparent finish, provide set of three Samples showing typical range of color and grain to be expected in finished Work.
 - 2. Frames for light openings, 6 inches long, for each material, type, and finish required.

1.4 INFORMATIONAL SUBMITTALS

- A. Sample Warranty: For special warranty.
- B. Certificates: For door manufacturer as set forth in Quality Assurance article.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer that is a certified participant in AWI's Quality Certification Program.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.
 - 1. Do not deliver doors until building interior environmental conditions are maintained to meet Manufacturer's requirements for relative humidity.
- B. Package doors individually in plastic bags or cardboard cartons.
 - 1. Protect doors in place as necessary to prevent scratches, dents, and other damage.
- C. Mark each door on bottom rail with opening number used on Shop Drawings.
- D. Do not place other items on top of stored doors.
- E. Do not drag doors across one another or across other surfaces.
- F. Handle doors using clean gloves.

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 25 and 55 percent during remainder of construction period.

1.8 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
 - b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.
 - 2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
 - 3. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements provide products by one of the following:
 - 1. Algoma / Graham / Marshfield / Mohawk / Masonite Architectural Doors.
 - 2. Eggers Industries.
 - 3. Oshkosh Door Company.
 - 4. VT Industries, Inc.
 - 5. Western Oregon Doors.
- B. Source Limitations: Obtain flush wood doors from single manufacturer.

2.2 FLUSH WOOD DOORS, GENERAL

- A. Quality Standard: In addition to requirements specified, comply with WDMA I.S.1-A, "Architectural Wood Flush Doors."
 - 1. Provide labels indicating that doors comply with requirements of grades specified.
 - 2. Contract Documents contain selections chosen from options in quality standard and additional requirements beyond those of quality standard. Comply with those selections and requirements in addition to quality standard.
- B. WDMA I.S.1-A Performance Grade:
 - 1. Extra Heavy Duty.
- C. Particleboard-Core Doors:
 - 1. Particleboard: ANSI A208.1, Grade LD-2.
 - 2. Blocking: Provide wood blocking in particleboard-core doors as follows:
 - a. 5-inch top-rail blocking, in doors indicated to have closers.
 - b. 5-inch bottom-rail blocking, in exterior doors and doors indicated to have kick, mop, or armor plates.
 - 3. Provide doors with structural-composite-lumber cores instead of particleboard cores for doors indicated to receive exit devices.

2.3 VENEER-FACED DOORS FOR TRANSPARENT FINISH

- A. Interior Solid-Core Doors (081416.A01 – A1, B1):
 - 1. Grade: Premium, with Grade A faces.
 - 2. Species: Red Oak.
 - a. Match species of existing wood doors at each location as determined by Architect and Owner from manufacturer's full range of options.
 - 3. Cut:
 - a. Plain sliced (flat sliced).
 - 4. Match between Veneer Leaves:
 - a. Book match.
 - b. Match veneer matching of existing doors at project site.
 - 5. Assembly of Veneer Leaves on Door Faces: Running match.
 - 6. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
 - 7. Exposed Vertical and Top Edges: Same species as faces - edge Type A.
 - a. Stile edges shall be 2-ply, not less than 1-3/8 inch thick. Outer hardwood edge ply shall be 5/8 inch thick. Inner ply shall be structural composite lumber or hardwood. Stile edges shall be continuous and shall not be finger jointed.
 - 8. Core: Particleboard or structural composite lumber.
 - 9. Construction: Five plies. Stiles and rails are bonded to core, then entire unit is abrasive planed before veneering. Faces are bonded to core using a hot press.
 - a. MDF cross bands are not acceptable.
 - 10. Color:
 - a. Stain shall be custom-mixed to match color of 3 existing schools wood doors as approved by Architect and Owner.
 - 11. Doors thickness for the sliding barn doors shall be 1-3/8 inches.

2.4 LIGHT FRAMES AND LOUVERS

- A. General: Light frames are to match light frames in existing doors for each school. Contractor shall field verify material type and profile for light frames.
- B. Metal Frames for Light Openings: Manufacturer's standard frame formed of 0.048-inch-thick, cold-rolled steel sheet; with baked-enamel- or powder-coated finish.
 - 1. Colors to be selected by Architect from full range of manufacturer's options.

2.5 FABRICATION

- A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
- B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, BHMA-156.115-W, and hardware templates.
 - 1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
- C. Transom and Side Panels: Fabricate matching panels with same construction, exposed surfaces, and finish as specified for associated doors. Finish bottom edges of transoms and top edges of rabbeted doors same as door styles.
 - 1. Fabricate door and transom panels with full-width, solid-lumber meeting rails. Provide factory-installed spring bolts for concealed attachment into jambs of metal door frames.
- D. Openings: Factory cut and trim openings through doors.
 - 1. Light Openings: Trim openings with moldings of material and profile indicated.
 - 2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 088000 "Glazing."
 - 3. Louvers: Factory install louvers in prepared openings.

2.6 FACTORY FINISHING

- A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
 - 1. Finish two faces, two vertical edges, edges of cutouts, and mortises. Stains and fillers may be omitted on bottom edges, edges of cutouts, and mortises.
 - a. Where top edge is visible from an upper level (occupiable space) top edge shall be finished.
- B. Factory finish doors that are indicated to receive transparent finish.
- C. Transparent Finish:
 - 1. General: Intent is to match Architect's control sample.
 - 2. Grade: Premium.
 - 3. Finish: Provide one of the following finishes:
 - a. AWI's "Architectural Woodwork Standards" System 10, UV curable, water based polyurethane.
 - b. WDMA TR-6 catalyzed polyurethane.
 - 4. Staining: Custom, to match Architect's control sample.
 - 5. Effect: Semifilled finish, produced by applying an additional finish coat to partially fill the wood pores.
 - 6. Sheen: Satin.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine doors and installed door frames, with Installer present, before hanging doors.
 - 1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
 - 2. Reject doors with defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Hardware: For installation, see Section 087100 "Door Hardware."

- B. Installation Instructions: Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.
 - 1. Clearances: Provide 1/8 inch at heads, jambs, and between pairs of doors. Provide 1/8 inch from bottom of door to top of decorative floor finish or covering unless otherwise indicated. Where threshold is shown or scheduled, provide 1/4 inch from bottom of door to top of threshold unless otherwise indicated.
 - a. Bevel non-fire-rated doors 1/8 inch in 2 inches at lock and hinge edges.
- C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
- D. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 ADJUSTING

- A. Operation: Rehang or replace doors that do not swing or operate freely.
- B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 081416

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SECTION 084113 - ALUMINUM FRAMED ENTRANCES AND STOREFRONTS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Thermal Broken Storefront Framing (4.5") (084113.A01).
 - 2. Thermal Broken Storefront Framing (6") (084113.A02).
 - 3. Non-Thermal Broken Storefront Framing (4.5") (084113.A06).
 - 4. Aluminum Door (Standard)(084113.A11 - E9).
 - 5. Aluminum Door (Heavy Duty) (084113.A12 - E10).
 - 6. Aluminum Subsills (084113.A21).
 - 7. Aluminum Closure Flashing (084113.A22).
 - 8. Aluminum Pan Flashing (084113.A23).
 - 9. Concealed Flashing (084113.A24).
 - 10. Jamb Closure Membrane (084113.A25).
 - 11. Aluminum Receptor (084113.A26).
- B. Related Requirements:
 - 1. Section 079200 "Joint Sealants" for installation of joint sealants installed in storefronts and entrance framing and for sealants not specified in this Section.
 - 2. Section 084126 "All-Glass Entrances and Storefronts" for systems without aluminum support framing.
 - 3. Section 085113 "Aluminum Windows" for windows installed within storefront framing.
 - 4. Section 087100 "Door Hardware" for door hardware for aluminum doors.
 - 5. Section 088000 "Glazing" for glass within storefront and entrance systems.

1.2 PREINSTALLATION MEETINGS

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

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, installation instructions, material descriptions, dimensions of individual components and profiles, hardware, accessories and finishes.
- B. Shop Drawings: For aluminum-framed entrances and storefronts. Include plans, elevations, sections, full-size details, and attachments to other work.
 - 1. Elevations shall be drawn at ½ inch scale.
 - 2. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
 - 3. Include full-size isometric details of each vertical-to-horizontal intersection of aluminum-framed entrances and storefronts, showing the following:
 - a. Joinery, including concealed welds.
 - b. Anchorage.
 - c. Interface with adjoining building construction.
 - d. Expansion provisions.
 - e. Glazing.
 - f. Flashing and drainage.
 - 4. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
 - 5. Shop Drawings shall be signed and sealed by a structural engineer licensed in the state where the project is located.
- C. Samples for Initial Selection: For units with factory-applied color finishes.
- D. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

1. Architect reserves the right to require additional samples for verification purposes that show fabrication techniques and workmanship.
- E. Fabrication Sample: Of each vertical-to-horizontal intersection of assemblies, made from 12-inch lengths of full-size components and showing details of the following:
1. Joinery, including concealed welds.
 2. Anchorage.
 3. Expansion provisions.
 4. Glazing.
 5. Flashing and drainage.
- F. Entrance Door Hardware Schedule: Prepared by or under supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.
- G. Delegated-Design Submittal: For aluminum-framed entrances and storefronts indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
1. Detail fabrication and assembly of aluminum-framed systems.
 2. Include design calculations.
 3. Indicate design solutions for deflections of overhead structure as indicated on Structural Drawings.
 4. For aluminum-framed entrances and storefronts indicated to receive laminated (security) glazing systems, indicate design solutions recommended by laminated (security) glazing manufacturer to provide forced entry resistance level indicated in Section 088000 "Glazing".

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and field-testing agency.
- B. Energy Performance Certificates: For aluminum-framed entrances and storefronts, accessories, and components, from manufacturer.
1. Basis for Certification: NFRC-certified energy performance values for each aluminum-framed entrance and storefront.
- C. Product Test Reports: For aluminum-framed entrances and storefronts, for tests performed by manufacturer and witnessed by a qualified testing agency.
- D. Preconstruction Test Reports: For sealant.
- E. Quality-Control Program: Developed specifically for Project, including fabrication and installation, according to recommendations in ASTM C 1401. Include periodic quality-control reports.
- F. Source quality-control reports.
- G. Field quality-control reports.
- H. Sample Warranties: For special warranties.

1.5 QUALITY ASSURANCE

- A. Engineering Responsibility: Prepare data for aluminum-framed systems, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in systems similar to those indicated for this Project.
- B. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- C. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated.
- D. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements,

alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.

1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

E. Structural-Sealant Glazing: Comply with ASTM C 1401 for design and installation of storefront systems.

F. Source Limitations:

1. For Aluminum-Framed Storefront Systems: Obtain from single source from single manufacturer.
2. For Heavy-Duty Door Systems: Obtain from single source from single manufacturer.

1.6 MOCKUPS

A. Mockups/Field Samples: Build mockups/field samples, to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1. Mockups/Field Samples: Furnish and install quantity and size of aluminum windows indicated on Drawings within mockup constructed under Section 042000 "Unit Masonry." Mockup/Field Sample will be used set quality standards for materials and execution.
 - a. Install aluminum window to demonstrate surface preparation and installation of: jamb closure membrane, subsill, window framing, and application of perimeter window sealant and associated flashing.
 - b. Window shall include specified glazing where mockup is erected.
 - c. Maintain a 3/8 to 1/2 inch wide gap around entire perimeter of window to receive sealant.
 - d. Coordinate installation of window within mockups to permit inspection by Architect. Approved window installation will set quality standard of installation and aesthetic qualities of workmanship for project.
2. Field Samples: Build field sample/mockup of typical wall areas as shown on Drawings.
 - a. Note: Mockup shall be a field sample of storefront, entrance and punched opening areas in Project. Architect and manufacturer's representative will observe installation of first 100 square feet of storefront installation and 100 square feet of entrance framing installation.
3. Field testing shall be performed on field sample areas according to requirements in "Field Quality Control" Article.
4. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
5. Subject to compliance with requirements, approved mockups/field sample areas may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver aluminum framing components in manufacturer's original protective packaging.

B. Store aluminum components in a clean dry location away from uncured masonry and concrete. Cover components with waterproof paper, tarpaulin or polyethylene sheeting in a manner to permit circulation of air.

1. Stack framing components in a manner that will prevent bending and avoid damage.

1.8 PROJECT CONDITIONS

A. Field Measurements: Check openings by accurate field measurements before fabrication. Show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay in the work.

B. Commencement of aluminum entrance and storefront work will be construed as Installer's acceptance of substrate surfaces and rough openings indicated to receive work of this Section.

1.9 WARRANTY

A. Special Warranty: Installer agrees to repair or replace components of aluminum-framed entrances and storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty

period.

1. Failures include, but are not limited to, the following:
 - a. Structural failures including, but not limited to, excessive deflection.
 - b. Noise or vibration created by wind and thermal and structural movements.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - d. Water penetration through fixed glazing and framing areas.
 - e. Failure of operating components.
 2. Warranty Period: Two years from date of Substantial Completion.
 3. Warranty period for heavy-duty doors and associated frames shall be ten (10) years from date of Substantial Completion.
- B. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.
1. Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design aluminum-framed entrances and storefronts.
- B. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances and storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
1. Aluminum-framed entrances and storefronts shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
 2. Failure also includes the following:
 - a. Thermal stresses transferring to building structure.
 - b. Glass breakage.
 - c. Noise or vibration created by wind and thermal and structural movements.
 - d. Loosening or weakening of fasteners, attachments, and other components.
 - e. Failure of operating units.
- C. Structural Loads:
1. Wind Loads: As indicated on Drawings.
 2. Other Design Loads: As indicated on Drawings.
- D. Deflection of Framing Members: At design wind pressure, as follows:
1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans up to 13 feet 6 inches and to 1/240 of clear span plus 1/4 inch for spans greater than 13 feet 6 inches or an amount that restricts edge deflection of individual glazing lites to 3/4 inch, whichever is less.
 2. Deflection Parallel to Glazing Plane: Limited to amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than 1/8 inch.
 - a. Operable Units: Provide a minimum 1/16-inch clearance between framing members and operable units.
 - b. Refer to Structural Drawings for additional information regard structure and deflection criteria.
 3. Cantilever Deflection: Where framing members overhang an anchor point, as follows:
 - a. Perpendicular to Plane of Wall: No greater than 1/240 of clear span plus 1/4 inch for spans greater than 11 feet 8-1/4 inches or 1/175 times span, for spans less than 11 feet 8-1/4 inches.
- E. Structural: Test according to ASTM E 330 as follows:
1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.

2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
 3. Test Durations: As required by design wind velocity, but not less than 10 seconds.
- F. Air Infiltration: Test according to ASTM E 283 for infiltration as follows:
1. Fixed Framing and Glass Area:
 - a. Maximum air leakage of 0.04 cfm/sq. ft. at a static-air-pressure differential of 6.24 lbf/sq. ft.
 2. Entrance Doors:
 - a. Pair of Doors: Maximum air leakage of 1.0 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft.
 - b. Single Doors: Maximum air leakage of 0.5 cfm/sq. ft. at a static-air-pressure differential of 6.24 lbf/sq. ft.
- G. Water Penetration under Static Pressure: Test according to ASTM E 331 as follows:
1. No evidence of water penetration through fixed glazing and framing areas when tested according to a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 10.0 lbf/sq. ft. for entrance/storefront framing.
 2. Maximum Water Leakage: No uncontrolled water penetrating assemblies or water appearing on assemblies' normally exposed interior surfaces from sources other than condensation. Water leakage does not include water controlled by flashing and gutters, or water that is drained to exterior.
- H. Heavy Duty Aluminum Storefront Doors and Frames:
1. Swing Door Cycle Test: Test doors and frames according to ANSI A250.4 as follows:
 - a. Minimum 16,000,000 cycles.
 2. Cycle Slam Test Method: Test according to NWWDA T.M. 7-90 as follows:
 - a. Minimum 1,000,000 cycles.
- I. Interstory Drift: Accommodate design displacement of adjacent stories indicated.
1. Design Displacement: As indicated on Drawings.
 2. Test Performance: Complying with criteria for passing based on building occupancy type when tested according to AAMA 501.4 at design displacement and 1.5 times the design displacement.
- J. Seismic Performance: Aluminum-framed entrances and storefronts shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
1. Seismic Drift Causing Glass Fallout: Complying with criteria for passing based on building occupancy type when tested according to AAMA 501.6 at design displacement and 1.5 times the design displacement.
 2. Vertical Interstory Movement: Complying with criteria for passing based on building occupancy type when tested according to AAMA 501.7 at design displacement and 1.5 times the design displacement.
- K. Energy Performance: Certify and label energy performance according to NFRC as follows:
1. Thermal Transmittance (U-factor): Fixed glazing and framing areas shall have U-factor of not more than 0.40 Btu/sq. ft. x h x deg F as determined according to NFRC 100.
 2. Solar Heat Gain Coefficient: Fixed glazing and framing areas shall have a solar heat gain coefficient of no greater than 0.40 as determined according to NFRC 200.
 3. Condensation Resistance: Fixed glazing and framing areas shall have an NFRC-certified condensation resistance rating of no less than 45 as determined according to NFRC 500.
- L. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:
1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
 2. Thermal Cycling: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5.
 - a. High Exterior Ambient-Air Temperature: That which produces an exterior metal-surface temperature of 180 deg F.
 - b. Low Exterior Ambient-Air Temperature: 0 deg F.
 - c. Interior Ambient-Air Temperature: 75 deg F.
- M. Structural-Sealant Joints:
1. Designed to carry gravity loads of glazing.
 2. Designed to produce tensile or shear stress of less than 20 psi.
- N. Structural Sealant: Capable of withstanding tensile and shear stresses imposed by structural-sealant-glazed storefront system without failing adhesively or cohesively. When tested for preconstruction adhesion and compatibility, cohesive failure of sealant shall occur before adhesive failure.

1. Adhesive failure occurs when sealant pulls away from substrate cleanly, leaving no sealant material behind.
2. Cohesive failure occurs when sealant breaks or tears within itself but does not separate from each substrate because sealant-to-substrate bond strength exceeds sealant's internal strength.

2.2 MANUFACTURERS AND PRODUCTS

- A. Basis-of-Design Criteria: Drawings indicate sizes, profiles, and dimensional requirements for storefront, entrance and window framing systems required, that are based on specific types, models and performance criteria indicated. Systems from other manufacturers may be considered, provided deviations in dimensions, profiles and performance are minor and do not change the design concept as judged by the Architect. Burden of proof is on the proposer.
- B. Basis-of-Design Products for Storefront Framing Systems: Subject to compliance with requirements, provide or one of the systems listed below or comparable product submitted to and accepted by Architect prior to bidding.
 1. Thermally Broken Storefront and Entrance Framing (084113.A01 – Center Plane Glazed):
 - a. Basis of Design: Kawneer North America; Trifab VG 451T.
 - b. EFCO Corporation; S 403.
 - c. Manko Windows and Doors; 2450 Series.
 - d. Tubelite; 14000.
 2. Thermally Broken Storefront and Entrance Framing (084113.A02 – Center Plane Glazed):
 - a. Basis-of-Design: Kawneer North America; Trifab 601T.
 - b. EFCO Corporation; Series 406.
 - c. Manko; Series 2650.
 - d. Tubelite; T24650 Series.
 3. Non-thermal Storefront and Entrance Framing (084113.A06 - Center Plane Glazed):
 - a. Basis-of-Design: Kawneer North America; Trifab VG 451.
 - b. EFCO Corporation; Series 402 NT.
 - c. Manko Windows and Doors; 450 Series.
 - d. Tubelite; 14000 Series (non-thermal).
 4. Interior standard-duty manual-swing doors (084113.A11 - E9):
 - a. Basis-of-Design: Kawneer North America; Series 500 Wide Stile.
 - 1) EFCO Corporation; D-500.
 - 2) Manko Windows and Doors; 150 Series.
 - 3) Tubelite; Comparable product.
 5. Heavy-Duty (Stile and Rail Construction) Manual-Swing Doors and Associated Frames (084113.A12 - E10):
 - a. Basis-of-Design: Special-Lite, Inc. No substitutions allowed.
 - 1) Exterior heavy-duty manual-swing entrance doors: Model "SL-15" (wide stile).
 - 2) Interior heavy-duty manual-swing vestibule doors: Model "SL-15" (wide stile).
- C. Source Limitations: Obtain all components of aluminum-framed entrance and storefront system, including framing and accessories, from single manufacturer.

2.3 FRAMING

- A. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
 1. Construction:
 - a. Thermally broken.
 - b. Non-Thermal.
 2. Glazing System:
 - a. Retained mechanically with gaskets on four sides.
 3. Glazing Plane:
 - a. Exterior Locations:
 - 1) Center plane glazed.
 - b. Interior Locations:
 - 1) Center plane glazed.
 4. Finish: Refer to Exterior Finish Legend on Drawings for locations.
 - a. Clear anodized finish.
 5. Fabrication Method: Field-fabricated stick system.

- B. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.
- C. Pressure Caps: Manufacturer's standard snap-on aluminum caps that mechanically retain glazing.
 - 1. Provide extended caps where indicated.
 - 2. At 90 degree outside corners, provide pre-manufactured mullion cap/trim as single unit to cover both sides where shown.
- D. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.
- E. Materials:
 - 1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 - a. Sheet and Plate: ASTM B 209.
 - b. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
 - c. Extruded Structural Pipe and Tubes: ASTM B 429/B 429M.
 - d. Structural Profiles: ASTM B 308/B 308M.
 - 2. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM, and prepare surfaces according to applicable SSPC standard.
 - a. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
 - b. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
 - c. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.4 ENTRANCE DOOR SYSTEMS

- A. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing operation.
 - 1. General:
 - a. Thermal Construction: Manufacturer's standard elastomeric type.
 - b. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets.
 - 1) Provide nonremovable glazing stops on outside of door.
 - 2. Standard Duty – Manual Swing Doors (084113.A11): 1-3/4 inch overall thickness, with minimum 0.125-inch-thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
 - a. Doors shall have 4-1/2- to 5-inch wide stiles, 6-1/2 inch top rail, 8 inch intermediate rail and 10 inch bottom rail.
 - 3. Heavy Duty - Stile and Rail Door Construction (084113.A12): 1-3/4-inch overall thickness, with minimum 0.125-inch-thick, extruded-aluminum tubular rail and stile members. Corners shall be mortised and tenon construction, reinforced with 3/8-inch diameter galvanized steel concealed tie rods. Glass stops shall be integral with stile and rail extrusions on one side.
 - a. Exterior heavy-duty manual-swing entrance doors: Doors shall have 4-3/4-inch-wide stiles, 6-1/2-inch top rail, 12-inch intermediate rail and 10 inch bottom rail.
 - b. Interior heavy-duty manual-swing vestibule doors: Doors shall have 4-3/4-inch-wide stiles, 6-1/2-inch top rail, 12-inch intermediate rail and 10 inch bottom rail.
- B. Entrance Door Framing and Subframing:
 - 1. Door Framing (Heavy Duty Doors):
 - a. For 4-1/2 inch framing – Basis of Design: Special-Lite, Inc.; "SL-245FG", compatible with storefront framing system.
 - b. At the request of the Owner, substitutions for this product are not allowed.
 - 2. Door Subframing: Manufacturer's standard, not greater than 1-inch face dimension for use at entrances within curtain wall. Finish to match adjacent curtain wall framing.

2.5 ENTRANCE DOOR HARDWARE

- A. Entrance Door Hardware: Hardware not specified in this Section is specified in Section 087100 "Door Hardware."
 - 1. Hardware for heavy-duty aluminum doors shall be installed at the door manufacturer's factory and be included in the warranty.

- B. General: Provide entrance door hardware and entrance door hardware sets indicated in door and frame schedule, Section 087100 "Door Hardware", and as specified hereinafter.
 - 1. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.
 - 2. Opening Force Requirements:
 - a. Egress Doors: Not more than 15 lbf to release the latch and not more than 30 lbf to set the door in motion and not more than 15 lbf to open the door to its minimum required width.
 - b. Accessible Interior Doors: Not more than 5 lbf to fully open door.
- C. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of entrance door hardware are indicated in "Entrance Door Hardware Sets" Article. Products are identified by using entrance door hardware designations as follows:
 - 1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in "Entrance Door Hardware Sets" Article.
 - 2. References to BHMA Standards: Provide products complying with these standards and requirements for description, quality, and function.
- D. Strikes: Provide strike with black-plastic dust box for each latch or lock bolt; fabricated for aluminum framing.
- E. Weather Stripping: Manufacturer's standard replaceable components. "Fin" type stops and vinyl weatherstripping are not acceptable.
 - 1. Compression Type: Made of ASTM D 2000, molded neoprene, or ASTM D 2287, molded PVC.
 - 2. Sliding Type: AAMA 701/702, made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.
- F. Weather Sweeps: Manufacturer's standard exterior-door bottom sweep with concealed fasteners on mounting strip.
- G. Silencers: BHMA A156.16, Grade 1.
- H. Thresholds: BHMA A156.21, raised thresholds beveled with a slope of not more than 1:2, with maximum height of 1/2 inch.
- I. Finger Guards: Manufacturer's standard collapsible neoprene or PVC gasket anchored to frame hinge-jamb at center-pivoted doors.

2.6 GLAZING

- A. Glazing: Comply with Section 088000 "Glazing."
- B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.
- C. Glazing Sealants: As recommended by manufacturer.
 - 1. Sealant shall have a VOC content of 250 g/L or less.
 - 2. Sealant shall comply with the testing and product 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."
- D. Structural Glazing Sealants: ASTM C 1184, chemically curing silicone formulation that is compatible with system components with which it comes in contact, specifically formulated and tested for use as structural sealant and approved by structural-sealant manufacturer for use in storefront system indicated.
 - 1. Color: As selected by Architect from manufacturer's full range of colors.
- E. Weatherseal Sealants: ASTM C 920 for Type S; Grade NS; Class 25; Uses NT, G, A, and O; chemically curing silicone formulation that is compatible with other system components with which it comes in contact; recommended by weatherseal-sealant and glazed storefront manufacturers for this use.
 - 1. Color: As selected by Architect from manufacturer's full range of colors.
 - 2. Color: Match structural sealant.
- F. Security Glazing: Refer to Section 088000 "Glazing" for minimum edge engagement.

2.7 ACCESSORIES

- A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
 - 1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
 - 2. Reinforce members as required to receive fastener threads.
 - 3. Exposed Fasteners: Do not use exposed fasteners except for application of hardware. For application of exposed hardware, use exposed fasteners with countersunk Phillips screw heads or flat-head machine screws, fabricated from 300 series stainless steel.
- B. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.
 - 1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.
- C. Aluminum Subsills (084113.A21): Provide high performance subsill that incorporates a watertight interior back leg with end dams and integral water collection trough that weeps to exterior. Subsill shall be of profile and dimensions required for installation indicated. Finish subsill to match adjacent aluminum framing. Seal all penetrations through subsills to be watertight.
 - 1. Provide high performance subsills at all storefront, entrance and window framing, unless specifically indicated otherwise.
- D. Aluminum Closure Flashing (084113. A22): Provide prefinished aluminum, not less than 0.090 inch thick, of alloy and type selected by manufacturer for compatibility with other components. Fabricate closure flashing to configurations indicated. Finish to match adjacent storefront, entrance and window framing. Seal closure flashing to be watertight.
- E. Aluminum Pan Flashing (084113.A23): Provide prefinished aluminum, not less than 0.090 inch thick, of alloy and type selected by manufacturer for compatibility with other components. Fabricate pan flashing to configurations indicated to direct water to exterior away from storefront and window framing. Finish to match adjacent storefront and window framing.
- F. Aluminum Jamb Extensions: prefinished aluminum of finish, size, profile and material to match framing system. Anchor to framing member. Extension depth as indicated on drawings.
 - 1. Size: As indicated on Drawings.
- G. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.
- H. Jamb Closure Membrane (084113.A25):
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide one of the following products:
 - a. "CCW-705-TWF"; as manufactured by Carlisle Coatings and Waterproofing.
 - b. "Perm-A-Barrier Wall Flashing"; as manufactured by Grace Construction Products.
 - c. "Air-Shield"; as manufactured by W. R. Meadows, Inc.
 - d. "Blueskin"; as manufactured by Henry Corp.
 - 2. Product Characteristics:
 - a. Self-adhering, membrane, 40 mils thick.
 - b. Flashing shall function as an air, vapor and water barrier.
 - c. Flashing shall be compatible with air barrier coating specified in Section 072729.
- I. Aluminum Receptor (084113.A26): Provide manufacturer's high performance head compensating receptor as required. Provide prefinished aluminum, of alloy and type selected by manufacturer for compatibility with other components. Finish to match adjacent storefront, entrance and window framing. Seal all penetrations through head to be watertight.
 - 1. Provide high performance head compensating receptor as indicated on the drawings.
- J. Aluminum Snap Trim (Mullion Extensions)(084113.A33): Provide prefinished aluminum trim, in manufacturer's standard thickness, of alloy and type selected by manufacturer for compatibility with other components. Snap trim shall be two-piece trim, including continuous trim clip and continuous trim cover. Finish for trim clip shall be mill finish. Finish for trim cover to match adjacent storefront and window framing.

1. Size: 1 by 1-1/4 inches.
 2. Size: As indicated on Drawings.
- K. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil thickness per coat.

2.8 FABRICATION

- A. Form or extrude aluminum shapes before finishing.
- B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- C. Fabricate components that, when assembled, have the following characteristics:
1. Profiles that are sharp, straight, and free of defects or deformations.
 2. Accurately fitted joints with ends coped or mitered.
 3. Physical and thermal isolation of glazing from framing members.
 4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
 5. Provisions for field replacement of glazing from interior.
 6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
- D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.
- E. Structural-Sealant-Glazed Framing Members: Include accommodations for using temporary support device to retain glazing in place while structural sealant cures.
- F. Storefront Framing: Fabricate components for assembly using shear-block system, or screw-spline system, or head-and-sill-receptor system with shear blocks at intermediate horizontal members.
- G. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.
1. At exterior door frames, provide compression weather stripping at fixed stops.
 2. At interior door frames, provide silencers at stops to prevent metal-to-metal contact. Install three silencers on strike jamb of single-door frames and two silencers on head of frames for pairs of doors.
 3. Fin-type door stops are not acceptable.
- H. Entrance Doors: Reinforce doors as required for installing entrance door hardware.
1. Heavy Duty – Stile and Rail Construction (084113.A12): Aluminum standard doors shall be fabricated as previously specified.
 2. Reinforce doors as required for installing entrance door hardware.
 3. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
 4. At exterior doors, provide weather sweeps applied to door bottoms.
- I. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.
- J. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.9 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

2.10 SOURCE QUALITY CONTROL

- A. Structural Sealant: Perform quality-control procedures complying with ASTM C 1401 recommendations including, but not limited to, assembly material qualification procedures, sealant testing, and assembly fabrication reviews and checks.

PART 3 EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

- A. Prepare surfaces that are in contact with sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.

3.3 INSTALLATION

- A. General:
 - 1. Comply with manufacturer's written instructions.
 - 2. Do not install damaged components.
 - 3. Fit joints to produce hairline joints free of burrs and distortion.
 - 4. Rigidly secure non-movement joints.
 - 5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
 - 6. Seal perimeter and other joints watertight unless otherwise indicated.
 - 7. Completely fill gaps between shims and adjacent construction with loose fiberglass insulation or spray foam insulation.
- B. Metal Protection:
 - 1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
 - 2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
- C. Set continuous sill members and flashing in full sealant bed as specified in Section 079200 "Joint Sealants" to produce weathertight installation.
- D. Install components plumb and true in alignment with established lines and grades.
 - 1. Install two-piece snap trim with long leg oriented horizontally and short leg fastened to aluminum framing, so that trim cover is exposed, and trim clip is concealed. Secure trim to aluminum framing and adjacent construction in accordance with trim manufacturer's written instructions.
- E. Prior to installation of perimeter vertical members, install jamb closure membrane at cavity walls to cover gap/joint between interior and exterior substrates. Intent is to seal air cavity and joints between substrates. Extend membrane from interior face of framing/blocking to exterior. Trim membrane so that it will not be exposed to view after vertical members are set, and edge of membrane is terminated in sealant installed around perimeter of aluminum framing.
 - 1. Seal tops of end dams at jambs to adjacent construction or extend jamb closure membrane over end dam to direct water into subsill in order to drain to exterior.
- F. Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.
- G. Install glazing as specified in Section 088000 "Glazing."
- H. Install weatherseal sealant according to Section 079200 "Joint Sealants" and according to sealant manufacturer's written instructions to produce weatherproof joints. Install joint filler behind sealant as recommended by sealant manufacturer.

- I. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.
 - 1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
 - 2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

3.4 ERECTION TOLERANCES

- A. Erection Tolerances: Install aluminum-framed entrances and storefronts to comply with the following maximum tolerances:
 - 1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.
 - 2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
 - 3. Alignment:
 - a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
 - b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
 - c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.
 - 4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Field Quality-Control Testing: Perform the following test on representative areas of aluminum-framed entrances and storefronts.
 - 1. Water-Spray Test: Before installation of interior finishes has begun, areas designated by Architect shall be tested according to AAMA 501.2 and shall not evidence water penetration.
 - a. Perform tests in each test area as directed by Architect.
 - 1) For punched openings, test 25 percent of installation, in each type of exterior finish substrate, unless noted otherwise.
 - 2) For storefront, and clerestories; test each installation, unless noted otherwise.
- C. Structural-Sealant Adhesion: Test structural sealant according to recommendations in ASTM C 1401, Destructive Test Method A, "Hand Pull Tab (Destructive)," Appendix X2.
 - 1. Test a minimum of four areas on each building facade.
 - 2. Repair installation areas damaged by testing.
- D. Aluminum-framed entrances and storefronts will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports.

END OF SECTION 084113

SECTION 087100 – DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

- A. Intent: The intent of this Section is to provide finish hardware for the proper operation and control of all wood, hollow metal and aluminum doors in the Project. Prior to bidding, notify the Architect of any doors that do not have hardware meeting this intention.
- B. This Section includes items known commercially as finish or door hardware that are required for swinging doors, except special types of unique hardware specified in the same sections as the doors and door frames on which they are installed. This Section includes, but is not necessarily limited to furnishing and installing complete, the following:
 - 1. Finish hardware for proper operation and control of all wood, aluminum and hollow metal doors, including hinges, locks and latch sets, closers, panic devices, auto-flushbolts, electric strikes, magnetic holders, removable mullions, cylinders, keys, miscellaneous stops, flat goods, weatherstripping and thresholds as required.
 - 2. Cylinder for access doors where specified.
- C. Related work in other sections:
 - 1. Hollow metal doors, frames and silencers: Section 081113.
 - 2. Wood doors: Section 081416.
 - 3. Aluminum doors: Section 084113.

1.2 DEFINITIONS

- A. "Finish Hardware" includes items known commercially as finish hardware which are required for swing, and folding doors, except special types of unique and non-matching hardware specified in the same section as the door and door frame.

1.3 ACTION SUBMITTALS

- A. Product Data: Submit manufacturers technical product data for each hardware item. Include information necessary to show compliance with requirements and include instructions for installation and for maintenance of operating parts and finishes.
 - 1. Manufacturer shall submit written certification confirming closers compliance with U.L. 10C.
- B. Hardware Schedule: Submit a hardware schedule in a vertical format (horizontal format not acceptable), organized into sets, including the information below. Designations for door numbers and hardware sets in the schedule shall match those used in the Construction Documents for each opening.
 - 1. Hardware Schedule shall be coordinated with doors, frames, and related work to ensure proper size, thickness, hand function, and finish of door hardware.
 - 2. Catalog cuts of each type of exposed hardware unit, highlighted in color to indicate compliance with the Hardware Schedule.
 - 3. Type, style, function, size and finish of each hardware item.
 - 4. Name and manufacturer of each item.
 - 5. Fastenings and other pertinent information.
 - 6. Explanation of all abbreviations, symbols, codes, etc., contained in schedule.
 - 7. Mounting locations for hardware.
 - 8. Door and frame sizes and materials.
 - 9. Deviations from Specifications shall be noted in cover letter.
- C. Submittal Sequence: Submit schedule at earliest possible date particularly where acceptance of hardware schedule must precede fabrication of other work (e.g., hollow metal frames) which is critical in the project construction schedule. Include with schedule the product data, samples, shop drawings of other work affected by finish hardware, and other information essential to the coordinated review of hardware schedule.
- D. Keying Schedule: Submit separate detailed schedule, at the same time as the Hardware Schedule, indicating keying for all locks and how Owner's instructions, on keying of locks has been fulfilled. Keying schedule must be approved before ordering any locks.

- E. Pinning Transcript: Submit detailed schedule indicating each lock cylinder and core.
- F. Templates: Furnish hardware templates to each fabricator of doors, frames and other work to be factory-prepared for the installation of hardware. Upon request, check shop drawings of such other work, to confirm that adequate provisions are made for proper location and installation of hardware.

1.4 QUALITY ASSURANCE

- A. Manufacturer: Obtain each type of hardware (latch and lock sets, hinges, closers, etc.) from a single manufacturer, although several may be indicated as offering products complying with requirements.
- B. Product/Material Qualifications: Manufacturer's product numbers are indicated for convenience in identifying finish hardware items. Unless otherwise indicated, manufacturer's description for indicated product number constitutes minimum standards of quality, design, function and performance required for each item to be incorporated into the Project.
 - 1. It will be the responsibility of the Bidder to furnish with his Bid a list clarifying any deviations from these specifications written or implied, in order that a fair and proper evaluation be made. Those Bidders not submitting a list of deviations will be presumed to have Bid as specified.
- C. Supplier Qualifications: A recognized Architectural Finish Hardware Supplier, with warehousing facilities, who has been furnishing hardware in the project's vicinity for a period of not less than 2 years. Supplier shall be or employ an experienced Architectural Hardware Consultant (AHC) who is certified by and member of the Door and Hardware Institute. The Architectural Hardware Consultant shall be available, at reasonable times during the course of the work, for consultation about project's hardware requirements, to Owner, Architect and Contractor.
 - 1. Supplier shall meet with the Owner to finalize keying requirements and obtain final instructions in writing.
- D. Fire-Rated Openings: Provide hardware for fire-rated openings in compliance with NFPA Pamphlets No. 80, No. 101 and of authorities having jurisdiction requirements. Provide only hardware which has been tested and listed by UL, FM or Warnock Hersey for types and sizes of doors required and complies with requirements of door and door frame labels.
 - 1. Where emergency exit devices are required on fire-rated doors, (with supplementary marking on doors' UL or FM labels indicating "Fire Door to be Equipped with Fire Exit Hardware") provide UL or FM label on exit devices indicating "Fire Exit Hardware".
- E. Standards: Comply with the requirements of the latest edition of the following standards, unless indicated otherwise:
 - 1. American National Standards Institute (ANSI) Publications:
 - 1. A115 Series - Door and Frame Preparation.
 - 2. A156 Series - Hardware.
 - 2. Builders Hardware Manufacturers Association (BHMA) Publications:
 - 1. 1201 - Auxiliary Hardware.
 - 2. 1301 - Materials and Finishes.
 - 3. Door and Hardware Institute (DHI) Publications:
 - 1. Keying - Procedures, Systems, and Nomenclature.
 - 2. Abbreviations and Symbols.
 - 3. Hardware for Labeled Fire Doors.
 - 4. Recommended Locations for Builder's Hardware for Standard and Custom Steel Doors and Frames.
 - 5. Wood Door Standards W1, W2, WDHS-2, WDHS-3.
 - 4. National Fire Protection Association (NFPA) Publications:
 - 1. NFPA Pamphlet No. 80 - Standards for Fire Doors and Windows.
 - 5. International Building Code - current edition adopted.
 - 6. Americans with Disabilities Act (ADA).
- F. Keying Conference: Conduct conference in accordance with Section 013100. In addition to Owner, Construction Manager, and Architect, conference participants shall also include Installer's Architectural Hardware Consultant. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including, but not limited to, the following:
 - 1. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
 - 2. Preliminary key system schematic diagram.
 - 3. Requirements for key control system.

4. Address for delivery of keys.

G. Preinstallation Conference: Conduct conference at Project site to comply with requirements of Section 013100 as follows:

1. Architectural Finish Hardware supplier (AFHS) shall conduct the preinstallation conference at the site. The AFHS shall instruct finish hardware installer on proper installation, adjustment and troubleshooting for each operable item of finish hardware specified. The AFHS shall observe the installation and adjustment of the first three locksets, closers and exit devices.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Package each hardware item in separate containers with all screws, wrenches, installation instructions and installation templates. Mark or tag each box with hardware heading and door number according to approved hardware schedule.
- B. Packaging of door hardware is responsibility of supplier. As material is received by hardware supplier from various manufacturers, sort and repackage in containers clearly marked with appropriate hardware set number to match set numbers of approved hardware schedule. Two or more identical sets may be packed in same container.
- C. Deliver individually packaged hardware items at the proper times to the proper locations (shop or project site) for installation. Provide a complete packing list showing items, door numbers and hardware headings with each shipment.
- D. Store hardware in shipping cartons above ground and under cover to prevent damage.
 1. Provide secure lockup for door hardware delivered to the Project, but not yet installed. Control handling and installation of hardware items that are not immediately replaceable so that completion of the Work will not be delayed by hardware losses both before and after installation.
- E. Aluminum Door Hardware: If required by door manufacturer deliver hardware for aluminum doors as directed by the door supplier for factory installation.

1.6 COORDINATION

- A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing door hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- B. Electrical System Roughing-in: Coordinate layout and installation of electrified door hardware with connections to power supplies, fire alarm system and detection devices, access control system, security system, and building control system, as applicable.

1.7 MAINTENANCE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 HARDWARE - GENERAL

- A. Provide the materials or products indicated by trade names, manufacturer's name, or catalog number.
- B. Provide manufacturer's standard products meeting the design intent of this Specifications, free of imperfections affecting appearance or serviceability.
 1. Base Metals: Produce hardware units of basic metal and forming method indicated using manufacturer's standard metal alloy, composition, temper, and hardness, but in no case of lesser (commercially recognized) quality than specified for applicable hardware units for finish designations indicated.

2. Provide hardware complete with all fasteners, anchors, instructions, layout templates, and any specialized tools as required for satisfactory installation and adjustment.
 3. Hand of door: Drawings show direction of slide, swing or hand of each door leaf. Furnish each item of hardware for proper installation and operation of door movement as shown.
 4. Furnish screws for installation, with each hardware item. Provide Phillips flat-head screws except as otherwise indicated or approved. Finish screws exposed under any condition to match hardware finish or, if exposed in surfaces of other work, to match finish of such other work as closely as
 5. Finish all other hardware in accordance with the BHMA finish as follows, unless otherwise indicated in manufacturers screws to secure hardware.
 6. Provide concealed fasteners for hardware units which are exposed when door is closed, except to extent no standard units of type specified are available with concealed fasteners. Do not use thru-bolts for installation where bolt head or nut on opposite face is exposed in other work, except where indicated otherwise or where it is not feasible to adequately reinforce the work. In such cases, provide sleeves for each thru-bolt or use sex bolt fasteners.
 7. Provide factory pinned cylinders and cores.
- C. Hardware is specified in the hardware schedule by set, type, and functions which have been selected as best meeting the application requirements. Acceptable products for each category are specified under PART 2 of this Specification.

2.2 SPECIAL REQUIREMENTS

- A. Hinges:
1. Provide non-removable pins for all exterior doors and out-swinging corridor doors. Use nonrising pins for all other doors.
 2. Pre-drill pilot holes for hinge fasteners at factory to suit hinge type.
 3. Provide continuous hinges where specified.
- B. Locksets:
1. Locksets shall meet or exceed ANSI A156.13-94, Grade 1 requirements.
- C. Panic Devices:
1. All panic devices shall have touchbars made of stainless steel, provide devices in stainless finish where specified.
 2. All latchbolts are to be deadlatching.
 3. Panic devices shall be through-bolted, using sex bolt fasteners.
 4. Exit devices are to incorporate a flush and tapered end cap.
 5. Hardware mullions are to be of the same manufacturer as the panic device. Provide keyed mullions unless otherwise specified. Provide mullion storage kits where specified.
 6. Except on fire-rated doors, or unless specified otherwise, provide panic devices with hex key dogging device to hold latch bolt open on doors with closers.
 7. Devices incorporating plastic dogging components will not be allowed.
 8. Provide electrical options as specified.
- D. Closers:
1. Comply with manufacturer's recommendations for unit size based on door size, weather exposure and usage.
 2. Through-bolt all closer units, using sex bolt fasteners.
 3. Provide parallel arms for all overhead closers, except as otherwise indicated.
 4. All surface closers shall exceed ANSI A156.4 Grade 1 requirements in all aspects as called for below. All closers shall have certification by an independent testing laboratory of 10,000,000 cycles without failure. Provide special rust inhibitive primer (SRI) where specified.
 5. Furnish all brackets, drop plates and any other necessary hardware required to insure proper installation.
- E. Stops
1. Provide heavy duty and concealed or surface mounted overhead stop or holder for interior doors as specified. Provide overhead stop for interior doors that swing more than opens against equipment, casework, sidelights, and where conditions do not allow wall stop.
- F. Thresholds and Gasketing
1. Provide thresholds, weatherstripping (including door sweeps, seals, astragals) and gasketing systems (including smoke, sound, and light) as specified and per architectural details. Match finish of other items.

2. Provide door sweeps, seals, astragals, and auto door bottoms only of type where resilient or flexible seal strip is easily replaceable and readily available.
3. Gasketing and astragals on aluminum frames by door manufacturer.

G. Silencers

1. Provide "push-in" type silencers for hollow metal or wood frames.
2. Provide one silencer per 30 inches of height on each single frame, and two for each pair frame.
3. Omit where gasketing is specified.

2.3 KEYING

- A. Standard Lock Cylinders: BHMA A156.5; Grade 1 cylinders; face finished to match lockset.
- B. Key all locks separately, or alike, as directed by the Owner's representative and Architect. Provide keys as follows:
 1. Change Keys: Two (2) per lock.
 2. Master Keys: Six (6) required (per system).
- C. Existing Key System: Key cylinders to Owners existing master key system.
- D. All exterior doors to be keyed to Schlage Primus, interior doors to match existing keyway.
- E. Provide Schlage cylinders with large format interchangeable construction cores on all exterior openings.

2.4 KEY CONTROL SYSTEM

- A. Fire Department Access Boxes:
 1. Provide key lock boxes designed for storage of 2-5 keys. Manufactured by Knox Company or equal.
 2. Provide one lock box at exterior and provide one near elevators, if applicable.
 3. Locate in accordance with architectural detail. Where not specifically indicated, locate as directed by Architect.
 4. Provide surface mounted or recessed based on direction from Architect.

2.5 HARDWARE FINISHES

- A. Provide matching finishes for hardware units at each door to the greatest extent possible, unless otherwise indicated. In general, match items to the finish for the latch, lock or push-pull unit for color and texture.
 1. Product description or schedule:
 - 1) 626 satin chrome-plated.
 - 2) 630 satin stainless steel.

2.6 HARDWARE PRODUCTS

- A. Hinges:
 1. Specified manufacturer: IVES Hardware; an Allegion Company.
 2. Acceptable substitutions:
 1. Hager Companies.
 2. McKinney Products Company; an ASSA ABLOY Group company.
 3. Stanley Commercial Hardware; Div. of The Stanley Works.
- B. Continuous Gear-Type Hinges:
 1. Specified manufacturer: IVES Hardware; an Allegion Company.
 2. Acceptable substitutions:
 1. Hager Companies.
 2. McKinney Products Company; an ASSA ABLOY Group company.
 3. Select Products Limited.
- C. Locksets:
 1. Specified manufacturer: Schlage Commercial Lock Division; an Allegion Company.
 2. Substitutions: Not allowed. Products to match District standard.
- D. Exit Devices:
 1. Specified manufacturer: Von Duprin; an Allegion Company

2. Substitutions: Not allowed. Products to match District standard.
- E. Closers:
 1. Specified manufacturer: LCN Closers; an Allegion Company.
 2. Substitutions: Not allowed. Products to match District standard.
- F. Flatgoods:
 1. Specified manufacturer: Ives Hardware; an Allegion Company.
 2. Acceptable substitutions:
 1. Burns.
 2. Rockwood.
- G. Stops:
 1. Specified manufacturer: Ives Hardware; an Allegion Company.
 2. Acceptable substitutions:
 1. Burns Manufacturing Incorporated.
 2. Hager Companies.
 3. Rockwood Manufacturing Company.
 4. Trimco
- H. Overhead stops:
 1. Specified manufacturer: Glynn-Johnson; an Allegion Company.
 2. Acceptable substitutions:
 1. Architectural Builders Hardware Mfg., Inc.
 2. Door Controls International.
 3. Ives Hardware; an Allegion Company.
 4. Rixson Specialty Door Controls; an ASSA ABLOY Group.
- I. Thresholds:
 1. Specified manufacturer: Zero International
 2. Acceptable substitutions:
 1. Pemko Manufacturing Co.
 2. Reese Enterprises.
 3. National Guard Products.
- J. Door Gasketing:
 1. Specified manufacturer: Zero International
 2. Acceptable substitutions:
 1. Pemko Manufacturing Co.
 2. Reese Enterprises.
 3. National Guard Products.
- K. Weatherstripping:
 1. Specified manufacturer: Zero International
 2. Acceptable substitutions:
 1. Pemko Manufacturing Co.
 2. Reese Enterprises.
 3. National Guard Products.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Carefully inspect doors, frames, and conditions under which hardware will be installed. Notify the Architect of any conditions that would adversely affect the installation or subsequent door operations. Do not proceed until unsatisfactory conditions are corrected.
 1. Frames shall be verified, inspected, and confirmed by General Contractor as being plumb and true.
- B. Refer to Sections 081113, 081416, and 084113 for additional installation requirements.
- C. Prior to hardware installation, the Hardware Supplier shall meet with the Owner's Representative, Architect, and Hardware Installer to ensure the Installer has and understands the manufacturers' installation requirements for all hardware items.
 1. The Supplier shall observe the installation of the first lockset, closer and panic device.

3.2 INSTALLATION

- A. Mount Hardware units at heights indicated in respective DHI Standards, except as specifically indicated or required to comply with governing regulations, and except as may be otherwise directed by Architect.
- B. Install each hardware item in compliance with the manufacturer's instructions and written recommendations. Wherever cutting and fitting is required to install hardware onto or into surfaces which are later to be field finished, coordinate removal, storage and reinstallation or application of surface protections with finishing work. Do not install surface-mounted items until finishes have been completed on the substrate.
- C. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
 - 1. Special care shall be taken to avoid damaging surrounding surfaces.
- D. Provide fasteners and anchoring devices of suitable size, quantity, and type to secure hardware in proper position for heavy use and long life.
 - 1. Drill and countersink units which are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.
- E. Adjust door closers immediately upon installation. Adjust in exact conformance with manufacturer's printed instructions. Advance backcheck to eliminate shock at dead stop. Set latching speed to assure unassisted positive latching.
 - 1. Degrees of swing of doors for self-limiting closers shall be maximum available.
- F. Install each protection plate with a thinly-spread spot of mastic at its center to assure even contact before fastening with screws. Install all such plates on visual centers of closed doors. Set bottom edges of all such plates flush with door bottom.
- G. Cut and fit thresholds to door frame profiles. Prepare thresholds for the attachment of strikes and clearance for spindles as required. Set thresholds in a continuously laid bed of polyisobutylene mastic sealant to completely fill voids and exclude moisture from every source.
- H. Seal weather protection components attached to the exterior sides of doors and frames, such as drip caps and weatherstripping, in place with clear silicone caulk in such a manner as to ensure a continuously filled seam throughout the joinery.
- I. Cut and fit weatherstripping accurately to provide the greatest possible continuity of the contact element. Adjust closer templating as required.
- J. At exterior doors, obtain satisfactory operation of the installation, then apply a thin layer of clear silicone caulk under hinge leaves, and outside lock trim. Remove excess caulk after torquing fasteners.

3.3 ADJUST AND CLEAN

- A. Adjust and check each operating item of hardware and each door, to ensure proper operation or function of every unit. Replace units which cannot be adjusted to operate freely and smoothly as intended for the application made.
 - 1. Clean adjacent surfaces soiled by hardware installation.
- B. Final Adjustment: Wherever hardware installation is made more than one month prior to acceptance or occupancy of a space or area, return to the work during the week prior to acceptance or occupancy, and make final check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.

3.4 INSTRUCTION AND INSPECTION

- A. Instruct Owner's Personnel in proper adjustment and maintenance of hardware and hardware finishes, during the final adjustment of hardware.
- B. After hardware is installed and adjusted, the Supplier shall inspect the job with the Architect and the Contractor to determine if the hardware is functioning properly.
 - 1. Maintain the instruction sheets, layout templates, and any supplementary literature regarding hardware in a readable condition. Transmit all such items to the Owner's Representative, together with all spare parts, specialized tools, other accessories supplied with the hardware, and a copy of the approved hardware schedule at the time of instruction.

- C. Continued Maintenance Service: Approximately six months after the acceptance of hardware in each area, the Installer, accompanied by the representative of the latch and lock manufacturer, shall return to the project and re-adjust every item of hardware to restore proper function of doors and hardware. Consult with and instruct Owner's personnel in recommended additions to the maintenance procedures. Replace hardware items which have deteriorated or failed due to faulty design, materials or installation of hardware units at no cost to the Owner. Prepare a written report of current and predictable problems (of substantial nature) in the performance of the hardware.

HARDWARE SET: 01

DOOR NUMBER:

E-A101A E-A102C

EACH TO HAVE:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|-----|----|---------------------|--------------------------|--------|-----|
| 2 | EA | CONT. HINGE | 112XY EPT | 628 | IVE |
| 2 | EA | POWER TRANSFER | EPT10 | 689 | VON |
| 1 | EA | REMOVABLE MULLION | KR4954 STAB | 689 | VON |
| 1 | EA | ELEC PANIC HARDWARE | HD-QEL-99-L-DT-06 24 VDC | 626 | VON |
| 1 | EA | ELEC PANIC HARDWARE | HD-QEL-99-L-NL-06 24 VDC | 626 | VON |
| 1 | EA | MULLION STORAGE KIT | MT54 | 689 | VON |
| 1 | EA | MORTISE CYLINDER | 20-001 | 626 | SCH |
| 1 | EA | RIM CYLINDER | 20-057 | 626 | SCH |
| 2 | EA | SURFACE CLOSER | 4040XP SCUSH | 689 | LCN |
| 2 | EA | CUSH SHOE SUPPORT | 4040XP-30 SRT | 689 | LCN |
| 2 | EA | BLADE STOP SPACER | 4040XP-61 SRT | 689 | LCN |
| 1 | EA | MULLION SEAL | 8780NBK PSA | BK | ZER |
| 2 | EA | DOOR SWEEP | 8192AA | AA | ZER |
| 2 | EA | DOOR SWEEP | 8197AA | AA | ZER |
| 1 | EA | THRESHOLD | 65A-223 | A | ZER |
| 2 | EA | DOOR CONTACT | 679-05HM | BLK | SCE |
| 1 | EA | POWER SUPPLY | BY OWNER | | |
| 1 | EA | WEATHERSTRIP | BY DOOR/FRAME MANUF | | |
| 1 | EA | NOTE | CARD ACCESS BY OTHERS | | |

OPERATION: DOOR NORMALLY CLOSED AND LOCKED. ACCESS VIA VALID CARD READ. PANICS MAY BE DOGGED (MADE PUSH/PULL) ELECTRONICALLY OR VIA HEX KEY ON DEVICE. ALWAYS FREE EGRESS.

HARDWARE SET: 02

DOOR NUMBER:

D-A100 S-A100

EACH TO HAVE:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|-----|----|---------------------|--------------------------|--------|-----|
| 2 | EA | CONT. HINGE | 112XY EPT | 628 | IVE |
| 2 | EA | POWER TRANSFER | EPT10 | 689 | VON |
| 1 | EA | REMOVABLE MULLION | KR4954 STAB | 689 | VON |
| 2 | EA | ELEC PANIC HARDWARE | HD-QEL-99-L-DT-06 24 VDC | 626 | VON |
| 1 | EA | MULLION STORAGE KIT | MT54 | 689 | VON |
| 1 | EA | PRIMUS MORT. CYL. | 20-700 | 626 | SCH |
| 2 | EA | OH STOP & HOLDER | 90H | 630 | GLY |
| 2 | EA | SURFACE CLOSER | 4040XP EDA ST-2731 | 689 | LCN |
| 2 | EA | BLADE STOP SPACER | 4040XP-61 SRT | 689 | LCN |
| 1 | EA | MULLION SEAL | 8780NBK PSA | BK | ZER |
| 2 | EA | DOOR SWEEP | 8192AA | AA | ZER |
| 2 | EA | DOOR SWEEP | 8197AA | AA | ZER |
| 1 | EA | THRESHOLD | 65A-223 | A | ZER |
| 2 | EA | DOOR CONTACT | 679-05HM | BLK | SCE |
| 1 | EA | REQUEST TO EXIT | BY OWNER | | |
| 1 | EA | POWER SUPPLY | BY OWNER | | |
| 1 | EA | WEATHERSTRIP | BY DOOR/FRAME MANUF | | |
| 1 | EA | NOTE | CARD ACCESS BY OTHERS | | |

OPERATION: DOOR NORMALLY CLOSED AND LOCKED. ACCESS VIA VALID CARD READ. PANICS MAY BE DOGGED (MADE PUSH/PULL) ELECTRONICALLY OR VIA HEX KEY ON DEVICE. ALWAYS FREE EGRESS.

HARDWARE SET: 03

DOOR NUMBER:

S-A113

EACH TO HAVE:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|-----|----|---------------------|--------------------------|--------|-----|
| 1 | EA | CONT. HINGE | 112XY EPT | 628 | IVE |
| 1 | EA | POWER TRANSFER | EPT10 | 689 | VON |
| 1 | EA | ELEC PANIC HARDWARE | HD-QEL-99-L-NL-06 24 VDC | 626 | VON |
| 1 | EA | RIM CYLINDER | 20-057 | 626 | SCH |
| 1 | EA | RIM HOUSING | 20-079 X 23-030 ICX | 626 | SCH |
| 1 | EA | OH STOP & HOLDER | 90H | 630 | GLY |
| 1 | EA | SURFACE CLOSER | 4040XP EDA ST-2731 | 689 | LCN |
| 1 | EA | BLADE STOP SPACER | 4040XP-61 SRT | 689 | LCN |
| 1 | EA | DOOR SWEEP | 8192AA | AA | ZER |
| 1 | EA | DOOR SWEEP | 8197AA | AA | ZER |
| 1 | EA | THRESHOLD | 65A-223 | A | ZER |
| 1 | EA | DOOR CONTACT | 679-05HM | BLK | SCE |
| 1 | EA | POWER SUPPLY | BY OWNER | | |
| 1 | EA | WEATHERSTRIP | BY DOOR/FRAME MANUF | | |
| 1 | EA | NOTE | CARD ACCESS BY OTHERS | | |

OPERATION: DOOR NORMALLY CLOSED AND LOCKED. ACCESS VIA VALID CARD READ. PANICS MAY BE DOGGED (MADE PUSH/PULL) ELECTRONICALLY OR VIA HEX KEY ON DEVICE. ALWAYS FREE EGRESS.

HARDWARE SET: 04

DOOR NUMBER:

D-A100B S-A100B

EACH TO HAVE:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|-----|----|---------------------|--------------------------|--------|-----|
| 1 | EA | CONT. HINGE | 112XY EPT | 628 | IVE |
| 1 | EA | POWER TRANSFER | EPT10 | 689 | VON |
| 1 | EA | ELEC PANIC HARDWARE | HD-QEL-99-L-NL-06 24 VDC | 626 | VON |
| 1 | EA | RIM HOUSING | 20-079 X 23-030 ICX | 626 | SCH |
| 1 | EA | PRIMUS CORE | 20-740 | 626 | SCH |
| 1 | EA | SURF. AUTO OPERATOR | 4642 WMS 120 VAC | 689 | LCN |
| 2 | EA | ACTUATOR, TOUCH | 8310-818T | 630 | LCN |
| 1 | EA | WALL STOP | WS406/407CVX | 630 | IVE |
| 1 | EA | DOOR SWEEP | 8192AA | AA | ZER |
| 1 | EA | DOOR SWEEP | 8197AA | AA | ZER |
| 1 | EA | THRESHOLD | 65A-223 | A | ZER |
| 1 | EA | DOOR CONTACT | 679-05HM | BLK | SCE |
| 1 | EA | REQUEST TO EXIT | BY OWNER | | |
| 1 | EA | POWER SUPPLY | BY OWNER | | |
| 1 | EA | WEATHERSTRIP | BY DOOR/FRAME MANUF | | |
| 1 | EA | NOTE | CARD ACCESS BY OTHERS | | |

OPERATION: DOOR NORMALLY CLOSED AND LOCKED. ACCESS VIA VALID CARD READ OR BUZZ IN FROM DESK. PANICS MAY BE DOGGED (MADE PUSH/PULL) ELECTRONICALLY OR VIA HEX KEY ON DEVICE. OUTSIDE ACTUATOR ONLY OPERABLE WHEN DOOR IS DOGGED OR AFTER VALID CARD READ, INSIDE ACTUATOR ALWAYS OPERABLE. ALWAYS FREE EGRESS.

HARDWARE SET: 05

DOOR NUMBER:

D-A100A S-A100A

EACH TO HAVE:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|-----|----|---------------------|--------------------------|--------|-----|
| 1 | EA | CONT. HINGE | 112XY EPT | 628 | IVE |
| 1 | EA | POWER TRANSFER | EPT10 | 689 | VON |
| 1 | EA | ELEC PANIC HARDWARE | HD-QEL-99-L-DT-06 24 VDC | 626 | VON |
| 1 | EA | SURFACE CLOSER | 4040XP SCUSH | 689 | LCN |
| 1 | EA | CUSH SHOE SUPPORT | 4040XP-30 SRT | 689 | LCN |
| 1 | EA | BLADE STOP SPACER | 4040XP-61 SRT | 689 | LCN |
| 1 | EA | DOOR SWEEP | 8192AA | AA | ZER |
| 1 | EA | DOOR SWEEP | 8197AA | AA | ZER |
| 1 | EA | THRESHOLD | 65A-223 | A | ZER |
| 1 | EA | DOOR CONTACT | 679-05HM | BLK | SCE |
| 1 | EA | POWER SUPPLY | BY OWNER | | |
| 1 | EA | WEATHERSTRIP | BY DOOR/FRAME MANUF | | |
| 1 | EA | NOTE | CARD ACCESS BY OTHERS | | |

OPERATION: DOOR NORMALLY CLOSED AND LOCKED. ACCESS VIA VALID CARD READ. PANICS MAY BE DOGGED (MADE PUSH/PULL) ELECTRONICALLY OR VIA HEX KEY ON DEVICE. ALWAYS FREE EGRESS.

HARDWARE SET: 06

DOOR NUMBER:

D-A103C D-A108 S-A103C S-A104A S-A108

EACH TO HAVE:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|-----|-----|---------------------|----------------------------|--------|-----|
| 1 | EA | CONT. HINGE | 224XY EPT | 628 | IVE |
| 1 | EA | POWER TRANSFER | EPT10 | 689 | VON |
| 1 | EA | ELEC PANIC HARDWARE | HD-QEL-9957-L-DT-06 24 VDC | 626 | VON |
| 1 | EA | ROD AND LATCH GUARD | WS-LGO X LENGTH REQ | 630 | VON |
| 1 | EA | OH STOP & HOLDER | 90H | 630 | GLY |
| 1 | EA | SURFACE CLOSER | 4040XP EDA ST-2731 | 689 | LCN |
| 1 | EA | RAIN DRIP | 142AA | AA | ZER |
| 1 | EA | GASKETING | 188SBK PSA | BK | ZER |
| 1 | SET | GASKETING | 429AA-S | AA | ZER |
| 1 | EA | DOOR SWEEP | 8197AA | AA | ZER |
| 1 | EA | THRESHOLD | 566A-223 | A | ZER |
| 1 | EA | DOOR CONTACT | 679-05HM | BLK | SCE |
| 1 | EA | POWER SUPPLY | BY OWNER | | |
| 1 | | CARD READER | BY ACCESS CONTROL PROVIDER | | |

OPERATION: DOOR NORMALLY CLOSED AND LOCKED. ACCESS VIA VALID CARD READ.
ALWAYS FREE EGRESS.

NOTE: DOOR/FRAME ASSEMBLY TO CONFORM WITH REQUIREMENTS OF FEMA 361/ICC 500.

HARDWARE SET: 06A

DOOR NUMBER:

D-A104A

EACH TO HAVE:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|-----|-----|----------------------------|----------------------------|--------|-----|
| 1 | EA | CONT. HINGE | 224XY EPT | 628 | IVE |
| 1 | EA | POWER TRANSFER | EPT10 | 689 | VON |
| 1 | EA | ELEC FIRE EXIT HARDWARE | QEL-9957-L-DT-F-06 24 VDC | 626 | VON |
| 1 | EA | ROD AND LATCH GUARD | WS-LGO X LENGTH REQ | 630 | VON |
| 1 | EA | OH STOP | 90S | 630 | GLY |
| 1 | EA | SURFACE CLOSER | 4041 DEL EDA | 689 | LCN |
| 1 | EA | RAIN DRIP | 142AA | AA | ZER |
| 1 | EA | GASKETING | 188SBK PSA | BK | ZER |
| 1 | SET | GASKETING | 429AA-S | AA | ZER |
| 1 | EA | DOOR SWEEP | 8197AA | AA | ZER |
| 1 | EA | THRESHOLD | 566A-223 | A | ZER |
| 1 | EA | DOOR CONTACT | 679-05HM | BLK | SCE |
| 1 | EA | POWER SUPPLY | BY OWNER | | |
| 1 | | CARD READER | BY ACCESS CONTROL PROVIDER | | |

OPERATION: DOOR NORMALLY CLOSED AND LOCKED. ACCESS VIA VALID CARD READ.
ALWAYS FREE EGRESS.

NOTE: DOOR/FRAME ASSEMBLY TO CONFORM WITH REQUIREMENTS OF FEMA 361/ICC 500.

HARDWARE SET: 07

DOOR NUMBER:

E-A111B

EACH TO HAVE:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|-----|-----|---------------------|----------------------------|--------|-----|
| 2 | EA | CONT. HINGE | 224XY EPT | 628 | IVE |
| 2 | EA | POWER TRANSFER | EPT10 | 689 | VON |
| 1 | EA | ELEC PANIC HARDWARE | HD-QEL-9927-L-DT-06 24 VDC | 626 | VON |
| 1 | EA | PANIC HARDWARE | WS-9927-EO | 626 | VON |
| 2 | EA | ROD AND LATCH GUARD | WS-LGO X LENGTH REQ | 630 | VON |
| 2 | EA | SURFACE CLOSER | 4040XP SCUSH | 689 | LCN |
| 1 | EA | RAIN DRIP | 142AA | AA | ZER |
| 1 | EA | GASKETING | 188SBK PSA | BK | ZER |
| 1 | SET | GASKETING | 429AA-S | AA | ZER |
| 1 | EA | GASKETING | 8172NBK PSA | BK | ZER |
| 2 | EA | DOOR SWEEP | 8197AA | AA | ZER |
| 2 | EA | MEETING STILE | 873AA | AA | ZER |
| 1 | EA | THRESHOLD | 566A-223 | A | ZER |
| 2 | EA | DOOR CONTACT | 679-05HM | BLK | SCE |
| 1 | EA | REQUEST TO EXIT | BY OWNER | | |
| 1 | EA | POWER SUPPLY | BY OWNER | | |
| 1 | | CARD READER | BY ACCESS CONTROL PROVIDER | | |

OPERATION: DOOR NORMALLY CLOSED AND LOCKED. ACCESS VIA VALID CARD READ.
ALWAYS FREE EGRESS.

NOTE: DOOR/FRAME ASSEMBLY TO CONFORM WITH REQUIREMENTS OF FEMA 361/ICC 500.

HARDWARE SET: 08

DOOR NUMBER:

D-A100E S-A100E

EACH TO HAVE:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|-----|----|---------------------|---------------------|--------|-----|
| 1 | EA | CONT. HINGE | 112XY | 628 | IVE |
| 1 | EA | DUMMY PUSH BAR | 330 | 626 | VON |
| 1 | EA | TRIM | 996-L-DT-06 | 626 | VON |
| 1 | EA | OH STOP | 90S | 630 | GLY |
| 1 | EA | SURF. AUTO OPERATOR | 4642 WMS 120 VAC | 689 | LCN |
| 2 | EA | ACTUATOR, TOUCH | 8310-818T | 630 | LCN |
| 1 | EA | WEATHERSTRIP | BY DOOR/FRAME MANUF | | |

HARDWARE SET: 09

DOOR NUMBER:

D-A100D S-A100D

EACH TO HAVE:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|-----|----|-------------------|---------------------|--------|-----|
| 1 | EA | CONT. HINGE | 112XY | 628 | IVE |
| 1 | EA | DUMMY PUSH BAR | 330 | 626 | VON |
| 1 | EA | TRIM | 996-L-DT-06 | 626 | VON |
| 1 | EA | SURFACE CLOSER | 4040XP SCUSH | 689 | LCN |
| 1 | EA | CUSH SHOE SUPPORT | 4040XP-30 SRT | 689 | LCN |
| 1 | EA | BLADE STOP SPACER | 4040XP-61 SRT | 689 | LCN |
| 1 | EA | WEATHERSTRIP | BY DOOR/FRAME MANUF | | |

HARDWARE SET: 10

DOOR NUMBER:

D-A100C S-A100C

EACH TO HAVE:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|-----|----|-------------------|---------------------|--------|-----|
| 2 | EA | CONT. HINGE | 112XY | 628 | IVE |
| 2 | EA | DUMMY PUSH BAR | 330 | 626 | VON |
| 2 | EA | TRIM | 996-L-DT-06 | 626 | VON |
| 2 | EA | OH STOP & HOLDER | 90H | 630 | GLY |
| 2 | EA | SURFACE CLOSER | 4040XP EDA ST-2731 | 689 | LCN |
| 2 | EA | BLADE STOP SPACER | 4040XP-61 SRT | 689 | LCN |
| 1 | EA | WEATHERSTRIP | BY DOOR/FRAME MANUF | | |

HARDWARE SET: 11

DOOR NUMBER:

E-A101B

EACH TO HAVE:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|-----|----|---------------------|---------------------|--------|-----|
| 2 | EA | CONT. HINGE | 112XY | 628 | IVE |
| 2 | EA | DUMMY PUSH BAR | 330 | 626 | VON |
| 2 | EA | TRIM | 996-L-DT-06 | 626 | VON |
| 1 | EA | SURFACE CLOSER | 4040XP SCUSH | 689 | LCN |
| 1 | EA | SURF. AUTO OPERATOR | 4642 WMS 120 VAC | 689 | LCN |
| 1 | EA | CUSH SHOE SUPPORT | 4040XP-30 SRT | 689 | LCN |
| 1 | EA | BLADE STOP SPACER | 4040XP-61 SRT | 689 | LCN |
| 1 | EA | WEATHERSTRIP | BY DOOR/FRAME MANUF | | |

HARDWARE SET: 12

DOOR NUMBER:

E-A102A

EACH TO HAVE:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|-----|----|---------------------|--------------------------|--------|-----|
| 2 | EA | CONT. HINGE | 112XY EPT | 628 | IVE |
| 2 | EA | POWER TRANSFER | EPT10 | 689 | VON |
| 1 | EA | PANIC HARDWARE | 9927-EO-LBR | 626 | VON |
| 1 | EA | ELEC PANIC HARDWARE | QEL-9927-L-LBR-06 24 VDC | 626 | VON |
| 1 | EA | RIM CYLINDER | 20-057 | 626 | SCH |
| 2 | EA | SURFACE CLOSER | 4040XP EDA | 689 | LCN |
| 2 | EA | KICK PLATE | 8400 10" X 1" LDW B-CS | 630 | IVE |
| 2 | EA | FLOOR STOP/HOLDER | FS41 | 626 | IVE |
| 2 | EA | SILENCER | SR64 | GRY | IVE |
| 2 | EA | DOOR CONTACT | 679-05HM | BLK | SCE |
| 1 | EA | REQUEST TO EXIT | BY OWNER | | |
| | EA | POWER SUPPLY | BY OWNER | | |
| 1 | EA | WEATHERSTRIP | BY DOOR/FRAME MANUF | | |
| | EA | NOTE | CARD ACCESS BY OTHERS | | |

OPERATION: DOOR NORMALLY CLOSED AND LOCKED. PANICS MAY BE DOGGED (MADE PUSH/PULL) ELECTRONICALLY OR VIA HEX KEY ON DEVICE PUSH RAIL. ALWAYS FREE EGRESS.

HARDWARE SET: 13

DOOR NUMBER:

D-A110

E-A111A

E-A114A

S-X112A

EACH TO HAVE:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|-----|----|-------------------|------------------------------|--------|-----|
| 6 | EA | HINGE | 5BB1HW 4.5 X 4.5 | 652 | IVE |
| 1 | EA | REMOVABLE MULLION | KR4954 | 689 | VON |
| 1 | EA | PANIC HARDWARE | CDSI-99-L-DT-06 | 626 | VON |
| 1 | EA | PANIC HARDWARE | CDSI-99-L-NL-06 | 626 | VON |
| 2 | EA | MORTISE CYL TURN | 09-904 114 B502-191 XQ11-949 | 626 | SCH |
| 1 | EA | MORTISE CYLINDER | 20-001 | 626 | SCH |
| 1 | EA | RIM CYLINDER | 20-057 | 626 | SCH |
| 2 | EA | SURFACE CLOSER | 4040XP HEDA | 689 | LCN |
| 2 | EA | KICK PLATE | 8400 10" X 2" LDW B-CS | 630 | IVE |
| 2 | EA | WALL STOP | WS406/407CCV | 630 | IVE |
| 1 | EA | GASKETING | 488SBK PSA | BK | ZER |
| 1 | EA | ASTRAGAL SET | 8193AA | AA | ZER |
| 1 | EA | MULLION SEAL | 8780NBK PSA | BK | ZER |

HARDWARE SET: 14

DOOR NUMBER:

D-A101 S-A101

EACH TO HAVE:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|-----|----|---------------------|------------------------------|--------|-----|
| 2 | EA | CONT. HINGE | 112XY | 628 | IVE |
| 1 | EA | REMOVABLE MULLION | KR4954 | 689 | VON |
| 1 | EA | PANIC HARDWARE | CDSI-99-L-DT-06 | 626 | VON |
| 1 | EA | PANIC HARDWARE | CDSI-99-L-NL-06 | 626 | VON |
| 1 | EA | MULLION STORAGE KIT | MT54 | 689 | VON |
| 2 | EA | MORTISE CYL TURN | 09-904 114 B502-191 XQ11-949 | 626 | SCH |
| 1 | EA | MORTISE CYLINDER | 20-001 | 626 | SCH |
| 1 | EA | RIM CYLINDER | 20-057 | 626 | SCH |
| 1 | EA | OH STOP & HOLDER | 90H | 630 | GLY |
| 2 | EA | SURFACE CLOSER | 4040XP EDA ST-2731 | 689 | LCN |
| 2 | EA | BLADE STOP SPACER | 4040XP-61 SRT | 689 | LCN |
| 1 | EA | FLOOR STOP/HOLDER | FS41 | 626 | IVE |
| 1 | EA | MULLION SEAL | 8780NBK PSA | BK | ZER |

HARDWARE SET: 15

DOOR NUMBER:

E-A113 E-C124

EACH TO HAVE:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|-----|----|------------------|------------------------------|--------|-----|
| 3 | EA | HINGE | 5BB1HW 4.5 X 4.5 | 652 | IVE |
| 1 | EA | PANIC HARDWARE | CDSI-99-L-NL-06 | 626 | VON |
| 1 | EA | MORTISE CYL TURN | 09-904 114 B502-191 XQ11-949 | 626 | SCH |
| 1 | EA | RIM CYLINDER | 20-057 | 626 | SCH |
| 1 | EA | SURFACE CLOSER | 4040XP EDA | 689 | LCN |
| 1 | EA | KICK PLATE | 8400 10" X 2" LDW B-CS | 630 | IVE |
| 1 | EA | WALL STOP | WS406/407CCV | 630 | IVE |
| 1 | EA | GASKETING | 488SBK PSA | BK | ZER |

HARDWARE SET: 16

DOOR NUMBER:

D-A101A D-A101B S-A101A S-A101B

EACH TO HAVE:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|-----|----|-------------------|------------------------------|--------|-----|
| 1 | EA | CONT. HINGE | 112XY | 628 | IVE |
| 1 | EA | PANIC HARDWARE | CDSI-99-L-DT-06 | 626 | VON |
| 1 | EA | MORTISE CYL TURN | 09-904 114 B502-191 XQ11-949 | 626 | SCH |
| 1 | EA | OH STOP & HOLDER | 90H | 630 | GLY |
| | | | (OMIT AT S-A101B) | | |
| 1 | EA | SURFACE CLOSER | 4040XP EDA ST-2731 | 689 | LCN |
| 1 | EA | BLADE STOP SPACER | 4040XP-61 SRT | 689 | LCN |
| 1 | EA | FLOOR STOP/HOLDER | FS41 | 626 | IVE |
| | | | (AT S-A101B ONLY) | | |

HARDWARE SET: 17

DOOR NUMBER:

D-A103 S-A103

EACH TO HAVE:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|-----|----|---------------------|----------------------|--------|-----|
| 3 | EA | HINGE | 5BB1HW 4.5 X 4.5 | 652 | IVE |
| 1 | EA | FIRE EXIT HARDWARE | WS-9927-L-F-06 | 626 | VON |
| 1 | EA | ROD AND LATCH GUARD | WS-LGO X LENGTH REQ | 630 | VON |
| 1 | EA | RIM CYLINDER | 20-057 | 626 | SCH |
| 1 | EA | SURFACE CLOSER | 4040XP EDA | 689 | LCN |
| 1 | EA | WALL STOP | WS406/407CCV | 630 | IVE |
| 1 | EA | MAGNET | SEM7850 12V/24V/120V | 689 | LCN |
| 1 | EA | GASKETING | 488SBK PSA | BK | ZER |

NOTE: DOOR/FRAME ASSEMBLY TO CONFORM WITH REQUIREMENTS OF FEMA 361/ICC 500.

HARDWARE SET: 18

DOOR NUMBER:

D-A103A D-A110A E-A106 S-A103A S-A110A

EACH TO HAVE:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|-----|----|---------------------|---|--------|-----|
| 6 | EA | HINGE | 5BB1HW 4.5 X 4.5 | 652 | IVE |
| 1 | EA | FIRE EXIT HARDWARE | WS-9927-EO-F | 626 | VON |
| 1 | EA | FIRE EXIT HARDWARE | WS-9927-L-F-06 | 626 | VON |
| 2 | EA | ROD AND LATCH GUARD | WS-LGO X LENGTH REQ | 630 | VON |
| 1 | EA | RIM CYLINDER | 20-057 | 626 | SCH |
| 2 | EA | SURFACE CLOSER | 4040XP EDA | 689 | LCN |
| 2 | EA | WALL STOP | WS406/407CCV | 630 | IVE |
| 1 | EA | MAGNET | SEM7820 12V/24V/120V (IN LIEU OF WALL MAG AT S- A110A RHR LEAF) | 689 | LCN |
| 2 | EA | MAGNET | SEM7850 12V/24V/120V | 689 | LCN |
| 1 | EA | GASKETING | 488SBK PSA | BK | ZER |
| 2 | EA | ASTRAGAL SET | 8194AA | AA | ZER |

NOTE: DOOR/FRAME ASSEMBLY TO CONFORM WITH REQUIREMENTS OF FEMA 361/ICC 500.

HARDWARE SET: 19

DOOR NUMBER:

E-A115

EACH TO HAVE:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|-----|----|---------------------|----------------------------|--------|-----|
| 3 | EA | HINGE | 5BB1HW 4.5 X 4.5 | 652 | IVE |
| 1 | EA | POWER TRANSFER | EPT10 | 689 | VON |
| 1 | EA | ELEC PANIC HARDWARE | HD-QEL-99-L-NL-06 24 VDC | 626 | VON |
| 1 | EA | RIM CYLINDER | 20-057 | 626 | SCH |
| 1 | EA | SURFACE CLOSER | 4040XP EDA | 689 | LCN |
| 1 | EA | KICK PLATE | 8400 10" X 2" LDW B-CS | 630 | IVE |
| 1 | EA | WALL STOP | WS406/407CCV | 630 | IVE |
| 1 | EA | GASKETING | 488SBK PSA | BK | ZER |
| 1 | EA | REQUEST TO EXIT | BY OWNER | | |
| 1 | EA | POWER SUPPLY | BY OWNER | | |
| 1 | | CARD READER | BY ACCESS CONTROL PROVIDER | | |

HARDWARE SET: 20

DOOR NUMBER:

E-B146

EACH TO HAVE:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|-----|----|------------------|------------------------|--------|-----|
| 6 | EA | HINGE | 5BB1HW 4.5 X 4.5 | 652 | IVE |
| 1 | EA | AUTO FLUSH BOLT | FB31T | BLK | IVE |
| 1 | EA | STOREROOM LOCK | ND80LD RHO | 626 | SCH |
| 1 | EA | K-I-L CYLINDER | 23-065 | 626 | SCH |
| 1 | EA | COORDINATOR | COR X FL | 628 | IVE |
| 2 | EA | MOUNTING BRACKET | MB | 689 | IVE |
| 2 | EA | OH STOP & HOLDER | 90H | 630 | GLY |
| 2 | EA | SURFACE CLOSER | 4040XP RW/PA | 689 | LCN |
| 2 | EA | KICK PLATE | 8400 10" X 1" LDW B-CS | 630 | IVE |
| 2 | EA | MEETING STILE | 8195AA | AA | ZER |
| 2 | EA | SILENCER | SR64 | GRY | IVE |

HARDWARE SET: 21

DOOR NUMBER:

D-A103B E-A105 S-A103B S-A111 S-A112 S-A112A

EACH TO HAVE:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|-----|----|----------------|------------------------|--------|-----|
| 3 | EA | HINGE | 5BB1HW 4.5 X 4.5 | 652 | IVE |
| 1 | EA | STOREROOM LOCK | ND80LD RHO | 626 | SCH |
| 1 | EA | K-I-L CYLINDER | 23-065 | 626 | SCH |
| 2 | EA | SURFACE CLOSER | 4040XP EDA | 689 | LCN |
| 2 | EA | KICK PLATE | 8400 10" X 2" LDW B-CS | BLK | IVE |
| 1 | EA | WALL STOP | WS406/407CCV | 630 | IVE |
| 2 | EA | SILENCER | SR64 | GRY | IVE |

HARDWARE SET: 22

DOOR NUMBER:

D-A111 D-A112 D-A112A E-A109

EACH TO HAVE:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|-----|----|----------------|------------------------|--------|-----|
| 3 | EA | HINGE | 5BB1HW 4.5 X 4.5 | 652 | IVE |
| 1 | EA | STOREROOM LOCK | ND80LD RHO | 626 | SCH |
| 1 | EA | K-I-L CYLINDER | 23-065 | 626 | SCH |
| 1 | EA | OH STOP | 90S | 630 | GLY |
| | | | (AT D-A111 ONLY) | | |
| 2 | EA | SURFACE CLOSER | 4040XP HW/PA | 689 | LCN |
| 2 | EA | KICK PLATE | 8400 10" X 2" LDW B-CS | BLK | IVE |
| 1 | EA | WALL STOP | WS406/407CCV | 630 | IVE |
| 2 | EA | SILENCER | SR64 | GRY | IVE |

HARDWARE SET: 23

DOOR NUMBER:

E-A110

EACH TO HAVE:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|-----|----|--------------------|----------------------|--------|-----|
| 3 | EA | HINGE | 5BB1HW 4.5 X 4.5 | 652 | IVE |
| 1 | EA | CLASSROOM SECURITY | ND75P6D RHO XN12-035 | 626 | SCH |
| 2 | EA | K-I-L CYLINDER | 23-065 | 626 | SCH |
| 1 | EA | OH STOP | 90S | 630 | GLY |
| 1 | EA | SURFACE CLOSER | 4040XP RW/PA | 689 | LCN |
| 1 | EA | WALL STOP | WS406/407CCV | 630 | IVE |
| 3 | EA | SILENCER | SR64 | GRY | IVE |

HARDWARE SET: 24

DOOR NUMBER:

E-A103

EACH TO HAVE:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|-----|----|--------------------|------------------------|--------|-----|
| 3 | EA | HINGE | 5BB1HW 4.5 X 4.5 | 652 | IVE |
| 1 | EA | CLASSROOM SECURITY | ND75P6D RHO XN12-035 | 626 | SCH |
| 2 | EA | K-I-L CYLINDER | 23-065 | 626 | SCH |
| 1 | EA | SURFACE CLOSER | 4040XP HEDA | 689 | LCN |
| 1 | EA | KICK PLATE | 8400 10" X 2" LDW B-CS | 630 | IVE |
| 1 | EA | WALL STOP | WS406/407CCV | 630 | IVE |
| 3 | EA | SILENCER | SR64 | GRY | IVE |

HARDWARE SET: 25

DOOR NUMBER:

E-A104 E-A114

EACH TO HAVE:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|-----|----|----------------|------------------------|--------|-----|
| 3 | EA | HINGE | 5BB1HW 4.5 X 4.5 | 652 | IVE |
| 1 | EA | CLASSROOM LOCK | ND70LD RHO | 626 | SCH |
| 1 | EA | K-I-L CYLINDER | 23-065 | 626 | SCH |
| 1 | EA | OH STOP | 90S | 630 | GLY |
| 1 | EA | KICK PLATE | 8400 10" X 2" LDW B-CS | 630 | IVE |
| 1 | EA | WALL STOP | WS406/407CCV | 630 | IVE |
| 3 | EA | SILENCER | SR64 | GRY | IVE |

HARDWARE SET: 26

DOOR NUMBER:

E-A112

EACH TO HAVE:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|-----|----|----------------------|------------------------|--------|-----|
| 6 | EA | HINGE | 5BB1HW 4.5 X 4.5 | 652 | IVE |
| 1 | EA | CONST LATCHING BOLT | FB51T | 630 | IVE |
| 1 | EA | ENTRANCE/OFFICE LOCK | ND50LD RHO | 626 | SCH |
| 1 | EA | K-I-L CYLINDER | 23-065 | 626 | SCH |
| 1 | EA | COORDINATOR | COR X FL | 628 | IVE |
| 2 | EA | MOUNTING BRACKET | MB | 689 | IVE |
| 2 | EA | SURFACE CLOSER | 4040XP HEDA | 689 | LCN |
| 2 | EA | KICK PLATE | 8400 10" X 1" LDW B-CS | 630 | IVE |
| 2 | EA | MEETING STILE | 8195AA | AA | ZER |
| 2 | EA | SILENCER | SR64 | GRY | IVE |

HARDWARE SET: 27

DOOR NUMBER:

E-B148 E-B149 E-B150

EACH TO HAVE:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|-----|----|------------------------------|------------------------------|--------|-----|
| 3 | EA | HINGE | 5BB1HW 4.5 X 4.5 | 652 | IVE |
| 1 | EA | KEYED PRIVACY W/INDICATOR | L9056L 06A L583-363 L283-722 | 626 | SCH |
| 1 | EA | MORTISE CYLINDER | 20-001 | 626 | SCH |
| 1 | EA | SURFACE CLOSER | 4040XP RW/PA | 689 | LCN |
| 1 | EA | KICK PLATE | 8400 10" X 2" LDW B-CS | 630 | IVE |
| 1 | EA | WALL STOP | WS406/407CCV | 630 | IVE |
| 1 | EA | GASKETING | 488SBK PSA | BK | ZER |

HARDWARE SET: 28

DOOR NUMBER:

D-A105 D-A106 S-A105 S-A106

EACH TO HAVE:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|-----|----|--------------------|------------------------|--------|-----|
| 3 | EA | HINGE | 5BB1HW 4.5 X 4.5 | 652 | IVE |
| 1 | EA | CLASSROOM DEADBOLT | B663P6 | 626 | SCH |
| 1 | EA | K-I-L CYLINDER | 23-065 | 626 | SCH |
| 1 | EA | PUSH PLATE | 8200 6" X 16" | 630 | IVE |
| 1 | EA | PULL PLATE | 8303 10" 4" X 16" | 630 | IVE |
| 2 | EA | SURFACE CLOSER | 4040XP RW/PA | 689 | LCN |
| 2 | EA | KICK PLATE | 8400 10" X 2" LDW B-CS | BLK | IVE |
| 1 | EA | WALL STOP | WS406/407CCV | 630 | IVE |
| 2 | EA | SILENCER | SR64 | GRY | IVE |

HARDWARE SET: 29

DOOR NUMBER:

S-X112

EACH TO HAVE:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|-----|--|-------------|--------------------------|--------|-----|
| 1 | | | RE-USE EXISTING HARDWARE | | |

HARDWARE SET: 30

DOOR NUMBER:

D-A104 S-A104

EACH TO HAVE:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|-----|----|----------------|------------------------|--------|-----|
| 6 | EA | HINGE | 5BB1HW 4.5 X 4.5 | 652 | IVE |
| 2 | EA | PUSH PLATE | 8200 6" X 16" | 630 | IVE |
| 2 | EA | PULL PLATE | 8303 10" 4" X 16" | 630 | IVE |
| 2 | EA | SURFACE CLOSER | 4040XP HEDA | 689 | LCN |
| 2 | EA | KICK PLATE | 8400 10" X 2" LDW B-CS | 630 | IVE |
| 2 | EA | WALL STOP | WS406/407CCV | 630 | IVE |
| 1 | EA | GASKETING | 488SBK PSA | BK | ZER |
| 1 | EA | ASTRAGAL SET | 8193AA | AA | ZER |

HARDWARE SET: 31

DOOR NUMBER:

D-A103D D-A103E D-A103F S-X112B S-X112C S-X112D

EACH TO HAVE:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|-----|--|-------------|--|--------|-----|
| 1 | | | EXISTING DOOR, FRAME AND HARDWARE TO REMAIN | | |

NOTE: REMOVE MAG LOCK. PATCH/PAINT DOOR/FRAME AS REQUIRED.

DOOR/HARDWARE SET INDEX

| DOOR # | HwSet # |
|---------|---------|
| D-A100 | 02 |
| D-A100A | 05 |
| D-A100B | 04 |
| D-A100C | 10 |
| D-A100D | 09 |
| D-A100E | 08 |
| D-A101 | 14 |
| D-A101A | 16 |
| D-A101B | 16 |
| D-A103 | 17 |
| D-A103A | 18 |
| D-A103B | 21 |
| D-A103C | 06 |
| D-A103D | 31 |
| D-A103E | 31 |
| D-A103F | 31 |
| D-A104 | 30 |
| D-A104A | 06A |
| D-A105 | 28 |
| D-A106 | 28 |
| D-A108 | 06 |
| D-A110 | 13 |
| D-A110A | 18 |
| D-A111 | 22 |
| D-A112 | 22 |
| D-A112A | 22 |

| DOOR # | HwSet # |
|---------|---------|
| E-A101A | 01 |
| E-A101B | 11 |
| E-A102A | 12 |
| E-A102C | 01 |
| E-A103 | 24 |
| E-A104 | 25 |
| E-A105 | 21 |
| E-A106 | 18 |
| E-A109 | 22 |
| E-A110 | 23 |
| E-A111A | 13 |
| E-A111B | 07 |
| E-A112 | 26 |
| E-A113 | 15 |
| E-A114 | 25 |
| E-A114A | 13 |
| E-A115 | 19 |
| E-B146 | 20 |
| E-B148 | 27 |
| E-B149 | 27 |
| E-B150 | 27 |
| E-C124 | 15 |
| S-A100 | 02 |
| S-A100A | 05 |
| S-A100B | 04 |
| S-A100C | 10 |

| DOOR # | HwSet # |
|---------|---------|
| S-A100D | 09 |
| S-A100E | 08 |
| S-A101 | 14 |
| S-A101A | 16 |
| S-A101B | 16 |
| S-A103 | 17 |
| S-A103A | 18 |
| S-A103B | 21 |
| S-A103C | 06 |
| S-A104 | 30 |
| S-A104A | 06 |
| S-A105 | 28 |
| S-A106 | 28 |
| S-A108 | 06 |
| S-A110A | 18 |
| S-A111 | 21 |
| S-A112 | 21 |
| S-A112A | 21 |
| S-A113 | 03 |
| S-X112 | 29 |
| S-X112A | 13 |
| S-X112B | 31 |
| S-X112C | 31 |
| S-X112D | 31 |

END OF SECTION

SECTION 088000 - GLAZING

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
 - a. Windows.
 - b. Doors.
 - c. Interior borrowed lites.
 - d. Storefront framing.
 - e. Glazed entrances.
 - f. Display case doors and display case shelving.
 - 2. Glazing sealants and accessories.
 - 3. Glass types include:
 - a. Fully Tempered Monolithic Float Glass.
 - b. Laminated Glass.
 - c. Insulated Glass.
 - d. Insulated Fully Tempered Glass.
 - e. Insulated Laminated Glass.
- B. Related Requirements:
 - 1. Section 081113 "Hollow Metal Doors and Frames" for vision light glass in hollow metal frames and doors.
 - 2. Section 084113 "Aluminum Framed Entrances and Storefronts."

1.2 DEFINITIONS

- A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
- B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.
- C. IBC: International Building Code.
- D. Interspace: Space between lites of an insulating-glass units.

1.3 COORDINATION

- A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.4 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM E 119: Fire Tests of Building Construction and Materials.
- B. American National Standards Institute (ANSI):
 - 1. ANSI Z97.1: Standard for Safety Glazing Materials Used in Buildings.
- C. Consumer Product Safety Commission (CPSC):
 - 1. CPSC 16 CFR 1201: Safety Standard for Architectural Glazing Materials, Category II.

1.5 PREINSTALLATION MEETINGS

- A. Pre-installation Conference: Conduct conference at Project site.
 - 1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 2. Review temporary protection requirements for glazing during and after installation.
 - 3. Review drawings for locations and details of glazing.

1.6 PRECONSTRUCTION TESTING

- A. Preconstruction Adhesion and Compatibility Testing: Test each glazing material type, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants.
 - 1. Testing will not be required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted.
 - 2. Use ASTM C 1087 to determine whether priming and other specific joint-preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.
 - 3. Test no fewer than eight Samples of each type of material, including joint substrates, shims, sealant backings, secondary seals, and miscellaneous materials.
 - 4. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
 - 5. For materials failing tests, submit sealant manufacturer's written instructions for corrective measures including the use of specially formulated primers.

1.7 ACTION SUBMITTALS

- A. Product Data: For each glass product and glazing material indicated.
 - 1. For security "forced entry resistant" glass, include UL listing verification and UL-752 Test Results.
 - 2. For security "forced entry resistant" glass, include manufacturer's written installation and cleaning instructions.
- B. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches square. Submit the samples listing glass type corresponding to Glass Legend indicated on Drawings and as follows:
 - 1. Insulated Glass.
 - 2. Insulated Fully Tempered Glass.
 - 3. Insulated Laminated Glass.
- C. Glazing Accessory Samples: For sealants and spacers, in 12-inch lengths.
 - 1. Install sealant Samples between two strips of material representative in color of the adjoining framing system.
- D. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.
 - 1. Indicate coordinated dimensions of security glazing and construction that receives security glazing, including clearances and glazing channel dimensions.
- E. Delegated-Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.8 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For the following:
 - 1. Installers.
 - 2. Manufacturers of insulated glass units with low-E coatings.
 - 3. Glass testing agency.
 - 4. Sealant testing agency.
- B. Product Certificates: For each type of glass and glazing product, from manufacturer. For glass.

- C. Product Test Reports: For glazing sealants, for tests performed by a qualified testing agency.
 - 1. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.
- D. Preconstruction adhesion and compatibility test report.

1.9 CLOSEOUT SUBMITTALS

- A. Warranties: Sample of special warranties.

1.10 QUALITY ASSURANCE

- A. Manufacturer Qualifications for Insulating-Glass Units with Low-E Coatings: A qualified insulating-glass manufacturer who is approved and certified by coated-glass manufacturer.
- B. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.
- C. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.
- D. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.
- E. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- F. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.
- G. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for materials and execution.
 - 1. Install glazing in mockups specified in related Sections indicated below to match glazing systems required for Project, including glazing methods.
 - a. Section 084113 "Aluminum-Framed Entrances and Storefronts".
 - b. Section 084413 "Glazed Aluminum Curtain Walls."
 - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.11 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
- B. Comply with insulating-glass manufacturer's written instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.12 FIELD CONDITIONS

- A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
 - 1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below 40 deg F.
- B. Environmental Limitations for Fire Glazing: Do not deliver or install fire-resistant glazing until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature conditions at

occupancy levels during the remainder of the construction period.

1.13 WARRANTY

- A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.
 - 1. Warranty Period: 10 years from date of Substantial Completion.
- B. Manufacturer's Special Warranty for Laminated Glass: Manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.
 - 1. Warranty Period: 10 years from date of Substantial Completion.
- C. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.
 - 1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations for Glass: Obtain from single source from single manufacturer for each glass type
 - 1. Obtain insulating glass from single source from single manufacturer.
 - 2. Obtain laminated glazing from single source from single manufacturer using the same types of lites, plies, interlayers, and spacers for each laminated glazing type.
- B. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

2.2 PERFORMANCE REQUIREMENTS

- A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design glazing. Design glass, including comprehensive engineering analysis according to the ICC's International Building Code (IBC) listed on Drawings and ASTM E 1300 by a qualified professional engineer, using design criteria set forth in Article 2.2 and as follows:
 - 1. Design Wind Pressures: As indicated on Drawings.
 - 2. Design Snow Loads: As indicated on Drawings.
 - 3. Vertical Glazing: For glass surfaces sloped 15 degrees or less from vertical, design glass to resist design wind pressure based on glass type factors for short-duration load.
 - 4. Thickness of Patterned Glass: Base design of patterned glass on thickness at thinnest part of the glass.
 - 5. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch, whichever is less.
 - 6. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.
- C. Windborne-Debris-Impact Resistance: Exterior glazing shall comply with basic-protection testing requirements in ASTM E 1996 for Wind Zone 4 when tested according to ASTM E 1886. Test specimens shall be no smaller in

width and length than glazing indicated for use on Project and shall be installed in same manner as glazing indicated for use on Project.

1. Large-Missile Test: For glazing located within 30 feet of grade.
 2. Small-Missile Test: For glazing located more than 30 feet above grade.
- D. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.
- E. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
1. For monolithic-glass lites, properties are based on units with lites 6 mm thick.
 2. For laminated-glass lites, properties are based on products of construction indicated.
 3. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
 4. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F.
 5. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
 6. Visible Reflectance: Center-of-glazing values, according to NFRC 300.
 7. Self-ignition temperature of 650 deg F or more when tested according to ASTM D 1929 on plastic sheets in thicknesses indicated for the Work.
 8. Smoke-Developed Index of 450 or less when tested according to ASTM E 84, or smoke density of 75 or less when tested according to ASTM D 2843 on plastic sheets in thicknesses indicated for the Work.
 9. Burning extent of 1 inch or less when tested according to ASTM D 635 at a nominal thickness of 0.060 inch or thickness indicated for the Work.
- F. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.3 GLASS PRODUCTS, GENERAL

- A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.
1. GANA Publications: "Glazing Manual."
 2. GANA Publications: "Laminated Glazing Reference Manual"
 3. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
- B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the Safety Glazing Certification Council (SGCC) or another certification agency acceptable to authorities having jurisdiction or manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.
- D. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass lites in thicknesses as needed to comply with requirements indicated.
1. Minimum Glass Thickness for Exterior Lites: 6.0 mm, except where specifically indicated otherwise.
- E. Strength:
1. Where float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass as needed to comply with "Performance Requirements" Article.
 2. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass as needed to comply with "Performance Requirements" Article.
 3. Where fully tempered float glass is indicated, provide fully tempered float glass.

2.4 GLASS PRODUCTS

- A. Clear Annealed Monolithic Float Glass: ASTM C 1036, Type I, Class 1 (clear), Quality-Q3.

- B. Heat-Strengthened Float Glass: ASTM C 1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
 - 1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
- C. Fully-Tempered Monolithic Float Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
 - 1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
- D. Ceramic-Coated Vision Glass: ASTM C 1048, Condition C, Type I, Class 1 (clear) [or Class 2 (tinted)] as indicated, Quality-Q3; and complying with Specification No. 95-1-31 in GANA's "Engineering Standards Manual."
 - 1. Glass: Clear float, heat strengthened.
- E. Glass Types: Refer to Glass Type Schedules at end of this Section.

2.5 LAMINATED GLASS

- A. Laminated Glass: ASTM C 1172, and complying with testing requirements in 16 CFR 1201 for Category II materials, and with other requirements specified. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.
 - 1. Construction: Laminate glass with the following interlayer types to comply with interlayer manufacturer's written instructions.
 - a. Polyvinyl butyral interlayer.
 - 2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
 - 3. Interlayer Color: Clear unless otherwise indicated.
 - 4. Glass: Comply with applicable requirements in "Glass Products" Article as indicated by designations in "Laminated Glass Schedule" at end of this Section.
- B. Windborne-Debris-Impact-Resistant Laminated Glass: Comply with requirements specified above for laminated glass except laminate glass with[one of] the following to comply with interlayer manufacturer's written instructions:
 - 1. Polyvinyl butyral interlayer.
 - 2. Polyvinyl butyral interlayers reinforced with polyethylene terephthalate film.
- C. Glass Types: Refer to Glass Type Schedules at end of this Section.

2.6 INSULATING GLASS

- A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190.
 - 1. Sealing System: Dual seal, with polyisobutylene and silicone, primary and secondary seals, respectively.
 - 2. Perimeter Spacer: Aluminum with black, color anodic finish .
 - 3. Desiccant: Molecular sieve or silica gel, or a blend of both.
- B. Glass Types: Refer to Glass Type Schedules at end of this Section.

2.7 GLAZING GASKETS

- A. Dense Compression Gaskets: Molded or extruded gaskets of profile and hardness required to maintain watertight seal, made from one of the following:
 - 1. EPDM complying with ASTM C 864.
 - 2. Silicone complying with ASTM C 1115.
- B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned EPDM or silicone gaskets complying with ASTM C 509, Type II, black; of profile and hardness required to maintain watertight seal.
 - 1. Application: Use where soft compression gaskets will be compressed by inserting dense compression gaskets on opposite side of glazing or pressure applied by means of pressure-glazing stops on opposite

side of glazing.

2.8 GLAZING SEALANTS

- A. General:
 - 1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
 - 2. Provide glazing sealants that are compatible with glazing products and each other and are approved by testing agencies that listed and labeled fire-resistant glazing products with which products are used for applications and fire-protection ratings indicated.
 - 3. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
 - 4. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.
- B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.

2.9 GLAZING TAPES

- A. General: Provide glazing tapes that are compatible with glazing products and each other and are approved by testing agencies that listed and labeled fire-resistant glazing products with which products are used for applications and fire-protection ratings indicated.
- B. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:
 - 1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
 - 2. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.
- C. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
 - 1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
 - 2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.10 MISCELLANEOUS GLAZING MATERIALS

- A. General:
 - 1. Provide products of material, size, and shape complying with referenced glazing standard, with requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
 - 2. Provide glazing gaskets, glazing sealants, glazing tapes, setting blocks, spacers, edge blocks, and other glazing accessories that are compatible with glazing products and each other and are approved by testing agencies that listed and labeled fire-resistant glazing products with which products are used for applications and fire-protection ratings indicated.
- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
- E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).
- F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.11 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
 - 1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
 - a. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
- B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.
- C. Grind smooth and polish exposed glass edges and corners.
 - 1. Provide ground and polished edges for glass doors and shelving at display cases.
 - 2. Provide ground and polished edges for glass shelving at merchandising walls.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
 - 1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
 - 2. Presence and functioning of weep systems.
 - 3. Minimum required face and edge clearances.
 - 4. Minimum required bite.
 - a. No less than 1/2" on all 4 sides.
 - 5. Effective sealing between joints of glass-framing members.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.
- B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

3.3 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
 - 1. Use methods approved by testing agencies that listed and labeled fire-resistive glazing or fire-protective glazing products.
- B. Adjust glazing channel dimensions as required by Project conditions during installation to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.
- C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.
- D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

- F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- G. Provide spacers for glass lites where length plus width is larger than 50 inches.
 - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
 - 2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
- I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- J. Set glass lites with proper orientation so that coatings face exterior face exterior or interior as specified.
- K. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.
- L. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Do not remove release paper from tape until right before each glazing unit is installed.
- F. Apply heel bead of elastomeric sealant.
- G. Center glass lites in openings on setting blocks, and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
- H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

- A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
- C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket

joints with sealant recommended by gasket manufacturer.

- D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- E. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
- B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.7 CLEANING AND PROTECTION

- A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.
- C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.
- D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.
- E. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

3.8 HEAT TREATED MONOLITHIC GLASS SCHEDULE

- A. Glass Type 11 - Clear Fully Tempered monolithic float glass (088000.A11):
 - 1. 1/4 inch (6 mm).
 - 2. Visible Light Transmittance: 85 percent minimum.
 - 3. Provide safety glazing labeling.
- B. Glass Type 12 - Clear Fully Tempered monolithic float glass (088000.A12):
 - 1. 3/8 inch (9.5 mm).
 - 2. Visible Light Transmittance: 85 percent minimum.
 - 3. Provide safety glazing labeling.
- C. Glass Type 13 - Clear Fully Tempered monolithic float glass (088000.A13):
 - 1. 1/2 inch (12 mm).
 - 2. Visible Light Transmittance: 85 percent minimum.
 - 3. Provide safety glazing labeling.

3.9 LAMINATED GLASS SCHEDULE

- A. Glass Type 21 - Clear laminated glass. (088000.A21)
 - 1. Basis-of-Design Product: Vitro Architectural Glass
 - 2. Two plies of fully tempered float glass.
 - 3. Minimum Thickness of Each Glass Ply: 6mm.
 - 4. Interlayer Thickness: 0.060 inch.
 - 5. Safety glazing required.

3.10 INSULATING GLASS SCHEDULE

- A. Glass Type 31 - Low-E-coated, clear insulating glass (088000.A31)
 - 1. Overall Unit Thickness: 1 inch (24 mm)
 - a. Minimum Thickness of Each Glass Lite: 1/4 inch (6 mm).
 - 2. Outdoor Lite: Heat strengthened clear and low-E coated float glass.
 - a. Low-E Basis of Design Product:
 - 1) Vitro Architectural Glass; "Solarban 70 Solar Control (formerly Solarban 70 XL)"
 - b. Low-E Coating: Sputter coated on second surface.
 - 3. Indoor Lite: Heat strengthened clear float glass.
 - 4. Product Characteristics:
 - a. Visible Light Transmittance: 64 percent minimum.
 - b. Visible Light Reflectance (Exterior): 10 to 12 percent.
 - c. Winter Nighttime U-Factor (air): 0.28 maximum.
 - d. Solar Heat Gain Coefficient: 0.27 maximum.
 - e. Light-to-Solar Gain Ratio (LSG): 2.30 minimum.
 - f. Safety glazing required.

3.11 INSULATING FULLY-TEMPERED GLASS SCHEDULE

- A. Glass Type 41 - Low-E-coated, clear insulating fully tempered glass (088000.A41)
 - 1. Overall Unit Thickness: 1 inch (24 mm)
 - a. Minimum Thickness of Each Glass Lite: 1/4 inch (6 mm).
 - 2. Outdoor Lite: Fully tempered, clear and low-E coated float glass.
 - a. Low-E Basis of Design Product:
 - 1) Vitro Architectural Glass; "Solarban 70 Solar Control (formerly Solarban 70 XL)"
 - b. Low-E Coating: Sputter coated on second surface.
 - 3. Interspace Content: Air
 - 4. Indoor Lite: Fully tempered clear float glass.
 - 5. Product Characteristics:
 - a. Visible Light Transmittance: 64 percent minimum.
 - b. Visible Light Reflectance (Exterior): 13 to 14 percent.
 - c. Winter Nighttime U-Factor (air): 0.28 maximum.
 - d. Solar Heat Gain Coefficient: 0.27 maximum.
 - e. Light-to-Solar Gain Ratio (LSG): 2.30 minimum.
 - f. Safety glazing required.

END OF SECTION 088000

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SECTION 092116 - NON-STRUCTURAL METAL FRAMING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Non-load-bearing steel framing systems for interior partitions (092116.A01).
 - 2. Suspension systems for interior ceilings, bulkheads, soffits, and exterior soffits.
 - a. For spans exceeding 8 feet in any direction refer to Section 054000 for design requirements.
 - 3. Grid suspension systems for gypsum board ceilings (092116.A06).
- B. Related Requirements:
 - 1. Section 054000 "Cold-Formed Metal Framing" for exterior and interior load-bearing and exterior non-load-bearing wall studs; floor joists; and ceiling joists. In addition, for all interior soffits and ceilings with an unsupported span in any direction exceeding 8 feet.
 - 2. Section 092117 "Gypsum Board Shaft Wall Assemblies" for gypsum board shaft wall assemblies.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Studs and Runners: Provide documentation that framing members' certification is according to SIFA's "Code Compliance Certification Program for Cold-Formed Steel Structural and Non-Structural Framing Members."

1.3 INFORMATIONAL SUBMITTALS

- A. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Certified Steel Stud Association, the Steel Framing Industry Association or the Steel Stud Manufacturers Association.
- B. Evaluation Reports: For embossed steel studs and runners and firestop tracks, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.
- B. Horizontal Deflection: For wall assemblies, limited to 1/360 of the wall height based on horizontal loading of 5 lbf/sq. ft..

2.2 FRAMING SYSTEMS

- A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.
 - 1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise indicated.
 - 2. Protective Coating: ASTM A 653/A 653M, G40 or coating with equivalent corrosion resistance of ASTM A 653/A 653M, G40, hot-dip galvanized unless otherwise indicated.
- B. Studs and Runners (092116.A01): ASTM C 645. Use either steel studs and runners or embossed steel studs and runners.
 - 1. Steel Studs and Runners:

- a. Minimum Base-Metal Thickness: 0.0179 inch.
 - b. Provide 0.0296 inch minimum base metal thickness for studs and runners at walls indicated to receive tile, walls indicated to receive abrasion-resistant drywall, impact-resistant drywall, and at other locations indicated.
 - c. Depth: 3-5/8 inches, unless otherwise indicated.
- 2. Embossed Steel Studs and Runners:
 - a. Minimum Base-Metal Thickness: 0.0147 inch.
 - b. Provide 0.025 inch minimum base metal thickness for studs and runners at walls indicated to receive tile, walls indicated to receive abrasion-resistant drywall, impact-resistant drywall, and at other locations indicated.
 - c. Depth: 3-5/8 inches, unless specifically indicated otherwise.
- C. Slip-Type Head Joints: Where indicated, provide one of the following:
 - 1. Double-Runner System: ASTM C 645 top runners, inside runner with 2-inch-deep flanges in thickness not less than indicated for studs and fastened to studs, and outer runner sized to friction fit over inside runner and one gauge heavier than gauge for wall construction indicated.
- D. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
 - 1. Minimum Base-Metal Thickness: 0.0296 inch.
- E. Furring Channels (Furring Members) (09216.A03):
 - 1. Cold-Rolled Channels: 0.0538-inch uncoated-steel thickness, with minimum 1/2-inch-wide flanges, 3/4 inch deep.
- F. Cold-Rolled Channel Bridging: Steel, 0.0538-inch minimum base-metal thickness, with minimum 1/2-inch-wide flanges.
 - 1. Depth: 1-1/2 inches.
 - 2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch-thick, galvanized steel.
- G. Hat-Shaped, Rigid Furring Channels (092116.A02): ASTM C 645.
 - 1. Minimum Base-Metal Thickness: 0.0179 inch.
 - 2. Depth: 7/8 inch, unless specifically indicated otherwise.
- H. Z-Shaped Furring (092116.A04): With slotted or nonslotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 inch, minimum uncoated-metal thickness of 0.0179 inch, and depth required to fit insulation thickness indicated.

2.3 SUSPENSION SYSTEMS

- A. Hanger Attachments to Concrete:
 - 1. Anchors: Capable of sustaining a load equal to 5 times that imposed as determined by ASTM E488.
 - a. Type: Post installed, chemical anchor or post-installed, expansion anchor.
 - 2. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with allowable load capacities calculated according to ICC-ES AC70, greater than or equal to the design load, as determined by testing per ASTM E 1190 conducted by a qualified testing agency.
- B. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.16 inch in diameter.
- C. Flat Hangers: Steel sheet, 1 by 3/16 inch by length indicated.
- D. Carrying Channels (092116.A05): Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.0538 inch and minimum 1/2-inch-wide flanges, 3/4 inch deep. Hot-dip galvanize carrying channels in exterior locations to at least G40 requirements.
 - 1. Depth: 2 inches.
- E. Grid Suspension System for Gypsum Board Ceilings and Soffits (092116.A06): At Contractor's option, pre-manufactured grid suspension systems may be used. Grid suspension system shall comply with ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Armstrong World Industries, Inc; Drywall Grid Systems.
 - b. Chicago Metallic Corporation; 640/660 Drywall Ceiling Suspension.

- c. United State Gypsum Company; Drywall Suspension System.
- F. Furring Channels (Furring Members) (09216.A03) :
 - 1. Cold-Rolled Channels: 0.0538-inch uncoated-steel thickness, with minimum 1/2-inch-wide flanges, 3/4 inch deep.
 - 2. Furring Brackets: Adjustable, corrugated-edge-type steel sheet with minimum uncoated-steel thickness of 0.0329 inch.
 - 3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch-diameter wire, or double strand of 0.048-inch-diameter wire.
- G. Hat-Shaped, Rigid Furring Channels (092116.A02): ASTM C 645, 7/8 inch deep.
 - 1. Minimum Base-Metal Thickness: 0.0179 inch.
- H. Z-Shaped Furring (092116.A04): With slotted or nonslotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 inch, minimum uncoated-metal thickness of 0.0179 inch, and depth required to fit insulation thickness indicated.

2.4 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards.
 - 1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.
- B. Vertical Isolation Strips at Exterior Walls: Provide one of the following:
 - 1. Asphalt-Saturated Organic Felt: ASTM D 226/D 226M, Type I (No. 15 asphalt felt), nonperforated.
- C. Isolation Strips beneath Runner Tracks at Exterior Walls: Provide the following:
 - 1. Polyethylene-sheet-backed rubberized asphalt membrane, 40 mils thick. Field cut to match widths of runners.
- D. Resilient Sound Isolation Clips: Subject to compliance with requirements, provide "RSIC-1" by PAC International or a comparable product submitted to and accepted by Architect prior to bidding with the following product characteristic.
 - 1. Rubber Isolator
 - a. Natural and Manufactured rubber compound
 - b. Molded to isolate ferrule from clip
 - c. Minimum of 12 micro-vibration controlling pedestal at point of contact with framing member.
 - d. Manufactured to ASTM D2000, M2 AA 510 A13, which includes:
 - 1) Hardness, ASTM D2240, Shore A: 47 min
 - 2) Modulus 300 Percent, ASTM D412, Die C: 5.3 MPa.
 - 3) Tensile Strength, ASTM D412, Die C: 11.2 MPa
 - 4) Elongation at Break, ASTM D573: 454 percent.
 - 2. Clip: Galvanized or aluminum-zinc coated steel, 16 gauge.
 - 3. Ferrule: Zinc-electroplated steel.
 - 4. Projection: 1-5/8 inches from supporting structure, when 7/8-inch drywall furring channels are used.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive

hangers at spacing required to support the Work and that hangers will develop their full strength.

1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

3.3 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C 754.
 1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.
- B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.
- C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- D. Install bracing at terminations in assemblies.
- E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING FRAMED ASSEMBLIES

- A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
 1. Single-Layer Application: 16 inches o.c. unless otherwise indicated.
 2. Multilayer Application: 16 inches o.c. unless otherwise indicated.
 3. Tile Backing Panels: 16 inches o.c. unless otherwise indicated.
- B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- C. Where runner tracks for exterior walls are installed directly against concrete or dissimilar metals, install rubberized asphalt isolation strips between bottom of runner track and concrete.
- D. Install studs so flanges within framing system point in same direction.
- E. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.
 1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
 2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
 - a. Install two studs, having a minimum base metal thickness of 0.0296 inches, at each jamb.
 - b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
 - c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
 3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
 4. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
- F. Direct Furring:
 1. Screw to wood framing.
 2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
- G. Z-Shaped Furring Members:
 1. Erect insulation, specified in Section 072100 "Thermal Insulation," vertically and hold in place with Z-shaped furring members spaced 24 inches o.c.

2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
 3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.
- H. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

3.5 INSTALLING SOUND ISOLATION CLIPS AND CEILING HANGERS

- A. Install ceiling hangers, resilient sound isolation clips and drywall furring channels in accordance with manufacturer's written instructions.
 1. Locate resilient sound isolation clips maximum of 8 inches from ends of dry wall furring channels.
- B. Mechanically fasten resilient sound isolation clips to structure with screws, bolts, or expansion anchors, dependent upon structure.
- C. Space resilient sound isolation clips at maximum of 24 inches by 48 inches on center for walls and ceilings.
- D. Do not exceed design load (pull and shear) of 36 pounds per isolation clip.
- E. Stagger isolation clip installation, so dead load is supported by all support members.
- F. Space ceiling hangers as recommended by manufacturer.
 1. Do not exceed design load (pull and shear) of ceiling hanger.
- G. Splicing Drywall Furring Channels:
 1. Splice drywall furring channels with minimum of 6-inch (150-mm) laps.
 2. Secure laps with 2 framing screws or 18 gauge tie wire double wrapped.
 3. Locate splices between resilient sound isolation clips.
 4. Do not locate splices on resilient sound isolation clips.
- H. Install resilient sound isolation clips on 1 side of wall assembly, unless otherwise indicated on the drawings.
- I. Flanking Noise:
 1. Review installation details to prevent structure-borne flanking noise.
 2. Do not allow drywall furring channels or gypsum board to contact foreign materials, including floors, ceilings, or wall framing members.
- J. Ensure metal ferrule of resilient sound isolation clips is in firm contact with structural member.
- K. Gypsum Board:
 1. Install gypsum board in vertical or horizontal position with 1/8-inch to 1/4-inch gap around perimeter for acoustical sealant application.
 2. Install gypsum board in accordance with ASTM C 840 as specified in Section 092900.
- L. Acoustical Sealant:
 1. Seal potential air leaks with acoustical sealant to achieve best Field Sound Transmission Class (FSTC).
 2. Seal electrical outlets and penetrations with acoustical sealant.
 3. Apply fire-rated acoustical sealant at locations where fire-rated assembly is required.
- M. Putty Pad Sealant: Acoustically seal with putty pads, electrical boxes in walls and ceilings in which resilient sound isolation clips are used.

3.6 INSTALLING SUSPENSION SYSTEMS

- A. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
 1. Hangers: 48 inches o.c.

2. Carrying Channels (Main Runners): 48 inches o.c.
 3. Furring Channels (Furring Members): 16 inches o.c.
- B. Suspend hangers from building structure as follows:
1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
 - a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
 - a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
 3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 5. Do not attach hangers to steel roof deck.
 6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
 7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
 8. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- C. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.
- D. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 092116

SECTION 092900 - GYPSUM BOARD

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Interior gypsum board.
 - a. Gypsum Board, Type X (092900.A02).
 - b. Impact-Resistant Gypsum Board (092900.A05).
 - c. Mold-Resistant Gypsum Board (092900.A06).
 - 2. Tile backing panels (092900.A10).
 - 3. Expansion control joint (092900.A12).
 - 4. Aluminum reveal trim (092900.A13).
 - 5. Sound attenuation blankets (092900.A14).
 - 6. Acoustical sealant for sound control assemblies (092900.A15).
- B. Related Requirements:
 - 1. Section 061600 "Sheathing" for gypsum sheathing for exterior walls.
 - 2. Section 092116 "Non-Structural Metal Framing" for non-structural steel framing and suspension systems that support gypsum board panels.
 - 3. Division 26 Sections for electrical connections to lighting components within trim pieces.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For the following products:
 - 1. Trim Accessories: Full-size Sample in 12-inch-long length for each trim accessory indicated.
- C. Samples for Verification: For the following products:
 - 1. Trim Accessories: Full-size Sample in 12-inch-long length for each trim accessory indicated.

1.3 QUALITY ASSURANCE

- A. Integrated Field Sample: Build mockups of at least 100 sq. ft. in surface area to demonstrate aesthetic effects and to set quality standards for materials and execution.
 - 1. Build integrated field sample for the following:
 - a. Each level of gypsum board finish indicated for use in exposed locations.
 - b. Each texture finish indicated.
 - 2. Apply or install final decoration indicated, including painting and wallcoverings, on exposed surfaces for review of mockups.
 - 3. Simulate finished lighting conditions for review of mockups.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.5 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.
- B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, moisture damaged, and mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

2.2 GYPSUM BOARD, GENERAL

- A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

- A. Manufacturer: Subject to compliance with requirements, provide products by one of the following:
 - 1. American Gypsum.
 - 2. CertainTeed Corp.
 - 3. Lafarge North America, Inc.
 - 4. National Gypsum Company.
 - 5. USG Corporation.
- B. Gypsum Board, Type X (092900.A02): ASTM C 1396/C 1396M.
 - 1. Thickness: 5/8 inch.
 - 2. Long Edges: Tapered and featured (rounded or beveled) for prefilling.
- C. Impact-Resistant Gypsum Board (092900.A05): ASTM C 1629/C 1629M.
 - 1. Core: 5/8 inch, Type X.
 - 2. Long Edges: Tapered.
 - 3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
 - 4. Physical Properties when tested in accordance with ASTM C 1629:
 - a. Surface Abrasion Resistance: Level 3.
 - b. Indentation Resistance: Level 1, minimum.
 - c. Soft-Body Impact Resistance: Level 3.
 - d. Hard-Body Impact Resistance: Level 3.
- D. Mold-Resistant Gypsum Board (092900.A06): ASTM C 1396/C 1396M. With moisture- and mold-resistant core and paper surfaces.
 - 1. Core: 5/8 inch, Type X.
 - 2. Long Edges: Tapered.
 - 3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.4 TILE BACKING PANELS

- A. Cementitious Backer Units (092900.A10): ANSI A118.9 and ASTM C 1288 or ASTM C 1325, with manufacturer's standard edges.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide one of the following products or a comparable product, with the following product characteristics, submitted to and accepted by Architect prior to bidding.
 - a. C-Cure.; C-Cure Board 990
 - b. National Gypsum Company.; Permabase Cement Board.
 - c. USG Corporation.; DUROCK Cement Board.
 - 2. Thickness: 5/8 inch.
 - 3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.5 TRIM ACCESSORIES

- A. Interior Trim (092900.A11): ASTM C 1047.
 - 1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
 - 2. Shapes:
 - a. Cornerbead.
 - b. L-Bead: L-shaped; exposed long flange receives joint compound.
 - c. J-Bead: J-shaped; exposed short flange does not receive joint compound.
 - d. Expansion (control) joint.
 - e. Wall end cap: Provide "Fast Cap" as manufactured by Trim-Tex Drywall Products.
- B. Aluminum Reveal Trim (092900.A13): Extruded accessories of profiles and dimensions indicated.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Fry Reglet Corporation.
 - b. Gordon Inc.
 - c. Pittcon Industries.
 - d. Softforms.
 - 2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221, Alloy 6063-T5.
 - 3. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.
 - a. Provide a paintable mill finish for reveal trim indicated to be painted.
 - 4. Profiles:
 - a. Linear 1/2" Reveal Molding; Basis of Design; Fry Reglet Corp., Model DRM-50-50 or comparable product from listed manufacturers.

2.6 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475/C 475M.
- B. Joint Tape:
 - 1. Interior Gypsum Board: Paper.
 - 2. Tile Backing Panels: As recommended by panel manufacturer.
 - 3. Cementitious Backer Units: As recommended by backer unit manufacturer.
- C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.
 - 1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
 - 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use drying-type, all-purpose compound.
 - 3. Fill Coat: For second coat, use drying-type, all-purpose compound.
 - 4. Finish Coat: For third coat, use drying-type, all-purpose compound.
 - 5. Skim Coat: For final coat of Level 5 finish, use drying-type, all-purpose compound.
 - a. Where specifically indicated on Drawings, provide a setting-type, sandable topping compound for trowel-applied skim coat.

- D. Joint Compound for Tile Backing Panels:
 - 1. Cementitious Backer Units: As recommended by backer unit manufacturer.

2.7 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.
- B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
 - 1. Laminating adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Laminating adhesive shall comply with the testing and product 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."
- C. Steel Drill Screws: ASTM C 1002 unless otherwise indicated.
 - 1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
 - 2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
- D. Thermal Insulation: As specified in Section 072100 "Thermal Insulation."
- E. Sound-Attenuation Blankets (092900.A14): ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
 - 1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
 - 2. Recycled Content of Blankets: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- F. Acoustical Impaling clips (092900.A14): Galvanized sheet metal impaling clips each with 8 spikes that stick onto the fiberglass and hold the panel in place; 2-1/8" x 1-1/2"; install by either drywall screws or attached with adhesive as recommended by the manufacturer.
- G. Acoustical Joint Sealant (092900.A15): Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide one of the following products or a comparable product, with the following product characteristics, submitted to and accepted by Architect prior to bidding.
 - a. Accumetric LLC.; BOSS 824 Acoustical Sound Sealant.
 - b. Pecora Corporation.; AIS-919.
 - c. USG Corporation.; SHEETROCK Acoustical Sealant.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

- A. Comply with ASTM C 840.

- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
 - 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
 - 2. Fit gypsum panels around ducts, pipes, and conduits.
 - 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch-wide joints to install sealant.
 - 4. Where ceilings in showers abut adjacent walls, Provide 1/4- to 3/8-inch-wide spaces and trim edges with plastic edge trim to allow for sealant.
- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch-wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- I. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written instructions for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
- J. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 APPLYING INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations:
 - 1. Type X: Vertical and horizontal surfaces of walls, soffits, bulkheads and ceiling surfaces unless otherwise indicated.
 - 2. Impact-Resistant Type: Refer to Drawings for locations required.
 - 3. Tile Backing Panels: Restroom walls indicated to receive tile.
- B. Single-Layer Application:
 - 1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
 - 2. On partitions/walls, apply gypsum panels vertically (parallel to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
 - a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
 - b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.
 - 3. On Z-shaped furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
 - 4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.
- C. Multilayer Application:

1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
3. On Z-shaped furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
4. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

3.4 APPLYING TILE BACKING PANELS

- A. Cementitious Backer Units: ANSI A108.11
 1. Locations:
 - a. At shower ceiling locations and vertical surfaces indicated to receive tile
 - b. At showers, tubs, and where indicated
 - c. At locations indicated to receive tile.
- B. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.5 INSTALLING TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.
- C. Interior Trim: Install in the following locations:
 1. Cornerbead: Use at outside corners.
 2. L-Bead: Use where indicated.
 3. U-Bead: Use at exposed panel edges.
- D. Aluminum Trim: Install in locations indicated on Drawings.
- E. Wall-to-Mullion Sound Seals: Install according to manufacturer's written instructions at locations indicated on Drawings.

3.6 FINISHING GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints, rounded or beveled edges, and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
 1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
 2. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.
 - a. Primer and its application to surfaces are specified in other Division 09 Sections.
 3. Level 5:
 - a. Provide at the following locations:
 - 1) Behind custom wallcovering murals

- 2) At walls perpendicular to exterior glazing.
 - 3) Down Light / Wall Washers.
 - 4) Where indicated on Drawings.
 - b. Primer and its application to surfaces are specified in Other Division 09 Sections.
- E. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.7 PROTECTION

- A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.
- B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900

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SECTION 093000 - TILING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Ceramic and quarry tile (093000.A01).
 - 2. Metal edge strips (093000.A04).
- B. Related Requirements:
 - 1. Section 042000 "Unit Masonry" for references to installation over concrete masonry units.
 - 2. Section 079200 "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
 - 3. Section 092900 "Gypsum Board" for cementitious backer units.

1.2 DEFINITIONS

- A. General: Definitions in the ANSI A108 series of tile installation standards and, in ANSI A137.1 apply to Work of this Section unless otherwise specified.
- B. ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1A, ANSI A108.1B, ANSI A108.1C, ANSI A108.4, ANSI A108.5, ANSI A108.6, ANSI A108.8, ANSI A108.9, ANSI A108.10, ANSI A108.11, ANSI A108.12, ANSI A108.13, ANSI A108.14, ANSI A108.15, ANSI A108.16, ANSI A108.17, 108.18, 108.19, 108.20, A118, A136 which are contained in its "Specifications for Installation of Ceramic Tile."
- C. ANSI A 137.1, American National Standard Specifications for Ceramic Tile.
- D. ANSI A 137.2, American National Standard Specifications for Glass Tile.
- E. ANSI A 37.3, American National Standards Specifications for Gauged Porcelain Tile and Gauged Porcelain Tile Panel/Slabs.
- F. Face Size: Actual tile size, excluding spacer lugs.
- G. Module Size: Actual tile size plus joint width indicated.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review requirements in ANSI A108.01 for substrates and for preparation by other trades.

1.4 PERFORMANCE REQUIREMENTS

- A. Static Coefficient of Friction: For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products per ASTM C 1028:
 - 1. Level Surfaces: Minimum 0.60.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.
 - 1. Show extent and locations for waterproof membrane and crack isolation membrane.

- C. Samples for Initial Selection: For tile, grout, and accessories involving color selection.
- D. Samples for Verification:
 1. Full-size units of each type and composition of tile and for each color and finish required.
 2. Full-size units of each type of trim and accessory for each color and finish required.
 3. Metal edge strips in 6-inch lengths.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.
- C. Product Certificates: For each type of product.
- D. Product Test Reports: For tile-setting and -grouting products.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Tile and Trim Units: Furnish one unopened box, but not more than 2 percent, for each type, composition, color, pattern, and size indicated.

1.8 QUALITY ASSURANCE

- A. Source Limitations for Tile: Obtain tile of each type and color or finish from one source or producer.
 1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.
- B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from one manufacturer and each aggregate from one source or producer.
- C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer for each product:
 1. Crack isolation membrane.
 2. Joint sealants.
 3. Metal edge strips.
- D. Installer Qualifications:
 1. Installer is a five-star member of the National Tile Contractors Association or a Trowel of Excellence member of the Tile Contractors' Association of America.
 2. Installer's supervisor for Project holds the International Masonry Institute's Foreman Certification.
 3. Installer employs Ceramic Tile Education Foundation Certified Installers or installers recognized by the U.S. Department of Labor as Journeyman Tile Layers.
- E. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 1. Build mockup of each type of wall tile installation.
 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- F. Mockups/Field Samples: Build mockups/field samples to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 1. Build mockups/field samples of each type of restroom wall tile installation. Mockup/field sample shall extend to floor to demonstrate transition from wall to floor.
 2. Build mockups/field samples of each type of wall tile installation.

3. Approved mockups/field samples may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.
- B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.
- C. Store liquid materials in unopened containers and protected from freezing.
- D. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.10 FIELD CONDITIONS

- A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Static Coefficient of Friction: For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products per ASTM C 1028:
 1. Level Surfaces: Minimum 0.60.

2.2 MANUFACTURERS

- A. Source Limitations for Tile: Obtain tile of each type from single source or producer.
 1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.
- B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from single manufacturer and each aggregate from single source or producer.
 1. Obtain setting and grouting materials, except for unmodified Portland cement and aggregate, from single manufacturer.
 2. Obtain waterproof membrane and crack isolation membrane, except for sheet products, from manufacturer of setting and grouting materials.
- C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer:
 1. Metal edge strips.

2.3 PRODUCTS, GENERAL

- A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.
 1. Provide tile complying with Standard grade requirements.
- B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.

- C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.
- D. Factory-Applied Temporary Protective Coating: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by pre-coating with continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.

2.4 CERAMIC TILE PRODUCTS

- A. Tile Type (093000.A01 – T21, T22, T23):
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Daltile; "Classic Color Wheel."
 - a. Comparable products from other manufacturer's, meeting specified requirements, colors and shape, will be considered when submitted to and accepted by Architect prior to bidding.
 - 2. Composition: Glazed ceramic.
 - 3. Size: Refer to Material Finish Legend.
 - 4. Thickness: 5/16 inch.
 - 5. Tile Color and Pattern: As indicated by manufacturer's designations on Material Finish Legend.
 - 6. Grout Color: As selected from manufacturers full range.
 - 7. DCOF: ≥ 0.42 .
 - 8. Performance Characteristics:
 - a. Water Absorption: ASTM C 373, <20%.
 - b. Breaking Strength: ASTM C 648, 120-230 lbs.
 - c. Scratch Hardness: MOHS, 4.0 - 6.0.
 - d. Chemical Resistance: ASTM C 650, Resistant.

2.5 WATERPROOF MEMBRANE AND CRACK ISOLATION MEMBRANE (093000.A03)

- A. Fluid-Applied Waterproofing/Crack Isolation Membrane: Liquid-latex rubber or elastomeric polymer.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Laticrete; "Hydro Ban" waterproofing and crack isolation membrane. Comparable products from other manufacturers will be considered when submitted to and accepted by Architect prior to bidding.
 - 2. Product Description and Characteristics:
 - a. Single component, self-curing liquid rubber polymer that forms a flexible and seamless membrane.
 - b. Thickness: Not less than 0.020 inches when cured.
 - c. Anti-fracture protection up to 1/8 inch.
 - d. Extra Heavy Service rating per TCNA.
 - 3. Adhesives shall have a VOC content of 65 g/L or less.
 - 4. Adhesive shall comply with the testing and product 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."

2.6 SETTING MATERIALS

- A. Improved Modified Dry-Set Mortar (Thinset and LHT Mortars): ANSI A118.15.
 - 1. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
 - 2. For large & heavy tile (LHT) use mortar meeting LHT requirements.
 - 3. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.15.

2.7 GROUT MATERIALS

- A. High-Performance Polymer-Modified Tile Grout: Meeting or exceeding ANSI A118.7. Grout shall be chemical and stain resistant type. Polymer modified with ethylene vinyl acetate or acrylic additive, in dry, re-dispersible form, pre-packaged with other dry ingredients. Grout shall be fast setting, highly stain resistant, crack and shrink resistant, and mold /mildew resistant.

1. Basis-of-Design Product: LATICRETE International, Inc., "Permacolor Grout" or comparable product from other manufacturers listed below, meeting specified requirements, submitted to and accepted by Architect prior to bidding.
 - a. Ardex.
 - b. Bostik, Inc.
 - c. Custom Building Products.
 - d. MAPEI.
 - e. Mer-Kote Products, Inc.
 - f. Southern Grouts & Mortars, Inc.
 - g. Summitville Tiles, Inc.
 - h. TEC; a subsidiary of H. B. Fuller Company.
 2. Grout Color: As selected by Architect.
- B. Water-Cleanable High Performance Epoxy Grout: ANSI A118.3, with a working time not less than 80 minutes, equipped with anti-microbial technology and a full cure time of 14 days at 70 degrees F, and with a VOC content of 65 g/L or less.
1. Basis-of-Design Product: LATICRETE International, Inc., "Spectralock PRO Grout" or comparable product from other manufacturers listed below, meeting specified requirements, submitted to and accepted by Architect prior to bidding.
 - a. Ardex.
 - b. Bostik, Inc.
 - c. Custom Building Products.
 - d. MAPEI.
 - e. Mer-Kote Products, Inc.
 - f. Southern Grouts & Mortars, Inc.
 - g. Summitville Tiles, Inc.
 - h. TEC; a subsidiary of H. B. Fuller Company.
 2. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 deg. F. and 212 deg. F., respectively, and certified by manufacturer for intended use.
 3. Grout Color: As selected by Architect.

2.8 MISCELLANEOUS MATERIALS

- A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.
- B. Rapid Set Pre-Tiling Mortar: mortar shall be designed for both interior and exterior use and shall be non-sag type.
 1. Basis-of-Design Product: Ardex; "AM 100 Rapid Set" or comparable product submitted to and accepted by Architect prior to bidding.
 2. Locations for Use: Provide as a ¼ inch thick leveling mortar over interior concrete unit masonry walls indicated to receive tile.
- C. Metal Edge Strips (093000.A04): Profile as specified below, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring and wall applications; white zinc alloy or Type 316 L stainless-steel, ASTM A 666, 300 Series exposed-edge material. Provide Schluter profiles as follows:
 1. Type TR23 – Schluter; "Jolly" straight-edge profile for the outside vertical edges of tiled surfaces on walls transitioning to another material.
 - a. Satin Anodized Aluminum.
 - b. Size: To be selected from manufacturers full range.
 - c. Provide at the outside corner as indicated on the drawings.
- D. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.
- E. Grout Sealer: Manufacturer's standard product for sealing grout joints and that does not change color or appearance of grout.

2.9 MIXING MORTARS AND GROUT

- A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
- B. Add materials, water, and additives in accurate proportions.
- C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 - 1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
 - 2. Verify that concrete substrates for tile floors installed with thinset mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.
 - a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
 - b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.
 - c. Verify that protruding edges of concrete masonry units have been ground smooth and flush with plane of wall.
 - 3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
 - 4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.
- B. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.
- C. Field-Applied Temporary Protective Coating: If indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, pre-coat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

3.3 TILE INSTALLATION

- A. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.
 - 1. For the following installations, follow procedures in the ANSI A108 series of tile installation standards for providing 95 percent mortar coverage:
 - a. Tile floors in wet areas.
 - b. Tile floors consisting of tiles 8 by 8 inches or larger.
 - c. Tile floors consisting of rib-backed tiles.

- B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
- C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
- D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.
- E. Jointing Pattern: Lay tile in stacked grid pattern, unless otherwise indicated. Lay tile Type TX in a straight stacked pattern. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
 - 1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
 - 2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
 - 3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.
- F. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:
 - 1. Wall Tile: 1/8 inch.
- G. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.
 - 1. Terminate top of wainscot decorative metal edge trim.
- H. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
 - 1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
 - 2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."
- I. Metal Edge Strips: Install where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with or below top of tile and no threshold is indicated.
- J. Grout Sealer: Apply grout sealer to cementitious grout joints in the wainscot according to grout-sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

3.4 WATERPROOFING INSTALLATION

- A. Install waterproofing to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness that is bonded securely to substrate.
 - 1. Allow waterproofing to cure and verify by testing that it is watertight before installing tile or setting materials over it.

3.5 CRACK ISOLATION MEMBRANE INSTALLATION

- A. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness that is bonded securely to substrate.
 - 1. Allow crack isolation membrane to cure before installing tile or setting materials over it.

3.6 ADJUSTING AND CLEANING

- A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.
- B. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

1. Remove grout residue from tile as soon as possible.
2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.
3. Remove temporary protective coating by method recommended by coating manufacturer and that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent drain clogging.

3.7 PROTECTION

- A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.
 1. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.
- B. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

3.8 INTERIOR TILE INSTALLATION SCHEDULE

- A. Interior Wall Installations (except wet walls), Metal Studs or Furring:
 1. Tile Installation: **Thin-set mortar on cementitious backer unit; TCNA W244C-18. [[OR]] LHT mortar on cementitious backer unit; TCNA W244C-18.**
 - a. Thin-Set Mortar: Latex-portland cement mortar.
 - b. Grout: High performance grout.
- B. Interior Wall Installations (Wet Walls), Metal Studs or Furring:
 1. Tile Installation: **Thin-set mortar on cementitious backer unit; TCNA W244C-18. [[OR]] LHT mortar on cementitious backer unit; TCNA W244C-18.**
 - a. Thin-Set Mortar: Latex-portland cement mortar over liquid waterproofing.
 - b. Grout: Water-cleanable epoxy grout.

END OF SECTION 093000

SECTION 095113 - ACOUSTICAL PANEL CEILINGS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Acoustical ceiling panels (095113.A01 - CLG1, CLG2, CLG3, CLG4, CLG5).
 - 2. Ceiling suspension systems (095113.A02).
 - 3. Decorative edge trim for ceilings. (095113.A04).
- B. Related Requirements:
 - 1. Section 012300, "Alternates" for alternates effecting work of this section.
 - 2. Division 26 Sections for electrical requirements.

1.2 PRE-INSTALLATION MEETINGS

- A. Pre-installation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified.
- C. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.
 - 1. Acoustical Panel: One 6 inch square Sample of each type, color, pattern, and texture.
 - 2. Decorative Edge Trim: One 6 inch long Sample of each type, finish, and color. Include splice plate and attachment clip.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Suspended ceiling components.
 - 2. Structural members to which suspension systems will be attached.
 - 3. Size and location of initial access modules for acoustical panels.
 - 4. Items penetrating finished ceiling including the following:
 - a. Lighting fixtures.
 - b. Air outlets and inlets.
 - c. Speakers.
 - d. Sprinklers.
 - e. Access panels.
 - 5. Perimeter moldings.
- B. Installer Qualifications: Submit written certification of compliance with requirements.
- C. Qualification Data: For testing agency.
- D. Evaluation Reports: For each acoustical panel ceiling suspension system, from ICC-ES.
- E. Product test reports.
- F. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For finishes to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Acoustical Ceiling Panels: Furnish two, unopened boxes of each type installed.
 - 2. Suspension-System Components: Quantity of each exposed component equal to 2 percent of quantity installed.
 - 3. Hold-Down Clips: Equal to 2 percent of quantity installed.
 - 4. Impact Clips: Equal to 2 percent of quantity installed.
 - 5. Single Tee Adapter Clips: Equal to 2 percent of quantity installed.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Firm with not less than three years of successful experience in installation of acoustical ceilings similar to requirements for this project and which is acceptable to manufacturer of acoustical units, as shown by current written statement from manufacturer.
- B. Pre-installation Conference: Conduct conference at Project site to comply with requirements of Section 01 31 00.
- C. Testing Agency Qualifications: Qualified according to NVLAP.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical panels, suspension-system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
- B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.
- C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
 - 1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Ceiling 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."
- B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: Comply with ASTM E 1264 for Class A materials.

2. Smoke-Developed Index: 50 or less.

2.2 ACOUSTICAL PANEL CEILINGS, GENERAL

- A. Source Limitations:
 1. Acoustical Ceiling Panel: Obtain each type from single source from single manufacturer.
 2. Suspension System: Obtain each type from single source from single manufacturer.
- B. Glass-Fiber-Based Panels: Made with binder containing no urea formaldehyde.
- C. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances unless otherwise indicated.
 1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches away from test surface according to ASTM E 795.
- D. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.
 1. Where appearance characteristics of acoustical panels are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.
- E. Metal Suspension System Standard: Comply with ASTM C 635.

2.3 ACOUSTICAL PANELS (095113.A01)

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product specified hereinafter or comparable product, meeting specified requirements, by one of the following:
 1. Acoustical Ceiling Units:
 - a. Armstrong World Industries, Inc.
 - b. Certainteed, Saint-Gobain.
 - c. USG Interiors, Inc.; Subsidiary of USG Corporation.
 2. Metal Suspension Systems, Edge Moldings and Decorative Edge Trim:
 - a. Armstrong World Industries, Inc.
 - b. Certainteed, Saint-Gobain.
 - c. Chicago Metallic Corporation.
 - d. Gordon, Inc.
 - e. USG Interiors, Inc.; Subsidiary of USG Corporation.
- B. Classification: Provide panels complying with ASTM E 1264 for type, form, and pattern as specified.
- C. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical panels treated with manufacturer's standard antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.

2.4 ACOUSTICAL CEILING PANELS

- A. Acoustical Ceiling Panel, (095113.A01 – CLG1, CLG2): Provide fine textured, square edge lay-in, mineral fiber ceiling panels with the following characteristics:
 1. ASTM E 1264 Classification: Type III, Form 2, Pattern CE.
 2. Size:
 - a. CLG1: 24" x 48" x 7/8".
 - b. CLG2: 24" x 24" x 7/8".
 3. Color: White.
 4. Average light reflectance (LR): 0.53.
 5. Noise reduction coefficient (NRC): 0.75, minimum.
 6. Ceiling attenuation class (CAC): 35, minimum.
 7. Flame Spread/Fire Resistance: Class A.

8. Antimicrobial: Manufacturer's standard antimicrobial treatment.
 9. Humidity Resistance: Manufacturer's standard humidity resistant treatment.
 10. Product warranty: 30 years.
 11. Suspension grid type: 15/16.
 12. Basis of Design Product: Provide Armstrong "Fine Fissured High NRC", or comparable products from manufacturers listed in Article 2.3 of this Section.
- B. Acoustical Ceiling Panel, (095113.A01 – CLG3): Provide fine textured, square edge lay-in, mineral fiber ceiling panels with the following characteristics:
1. ASTM E 1264 Classification: Type IV, form 2, Pattern E.
 2. Sizes: 24" x 24" x 3/4"
 3. Color: White.
 4. Average light reflectance (LR): 0.88.
 5. Noise reduction coefficient (NRC): 0.75
 6. Ceiling attenuation class (CAC): 0.35 minimum.
 7. Flame Spread/Fire Resistance: Class A.
 8. Antimicrobial: Manufacturer's standard antimicrobial treatment.
 9. Humidity Resistance: Manufacturer's standard humidity resistant treatment.
 10. Product warranty: 30 years.
 11. Suspension grid type: 15/16.
 12. Basis of Design Product: Provide Armstrong "Ultima High NRC" or comparable products from manufacturers listed in Article 2.3 of this Section.
- C. Acoustical Ceiling Panel, (095113.A01 – CLG4, CLG5): Provide fine textured, tegular, mineral fiber ceiling panels with the following characteristics:
1. ASTM E 1264 Classification: Type IX, Form 2, Pattern G.
 2. Size:
 - a. CLG4: 24" x 48" x 5/8".
 - b. CLG5: 24" x 24" x 5/8".
 3. Color: White.
 4. Average light reflectance (LR): 0.89.
 5. Noise reduction coefficient (NRC): N/A.
 6. Flame Spread/Fire Resistance: Class A.
 7. Antimicrobial: Manufacturer's standard antimicrobial treatment.
 8. Humidity Resistance: Manufacturer's standard humidity resistant treatment.
 9. Product warranty: 30 years.
 10. Suspension grid type: 15/16.
 11. Basis of Design Product: Provide, Armstrong "Kitchen Zone" or comparable products from manufacturers listed in Article 2.3 of this Section.

2.5 METAL SUSPENSION SYSTEMS, GENERAL

- A. Metal Suspension-System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635/C 635M.
1. High-Humidity Finish: Comply with ASTM C 635/C 635M requirements for "Coating Classification for Severe Environment Performance" where high-humidity finishes are indicated.
- B. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
1. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing according to ASTM E 488 or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.
 - a. Type: Post-installed expansion anchors.
 - b. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (0.005 mm) for Class SC 1 service condition.
 2. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing according to ASTM E 1190, conducted by a qualified testing and inspecting agency.

- C. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
 - 1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
 - 2. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635/C 635M, Table 1, "Direct Hung") will be less than yield stress of wire, provide not less than 0.106-inch-diameter wire.
- D. Hanger Rods and Flat Hangers: Mild steel, zinc coated or protected with rust-inhibitive paint.
- E. Hold-Down Clips for Non-Fire-Resistance-Rated Ceilings: For vestibule and corridor ceilings adjacent to exterior doors, provide hold-down clips spaced 2'-0" o.c. on all cross-tees for a radius of 10 feet from center of door.
- F. Impact Clips: In all toilet provide manufacturer's standard impact clip system design to absorb impact forces against lay-in panels.
- G. Hemmed Edge Molding: Provide prefinished edge molding of profiles indicated. Finish to match adjacent suspension grid.
- H. Fixture Trim: Provide manufacturer's standard fixture trim for fixtures within the 4 by 4 ceiling panels.
 - 1. Color to match suspension trim.

2.6 METAL SUSPENSION SYSTEM (095113.A02)

- A. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; pre-painted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, not less than G30 coating designation; with prefinished 15/16-inch- wide metal caps on flanges.
 - 1. Structural Classification: Intermediate-duty system.
 - 2. End Condition of Cross Runners: Override (stepped) or butt-edge type.
 - 3. Face Design: Flat, flush.
 - 4. Cap Material: Steel cold-rolled sheet, except in kitchen and food preparation areas provide aluminum.
 - 5. Basis of Design:
 - a. Armstrong "Prelude XL"

2.7 ACOUSTICAL SEALANT

- A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Acoustical Sealant for Concealed Joints:
 - a. Henkel Corporation; OSI Pro-Series SC-175 Acoustical Sound Sealant.
 - b. Pecora Corporation; AIS-919.
 - c. Tremco, Inc.; Tremco Acoustical Sealant.
- B. Acoustical Sealant: Manufacturer's standard sealant complying with ASTM C 834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
 - 1. Concealed Joints: Nondrying, non-hardening, non-skinning, non-staining, gunnable, synthetic-rubber sealant.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.
- B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION

- A. General: Install acoustical panel ceilings to comply with ASTM C 636/C 636M and seismic design requirements indicated, according to manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."
- B. Suspend ceiling hangers from building's structural members and as follows:
 - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
 - 2. Splay hangers only where required and, if permitted with fire-resistance-rated ceilings, to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 - 3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
 - 4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
 - 5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
 - 6. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, post-installed mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
 - 7. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
 - 8. Do not attach hangers to steel deck tabs.
 - 9. Do not attach hangers to steel roof deck. Attach hangers to structural members.
 - 10. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
 - 11. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
- C. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.
 - 1. Arrange directionally patterned acoustical panels as indicated on reflected ceiling plans.
- D. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or post-installed anchors.
- E. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
 - 1. At areas indicated, apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
 - 2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
 - 3. Do not use exposed fasteners, including pop rivets, on moldings and trim, unless acceptable to Architect.
- F. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

- G. Install decorative edge trim at locations and in configurations indicated. Install in accordance with trim manufacturer's written instructions and approved shop drawings.
- H. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
 - 1. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension-system runners and moldings.
 - 2. For reveal-edged panels on suspension-system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
 - 3. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
 - 4. Hold-Down Clips for Non-Fire-Resistance-Rated Ceilings: For vestibule ceilings adjacent to exterior doors, provide hold-down clips spaced 2'-0" o.c. on all cross-tees for a radius of 10 feet from center of door.
 - 5. Impact Clips: In all toilet and locker rooms, provide manufacturer's standard impact clip system design to absorb impact forces against lay-in panels.

3.4 CLEANING

- A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095113

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SECTION 096466 - WOOD ATHLETIC AND STAGE FLOORING

PART 1 GENERAL

1.1 SUMMARY

- A. This Section includes:
 - 1. Wood strip gymnasium flooring (096466.A01 - AF1).
 - 2. Underlayment / Subflooring (096466.A02).
 - 3. Resilient pads (096466.A04).
 - 4. Vapor barriers (096466.A05).
 - 5. Vent cove base (099466.A06) and expansion cover plates (096466.A07).
 - 6. Stage coverboard (096466.A12 - AF2).
 - 7. Finishing of wood flooring.
 - 8. Refinishing existing wood gymnasium floor.
- B. Related Sections include the following:
 - 1. Section 061000 "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing woodwork and concealed within other construction before woodwork installation.
 - 2. Section 062023 "Interior Finish Carpentry" for wood running trim.

1.2 ACTION SUBMITTALS

- A. Product Data: Submit manufacturer's detailed technical product data and installation instructions for each type of wood flooring and accessory item. Include instructions for handling, storage, installation, finishing, protection and maintenance.
- B. Shop Drawings: For each type of floor assembly and accessory. Include plans, elevations, sections, details, and attachments to other work. Include the following:
 - 1. Expansion provisions and trim details.
 - 2. Layout, colors, widths, and dimensions of game lines and markers.
 - 3. Locations of floor inserts for athletic equipment installed through flooring assembly.
- C. Samples:
 - 1. Material Samples: Submit sets of range samples for each type of wood flooring. Include minimum 6" long samples of each type of required accessory item.
 - 2. Finish Samples: Upon selection of finish characteristics, submit three, 8 inch by 8 inch actual samples of each gloss range of finish for finish selection purposes.
 - 3. Samples for Verification: Upon selection of finish characteristics, submit one, 12 inch by 12 inch actual samples showing selected gloss of finish for wood strip gymnasium flooring for verification purposes.

1.3 INFORMATIONAL SUBMITTALS

- A. Product test reports.
- B. Quality Control Submittals:
 - 1. Installer's Statement of Qualifications: Installer's qualifications shall be submitted to Architect a minimum of 10 calendar days in advance of Bid Date.
 - 2. Maintenance Procedures: Submit three (3) copies of "MFMA Care and Preservation" pamphlet.

1.4 QUALITY ASSURANCE

- A. Floor Installer Qualifications: Firm experienced in application or installation of systems similar in complexity to those required for this Project, plus the following:
 - 1. Flooring installer shall have a minimum of five (5) years continuous years experience under current company name.

2. Successfully completed a minimum of ten (10) comparable scale projects using the specified system. The square footage of these projects must total at least 45,000 sq ft.
 3. Flooring installer shall submit a reference list, complete with Owner, Architect, phone number of each, and square footage installed of at least nine (9) completed projects in the States of Missouri similar in size and specification.
 4. Flooring installer shall provide written confirmation of required qualifications to Construction Manager accompanying his/her sub-bid proposal.
- B. Source Quality Control: Obtain flooring of each type from single manufacturer or source, to ensure match of quality, color, pattern and texture.
- C. Maple Flooring: Comply with MFMA grading rules for species, grade, and cut.
1. Certification: Provide flooring that carries MFMA mark on each bundle or piece.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver material to building until demolition and "wet work" such as painting have been completed and cured to a condition of equilibrium.
- B. Moisture Content: At time of delivery, limit average moisture content of wood flooring to 12 percent, with 14 percent maximum for any piece.
- C. Protect wood flooring from excessive moisture in shipment, storage, and handling. Deliver in unopened cartons or bundles and store in a dry place, with adequate air circulation.

1.6 PROJECT CONDITIONS

- A. Conditioning: Do not proceed with installation of wood flooring until all overhead mechanical and electrical work, backstops, etc., is complete and spaces are at approximate humidity condition planned for occupancy. Condition wood for 7 days prior to start of installation by placing in spaces to receive flooring and maintaining ambient temperature between 65 deg F and 70 deg F before, during, and after installation. Condition spaces to receive wood flooring to have a relative humidity range of 35 to 50. Open packages of wood flooring which are sealed (if any) to permit natural adjustment of moisture content.
- B. Protection: After wood flooring is completed it shall be protected to allow for proper curing time for the finishes. Flooring shall be protected until substantial completion by covering floors with non-fibred kraft paper.

1.7 SPECIAL PROJECT WARRANTY

- A. Submit three (3) year warranty signed by Manufacturer and Installer, agreeing to repair or replace wood flooring which shrinks, warps, cracks, or otherwise deteriorates excessively, or which breaks its anchorage or bond with substrate or otherwise fails to perform as required, due to failures of materials and/or workmanship and not due to unusual exposure to moisture or other abusive forces or elements not anticipated for application.

1.8 EXTRA STOCK/REPLACEMENT MATERIAL

- A. After completion of wood flooring work, deliver to project site not less than 1.0 percent of quantity of each type wood strip flooring installed on the project. Provide in manufacturer's original, unopened cartons or bundles.

1.9 CLOSEOUT SUBMITTALS

- A. Maintenance data.

PART 2 PRODUCTS

2.1 GENERAL

- A. Floor Type:
 - 1. Wood Athletic Flooring: Floating on resilient pads with gymnasium wood flooring.
 - 2. Hardboard Stage Flooring (back stage): Floating on resilient pads with stage coverboard.
- B. Floor System Thickness: 2 to 2-1/4 inches.

2.2 MANUFACTURER AND PRODUCT

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Robbins; "Bio-Cushion Classic Floor System or comparable product from another manufacturer submitted to and accepted by Architect prior to bidding.

2.3 WOOD STAGE FLOOR MATERIALS

- A. Plywood Underlayment / Subflooring (096466.A02): Provide 2 layers of APA Rated Sheathing, C-D plugged veneer grades, Exposure 1. Plywood shall be 15/32 (1/2) inch thick (span rated 48/24), 4' x 8' sheets, square edge; of. Veneer species shall be Group 2 classification.
- B. Resilient Pads (096466.A04): Provide resilient pads with air voids for resiliency and installed at manufacturer's standard spacing for product designation indicated below.
 - 1. Basis of Design Product: Robbins Sports Surfaces; Bio-Pads.
 - 2. Material: EPDM rubber or Neoprene.
 - 3. Thickness: 7/16 inch.
- C. Vapor Barrier (096466.A05): Provide six (6) mil polyethylene sheet having a perm rating not greater than 0.13. Use only materials which are resistant to decay when tested in accordance with ASTM D 2103.
 - 1. Lap Tape: Double-sided, asphalt based pressure sensitive tape; 1-1/2" wide or at Contractor's option, asphalt based sealant may be used.
- D. Hardboard Stage Flooring System (096466.A12 – AF2): System includes, but is not limited to the following, vapor barrier, resilient pads, three layers of 1/2 inch plywood and one layer of 1/4-inch thick coverboard.
- E. Mineral Wool Insulation (072100.A17):
 - 1. Provide mineral wool blaket insulation between wood sleepers and blocking.
 - 2. Refer to Section 072100 for mineral wool insulation product requirements.
- F. Stage Coverboard: Provide 1/4-inch thick, tempered hardboard, smooth two sides (S2S), complying with ANSI A135.4. Sheet sizes shall be 4 feet square.
 - 1. Coverboard shall be painted on both faces and all edges prior to installation.
 - 2. Coverboard shall be pre-drilled and screws shall be countersunk upon installation.
 - 3. Basis of Design: Provide DPI Decorative Panels International "1/4" Tempered Premium Hardboard"
 - a. NAUF (No Added Urea Formaldehyde).
- G. Wood Sleepers and Blocking: Provide 1 x 4, S4S lumber with 15 percent maximum moisture content and of the following species and grades:
 - 1. Mixed southern pine; No. 2 grade; SPIB.
 - 2. Wood blocking shall be located along entire perimeter of floor. Wood sleepers shall be located along entire perimeter of floor and in the field of floor spaced at 16-inch centers.
- H. Fasteners: Type and size recommended by manufacturer, but not less than those recommended by MFMA for application indicated.
- I. Refer to Section 055000 for requirements regarding steel angles, steel base, and coverplates.

2.4 GYMNASIUM WOOD FLOOR MATERIALS

- A. Wood Gymnasium Flooring System (096466.A01 – AF1): System includes, but is not limited to the following, vapor barrier, resilient pads, two layers of 1/2 inch plywood and one layer wood strip gymnasium flooring
- B. Plywood Underlayment / Subflooring (096466.A02): Provide 2 layers of APA Rated Sheathing, C-D plugged veneer grades, Exposure 1. Plywood shall be 15/32 (1/2) inch thick (span rated 48/24), 4' x 8' sheets, square edge; of. Veneer species shall be Group 2 classification.
- C. Resilient Pads (096466.A04): Provide resilient pads with air voids for resiliency and installed at manufacturer's standard spacing for product designation indicated below.
 - 1. Basis of Design Product: Robbins Sports Surfaces; Bio-Pads.
 - 2. Material: EPDM rubber or Neoprene.
 - 3. Thickness: 7/16 inch.
- D. Vapor Barrier (096466.A05): Provide six (6) mil polyethylene sheet having a perm rating not greater than 0.13. Use only materials which are resistant to decay when tested in accordance with ASTM D 2103.
 - 1. Lap Tape: Double-sided, asphalt based pressure sensitive tape; 1-1/2" wide or at Contractor's option, asphalt based sealant may be used.

2.5 FLOOR FINISHING MATERIALS

- A. Finishing - General: Finish shall consist of dye where indicated, two (2) sealer coats and two (2) finish coats. Game markings, complying with National Federation of State High School Association as adopted by the state of Missouri in colors as selected by the Architect, between first and second finish coats.
- B. Floor Finishing System: Sealer, topcoat and gameline/logo paints shall be GreenGuard Gold certified. System shall consist of the following:
 - 1. Sealer: Provide Bona SuperSport Seal or approved comparable product.
 - 2. Topcoats: Provide Bona SuperSport HD or approved comparable product.
 - 3. Game Line and Logo Paint: Provide Bona SuperSport Paint.
- C. Floor Finishing Sealer Material: Sealer shall be manufactured or approved by same manufacturer as topcoat. Provide 35 percent solids, minimum, urethane oil type sealer approved by Maple Flooring Manufacturer's Association and as follows:
- D. Floor Finish Topcoat Material: Topcoat shall be compatible with finish sealer and manufactured or approved by same manufacturer as sealer. Provide a 40 percent solids, minimum, urethane oil type finish approved by Maple Floor Manufacturer's Association and as follows:
- E. Game Line and Logo Paint: Compatible with finish sealer and topcoats. Approved and/or recommended by floor sealer and topcoat manufacturer and approved by Maple Floor Manufacturer's Association.
 - 1. Colors: As selected by Architect.
 - 2. Acceptable manufacturers and products:
 - a. Hillyard, Inc.; Gym Line Paint.
 - b. PoloPlaz; Fast Break Paint.
 - c. Advantage Coatings Technologies; ACT Game Line Paint.
 - d. Comparable products from other manufactures.
- F. Fasteners: Type and size recommended by manufacturer, but not less than those recommended by MFMA for application indicated.
- G. Painting of coverboard at stage floor is specified in Section 099123 "Interior Painting".
- H. ACCESSORIES
 - 1. Vent Cove Base (096466.A06 – RB2): Provide 3" x 4" vented cove base around perimeter of floor at all wall lines with molded exterior corners, in color as selected by the Architect from manufacturer's standard colors.
 - a. Provide manufacturer's recommended adhesive.

2. Expansion Cover/Saddle Plate (096466.A07): Provide aluminum, expansion void saddle plate. Plate shall have gaskets running the length of the plate to prevent marring of wood flooring. Install per manufacturer's recommendations. Plate shall be 1/8 inch thick in width indicated.
 - a. Basis-of-Design Product: Provide Balco, Model GF-2P or comparable product accepted by Architect prior to bidding.
3. Topical Concrete Vapor Sealer: Liquid penetrating type or film-forming type, designed to seal concrete and inhibit moisture transmission through slab. Concrete vapor sealers shall be as recommended by wood athletic flooring Contractor based upon successful previous installations and as acceptable to wood athletic flooring manufacturer.
4. Recessed Mount Ring Anchor: Galvanized steel, recessed mount, ring anchors, 5,000-pound capacity as manufactured by Highland. Provide ten (10) anchors to be located as directed by Architect.

PART 3 EXECUTION

3.1 INSPECTION

- A. Inspect substrates to receive flooring and report and condition detrimental to flooring installation to Architect in writing.

3.2 PREPARATION

- A. Concrete Slabs: Verify that concrete substrates are dry and moisture-vapor emissions are within acceptable levels according to manufacturer's written instructions.
- B. Grind high spots and fill low spots on concrete substrates to produce a maximum 1/8-inch deviation in any direction when checked with a 10-foot straight edge.
 1. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.
- C. Broom and vacuum clean substrates to be covered immediately before product installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Proceed with installation only after unsatisfactory conditions have been corrected.
- D. Concrete Substrates: Prepare according to ASTM F 710.
 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners
 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by flooring manufacturer. Do not use solvents
 3. Alkalinity and Adhesion Testing: Perform tests recommended by carpet tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
 4. Moisture Testing:
 - a. General: Methods and procedures for moisture testing shall be coordinated with concrete mix design properties contained in concrete slabs. Where waterproofing admixtures are used, testing methods shall coordinate with waterproofing admixture manufacturer's recommended testing procedures with warranty requirements.
 - b. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours, unless a higher rate is accepted by flooring manufacturer in writing.
 - 1) Perform tests so that each test area does not exceed 200 sq. ft., and perform no fewer than two tests in each installation area and with test areas evenly spaced in installation areas.
 - c. Perform relative humidity test using in-situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 80 percent relative humidity level measurement, unless a higher rate is acceptable to flooring manufacturer.
- E. Condition wood materials to average prevailing humidity conditions in installation areas prior to installing, when recommended by wood flooring system manufacturer.
 1. Install wood flooring after the permanent heating/cooling equipment is in operation and residual moisture from construction has dissipated.

- F. Concrete Vapor Sealer Application: When concrete vapor sealer is required, prepare surfaces to receive concrete vapor sealer and apply concrete vapor sealer in strict accordance with vapor sealer manufacturer's written instructions to suit slab moisture conditions encountered.

3.3 INSTALLATION OF WOOD ATHLETIC FLOORING

- A. General: Comply with wood athletic flooring manufacturer's written instructions, but not less than written recommendations of MFMA applicable to flooring type indicated.
 - 1. Pattern: Lay flooring parallel with long dimension of space to be floored unless otherwise indicated.
 - 2. Expansion Spaces: Provide 1-1/2 inch expansion spaces, but not less than that required by manufacturer's written instructions and MFMA's written recommendations at walls and other obstructions, and at interruptions and terminations of flooring.
 - a. Cover expansion spaces with base molding and cover plate trim.
- B. Wood Blocking: Provide solid wood blocking under locations that will support telescoping stands. Refer to Drawings for locations and additional information.
- C. Vapor Barrier: Install six (6) mil vapor barrier over concrete slab substrate, lapping edges and ends a minimum of 6 inches, and seal with specified tape or sealant. Seal all penetrations through vapor barrier.
- D. Plywood Underlayment / Subfloor: Provide 2 layers of plywood underlayment/subflooring. Install first layer of plywood perpendicular to direction of wood flooring (long wall) in a 1/2 running bond pattern. Install second layer of plywood laid at a 45 deg angle to center line axis of area to receive wood flooring. Stagger sheets in 2 running bond pattern. Allow for 1/8 inch to 3/16 inch expansion gap between ends and edges of adjacent sheets. At perimeter, where abutting walls and vertical obstructions occur, leave a 1-1/2 inch expansion space.
 - 1. Resilient Cushions: On underside of first layer of plywood underlayment/subfloor, install resilient cushions evenly spaced at 12-inch centers with not less than 32 cushions per sheet.
- E. Wood Strip Flooring: Machine nail maple flooring to plywood with 1-3/4 inch barbed cleats or equivalent fastening with end joints properly driven up and with proper spacing to suit humidity conditions at project. Space fasteners at 12 inch centers maximum.
 - 1. Maintain 1-1/2 inch expansion space at perimeter where abutting walls and vertical obstructions occur and at door openings.
 - 2. Installation Tolerances: 1/8 inch in 10 feet of variance from level.

3.4 INSTALLATION OF WOOD STAGE FLOORING

- A. General: Comply with written recommendations of MFMA applicable to flooring type indicated.
 - 1. Expansion Spaces: Provide 1-1/2 inch expansion spaces, but not less than that required by manufacturer's written instructions and MFMA's written recommendations at walls and other obstructions, and at interruptions and terminations of flooring.
 - a. Cover expansion spaces with base molding.
- B. Vapor Barrier: Install six (6) mil vapor barrier over concrete slab substrate, lapping edges and ends a minimum of 6 inches, and seal with specified tape or sealant. Seal all penetrations through vapor barrier.
- C. Wood Blocking: Install along entire perimeter of area to receive stage flooring.
- D. Wood Sleepers: Install sleepers along entire perimeter of area to receive stage flooring. Install 1 x 4 wood sleepers at 16 inches on center, perpendicular to length of floor. Mechanically fasten to wood blocking at perimeter. Along sleepers in field of floor, fasten resilient pads to underside of sleepers, spaced at 16 inches on center each way.
- E. Plywood Underlayment / Subfloor: Provide 2 layers of plywood underlayment/subflooring. Install first layer of plywood parallel with long wall in a 1/2 running bond pattern. Install second layer of plywood perpendicular to preceeding layer, offsetting joints from joints in preceeding layer 12 inches each way. Stagger sheets in 2 running bond pattern. Allow for 1/8" to 3/16" expansion gap between ends and edges of adjacent sheets. At perimeter, where abutting walls and vertical obstructions occur, leave a 1-1/2" expansion space.
- F. Stage Coverboard: Install 1/4 inch thick tempered hardboard coverboard, screw attached onto plywood substrate. Stagger joints in coverboard from joints in underlying plywood in one-half running bond. Pre-drill and countersink

for fastener holes. Fasten to plywood with #10 countersunk wood screws spaced at 8 inches centers along perimeter of coverboard and in two rows in field of coverboard with fasteners spaced at 16 inch centers. Hold fasteners back from edge 1 inch. Maintain 1/8 inch gap between all edges of coverboard.

- G. Installation Tolerances: 1/8 inch in 10 feet of variance from level.

3.5 SANDING AND FINISHING

- A. Allow installed flooring to acclimate to ambient conditions before sanding.
- B. Follow applicable recommendations in MFMA's "Industry Recommendations for Sanding, Sealing, Court Lining, Finishing, and Resurfacing of Maple Gym Floors" and as specified below.
- C. Sanding Flooring: Sand Strip flooring with drum sander, edger, buffer and hand scraper using coarse, medium and fine grade sandpaper. Hand scrape and sand in inaccessible areas. After sanding, buff entire floor using 100 grit screenback or equal grit sandpaper, with a heavy duty buffing machine. After final buffing, floor should be vacuumed and application of first coat of finish commenced.
- D. Finishing: Apply two coats of sealer, game lines and logos, and two finish topcoats in accordance with sealer and topcoat manufacturer's written instructions. Apply game markings, complying with National Federation of State High School Association as adopted by the state of Missouri in colors as selected by the Architect. Should dull spots appear, apply additional coat of finish.
 - 1. Floor markings will include center court graphic, end court markings and basketball and volleyball courts as indicated on the Drawings.
- E. Finishing: Apply two coats of sealer, game lines and logos, and two finish topcoats in accordance with sealer and topcoat manufacturer's written instructions. Apply game markings, complying with National Federation of State High School Association as adopted by the state of Missouri in colors as selected by the Architect. Should dull spots appear, apply additional coat of finish.
 - 1. Floor markings will include center court graphic, end court markings and basketball and volleyball courts as indicated on the Drawings.

3.6 INSTALLATION OF ACCESSORIES

- A. Vent-Cove Base: Install base around perimeter of floor at all wall lines in accordance with Manufacturer's recommendations for adhesive installation and attachment methods. Miter all inside corners.
- B. Cover-plate Assembly: Install at all transition between wood flooring and adjacent flooring entering gymnasium and stage in strict accordance with manufacturer's recommendations and approved shop drawings. Scribe to fit door frames and recessions.

3.7 CLEAN UP

- A. Remove all scrap and debris from site and leave floor in clean condition and protect finished floor from limited traffic until final inspection and acceptance by the Owner. Any damage after the floor is finished shall be repaired at the expense of the Contractor.
- B. Repair damaged and defective wood trim wherever possible to eliminate defects functionally and visually; where not possible to repair properly, replace woodwork. Adjust joinery for uniform appearance.

3.8 PROTECTION

- A. Protect wood athletic and stage flooring during remainder of construction period to allow finish to cure and to ensure that flooring and finish are without damage or deterioration at time of Substantial Completion.
 - 1. Do not cover flooring after finishing until finish reaches full cure and not before seven days after applying last finish coat.

2. Do not move heavy and sharp objects directly over flooring. Protect fully cured floor finishes and surfaces with plywood or hardboard panels to prevent damage from storing or moving objects over flooring.

END OF SECTION 096466

SECTION 096513 - RESILIENT BASE AND ACCESSORIES

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Resilient base (096513.A01 - RB21).
 - 2. Resilient molding accessories (096513.A06 - RB22).
 - 3. Metal transition strips.
- B. Related Requirements:
 - 1. Section 033000 "Cast-in-Place Concrete."
 - 2. Section 096466 "Wood Athletic and Stage Flooring" for vented cove base installed with wood athletic and stage flooring systems.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples for Initial Selection: For each type of product indicated.
- C. Samples for Verification: For each type of product indicated and for each color, texture, and pattern required in manufacturers' standard-size Samples, but not less than 12 inches long.

1.3 MAINTENANCE MATERIAL SUBMITTALS

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

1.5 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 65 deg F or more than 95 deg F, in spaces to receive resilient products during the following time periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
- C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

2.2 THERMOSET-RUBBER BASE (096513.A01 - RB21)

- A. Basis-of-Design Product: Subject to compliance with requirements, Roppe: "Pinnacle Rubber Wall Base" or comparable product from one of the following:
 - 1. Johnsonite Corporation.
 - 2. Kentile.
 - 3. Mercer Plastics Co, Inc.
 - 4. R.C. Musson Rubber Co.
 - 5. Tarkett.
- B. Product Standard: ASTM F 1861, Type TS (rubber, thermoset).
 - 1. Group: 1 (solid, homogeneous).
 - 2. Style: As indicated on Material Finish Legend.
- C. Product Characteristics:
 - 1. Thickness: 0.125 inch.
 - 2. Height: 4 inches as indicated on Drawings.
 - 3. Lengths: Coils in manufacturer's standard length.
 - 4. Outside Corners: Pre-formed.
 - 5. Inside Corners: Job formed.
 - 6. Colors: As indicated by manufacturer's designations on the Material Finish Legend.

2.3 RUBBER MOLDING ACCESSORY (096513.A06)

- A. Description: Reducer strips for carpet to resilient flooring transitions, nosing for carpet, nosing for resilient flooring, joiner for tile and carpet, and transition strips.
- B. Basis of Design Product: Subject to compliance with requirements provide "VIVCD" by Tarkett.
 - 1. Description: Provide 2-inches co-extruded visually impaired strip.
 - 2. Thickness: Provide 1/4 inch vinyl material.
- C. Locations: Provide rubber molding accessories in areas indicated.
- D. Colors and Patterns: As indicated by manufacturer's designations on Material Finish Legend.

2.4 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and suitable for substrate conditions indicated.
 - 1. Adhesives shall have a VOC content of 50 g/L or less.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
 1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- C. Do not install resilient products until they are the same temperature as the space where they are to be installed.
- D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.3 RESILIENT BASE INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient base.
- B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.
- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- E. Do not stretch resilient base during installation.
- F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
- G. Job-Formed Corners:
 1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
 - a. Form without producing discoloration (whitening) at bends.
 2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
 - a. Miter or cope corners to minimize open joints.

3.4 RESILIENT ACCESSORY INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient accessories.
- B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.
- B. Perform the following operations immediately after completing resilient-product installation:
 1. Remove adhesive and other blemishes from exposed surfaces.
 2. Sweep and vacuum horizontal surfaces thoroughly.
 3. Damp-mop horizontal surfaces to remove marks and soil.

- C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 096513

SECTION 096566 - RESILIENT ATHLETIC FLOORING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Sheet resilient athletic flooring (096566.A01 – AF21,AF22).
 - 2. Vent cove base and expansion cover plate.
- B. Related Sections:
 - 1. Section 012200 "Unit Prices" for unit prices effecting work of this Section.
 - 2. Section 033000 "Cast-in-Place Concrete" for integral moisture vapor sealing admixture.
 - 3. Section 096513 "Resilient Base and Accessories" for wall base and accessories installed with flooring.
 - 4. Section 099600 "High Performance Coatings" for game line painting.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show installation details and locations of the following:
 - 1. Floor patterns and transition strip locations.
 - 2. Layout, colors, widths, and dimensions of game lines and markers.
 - 3. Locations of floor inserts for athletic equipment installed through flooring.
 - 4. Seam locations for sheet flooring.
- C. Samples for Initial Selection: For each type of resilient athletic flooring.
 - 1. Game-Line and Marker Paint: Include charts showing available colors and glosses.
- D. Samples for Verification: For each type, color, and pattern of flooring specified, 6-inch- square in size and of same thickness and material indicated for the Work.
 - 1. Game-Line- and Marker-Paint Samples: Include Samples of each color selected applied to flooring.
 - 2. Seam Samples: For each vinyl sheet flooring color and pattern required; with seam running lengthwise and in center of 9 by 12 inch sample applied to a rigid backing and prepared by Installer for this Project.
 - 3. Vent cove base: Include color options matching color indicated on Interior Material Finish Legend.
- E. Manufacturer Certifications
 - 1. For ISO 9001 manufacture.
- F. Laboratory Test Results:
 - 1. Shock absorption (force reduction) test results certified by an independent testing laboratory certified to perform such testing.
 - a. ASTM test must be from certified North American laboratories.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data:
 - 1. For qualified resilient athletic flooring Installer.
 - 2. For qualified resilient athletic flooring Manufacturer.
- B. Preparation and Installation Guidelines: For each type of resilient athletic flooring, including current subfloor preparation guidelines in addition to installation guidelines published by flooring manufacturer.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance data to be included in the Operations and Maintenance Manuals.

- B. Warranty:
 - 1. Manufacturer material warranty.
 - 2. Installer installation warranty.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
 - 1. ISO 9001 Certified for quality control.
 - 2. ISO 14001 Certified for environmental care.
 - 3. At least ten years active experience in the manufacture and marketing of indoor resilient athletic flooring.
 - 4. A provider of authorized installer training.
 - 5. Must be competent in techniques required by manufacturer for resilient athletic flooring installation indicated.
- B. Sheet Athletic Flooring Installer Qualifications: An experienced Installer who has completed resilient sheet vinyl athletic flooring installations using seaming methods indicated for this Project and similar in material, design, and extent to that indicated for this Project; who is acceptable to manufacturer; and whose work has resulted in installations with a record of successful in-service performance.
 - 1. Installer shall have at least five years experience in the installation of resilient athletic flooring.
 - 2. Installer shall employ workers for this Project who are competent in techniques required by manufacturer for resilient athletic flooring installation indicated.
- C. Fire Test Characteristics: As determined by testing identical products according to ASTM E 648, Class 1, by a qualified testing agency acceptable to authorities having jurisdiction.
- D. Athletic Performance Properties: Comply with ASTM F 2772 Performance Level C2 for force reduction and ball rebound.
- E. Mockups/Field Samples: Build mockups/field samples to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Build mockups/field samples for resilient athletic flooring including resilient base and accessories.
 - a. Size: Minimum 50 sq. ft. for each type, color, and pattern in locations directed by Architect.
 - 2. Approval of mockups/field samples does not constitute approval of deviations from the Contract Documents contained in mockups/field samples unless Architect specifically approves such deviations in writing.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storing.
- B. Store materials to prevent deterioration as recommended by flooring manufacturer.

1.7 FIELD CONDITIONS

- A. Adhesively Applied Products:
 - 1. Maintain temperatures during installation within range recommended in writing by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive flooring 48 hours before installation, during installation, and 48 hours after installation unless longer period is recommended in writing by manufacturer.
 - 2. After post-installation period, maintain temperatures within range recommended in writing by manufacturer, but not less than 55 deg F or more than 95 deg F.
 - 3. Close spaces to traffic during flooring installation.
 - 4. Close spaces to traffic for 48 hours after flooring installation unless manufacturer recommends longer period in writing.
- B. Install flooring after other finishing operations, including painting, have been completed.

1.8 COORDINATION

- A. Coordinate layout and installation of flooring with floor inserts for gymnasium equipment.

1.9 WARRANTY

- A. Special Limited Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace sports flooring that fails within specified warranty period.
 - 1. Material warranty direct from the product manufacture and not a separate or third party insurance provider.
 - 2. Failures include, but are not limited to, the following
 - a. Material manufacturing defects.
 - b. Surface wear and deterioration to the point of wear-through.
 - c. Failure due to substrate moisture exposure not exceeding 5 pounds moisture vapor emission rate when tested according to ASTM F 1869, and 80 percent relative humidity when tested according to ASTM F 2170.
 - 3. Warranty Period:
 - a. For materials: 2 years from date of Substantial Completion.
 - b. For surface wear: 10 years from date of Substantial Completion.
- B. Special Limited Warranty: Installer's standard form in which installer agrees to repair or replace sports flooring that fails due to poor workmanship or faulty installation within the specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 RESILIENT ATHLETIC FLOORING (096566.A01 – AF21 - AF22)

- A. Basis-of-Design Product: Subject to compliance with requirements, provide; Gerflor Taraflex Sport M Plus DRY-TEX Sports Flooring installed with high-moisture tolerant full-spread adhesive or comparable product by one of the following, submitted to and accepted by Architect prior to bidding:
 - 1. "Omnisports" Tarkett company.
 - 2. Johnsonite; a Tarkett company.
 - 3. Robbins Sports Surfaces.
 - 4. Sport Court; Subsidiary of Connor Sport Court International.
- B. Description: Sheet vinyl flooring specifically designed for adhered athletic flooring applications.
- C. Athletic Sheet Flooring with Backing: ASTM F 1303.
 - 1. Overall Thickness: Not less than 0.28 inch (7 mm).
 - 2. Wear-Layer Thickness: Not less than 0.08 inch (2.1 mm).
 - 3. Backing: Very high density, two layer, dual-durometer, closed cell foam with reinforced fiberglass grid.
 - 4. Seaming Method: Heat welded.
 - 5. Traffic-Surface Texture: Wood visual shall have wood grain embossed texture for a genuine wood appearance.
 - 6. Applied Finish: Manufacturer's, factory-applied, permanent and UV-cured.
 - a. Basis-of-Design Product: Gerflor ProtecSol.
 - 7. Bacteriostatic and Fungicidal Treatment: Manufacturer's factory-applied permanent treatment.
 - a. Basis-of-Design Product: Gerflor Sanosol.
- D. Roll Size: Not less than 59 inches wide by longest length that is practical to minimize splicing during installation.
- E. Color and Pattern: Match color and pattern as indicated on Material Finish Schedule as acceptable to Architect.
- F. Performance Criteria:
 - 1. Shock Absorption/Force Reduction: ASTM F 2772; Pass/Class C2.
 - 2. Ball Bounce: ASTM F 2772; Pass, Greater than or equal to 90 percent.
 - 3. Sliding/Coefficient of Friction: DIN-18032; Pass.
 - 4. Surface effect/Coefficient of Friction: Between 80-110.

5. Vertical Deformation: Max. 3.5mm
6. Static Load Limit/Indentation Resistance: ASTM F 1303; Pass, Less than or equal to 0.005 inch of residual indentation as tested per ASTM F 970 at 175 p.s.i.
7. Fire Performance: ASTM E 648; Greater than 0.45 W/cm2, Class 1.
8. Chemical Product Resistance: ASTM D 543; excellent.
9. Surface Maintenance Requirements: No-wax surface requiring only cleaning and rinsing.
10. Antibacterial and Fungicidal Treatments: Similar to Gerflor/Taraflex Sports Flooring; "Sanosol".

2.2 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compound: Latex-modified, hydraulic-cement-based formulation approved by flooring manufacturer.
- B. Adhesives: Water-resistant type recommended in writing by manufacturer for substrate and conditions indicated.
- C. Topical Concrete Vapor Sealer: Liquid type, 2-part cross-linked latex solution designed to seal concrete and inhibit moisture transmission through slab. Sealer shall be capable of reducing MVER up to 15 lbs. down to 3 lbs or less.
 1. Basis of Design Product: Subject to compliance with requirements, provide "Vaporseal HM Plus" as manufactured by Dependable Floor Products or comparable products from other manufacturers recommended by flooring manufacturer.
- D. Game-Line and Marker Paint: Complete system including primer, if any, compatible with flooring and recommended in writing by flooring and paint manufacturers for use indicated.

2.3 ACCESSORIES

- A. Vent Cove Base: Provide vented cove base around perimeter of floor at all wall lines with molded exterior corners.
 1. Basis-of-Design Product: Subject to compliance with requirements, Johnsonite Inc.: "Resilient Vent Cove Wall Base".
 2. Product Standard: ASTM F 1861, Type TS (thermoset vulcanized rubber).
 - a. Group: I (solid, homogeneous).
 3. Product Characteristics:
 - a. Thickness: 5/16 inch.
 - b. Height: As indicated on drawings.
 - c. Lengths: 4 feet per manufacturer's standard length.
 - d. Outside Corners: Factory fabricated.
 - e. Inside Corners: Job formed.
 - f. Vents: 15 vents per 4-foot length.
 - g. Warranty: 5 years.
 4. Colors: As indicated by manufacturer's designations on Material Finish Legend. Provide manufacturer's recommended adhesive.
- B. Expansion Cover Plate: Provide aluminum, door expansion void cover plate. Install per manufacturer's recommendation at all door openings. Plate shall be 1/8 inch thick in width indicated.
 1. Manufacturers and Products:
 - a. National Guard Products; Model #818.
 - b. Pemko; Model 18/1A.
 - c. Reese; Model BAP18.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances, moisture content, and other conditions affecting performance of the Work.
 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere

with adhesion of resilient products.

- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written recommendations to ensure adhesion of flooring.
- B. Concrete Substrates: Prepare according to ASTM F 710.
 - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by carpet tile manufacturer. Do not use solvents.
 - 3. Alkalinity and Adhesion Testing: Perform tests recommended by carpet tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
 - 4. Moisture Testing of Concrete Slabs:
 - a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours, unless a higher rate is accepted by flooring manufacturer in writing.
 - 1) Perform tests so that each test area does not exceed 200 sq. ft., and perform no fewer than two tests in each installation area and with test areas evenly spaced in installation areas.
 - b. Perform relative humidity test using in-situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 80 percent relative humidity level measurement, unless a higher rate is acceptable to flooring manufacturer.
- C. Concrete Vapor Sealer Application: Prepare surfaces to receive concrete vapor sealer and apply concrete vapor sealer in strict accordance with vapor sealer manufacturer's written instructions to suit slab moisture conditions encountered.
- D. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended in writing by manufacturer. Do not use solvents.
- E. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate according to manufacturer's written instructions.
 - 1. Fill cracks 1/8 inch wide and wider, fill and level holes and depressions 1/4 wide or wider and grind level all protrusions more than 1/32 inch, unless more stringent requirements are required by manufacturer's written instructions.
- F. Move flooring and installation materials into spaces where they will be installed at least 48 hours in advance of installation unless manufacturer recommends a longer period in writing.
 - 1. Do not install flooring until they are same temperature as space where they are to be installed.
- G. Sweep and vacuum clean substrates to be covered by flooring immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust.
- H. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 FLOORING INSTALLATION, GENERAL

- A. Comply with manufacturer's written installation instructions.
- B. Scribe, cut, and fit flooring to butt neatly and tightly to vertical surfaces, equipment anchors, floor outlets, and other interruptions of floor surface.
- C. Extend flooring into toe spaces, door reveals, closets, and similar openings unless otherwise indicated.
- D. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating subfloor markings on flooring. Use non-permanent, non-staining marking device.

3.4 TILE FLOORING INSTALLATION

- A. Layout tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
 - 1. Lay tiles square with room axis in pattern indicated.
- B. Adhered Flooring: Adhere products to substrates using a full spread of adhesive applied to substrate to comply with adhesive and flooring manufacturer's written instructions.

3.5 SHEET FLOORING INSTALLATION

- A. General: Install in configurations indicated. Prepare surface and install flooring in strict accordance with the flooring manufacturer's written recommendations.
- B. Unroll sheet flooring and allow it to stabilize before cutting and fitting.
- C. Lay out sheet flooring as follows:
 - 1. Maintain uniformity of flooring direction.
 - 2. Minimize number of seams; place seams in inconspicuous and low-traffic areas, at least 6 inches away from parallel joints in flooring substrates.
 - 3. Match edges of flooring for color shading at seams.
 - 4. Locate seams per approved Shop Drawings.
- D. Adhered Flooring: Adhere products to substrates using a full spread of adhesive applied to substrate to comply with adhesive and flooring manufacturers' written instructions, including those for trowel notching, adhesive mixing, and adhesive open and working times.
 - 1. Provide completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.
- E. Sheet Flooring Seams: Prepare and finish seams to produce surfaces flush with adjoining flooring surfaces.
 - 1. Heat-Welded Seams: Comply with ASTM F 1516. Rout joints and use welding bead to permanently fuse sections into a seamless flooring.

3.6 GAME LINES AND MARKERS

- A. Mask flooring at game lines and markers, and apply paint to produce sharp edges. Where crossing, break minor game line at intersection; do not overlap lines.
- B. Lay out game lines and markers to comply with rules and diagrams published by National Federation of State High School Associations for athletic activities indicated.
- C. Lay out logos and graphics where indicated to comply with accepted shop drawings and other submittals.

3.7 FIELD-APPLIED FINISHES

- A. Apply finish after game-line and marker paint is fully cured.
- B. Apply finish according to manufacturer's written instructions to produce a sealed surface that is ready for use.
- C. Do not cover flooring after finishing until finish reaches full cure.

3.8 CLEANING AND PROTECTING

- A. Comply with manufacturer's written instructions for cleaning and protecting floor tile.
- B. Perform the following operations immediately after completing flooring installation:

1. Remove adhesive and other blemishes from flooring surfaces.
 2. Sweep and vacuum flooring thoroughly.
 3. Damp-mop flooring to remove marks and soil after time period recommended in writing by manufacturer.
- C. Protect flooring from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer.
1. Do not move heavy and sharp objects directly over flooring. Protect flooring with plywood or hardboard panels to prevent damage from storing or moving objects over flooring.

3.9 INSTALLATION OF ACCESSORIES

- A. Vent-Cove Base: Install base around perimeter of floor at all wall lines in accordance with Manufacturer's recommendations for adhesive installation and attachment methods. Miter all inside corners.
- B. Cover-plate Assembly: Install at all doors entering gymnasium and stage in strict accordance with manufacturer's recommendations and approved shop drawings. Scribe to fit door frames and recessions.

END OF SECTION 096566

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SECTION 096723 - RESINOUS FLOORING

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes seamless resinous flooring systems (096723.A01) with integral base (096723.A02).
- B. Related Sections:
 - 1. Section 012200 "Unit Prices" for waterproofing membrane.
 - 2. Section 096513 "Resilient Base and Accessories".

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review methods and procedures related to carpet tile installation including, but not limited to, the following:
 - a. Review delivery, storage, and handling procedures.
 - b. Review ambient conditions and ventilation procedures.
 - c. Review subfloor preparation procedures.
 - d. Review layout and patterns.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include manufacturer's technical data, application instructions, and recommendations for each resinous flooring component required; in addition to the following:
 - 1. List each material and cross-reference the specific coating, finish system and application. Identify each material by manufacturer's catalog number and general classification.
 - 2. Laboratory Test Reports: For resinous flooring systems, documentation indicating that products comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Department of Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers".
- B. Samples for Verification: Prior to beginning work, submit samples for each resinous flooring system color, texture and sheen required and as follows:
 - 1. Samples shall be 6 inches square, applied to a rigid backing by Installer for this Project.
 - 2. Resubmit samples as requested until required sheen, color and texture is acceptable to Architect.

1.4 INFORMATIONAL SUBMITTALS

- A. Installer Certificates: Submit certificates signed by manufacturer certifying that installers comply with specified requirements, in addition to the following:
 - 1. Submit substantiating evidence of experience installing the specific brand of products proposed in similar areas, in addition to meeting Installer Qualification criteria.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For resinous flooring to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an Installer who is certified in writing by resinous flooring manufacturer as qualified to apply resinous flooring systems indicated. Installer shall be/have been trained by flooring system manufacturer with experience in application and installation of systems similar in complexity to those required for this project, in addition to the following:

1. Installer shall have a minimum of two (2) years continuous experience under the current company name.
 2. Installer shall submit a reference list of at least three (3) projects, similar in size and applied system(s), completed in the states of (Missouri) (Kansas). Include contact information for General Contractor or Construction Manager and Owner. List types and names of systems installed, each material/component of system(s) installed, quantity installed and dates completed.
- B. Mockups/Field Samples: Build mockups/field samples to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
1. Build mockups/field samples in conjunction with the wall tile mock-up installation. Mockup/field sample shall extend to floor to demonstrate transition from wall to floor.
 2. Approved mockups/field samples may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in manufacturer's original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage and mixing with other components. Include handling instructions and precautions.
- B. Store materials not in actual use in tightly covered containers at a minimum ambient temperature of 45 deg F in a well-ventilated area. Maintain containers in clean condition, free from foreign material and residue.
1. Protect liquid components from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary precautionary measures to ensure workmen and work areas are adequately protected from fire hazards and health hazards resulting from handling, mixing and application of floor systems.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring application.
1. Do not commence work until the building can be maintained at a temperature range between 60 deg F and 90 deg F for 48 hours before, during and 48 hours after application. Broom clean areas (reasonably dust free) and have adequate controlled ventilation.
 2. Maintain ventilation in each area indicated to receive resinous flooring until completion of the resinous flooring work in that area.
- B. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring application.
- C. Close spaces to traffic during resinous flooring application and for 24 hours after application unless manufacturer recommends a longer period.
- D. Surfaces to receive resinous flooring must be acceptable and in accordance with flooring system manufacturer's recommendations.
1. Provide clean, dry, and neutral substrate for resinous flooring application.
 2. Notify Owner's Representative in writing of unsuitable surfaces and conditions. Commencement of work implies acceptance of surfaces and working conditions.

1.9 PROTECTION

- A. Protect adjacent surfaces from damage resulting from work of this trade. If necessary, mask and/or cover adjacent surfaces, fixtures, cabinetry, equipment, etc. by suitable means.
- B. Post "NO SMOKING" signs while work is in progress and during curing.

1.10 SPECIAL WARRANTY

- A. Contractor, manufacturer and installer have responsibility for an extended corrective period for work of this Section for a period of three (3) years from date of Substantial Completion against all conditions indicated below, and when notified in writing by Owner, Contractor/manufacturer/installer shall promptly and without inconvenience and cost to the Owner, correct said deficiencies in compliance with the requirements of the Conditions of the Contract.
 - 1. Flooring system manufacturer and Installer shall co-sign warranty and shall be responsible for:
 - a. Bond failure of system(s) to substrate.
 - b. System yellowing, including regionalized discoloration.
 - c. Excessive wear.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Low-Emitting Materials: Flooring system shall comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Department of Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- B. Flammability: Self-extinguishing according to ASTM D 635.
- C. Slip Resistance: Resinous flooring surfaces shall have the following minimum performance requirements as indicated below.
 - 1. Static Dry Coefficient of Friction: 0.6 minimum per ASTM D2047.
 - 2. Dynamic Wet Coefficient of Friction: 0.45 minimum per ANSI A326.3 or ANSI B101.3.

2.2 MANUFACTURERS

- A. Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, body coats, and topcoats, from single source from single manufacturer to ensure material compatibility, chemical and mechanical bond; quality of materials, color and pattern consistency. Obtain secondary materials, including patching and fill material, color chips/flakes and granules, joint sealant, and repair materials, of type and from manufacturer recommended in writing by manufacturer of primary materials.

2.3 RESINOUS FLOORING (096723.A01 – FT21, FTB21)

- A. Basis-of-Design Product: Subject to compliance with specified requirements, provide DESCO Coatings, Inc.; "Cremona TG" resinous flooring system or one of the resinous flooring systems listed below.
 - 1. Dur-A-Flex; "DUR-A-Quartz Q11" with aliphatic urethane topcoat.
 - 2. Tennant; "Flake DQF – Troweled" with aliphatic urethane topcoat.
 - 3. Tnemec; Series 223 "DECO-Trowel" with aliphatic urethane topcoat.
 - 4. Comparable products from manufacturers listed below and other manufacturers which meet or exceed specified requirements will also be considered when submitted to and accepted by Architect as a substitution prior to bidding only.
- B. Resinous Flooring System: System shall be a trowel-applied, abrasion-, UV-, impact-, and chemical-resistant, aggregate-filled, and resin-based monolithic floor surfacing designed to produce a seamless floor and integral cove base. System shall be capable of being applied over an existing epoxy resinous floor.
- C. System Characteristics:
 - 1. Color and Pattern: As noted on Material Finish Schedule.
 - 2. Wearing Surface: Orange-peel texture to match approved sample. Textured for slip resistance as selected by Owner's Representative.
 - a. Slip resistance shall not be less than performance requirements indicated in this Section.
 - 3. Overall System Thickness: Not less than 3/16 inch.

- D. Primer: Provide manufacturer's recommended primer to suit substrate and resinous flooring system indicated.
 - 1. Formulation Description: 100 percent solids.
- E. Body Coats:
 - 1. Resin: Epoxy.
 - 2. Formulation Description: 100 percent solids.
 - 3. Type: Clear or colored to suit design mix selected.
 - 4. Application Method: Self-leveling slurry with broadcast aggregates.
 - 5. Aggregates: Colored quartz (ceramic-coated silica).
 - a. Quartz aggregate shall be Grade 11.
- F. Topcoats: Sealing or finish coats.
 - 1. Resin: Aliphatic Urethane.
 - 2. Formulation Description: High solids.
 - 3. Type: Clear.
 - 4. Number of Coats: As required to achieve overall system thickness specified and texture selected.
 - 5. Finish Texture and Sheen: Match sample approved by Owner's Representative.
- G. Integral Cove Base: Provide integral coved base of height indicated with 1 inch radiused cove and bullnosed top edge termination. Provide keyed joint where resinous flooring terminates with other materials.
- H. System Physical Properties: Provide resinous flooring system with the following minimum physical property requirements when tested according to test methods indicated:
 - 1. Compressive Strength (Binder): 14,000 psi minimum according to ASTM D 695.
 - 2. Compressive Strength (System): 10,000 psi minimum according to ASTM C 579.
 - 3. Tensile Strength: 2,250 psi minimum according to ASTM C 307.
 - 4. Bond Strength: 400 psi minimum according to ASTM D 4541.
 - 5. Water Absorption: 0.04 percent maximum according to ASTM D 570.
 - 6. Impact Resistance: No chipping, cracking, or delamination and not more than 1/16-inch permanent indentation according to MIL-D-3134J.
 - 7. Resistance to Elevated Temperature: No slip or flow of more than 1/16 inch according to MIL-D-3134J.
 - 8. Abrasion Resistance: 80 mg maximum weight loss according to ASTM D 4060.
 - 9. Hardness: 75-80 Shore D according to ASTM D 2240.
 - 10. Flame Spread/NFPA 101: Class A according to ASTM E 84.
- I. System Chemical Resistance: Test specimens of cured resinous flooring system are unaffected when tested according to ASTM D 1308 for 50 percent immersion in the following reagents for no fewer than seven days:
 - 1. Bleach (3%).
 - 2. Coffee.
 - 3. Hydro peroxide (3%).
 - 4. Nitric acid (10%).
 - 5. Phosphoric acid (20%).
 - 6. Sodium hydrate (40%).
 - 7. Urine.

2.4 ACCESSORIES

- A. Reinforcing Membrane: Flexible resin formulation that is recommended by resinous flooring manufacturer for substrate and resinous flooring system indicated and that inhibits substrate cracks from reflecting through resinous flooring.
 - 1. Formulation Description: Manufacturer's standard high solids.
 - a. Provide fiberglass scrim embedded in reinforcing membrane.
- B. Metal Transition Strips: Provide pre-manufactured aluminum edging, 1/8 inch high by 2 inches wide in manufacturer's standard lengths and in longest lengths practical.
 - 1. Basis-of-Design Product: National Guard Products; Model 8132 "Heavy Duty Aluminum Transition Strip". Comparable products matching profile and characteristics of specified product will be considered.
 - 2. Fasteners: Provide post-installed expansion anchors with Type 304 stainless steel countersunk fasteners.
 - a. Provide all fasteners and accessories necessary for secure and proper installation.

- C. At top of resinous wall base provide the following product. Colors shall match existing at project site as determined by Architect. Height of trim shall match thickness of resinous flooring system.
 - 1. Basis of Design Product: "Jolly" by Schluter.
- D. Patching and Fill Material: Resinous product of or approved by resinous flooring manufacturer and recommended by manufacturer for application indicated.
- E. Joint Sealant: Type recommended or produced by manufacturer of resinous flooring system for type of service and joint condition indicated.
- F. Waterproofing Membrane: When required by manufacturer for a successful installation over project site conditions, provide and install a fluid applied moisture barrier membrane, to prevent excessive moisture/humidity conditions, allowing a fully warranted floor installation.
 - 1. Vapor barrier to allow 100% relative humidity at the floor surface, while maintaining the manufacturer's full warranty.
 - 2. Refer to Section 012200 "Unit Prices".

PART 3 EXECUTION

3.1 EXAMINATION

- A. Contractor shall examine subfloor surfaces to verify all substrates and conditions are satisfactory. A satisfactory subfloor surface is defined as one that is smooth and free from cracks, holes, ridges, curing compounds, and other adhesives and coatings that may inhibit bonding capability of resinous flooring and primer, as well as other defects that may impair performance and appearance.

3.2 PREPARATION

- A. Prepare and clean substrates according to resinous flooring manufacturer's written instructions for substrate indicated. Provide clean, dry substrate for resinous flooring application.
 - 1. Areas where flooring is existing, must be cleaned to remove all floor material, adhesives, grease or any residue that may interfere with interfacial adhesion between substrate and new resinous flooring system.
 - 2. Prepare concrete substrates by shot blasting or grinding to achieve surface profile recommended by resinous flooring manufacturer.
- B. Concrete Substrates: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, adhesives, dust, dirt, grease, oil, and other contaminants incompatible with resinous flooring.
 - 1. Roughen concrete substrates as follows:
 - a. Shot-blast surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.
 - b. Comply with ASTM C 811 requirements unless manufacturer's written instructions are more stringent.
 - 2. Repair damaged and deteriorated concrete according to resinous flooring manufacturer's written instructions.
 - 3. Moisture testing is not required. However, Contractors at their own expense may, as they deem necessary, verify that concrete substrates are dry and moisture-vapor emissions are within acceptable levels according to manufacturer's written instructions.
 - a. Anhydrous Calcium Chloride Test: ASTM F 1869. Proceed with application of resinous flooring only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. of slab area in 24 hours.
 - b. Relative Humidity Test: Use in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 80 percent relative humidity level measurement.
 - 4. Alkalinity and Adhesion Testing: Verify that concrete substrates have pH within acceptable range. Perform tests recommended by manufacturer. Proceed with application only after substrates pass testing.
- C. Patching and Filling: Use patching and fill material to fill holes and depressions in substrates according to manufacturer's written instructions.
 - 1. Control Joint Treatment: Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring according to manufacturer's written instructions.

- D. Resinous Materials: Mix components and prepare materials according to resinous flooring manufacturer's written instructions.
- E. Metal Transition Strips: Install at locations indicated and between resinous flooring and concrete. Transition strip may be used as a screed. Thicken resinous flooring application as necessary so flooring is flush with top of transition strip. Installation shall be in strict accordance with edging manufacturer's written recommendations.

3.3 APPLICATION

- A. Proceed with resinous flooring work after subfloor surfaces are satisfactory. Commencement of resinous flooring work is construed as Installer's acceptance of substrate surfaces within a particular area.
 - 1. Coordinate work within this section with adjacent finish work to achieve full coverage of each finish as required by each section.
- B. Apply components of resinous flooring system according to manufacturer's latest written instructions, employing technically-trained, approved mechanics, to produce a uniform, monolithic wearing surface of thickness indicated.
 - 1. Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate, and optimum intercoat adhesion.
 - 2. Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.
 - 3. Expansion and Isolation Joint Treatment: At substrate expansion and isolation joints, comply with resinous flooring manufacturer's written instructions.
 - a. Do not fill moving isolation joints or expansion joints.
 - b. At movement joints, provide membrane isolation strips and reinforcing tape as recommended by resinous flooring manufacturer.
- C. Primer: Apply primer over prepared substrate at manufacturer's recommended spreading rate.
- D. Reinforcing Membrane: Apply reinforcing membrane to substrate cracks.
 - 1. Fill non-moving control joints with approved elastomeric sealant or full-depth semi-rigid two-component epoxy joint filler, designed specifically for this purpose (use full-depth semi-rigid joint filler when reinforcement of the joint edge is desirable), or two-component epoxy and filler (epoxy to be same material as flooring).
- E. Troweled or Screeded Body Coats: Apply troweled or screeded body coats in thickness indicated for flooring system. Hand or power trowel and grout to fill voids. When body coats are cured, remove trowel marks and roughness using method recommended by manufacturer.
- F. Grout Coat: Apply grout coat, of type recommended by resinous flooring manufacturer, to fill voids in surface of final body coat.
- G. Topcoats: Apply topcoats in number indicated for flooring system and at spreading rates recommended in writing by manufacturer and to produce wearing surface indicated.
- H. Cure resinous flooring in compliance with flooring manufacturer's directions to prevent contamination during all stages of application.
- I. Finish work shall match approved samples; be uniform in thickness, sheen, color and texture; and be free of defects detrimental to appearance and performance.
- J. Install metal transition strips where resinous flooring abuts other flooring materials. Securely anchor in place with mechanical fasteners as recommended by transition strip manufacturer.

3.4 FIELD QUALITY CONTROL

- A. Material Sampling: Owner's Representative may, at any time and any number of times during resinous flooring application, require material samples for testing for compliance with requirements.
 - 1. Owner will engage an independent testing agency to take samples of materials being used. Material samples will be taken, identified, sealed, and certified in presence of Contractor.
 - 2. Testing agency will test samples for compliance with requirements, using applicable referenced testing procedures or, if not referenced, using testing procedures listed in manufacturer's product data.

3. If test results show applied materials do not comply with specified requirements, pay for testing, remove noncomplying materials, prepare surfaces coated with unacceptable materials, and reapply flooring materials to comply with requirements.
- B. Core Sampling: At the direction of Owner's Representative and at locations designated by Owner's Representative, take one core sample per 1000 sq. ft. of resinous flooring, or portion of, to verify thickness. For each sample that fails to comply with requirements, take two additional samples. Repair damage caused by coring. Correct deficiencies in installed flooring as indicated by testing.
- C. Touch-up or repair damaged coatings. Touch-up shall not be visibly different. Recoat entire surface if touch-up results are visible, either in sheen, texture or color.

3.5 CLEANING AND PROTECTION

- A. Clean resinous flooring prior to Substantial Completion. Use materials and procedures recommended by resinous flooring manufacturer.
- B. Protect resinous flooring from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by resinous flooring manufacturer.
 1. Remove any temporary covering prior to cleaning and final inspection.

END OF SECTION 096723

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SECTION 096813 - TILE CARPETING

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes modular carpet tile (096813.A01).
- B. Related Requirements:
 - 1. Section 012200 "Unit Prices" for waterproofing membrane.
 - 2. Section 096513 "Resilient Base and Accessories" for resilient wall base and accessories installed with carpet tile.

1.2 PRE-INSTALLATION MEETINGS

- A. Pre-installation Conference: Conduct conference at Project site.
 - 1. Review methods and procedures related to carpet tile installation including, but not limited to, the following:
 - a. Review delivery, storage, and handling procedures.
 - b. Review ambient conditions and ventilation procedures.
 - c. Review subfloor preparation procedures.
 - d. Review carpet tile layout and patterns.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
 - 2. Include installation recommendations for each type of substrate.
- B. Shop Drawings: Show the following:
 - 1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
 - 2. Type of substrate to receive tile carpeting.
 - 3. Type of installation.
 - 4. Pattern of installation.
 - 5. Pattern type, location, and direction.
 - 6. Carpet tile type, color and dye lot.
 - 7. Type, color and location of insets and borders.
 - 8. Type, color and location of edge, transition, and other accessory strips.
 - 9. Transition details to other flooring materials.
- C. Samples for Verification: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
 - 1. Carpet Tile: Full-size Sample.
- D. Product Schedule: For carpet tile. Use same designations indicated on Drawings.
- E. Sustainable Product Certification: Provide ANSI/NSF 140 certification for carpet products.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:
 - 1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
 - 2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Carpet Tile: Furnish one un-opened box of each carpet tile type, color and pattern for every 5 percent of amount installed.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who is certified by the International Certified Floorcovering Installers Association at the Commercial II certification level.
- B. Fire-Test-Response Ratings: Where indicated, provide carpet tile identical to those of assemblies tested for fire response according to NFPA 253 by a qualified testing agency.
- C. Mockups/Field Samples: Build mockups/field samples to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
 - 1. Build mockups/field samples for carpet tile including accessories.
 - a. Size: Minimum 50 sq. ft. for each type, color, and pattern in locations directed by Architect.
 - 2. Approval of mockups/field samples does not constitute approval of deviations from the Contract Documents contained in mockups/field samples unless Architect specifically approves such deviations in writing.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Comply with the Carpet and Rug Institute's CRI 104.

1.9 FIELD CONDITIONS

- A. Comply with the Carpet and Rug Institute's CRI 104 for temperature, humidity, and ventilation limitations.
- B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at occupancy levels during the remainder of the construction period.
- C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.

1.10 WARRANTY

- A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.
 - 1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
 - 2. Failures include, but are not limited to, more than 10 percent edge raveling, snags, runs, dimensional stability, excess static discharge, loss of tuft bind strength, loss of face fiber, and delamination.
 - 3. Warranty Period: 10 years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 CARPET TILE (096813.A01)

- A. Basis-of-Design Product: Subject to compliance with requirements, provide products specified on drawings or a comparable products meeting specified requirements, having similar colors and patterns as acceptable to Architect with the following characteristics submitted to and accepted by Architect prior to bidding.
 - 1. Refer to Material Finish Legend for carpet selections including name, manufacturer, and installation pattern.
- B. Carpet Type - C1: Subject to compliance with requirements, provide "Walk Right In II" by Patcraft.
 - 1. Product Collection: Foot In The Door II.
 - 2. Product Construction: Hobnail Tufted Yarn.
 - 3. Fiber Type: Polyester.
 - 4. Dye Method: 100% Solution Dyed.
 - 5. Tufted Yarn Weight: 49.3 oz/yd².
 - 6. Total Thickness: 0.362 inches.
 - 7. Average Density: 6,477 oz/yd³.
 - 8. Stitches: 0.66 per 10 cm.
 - 9. Radiant Panel: ASTM E-648 Class 1.
 - 10. Smoke Density: ASTM E-662 ≤ 450.
 - 11. Primary Backing: Polypropylene.
 - 12. Secondary Backing: Manufacturer's standard "EcoWorx Tile".
 - 13. Soil / Stain Protection: Manufacturer's standard with warranty.
 - 14. Color and Pattern: As indicated on Material Finish Legend.
 - 15. Installation Method: As indicated on Material Finish Legend.
- C. Carpet Type C2: Subject to compliance with requirements, provide "Step Repeat Collection SR899" by Interface
 - 1. Product Construction: Tufted Textured Loop.
 - 2. Fiber Type: 100% Recycled Content Nylon.
 - 3. Tufted Yarn Weight: 26 oz/yd².
 - 4. Pile Thickness: 0.14 inches.
 - 5. Pile Height: 0.20 inches.
 - 6. Pile Density: 6,545 oz/yd³.
 - 7. Stitches: 10 per inch.
 - 8. Radiant Panel: ASTM E-648 Class 1.
 - 9. Smoke Density: ASTM E-662 ≤ 450.
 - 10. Soil / Stain Protection: Manufacturer's standard with warranty.
 - 11. Color and Pattern: As indicated on Material Finish Legend.
 - 12. Installation Method: As indicated on Material Finish Legend.
- D. Carpet Type - C21: Subject to compliance with requirements, provide "Street Life 03973 " by Tarkett
 - 1. Product Construction: Patterned Loop Pile.
 - 2. Fiber System: Dynex SD® Nylon (Stain Resistant).
 - 3. Face Weight: 12 oz/yd².
 - 4. Pile Thickness: 0.070 inches (1.83 mm).
 - 5. Pile Density: 3,456 oz/yd³.
 - 6. Radiant Panel: ASTM E-648 Class 1.
 - 7. Smoke Density: ASTM E-662 ≤ 450.
 - 8. Primary Backing: Synthetic Non-Woven.
 - 9. Secondary Backing: Modular Ethos with Omnicat Technology.
 - 10. Soil / Stain Protection: Manufacturer's standard with warranty.
 - 11. Color and Pattern: As indicated on Material Finish Legend.
 - 12. Installation Method: As indicated on Material Finish Legend.

2.2 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.

- B. Adhesives: Water-resistant, mildew-resistant, non-staining, pressure-sensitive type. Select adhesives suitable for substrate conditions and compatible with flooring and backing. Adhesives shall comply with flammability requirements for installed carpet tile and be recommended by carpet tile manufacturer for releasable installation.
 - 1. Adhesives shall have a VOC content of 50 g/L or less.
 - 2. Adhesive shall comply with the testing and product 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."
- C. Adhesive Tape: Tile Carpeting manufacturer's recommended adhesive tape to suit backing type and substrates involved. Basis-of-Design Product: "TandusTape."
- D. Resilient Transition Strips: Refer to Section 096513 "Resilient Base and Accessories" and Interior Material Finish Legend for information and products for use at carpet transitions.
- E. Metal Edge/Transition Strips: Extruded aluminum with anodize aluminum finish of profile and width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.
 - 1. Fasteners: Provide post-installed expansion anchors with Type 304 stainless steel countersunk fasteners.
- F. Topical Concrete Vapor Sealer: Liquid penetrating type or film-forming type, designed to seal concrete and inhibit moisture transmission through slab. Concrete vapor sealers shall be as recommended by tile carpeting Contractor based upon successful previous installations and as acceptable to tile carpeting manufacturer.
 - 1. Basis of Design Product: Subject to compliance with requirements, provide "Vaporseal HM Plus" by Dependable Floor Products, or a comparable product acceptable to Architect and carpet tile manufacturer, with the following product characteristics:
 - a. Permeance: Less than 0.1 perms when applied at 11 mills (dry film thickness) per ASTM E96.
 - b. Moisture Barrier for slabs up to 100 percent relative humidity per ASTM F2170 and/or 25 pounds MVER per ASTM 1869.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance. Examine carpet tile for type, color, pattern, and potential defects.
- B. Metal Subfloors: Verify the following:
- C. Painted Subfloors: Perform bond test recommended in writing by adhesive manufacturer.
 - 1. Access Flooring Systems: Verify the following:
 - 2. Access floor substrate is compatible with carpet tile and adhesive if any.
 - 3. Underlayment surface is flat, smooth, evenly planed, tightly jointed, and free of irregularities, gaps greater than 1/8 inch, protrusions more than 1/32 inch, and substances that may interfere with adhesive bond or show through surface.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation," and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile installation.
- B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider and protrusions more than 1/32 inch unless more stringent requirements are required by manufacturer's written instructions.
- C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet tile manufacturer.

- D. Concrete Substrates: Prepare according to ASTM F 710.
 - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by carpet tile manufacturer. Do not use solvents.
 - 3. Alkalinity and Adhesion Testing: Perform tests recommended by carpet tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
 - 4. Moisture Testing of Existing Slabs:
 - a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours, unless a higher rate is accepted by flooring manufacturer in writing.
 - 1) Perform tests so that each test area does not exceed 200 sq. ft., and perform no fewer than two tests in each installation area and with test areas evenly spaced in installation areas.
 - b. Perform relative humidity test using in-situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 80 percent relative humidity level measurement, unless a higher rate is acceptable to flooring manufacturer.
- E. Concrete Vapor Sealer Application: When concrete vapor sealer is required, prepare surfaces to receive concrete vapor sealer and apply concrete vapor sealer in strict accordance with vapor sealer manufacturer's written instructions to suit slab moisture conditions encountered.
 - 1. Concrete vapor sealer shall be applied as base bid for installation of carpet over existing concrete slabs.
- F. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

- A. Installation: Comply with CRI 104, Section 14, "Carpet Modules," and with carpet tile manufacturer's written installation instructions.
- B. Installation Method:
 - 1. At perimeter of each room/area: Glue down; install every tile with full-spread, releasable, pressure-sensitive adhesive.
 - 2. In field of room/area (inside glued down perimeter): install tiles with factory-applied releasable, pressure-sensitive adhesive strips.
- C. Installation Layout: As indicated on Material Finish Legend.
- D. Maintain dye lot integrity. Do not mix dye lots in same area.
- E. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.
- F. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, non-staining marking device.
- H. Install pattern parallel to walls and borders.
- I. Metal Transition Strips: Install at locations indicated and between carpet tile and adjacent finishes. Installation shall be in strict accordance with edging manufacturer's written recommendations.

3.4 CLEANING AND PROTECTION

- A. Perform the following operations immediately after installing carpet tile:
 - 1. Remove excess adhesive and other surface blemishes using cleaner recommended by carpet tile manufacturer.
 - 2. Remove yarns that protrude from carpet tile surface.

3. Vacuum carpet tile using commercial machine with face-beater element.
- B. Protect installed carpet tile to comply with CRI's "Carpet Installation Standard," Section 20, "Protecting Indoor Installations."
- C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 096813

SECTION 097253 - DIGITAL WALL COVERING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes custom digital vinyl wall covering mural (097253.A01 - S01), adhesives and accessories.
- B. Related work in other sections:
 - 1. Section 092900 "Gypsum Board" for surface preparation of surfaces to receive wall coverings.
 - 2. Section 099123 "Interior Painting" for prime coats for substrates.
 - 3. Section 101400 "Signage" for related installation.

1.2 ACTION SUBMITTALS

- A. Manufacturer's technical product data for each type of product specified. Include data on physical characteristics, durability, fade resistance, flame resistance and manufacturing process.
 - 1. Product data shall show compliance with requirements for fire performance characteristics and physical properties.
- B. Shop Drawings: Showing locations and extent of each wall covering type. Indicate termination points.
 - 1. Include a panel map for each wall covering mural to coordinate installation.
- C. Samples for Initial Selection: Submit sample each wall covering mural required on actual wall covering material to be used for Project, in the form of small scale color proofs for each mural.
- D. Samples for Verification: Submit sample each wall covering mural not less than 4 feet square, on actual wall covering material to be used for Project.
 - 1. Sample shall be for Architect's verification purposes of each mural; including color, clarity of image, and artwork.
 - 2. Submit 12 inch long actual samples of each accessory required.
 - 3. Sample from same flitch to be used for the Work, with specified finish applied.
- E. Custom Digital Wall Covering Mural Proofs: Before printing, prepare full-color proofs which include a full-scale sample, as well as a reduced sample of the entire graphic for each mural for the Architect's approval. Approved proof will set the quality standards for graphic and aesthetic effect.
 - 1. When wall covering mural is divided into separate sections, provide proof of each section.
 - 2. Refer to the 700 Sheets: 2 Sections of wall covering section, 24"x 24" minimum:
 - a. Full sized section of each artwork.
 - b. Scaled version of entire graphic of each artwork.

1.3 CLOSEOUT SUBMITTALS

- A. A. Maintenance data for inclusion in "Operating and Maintenance Manual" specified in Division 1. Include the following:
 - 1. Methods for maintaining wall covering.
 - 2. Include precautions for use of cleaning materials and methods that could be detrimental to finishes and performance/longevity of wall covering murals.

1.4 QUALITY ASSURANCE

- A. Applicator/Installer Qualifications: Skilled commercial wall covering applicator/installer with not less than 3 years of documented experience installing wallcovering murals of the types and extent specified for the project.
- B. Pre-installation Conference: Conduct conference at Project site.
 - 1. Review methods and procedures related to installations including, but not limited to, the following:
 - a. Review delivery, storage, and handling procedures.

- b. Review ambient conditions and ventilation procedures.
 - c. Review preparation procedures.
 - d. Review installation areas and address any areas of concern.
- C. Fire Performance Characteristics: Provide wall coverings with the following surface burning characteristics as determined by testing identical products per ASTM E 84 by UL or other testing and inspecting organizations acceptable to authorities having jurisdiction. Identify wall coverings with appropriate markings of applicable testing and inspecting organization.
 - 1. Flame Spread: 5 or less.
 - 2. Smoke Developed: 25 or less.
- D. Field Dimensions for Digital Wall Covering: Provide field dimensions to Architect for graphic design of each digital wall covering. Include dimensions, locations, and graphic depictions of all disruptions within the field of wall surface indicated to receive custom digital wall covering. Examples of disruptions of wall surface include, but are not limited to: louvers, vents, outlets, switches, fire alarm devices, exit light signage, etc.
 - 1. Elevations and dimensions shall be drawn using a computer aided drafting program and submitted in a legible format.
 - 2. Dimensional Tolerance: 1/8 inch maximum.
 - 3. Dimensions shall be reviewed and accepted by signage manufacturer prior to submittal of shop drawings.

1.5 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver and install wall covering murals until spaces are enclosed and weathertight, wet work in spaces to receive murals is complete and dry, work above ceilings is complete, and temporary or permanent HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
 - 1. Maintain a constant temperature not less than 60 deg F in installation areas for at least 10 days before and 10 days after installation.
- B. Lighting: Do not install wall covering murals until permanent level of lighting is provided on the surfaces to receive murals.
- C. Ventilation: Provide continuous ventilation during installation and for not less than the time recommended by the wall covering mural manufacturer for full drying and curing.

PART 2 - PRODUCTS

2.1 WALL COVERING MATERIALS (097253.A01)

- A. Manufacturers:
 - 1. Basis-of-Design Product: Subject to compliance with requirements provide one of the following products:
 - a. Koroseal; "Digitally Printed Vinyl Wallcovering Murals".
 - b. Approved substitutes from other manufacturers, meeting specified requirements and design intent, will be considered when submitted to and accepted by Architect prior to bidding. Substitutes shall comply with Section 012500 and must be approved prior to bidding.
- B. Wall covering shall conform to the following minimum requirements:
 - 1. Printing for the wallcovering shall be done by the wall covering manufacturer.
 - 2. All wallcovering shall come from the same dye lot.
 - 3. Wall covering shall be a custom mural vinyl wall covering (Mural) with artwork produced by the digital imaging process. Wall covering shall be produced in manufacturer's standard panels sizes, not less than 4 by 10 feet. Fabric type shall be non-woven and mildew resistant.
 - 4. Wall covering material must be consistent in color and texture throughout all material prior to printing.
 - 5. Material Standard: Wallcovering shall meet or exceed Federal Specification CCC-W-408A and WA-101 Quality Standard for Polymer Coated Fabric Wallcovering for Type 1 and Type II wallcovering.
 - 6. Physical Properties and Characteristics: Provide wallcovering with the following properties and characteristics:
 - a. Total Weight: Minimum of 20 oz/lin.yd per ASTM D751.
 - b. Backing Weight: 3.1 oz/lin.yd per FS-CCC-T-191.
 - c. Vinyl Weight: 17.9 oz/lin.yd per FS-CCC-T-191.

- d. Thickness: 0.018 to 0.026 inches.
- e. Fabric Backing Content: Poly-Cotton Woven.
- f. Fire Resistance: Class A per ASTM E84.
 - 1) Flame Spread: 25 max per ASTM E84.
 - 2) Smoke Developed: 140 max per ASTM E84.
- g. Mold and Mildew Resistance: Passing per ASTM G21.
- 7. Wall Covering Substrate - Basis-of-Design Product: Koroseal; "Fine Texture" digital print substrate #DS0103, Type II, 52 to 54 inches in width.
- 8. Patterns and Colors:
 - a. Digital Wall Covering: Custom pattern.
 - b. Printing capability shall be 4-color Spectrum including the full Pantone color range including white colors.
- 9. Size: as indicated on drawings.
- 10. Artwork shall be furnished by the Owner, on disc to manufacturer's standards.

2.2 ADHESIVES AND ACCESSORIES

- A. Adhesives: Manufacturer's standard heavy-duty wall covering adhesive for use with specific wall covering and substrate application. Adhesives shall have the following characteristics:
 - 1. Mildew resistant, non-staining, and strippable.
 - 2. Basis-of-Design Adhesive: Koroseal; "A-848-B" heavy-duty premixed vinyl adhesive.
- B. Accessories: Provide all necessary accessories as recommended by the custom mural wall covering manufacturer for a complete and proper installation over substrates indicated.
- C. Primer/Sealer: Mildew resistant, recommended in writing by wall covering mural manufacturer for intended substrate.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Acclimatize wall covering materials by removing them from packaging in the installation areas not less than 24 hours before installation.
- B. Follow manufacturer's printed instructions for surface preparation.
 - 1. Prepare substrates to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, and defects.
 - 2. Painted Surfaces: Treat areas susceptible to pigment bleeding.
 - 3. Metals: If not factory primed, clean and apply rust inhibitive zinc primer.
 - 4. Moisture Content: Maximum of 5 percent on new plaster, concrete, and concrete masonry units when tested with an electronic moisture meter.
 - 5. Prime new gypsum board with a recommended primer/sealer.
- C. Check painted surfaces for pigment bleeding. Sand gloss, semi gloss, and eggshell finishes with fine sandpaper.

3.2 INSTALLATION

- A. General: Avoid damaging wall covering murals during installation. Murals damaged during installation will be removed, re-manufactured and installed at no additional cost to the Owner.
- B. Follow manufacturer's printed instructions and approved panel maps for installation of each custom wall covering mural. Install wall covering with no gaps or overlaps. Install seams vertical and plumb at least 6" from outside corners and 3" from inside corners. No horizontal seams. Remove air bubbles, wrinkles, blisters, and other defects.
 - 1. Fully bond wall covering mural to substrate.
 - 2. Trim edges for color uniformity, pattern match, and tight closure at seams and edges. Butt seams.
 - 3. Align artwork from panel to panel to ensure graphic is not compromised.

3.3 CLEANING

- A. Remove excess adhesive at finished seams, perimeter edges, and adjacent surfaces.
 - 1. Clean with damp sponge. Use mild soap and water as recommended by wall covering manufacturer. Test cleaning methods on inobtrusive area of mockup panel, obtaining Architect's approval prior to continuing with remaining cleaning.
- B. Use cleaning methods recommended by the wall covering manufacturer.
- C. Replace wall covering panels that cannot be cleaned.

END OF SECTION 097253

SECTION 097723 - FABRIC WRAPPED PANELS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Shop-fabricated, fabric-wrapped wall panels (097723.A01 – WP4, WP21, WP22, WP23).
- B. Related Sections:
 - 1. Section 098433 "Sound-Absorbing Wall Units" for shop-fabricated wall panels tested for acoustical performance.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of fabric facing, panel edge, core material, and mounting indicated.
- B. Shop Drawings: For fabric-wrapped wall panels. Include mounting devices and details; details at panel head, base, joints, and corners; and details at ceiling, floor base, and wall intersections. Indicate panel edge and core materials.
 - 1. Include elevations showing panel sizes and direction of fabric weave and pattern matching.
- C. Samples for Verification: For each type of fabric facing from fabric-wrapped, wall panel manufacturer's full range.

1.3 INFORMATIONAL SUBMITTALS

- A. Product certificates.
- B. Warranty: Sample of special warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For fabric-wrapped wall panels to include in maintenance manuals. Include fabric manufacturers' written cleaning and stain-removal recommendations.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain fabric-wrapped wall panels from single source from single manufacturer.
- B. Fire-Test-Response Characteristics: Provide fabric-wrapped wall panels meeting the following as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
 - 1. Surface-Burning Characteristics: As determined by testing per ASTM E 84, Class A.
- C. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.
- D. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.
- E. Mockup: Build mockup to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials, fabrication, and installation.
 - 1. Build mockup of typical wall area as indicated by the architect.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Comply with fabric and fabric-wrapped, wall panel manufacturers' written instructions for minimum and maximum temperature and humidity requirements for shipment, storage, and handling.
- B. Deliver materials and panels in unopened bundles and store in a temperature-controlled dry place with adequate air circulation.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install fabric-wrapped wall panels until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work at and above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- B. Lighting: Do not install fabric-wrapped wall panels until a permanent level of lighting is provided on surfaces to receive fabric-wrapped wall panels.
- C. Air-Quality Limitations: Protect fabric-wrapped wall panels from exposure to airborne odors such as tobacco smoke, and install panels under conditions free from odor contamination of ambient air.
- D. Field Measurements: Verify locations of fabric-wrapped wall panels and actual dimensions of openings and penetrations by field measurements before fabrication.
 - 1. Verify locations of switch plates and other similar items penetrating fabric-wrapped wall panels.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of fabric-wrapped wall panels that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Fabric sagging, distorting, or releasing from panel edge.
 - b. Delamination from wall substrate.
 - c. Warping of core.
 - 2. Warranty Period: Two years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Wall materials 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."
- B. Fire-Test-Response Characteristics: Panels shall comply with "Surface-Burning Characteristics" or "Fire Growth Contribution" Subparagraph below, or both, as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
 - 1. Surface-Burning Characteristics: Comply with ASTM E 84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 450 or less.
 - 2. Fire Growth Contribution: Comply with acceptance criteria of local code and authorities having jurisdiction when tested according to NFPA 265 Method B Protocol or NFPA 286.

2.2 FABRIC-WRAPPED WALL PANELS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Conwed.

2. Decoustics Limited; a CertainTeed Ceilings company.
 3. Golterman & Sabo.
 4. Lamvin, Inc.
 5. Signature Craft.
 6. Wall Technology, Inc.; an Owens Corning company.
- B. Fabric-Wrapped Wall Panel (097723.A01): Manufacturer's standard panel construction consisting of fabric facing material laminated to front face, edges, and back edge border of core.
1. Mounting: Back mounted with manufacturer's standard adhesive supplemented with impaling clips, secured to substrate.
 - a. Impaling clips shall be mechanically fastened to substrate.
 2. Core: mineral-fiber board.
 3. Edge Profile: Square.
 4. Corner Detail in Elevation: Square with continuous edge profile indicated.
 5. Facing Material (WP4, WP22, WP23): Designtex, Rocket.
 - a. Colors as indicated on Material Finish Legend.
 - b. Fire Performance Characteristics: Class A per ASTM E 84.
 - c. Contents: 28% Polyester, 72% Polyester (Postconsumer Recycled)
 - d. Weight: 16 oz/ly.
 6. Facing Material (WP21): Guilford of Maine, Bailey.
 - a. Colors as indicated on Material Finish Legend.
 - b. Fire Performance Characteristics: Class A per ASTM E 84.
 - c. Contents: 100% pre-consumer recycled polyester.
 - d. Weight: 8.5 plus or minus 0.5 oz/ly.
 - e. Treatment: Polyester Binder.
 - f. NRC (Noise Reduction Coefficient):
 - 1) NRC of anechoic termination: 1.00
 - 2) NRC of fabric in front of anechoic termination: 0.95
 7. Nominal Overall Panel Thickness: 3/4 inch.
 8. Panel Width: As indicated on Drawings.
 9. Panel Height: As indicated on Drawings.

2.3 MATERIALS

- A. Core Materials:
1. Mineral-Fiber Board: Maximum flame-spread and smoke-developed indexes of 25 and 10, respectively; minimum density of 20 lb/cu. ft. (320 kg/cu. m).
 - a. Basis of Design: Provide Micore MC300-SC with coated face as manufactured by USG or a comparable product.
 - b. Joint Treatment Material: As recommended by mineral fiber board manufacturer to create smooth uniform joints between core panels that will not telegraph through facing material.
- B. Facing Material: Fabric from same dye lot; color and pattern as indicated on Drawings.
- C. Mounting Devices: Concealed on back of panel, utilize adhesive supplemented with impaling clips as recommended by manufacturer to support weight of panel, and as follows:
1. Adhesives: As recommended by fabric-wrapped, wall panel manufacturer.
 - a. Adhesives shall have a VOC content of 70 g/L or less.
 - b. Adhesive shall comply with the testing and product 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. Impaling Clips: Manufacturer's standard.

2.4 FABRICATION

- A. General: Use manufacturer's standard construction except as otherwise indicated; with facing material applied to face, edges, and back border of dimensionally stable core; and with rigid edges to reinforce panel perimeter against warpage and damage.

- B. Mineral-Fiber Board Cores: Chemically harden core edges and areas of core where mounting devices are attached.
- C. Facing Material: Apply fabric fully covering visible surfaces of panel; with material stretched straight, on the grain, tight, square, and free from puckers, ripples, wrinkles, sags, blisters, seams, adhesive, or other visible distortions or foreign matter.
 - 1. Square Corners: Tailor corners.
 - 2. Fabrics with Directional or Repeating Patterns or Directional Weave: Mark fabric top and attach fabric in same direction so pattern or weave matches in adjacent panels.
- D. Dimensional Tolerances of Finished Panels: Plus or minus 1/16 inch (1.6 mm) for the following:
 - 1. Thickness.
 - 2. Edge straightness.
 - 3. Overall length and width.
 - 4. Squareness from corner to corner.
 - 5. Chords, radii, and diameters.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine fabric, fabricated panels, substrates, areas, and conditions, for compliance with requirements, installation tolerances, and other conditions affecting performance of fabric-wrapped wall panels.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install fabric-wrapped wall panels in locations indicated with vertical surfaces and edges plumb, top edges level and in alignment with other panels, faces flush, and scribed to fit adjoining work accurately at borders and at penetrations.
 - 1. For monolithic installation, adhere core to wall substrate, treat panel joints and apply liner material to entire surface to receive facing material. Install wall liner, with no gaps or overlaps, to form a smooth wrinkle-free surface for finished installation. Do not begin facing material installation until wall liner has dried.
- B. Comply with fabric-wrapped, wall panel manufacturer's written instructions for installation of panels using adhesive type mounting supplemented with impaling devices indicated. Mount panels securely to supporting substrate.
- C. Align and level fabric pattern and grain among adjacent panels.

3.3 INSTALLATION TOLERANCES

- A. Variation from Plumb and Level: Plus or minus 1/16 inch.
- B. Variation of Panel Joints from Hairline: Not more than 1/16 inch wide.

3.4 CLEANING

- A. Clip loose threads; remove pills and extraneous materials.
- B. Clean panels on completion of installation to remove dust and other foreign materials according to manufacturer's written instructions.

END OF SECTION 097723

SECTION 098433 - ACOUSTICAL WALL UNITS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes shop-fabricated, cementitious-fiber primed units and fabric-wrapped, sound-absorbing wall panel units tested for acoustical performance, including:
 - 1. Sound-Absorbing Wall Panels (098433.A01 – AP1, AP21, AP22, AP23, AP24, AP25).
 - 2. Fabricated Sound-Diffusing Wall Panels (098433.A15 – AP3).
- B. Related Requirements:
 - 1. Section 098436 "Acoustical Ceiling Units" for shop-fabricated ceiling panels tested for acoustical performance.

1.2 DEFINITIONS

- A. NRC: Noise Reduction Coefficient.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of fabric facing, panel edge, core material, and mounting indicated.
- B. Shop Drawings: For each type of sound-absorbing wall units. Include mounting devices and details; details at panel head, base, joints between panels and corners; sections through each type of panel, and details at ceiling and wall intersections. Indicate panel edge, core and facing materials.
 - 1. Include elevations showing layout of panels and panel sizes; direction of fabric weave and pattern matching.
- C. Samples for Verification: For each type of panel, submit an actual panel, not less than 12 inches square by full thickness.
 - 1. Submit samples for each type of fabric facing for sound-absorbing wall units.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For sound-absorbing wall units to include in maintenance manuals. Include fabric manufacturers' written cleaning and stain-removal recommendations.

1.6 QUALITY ASSURANCE

- A. Source Limitations: Obtain sound-absorbing wall units from single source from single manufacturer.
- B. Fire-Test-Response Characteristics: Provide sound-absorbing wall units meeting the following as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
 - 1. Surface-Burning Characteristics: As determined by testing per ASTM E 84.
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 450 or less.
 - 2. Fire Growth Contribution: Meeting acceptance criteria of local code and authorities having jurisdiction when tested according to NFPA 265.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Comply with sound-absorbing wall unit manufacturers' written instructions for minimum and maximum temperature and humidity requirements for shipment, storage, and handling.
- B. Comply with fabric manufacturers' written instructions for minimum and maximum temperature and humidity requirements for shipment, storage, and handling.
- C. Deliver materials and units in unopened bundles and store in a temperature-controlled dry place with adequate air circulation.

1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install sound-absorbing wall units until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work at and above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- B. Lighting: Do not install sound-absorbing wall units until a permanent level of lighting is provided on surfaces to receive the units.
- C. Air-Quality Limitations: Protect sound-absorbing wall units from exposure to airborne odors, such as tobacco smoke, and install units under conditions free from odor contamination of ambient air.
- D. Field Measurements: Verify locations of sound-absorbing wall units and actual dimensions of openings and penetrations by field measurements before fabrication.

1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of sound-absorbing wall units that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to the following:
 - a. Acoustical performance.
 - b. Fabric sagging, distorting, or releasing from panel edge.
 - c. Warping of core.
 - 2. Warranty Period: Two years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 SOUND-ABSORBING WALL PANELS (098433.A01 – AP22, AP23, AP24, AP25).

- A. Basis of Design Products: Subject to compliance with requirements, provide "Acousti-Panels" by Golterman & Sabo Acoustics or a comparable product by one of the listed acceptable manufacturers with the following product characteristics:
 - 1. Acceptable Manufacturers:
 - a. Conwed Designscape, Owens Corning.
 - b. Decoustics Limited, CertainTeed.
 - c. Kinetics Noise Control.
 - d. RPG Acoustical Systems.
 - e. Sound Seal.
 - f. Signature Craft.
 - g. Wall Technology, Owens Corning.
 - 2. Description: Manufacturer's standard panel construction consisting of facing material stretched over front face of edge-framed core and bonded or attached to edges and back of frame.
 - 3. Mounting: Back mounted with manufacturer's standard magnetic devices or metal clips or bar hangers, secured to substrate.

4. Edge Construction: Manufacturer's standard chemically hardened core with no frame, or extruded-aluminum or zinc-coated, rolled-steel frame.
5. Edge Profile: As indicated.
6. Facing Material: As indicated in Material Finish Legend.
7. Nominal Core Thickness: 2".
8. Panel Width: As indicated on Drawings.
9. Panel Height: As indicated on Drawings.

2.2 CEMENTITIOUS SOUND-ABSORBING WALL PANELS – (098433.A04 – AP1, AP21)

- A. Sound-Absorbing Wall Panel: Pre-manufactured cementitious-fiber cement panels on furring strips with sound absorbing insulation fill between furring.
 1. Mounting: Face mounted with manufacturer's standard mechanical fasteners.
 2. Core/Face: 1 inches thick cementitious-fiber board.
 3. Edge Profile: Chamfered (beveled) on all four sides.
 4. Corner Detail in Elevation: Square.
 5. Acoustical Performance: Sound absorption NRC of not less than 0.85 according to ASTM C 423 for Type "C-40" mounting.
 6. Overall Panel Thickness:
 - a. AP1: 2 inches.
 - b. AP21: 3 inches.
 7. Panel Width: As indicated on Drawings.
 8. Panel Height: As indicated on Drawings.
 9. Furring Strips: Manufacturer's standard 1x furring to match panel core/face. Provide furring pre-mounted/fastened to backs of panel faces. Provide furring as required for required acoustical performance and mounting type specified.
 10. Acoustical absorptive material: manufacturer's standard.
 11. Finish: Primed finish for field painting as shown in Material Finish Legend.
 12. Flame Spread: Class "A" according to ASTM E 1264.
 13. Basis of Design: Armstrong World Industries, Inc.; "Tectum Finale High NRC" - custom wall panels.
 - a. Comparable products from other manufacturers meeting specified requirements which are submitted to and accepted by Architect will be considered.

2.3 FABRICATED SOUND DIFFUSING WALL PANELS (098433.A15 - AP3)

- A. Basis of Design Products: Subject to compliance with requirements, provide "GFRG" by Formglass Products Ltd. or a comparable product with the following product characteristics:
- B. Componentets:
 1. Fabrications: Molded GRG parts made in accordance with samples, shop drawings and with ASTM C1381 Standard for Molded Glass Fiber Reinforced Gypsum Parts.
 2. Materials: Molded GRG parts to be made in accordance with ASTM C1355 Standard for Glass Fiber Reinforced Gypsum Composites.
 3. All castings shall be standard 3/16" thick unless notes as "Impact Resistant". Where this is indicated on drawings, material shall be thickened to 1/2".
 - a. Lower row to be 1/2" thick "Impact Resistant"; top two rows shall be 3/16".
 4. Embedments: GRG parts to have typical embedments and reinforcement of galvanized steel or wood, if required, for the purposes of suspension, attachment and stiffness.
 5. Molded GRG units to be ready for primer for typical flat paint finishes.
 6. GRG parts subject to critical lighting or scheduled to receive semi-gloss decoration shall be prepared as a Level 5 finish which may require skim coats, filling, and sanding to hide imperfections inherent in GRG, in accordance to ASTM Standards C840 and C1467.
- C. Properties:
 1. Molded Glass Fiber Reinforced Gypsum Parts to meet the mechanical properties specified in section 5.2 of ASTM Standard C1355:
 - a. Flexural Strength in accordance to ASTM C947; 4700 psi.
 - b. Impact Resistance in accordance to ASTM D256; 6.5 ft.lb/in.
 - c. Hardness in accordance to ASTM D2583; 60.
 - d. Coefficient of Linear Thermal Expansion in accordance to ASTM D696;

- e. Humidified Deflection in accordance to ASTM C473; 1/8" (3mm).
- f. Surface Burning Characteristics in accordance to ASTM E84.
- g. Behavior at 750° C in accordance to ASTM E136; Pass.
- h. Nail Pull Resistance in accordance to ASTM C473; 176 lbf.

2.4 MATERIALS

- A. Core Materials:
 - 1. Glass-Fiber Board Backing: ASTM C 612, Type standard with manufacturer; nominal density of 6 to 7 lb/cu. ft., unfaced, and dimensionally stable, molded rigid board; and with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.
 - 2. High Density Fiberglass Subfacing: 1/8-inch thick, 18 pcf fiberglass, unfaced, and dimensionally stable, impact resistant and tackable; and with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.
 - 3. Cementitious-Fiber Board: Density of not less than 20 lb/cu. ft.
- B. Mounting Devices: Concealed on back of unit, as recommended by manufacturer to support weight of unit, and as follows:
 - 1. Manufacturer's recommended adhesive.
 - 2. Metal Clips or Bar Hangers: Manufacturer's standard two-part metal "Z" clips, with one part of each clip mechanically attached to back of unit and the other part to substrate, designed to permit unit removal.
 - 3. Corrosion Resistant Fasteners: For cementitious-fiber board panels, provide manufacturer's standard corrosion resistant fasteners.

2.5 FABRICATION

- A. General: Use manufacturer's standard construction except as otherwise indicated; with facing material applied to face, edges, and back border of dimensionally stable core; and with rigid edges to reinforce panel perimeter against warpage and damage.
 - 1. Glass-Fiber Board Cores: Chemically harden core edges and areas of core where mounting devices are attached.
- B. Facing Material: Apply fabric facing fully covering visible surfaces of unit; with material stretched straight, on the grain, tight, square, and free from puckers, ripples, wrinkles, sags, blisters, seams, adhesive, or other visible distortions or foreign matter.
 - 1. Square Corners: Tailor corners.
 - 2. Fabrics with Directional or Repeating Patterns or Directional Weave: Mark fabric top and attach fabric in same direction so pattern or weave matches in adjacent units.
- C. Dimensional Tolerances of Finished Units: Plus or minus 1/16 inch for the following:
 - 1. Thickness.
 - 2. Edge straightness.
 - 3. Overall length and width.
 - 4. Squareness from corner to corner.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine fabric, fabricated units, substrates, areas, and conditions, for compliance with requirements, installation tolerances, and other conditions affecting performance of sound-absorbing wall units.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install sound-absorbing wall units in locations indicated with vertical surfaces and edges plumb, top edges level and in alignment with other units, faces flush, and scribed to fit adjoining work accurately at borders and at

penetrations.

- B. Comply with sound-absorbing wall unit manufacturer's written instructions for installation of units using type of mounting specified. Mount units securely to supporting substrate.
- C. Align and level fabric pattern and grain among adjacent units.
- D. Installation of GFRG units:
 - 1. Comply with ASTM C1467 Standard for the Installation of Molded Glass Fiber Reinforced Gypsum Parts.
 - 2. It is the Installer's responsibility to verify scope and to order the correct quantities of parts (including a waste allowance).
 - 3. Supply and install all shims and brackets required for work in this section and to ensure a solid and secure installation of GRG parts.
 - 4. Position GRG parts carefully into place and align with adjacent parts and materials in accordance to the drawings. Attach GRG parts to substrates and framing with fastening devices as specified by the GRG manufacturer. Use concealed shims as required and countersink screws below the surrounding surface.
 - 5. Install control joints between GRG parts as indicated and as required by the manufacturer.
 - 6. Countersunk fasteners and damage to be patched to match the GRG part's texture.
 - 7. Finishing of the GRG parts to be carried out by the painting contractor. Proper sealing of the finished GRG assemblies must be provided to avoid joint tape read through. For more information, consult the ASTM C840.

3.3 INSTALLATION TOLERANCES

- A. Variation from Plumb and Level: Plus or minus 1/16 inch.
- B. Variation of Panel Joints from Hairline: Not more than 1/16 inches wide.

3.4 CLEANING

- A. Clip loose threads; remove pills and extraneous materials.
- B. Clean panels on completion of installation to remove dust and other foreign materials according to manufacturer's written instructions.

END OF SECTION 098433

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SECTION 098436 - ACOUSTICAL CEILING UNITS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes shop-fabricated, pre-finished panel units tested for acoustical performance, including:
 - 1. Sound-Absorbing Ceiling Panels (098436.A01 – AP2).
 - 2. Sound-Diffusing Ceiling Panels (098436.A02 - CLG21).
- B. Related Requirements:
 - 1. Section 092900 "Gypsum Board" for sound absorptive perforated gypsum board.
 - 2. Section 098433 "Sound-Absorbing Wall Units" for shop-fabricated fabric-wrapped wall panels tested for acoustical performance.

1.2 DEFINITIONS

- A. NRC: Noise reduction coefficient.
- B. SAA: Sound absorption average.

1.3 PREINSTALLATION MEETINGS

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

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, mounting, material descriptions, dimensions of individual components and profiles, and finishes for sound-absorbing ceiling units.
 - 2. Include fabric facing, panel edge and ends, core material, and mounting indicated.
 - 3. Include furnished specialties and accessories.
- B. Shop Drawings: For unit assembly and installation.
 - 1. Include reflected ceiling plans, elevations, sections, and mounting devices and details.
 - 2. Include details at joints and corners; and details at ceiling intersections and intersections with walls. Indicate panel edge and end profiles and core materials.
 - 3. Include direction of fabric weave and pattern matching.
- C. Samples for Initial Selection: For each type of fabric facing.
 - 1. Include Samples of hardware and accessories involving color or finish selection.
- D. Samples for Verification: For the following products:
 - 1. Fabric: Full-width by approximately 24-inch- long Sample, but not smaller than required to show complete pattern repeat, from dye lot to be used for the Work, and with specified treatments applied. Mark top and face of fabric.
 - 2. Panel Edge: 12-inch-long Sample(s) showing each edge profile, corner, and finish.
 - 3. Core Material: 12-inch-square Sample at corner.
 - 4. Mounting Devices: Full-size Samples.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Suspended ceiling components above ceiling units.

2. Structural members to which suspension devices will be attached.
3. Items penetrating or covered by units including the following:
 - a. Lighting fixtures.
 - b. Air outlets and inlets.
 - c. Speakers.
 - d. Alarms.
 - e. Sprinklers.
 - f. Access panels.

B. Product certificates: For each type of sound-absorbing ceiling unit.

C. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sound-absorbing and sound diffusing ceiling units to include in maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Integrated Field Sample: Build integrated field samples to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials, fabrication, and installation.
1. Build mockup of each type of typical baffle.
 2. Approval of field samples does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 3. Subject to compliance with requirements, approved field sample may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Comply with sound-absorbing ceiling unit manufacturers' written instructions for minimum and maximum temperature and humidity requirements for shipment, storage, and handling.
- B. Deliver materials and units in unopened bundles and store in a temperature-controlled dry place with adequate air circulation.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Do not install units until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work at and above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- B. Lighting: Do not install units until a permanent level of lighting is provided on surfaces to receive the units.
- C. Air-Quality Limitations: Protect units from exposure to airborne odors, such as tobacco smoke, and install units under conditions free from odor contamination of ambient air.
- D. Field Measurements: Verify unit locations and actual dimensions of openings and penetrations by field measurements before fabrication, and indicate them on Shop Drawings.

1.10 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of sound-absorbing ceiling units that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
 - a. Acoustical performance.
 - b. Fabric sagging, distorting, or releasing from panel edge.
 - c. Warping of core.

2. Warranty Period: Two years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Armstrong Ceiling Solutions.
 2. Conwed Designscape; an Owens Corning company.
 3. Decoustics Limited; a CertainTeed Ceilings company.
 4. Golterman & Sabo.
 5. Signature Craft.
 6. SoundSeal.
 7. Turf.
 8. Wall Technology, Inc.; an Owens Corning company.
 9. Wenger.
- B. Source Limitations: Obtain sound-absorbing ceiling units from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: Provide sound-absorbing ceiling units meeting the following requirements as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
 1. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 450 or less.
 2. Fire Growth Contribution: Comply with acceptance criteria of local code and authorities having jurisdiction when tested according to NFPA 286.
- B. Ceiling materials 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."

2.3 CEMENTITIOUS SOUND-ABSORBING CEILING UNITS

- A. Sound-Absorbing Ceiling Panels (098436.A01 - AP2): Cementitious-fiber cement panels.
 1. Mounting: Face mounted with manufacturer's standard mechanical fasteners.
 2. Core: 1-1/2 inch thick cementitious-fiber board.
 3. Furring Strips: Provide 2 inch nominal, furring as required for required acoustical performance and mounting type specified.
 4. Overall Panel Thickness: 3 inches.
 5. Fiberglass Backing Thickness: 1-1/2 to 2 inches.
 6. Edge Profile: Beveled or Square.
 7. Acoustical Performance: Sound absorption NRC of not less than 0.90 according to ASTM C 423 for Type "C-40" mounting.
 8. Panel Width: As indicated on Drawings
 9. Panel Length: As indicated on Drawings
 10. Finish: Factory primed (white).
 11. Basis of Design: Armstrong World Industries, Inc.; "Tectum Finale".
 - a. Comparable products from other manufacturers meeting specified requirements which are submitted to and accepted by Architect prior to bidding will be considered.

2.4 SOUND-DIFFUSING CEILING UNITS

- A. Sound-Diffusing Ceiling Panels (098436.A02 – CLG21): Manufacturer's standard panel construction consisting of facing material laminated to front face, edges, and back edge border of core.
 - 1. Basis of Design: Provide "Pyramidal Ceiling Diffuser Panels" by Wenger Corporation or product by a manufacturer listed above meeting the listed product characteristics.
 - 2. Panel Shape: Pyramidal.
 - 3. Mounting: Lay-in ceiling grid clip. All lay-in ceiling panels include safety cable attachment to permanent ceiling grid in all four corners of panel. Use mounting brackets and back-support/stiffening angles for ceiling installation.
 - 4. Core: Fire-retardant formed plastic, prepared for required acoustical performance.
 - 5. Edge Construction: Manufacturer's standard.
 - 6. Facing Material: Molded thermoplastic impact-resistant.
 - 7. Panel Size: 48 inches, square, nominal.
 - 8. Acoustic Performance
 - a. NRC of 0.30 per ASTM C423.

2.5 MATERIALS

- A. Core Materials:
 - 1. Cementitious-Fiber Board: Density of not less than 20 lb/cu. ft. ()
 - 2. Fire-Retardant Formed Fiberglass-Reinforced Plastic: Manufacturer's standard formed plastic with flame-spread index of 25 or less and smoke-developed index of 25 or less according to ASTM E 84.
 - 3. Polyester Core: Manufacturer standard formulation with a flame-spread index of 10 or less and a smoke-developed Index of 185 or less according to ASTM E 84.
- B. Mounting Devices: Concealed on back of unit, recommended by manufacturer to support weight of unit.
- C. Fasteners: Provide stainless steel fasteners designed for mechanical attachment to concrete substrates, similar to "410 Stainless Steel Series" by Tapcon.

2.6 FABRICATION

- A. General: Use manufacturer's standard construction except as otherwise indicated; with dimensionally stable core and with rigid edges to reinforce panel perimeter against warpage and damage.
- B. Dimensional Tolerances of Finished Units: Plus or minus 1/16 inch for the following:
 - 1. Thickness.
 - 2. Edge straightness.
 - 3. Overall length and width.
 - 4. Squareness from corner to corner.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine fabricated units, substrates, areas, and conditions for compliance with requirements, installation tolerances, and other conditions affecting performance of sound-absorbing ceiling units.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install units in locations indicated. Unless otherwise indicated, install units with edges in alignment with walls and other units, faces flush, and scribed to fit adjoining work accurately at borders and at penetrations.

- B. For each type of diffuser and baffle, comply with unit manufacturer's written instructions and approved shop drawings, for installation of units using type of mounting devices indicated. Mount units securely to supporting substrate.

3.3 INSTALLATION TOLERANCES

- A. Variation from Alignment with Surfaces: Plus or minus 1/16 inch.
- B. Variation from Level or Slope: Plus or minus 1/16 inch.
- C. Variation of Panel Joints from Hairline: Not more than 1/16 inch wide.

3.4 CLEANING

- A. Clean panels on completion of installation to remove dust and other foreign materials according to manufacturer's written instructions.

END OF SECTION 098436

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SECTION 099113 - EXTERIOR PAINTING

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes surface preparation and the application of paint systems on the following exterior substrates:
 - 1. Concrete.
 - 2. Concrete masonry units (CMUs).
 - 3. Steel and iron.
 - 4. Galvanized metal.
 - 5. Aluminum (not anodized or otherwise coated).
 - 6. Steel doors and frames.
 - 7. Miscellaneous mechanical, electrical, plumbing, fire suppression, communication and technology work as delineated in this section.
- B. Related Requirements:
 - 1. Section 051200 "Structural Steel Framing" for shop priming of metal substrates.
 - 2. Section 055000 "Metal Fabrications" for shop priming metal fabrications.
 - 3. Section 055213 "Pipe and Tube Railings" for shop priming pipe and tube railings.
 - 4. Section 099123 "Interior painting" for surface preparation and the application of paint systems on interior substrates.
 - 5. Section 099300 "Staining and Transparent Finishing" for surface preparation and the application of wood stains and transparent finishes on exterior wood substrates.
 - 6. Section 099600 "High-Performance Coatings" for special-use coatings.

1.2 DEFINITIONS

- A. Gloss Level 1 "Matte": Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
- B. Gloss Level 3 "Eggshell": 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- C. Gloss Level 4 "Satin-like": 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.
- D. Gloss Level 5 "Semi-gloss": 35 to 70 units at 60 degrees, according to ASTM D 523.
- E. Gloss Level 6 "Gloss": 70 to 85 units at 60 degrees, according to ASTM D 523.
- F. Gloss Level 7 "High Gloss": More than 85 units at 60 degrees, according to ASTM D 523.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
 - 1. Indicate VOC content.
- B. Samples for Initial Selection: Where colors are not indicated on Drawings, submit for each type of topcoat product.
- C. Samples for Verification: For each type of paint system and each color and gloss of topcoat.
 - 1. Submit Samples on rigid backing, 6 inches square.
 - 2. Apply coats on Samples in steps to show each coat required for system.
 - 3. Label each coat of each Sample.
 - 4. Label each Sample for location and application area.

- D. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Paint: Two (2) gallons of each material and color applied.
- B. Full containers only.

1.5 QUALITY ASSURANCE

- A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Architect will select one surface to represent surfaces and conditions for application of each paint system.
 - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft..
 - b. Other Items: Architect will designate items or areas required.
 - 2. Final approval of color selections will be based on mockups.
 - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
 - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
 - 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers - Basis of Design Products: Subject to compliance with requirements, provide products The Sherwin-Williams Company, or comparable products from another manufacturers submitted to and accepted by Architect and Owner prior to bidding.

2.2 PAINT, GENERAL

- A. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
- B. VOC Content: For field applications, paints and coatings shall comply with VOC content limits of authorities having jurisdiction and the following VOC content limits:
1. Flat Paints and Coatings: 50 g/L.
 2. Nonflat Paints and Coatings: 50 g/L.
 3. Dry-Fog Coatings: 150 g/L.
 4. Primers, Sealers, and Undercoaters: 100 g/L.
 5. Rust-Preventive Coatings: 100 g/L.
 6. Zinc-Rich Industrial Maintenance Primers: 100 g/L.
 7. Pretreatment Wash Primers: 420 g/L.
 8. Shellacs, Clear: 730 g/L.
 9. Shellacs, Pigmented: 550 g/L.
- C. Colors: Where not indicated on Drawings, as selected by Architect from manufacturer's full range.
1. Twenty percent of surface area will be painted with deep tones.
- D. Paint Systems: Refer to schedule at end of this Section.

2.3 SOURCE QUALITY CONTROL

- A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:
1. Owner may engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
 2. Testing agency will perform tests for compliance with product requirements.
 3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
1. Concrete: 12 percent.
 2. Masonry (Clay and CMUs): 12 percent.
 3. Wood: 15 percent.
- C. Exterior Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
- D. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
- E. Proceed with coating application only after unsatisfactory conditions have been corrected.
1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
- E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.
- F. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer, but not less than the following:
 - 1. SSPC-SP 3.
- G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- I. Aluminum Substrates: Remove loose surface oxidation.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."
 - 1. Use applicators and techniques suited for paint and substrate indicated.
 - 2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
 - 3. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
 - 4. Paint entire exposed surface of window frames and sashes.
 - 5. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 - 6. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. Tint undercoats same color as topcoat, but tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

- E. Miscellaneous Painting of Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
 - 1. Paint the following work where exposed to view:
 - a. Equipment, including panelboards.
 - b. Uninsulated metal piping.
 - 1) Also includes gas lines on roof.
 - c. Uninsulated plastic piping.
 - 1) Also includes PVC condensate lines on roof.
 - d. Pipe hangers and supports.
 - e. Metal conduit.
 - f. Plastic conduit.
 - g. Tanks that do not have factory-applied final finishes.

3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
 - 1. Contractor shall touch up and restore painted surfaces damaged by testing.
 - 2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 EXTERIOR PAINTING SCHEDULE

- A. Concrete, including structural precast:
 - 1. The Sherwin-Williams Company.
 - a. 1 coat Loxon Concrete and Masonry Primer.
 - b. 2 coats Loxon Acrylic Masonry Coating, satin.
- B. Concrete, including structural precast – (Elastomeric, high build system not less than 10 mils):
 - 1. The Sherwin-Williams Company.
 - a. 2 coats Loxon XP High Build, satin (water vapor permeance of not less than 9 perms when tested according to ASTM D 1653).
- C. Steel Substrates - Unprimed:
 - 1. The Sherwin-Williams Company.
 - a. 1 coat Pro Industrial Pro-Cryl Universal WB Acrylic Primer.
 - b. 2 coats Pro Industrial WB Alkyd Urethane.
- D. Steel Substrates - Primed:
 - 1. The Sherwin-Williams Company.
 - a. 1 touchup coat Pro Industrial Pro-Cryl Universal WB Acrylic Primer.
 - b. 2 coats Pro Industrial WB Alkyd Urethane.
- E. Galvanized Steel Substrates – (except railings, handrails and guardrails):

1. The Sherwin-Williams Company.
 - a. 1 touchup coat Pro Industrial Pro-Cryl Universal WB Acrylic Primer.
 - b. 2 coats Pro Industrial WB Alkyd Urethane.
- F. Primed Steel Doors and Frames:
 1. The Sherwin-Williams Company.
 - a. 1 coat of Pro Industrial Pro-Cryl Universal WB Acrylic Primer.
 - b. 2 coats Pro Industrial WB Alkyd Urethane.
- G. Aluminum Substrates:
 1. The Sherwin-Williams Company.
 - a. 2 coats A-100 Latex, satin.

END OF SECTION 099113

SECTION 099123 - INTERIOR PAINTING

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes surface preparation and the application of paint systems on the following interior substrates:
 - 1. Concrete.
 - 2. Concrete masonry units (CMUs).
 - 3. Steel and iron.
 - 4. Galvanized metal.
 - 5. Aluminum (not anodized or otherwise coated).
 - 6. Gypsum board.
 - 7. Acoustic panels and tiles.
 - 8. Miscellaneous mechanical, electrical, plumbing, fire suppression, communication and technology work as delineated in this Section.
- B. Related Requirements:
 - 1. Section 051200 "Structural Steel Framing" for shop priming structural steel.
 - 2. Section 055000 "Metal Fabrications" for shop priming metal fabrications.
 - 3. Section 055100 "Metal Stairs" for shop priming metal pan stairs.
 - 4. Section 055213 "Pipe and Tube Railings" for shop priming pipe and tube railings.
 - 5. Section 097253 "Digital Wall Covering" for wall covering installation requirements.
 - 6. Section 099113 "Exterior Painting" for surface preparation and the application of paint systems on exterior substrates.
 - 7. Section 099600 "High-Performance Coatings" for special-use coatings.

1.2 DEFINITIONS

- A. Gloss Level 1 "Matte": Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
- B. Gloss Level 2 "Flat": Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- C. Gloss Level 3 "Eggshell": 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- D. Gloss Level 4 "Satin-like": 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.
- E. Gloss Level 5 "Semi-gloss": 35 to 70 units at 60 degrees, according to ASTM D 523.
- F. Gloss Level 6 "Gloss": 70 to 85 units at 60 degrees, according to ASTM D 523.
- G. Gloss Level 7 "High Gloss": More than 85 units at 60 degrees, according to ASTM D 523.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
 - 1. Indicate VOC content.
- B. Samples for Initial Selection: Where colors are not specifically indicated, submit for each type of topcoat product.
- C. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.
 - 1. Submit Samples on rigid backing, 8 inches square.
 - 2. Label each coat of each Sample.

- D. Product List: For each product indicated, include the following:
 - 1. Cross-reference to paint system and locations of application areas.
 - 2. Use same designations indicated on Drawings and in schedules.
 - 3. Include color designations.
 - 4. VOC content.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Paint: 2 gallon of each material and color applied.

1.5 QUALITY ASSURANCE

- A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Architect will select one surface to represent surfaces and conditions for application of each paint system.
 - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft..
 - b. Other Items: Architect will designate items or areas required.
 - 2. Final approval of color selections will be based on mockups.
 - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
 - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
 - 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers - Basis of Design Products: Subject to compliance with requirements, provide products by The Sherwin-Williams Company, or comparable products from other manufacturers submitted to and accepted by Architect and Owner prior to bidding.

2.2 PAINT, GENERAL

- A. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
- B. VOC Content: For field applications, paints and coatings shall comply with VOC content limits of authorities having jurisdiction and the following VOC content limits for paints and paint colorants:
1. Paints and Coatings: Less than 50 g/L.
 2. Colorants shall be 0 VOC.
- C. Low-Emitting Materials: For field applications that are inside the weatherproofing system, 90 percent of paints and coatings 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."
- D. Colors: Where not indicated on Drawings, as selected by Architect from manufacturer's full range.
1. Twenty percent of surface area will be painted with deep tones.
- E. Material Finish Schedule designations: As indicated on Material Finish Legend.
1. Provide "flat" sheen for ceilings, unless otherwise specified.
- F. Provide "eggshell" sheen for walls, unless otherwise specified.
- G. Paint Systems: Refer to schedule at end of this Section.

2.3 SOURCE QUALITY CONTROL

- A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:
1. Owner may engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
 2. Testing agency will perform tests for compliance with product requirements.
 3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
1. Concrete: 12 percent.
 2. Masonry (Clay and CMUs): 12 percent.
 3. Gypsum Board: 12 percent.
- C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
- D. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
- E. Proceed with coating application only after unsatisfactory conditions have been corrected.
1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, marker boards and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Concrete Substrates: Remove all surface contamination such as release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
 - 1. Wash previously painted surfaces with an abrasive cleanser and dull in one operation, or wash thoroughly and dull by sanding. Spot prime any bare areas with an appropriate primer.
- E. Masonry Substrates: Remove all surface contamination such as oil, grease, loose paint, mill scale, dirt, foreign matter, rust, mold, mildew, mortar, efflorescence and sealers. Wash surfaces with an abrasive cleanser and dull in one operation, or wash thoroughly and dull by sanding. Spot prime any bare areas with an appropriate primer.
 - 1. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.
- F. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer, but not less than the following:
 - 1. SSPC-SP 3.
- G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- I. Existing Substrates: Clean substrates of substances that could impair bond of coatings, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Prepare substrates in accordance with paint manufacturer's recommendations to ensure adhesion.

3.3 APPLICATION

- A. Apply paints according to paint manufacturer's written instructions and to recommendations.
 - 1. Use applicators and techniques suited for paint and substrate indicated.
 - 2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 - 3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
 - 4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 - 5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
 - 6. Paint exposed air diffusers and grilles same color as adjacent wall or ceiling finish as directed by Architect.
 - 7. Mask off surfaces of doors prior to painting vision lite frames. Clean any excess paint from door surface to so that there is no evidence of excess paint remaining on door face and glass.
- B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to

distinguish each separate coat.

- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
 - 1. Paint the following work where exposed in occupied spaces:
 - a. Equipment, including panelboards.
 - b. Uninsulated metal piping.
 - c. Uninsulated plastic piping.
 - d. Pipe hangers and supports.
 - e. Metal conduit.
 - f. Plastic conduit.
 - g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
 - h. Other items as directed by Architect.
 - 2. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.
- F. Marking and Identification: Fire walls, fire barriers, fire partitions, smoke barriers and smoke partitions or any other walls required to have protected openings and penetrations shall be permanently identified with stenciling. Such identification shall:
 - 1. Be located in accessible concealed floor, floor/ceiling or attic spaces;
 - 2. Be located within 15 feet of the end of each wall and at intervals not exceeding 30 feet measured horizontally along the wall or partition; and
 - 3. Shall include lettering not less than 3 inches in height with a minimum 3/8-inch wide stroke in a contrasting color incorporating the following wording on the first line: "FIRE AND/OR SMOKE BARRIER – PROTECT ALL OPENINGS".
- G. Green Screen Paint System:
 - 1. Refer to paint manufacturer's installation requirements for items including but not limited to: nap size and type, roller direction during application, storage and handling during application.
 - 2. Apply in three coats at rate recommended by paint manufacturer.

3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
 - 1. Contractor shall touch up and restore painted surfaces damaged by testing.
 - 2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 INTERIOR PAINTING SCHEDULE

- A. Concrete Substrates, Wall Surfaces – Latex System:
 - 1. The Sherwin-Williams Company.
 - a. 1 coat ProMar 200 Zero VOC Interior Latex Primer.
 - b. 2 coats ProMar 200 Zero VOC Latex, eggshell.
- B. CMU Substrates – Latex System:
 - 1. The Sherwin-Williams Company.
 - a. 1 touchup coat ProMar 200 Zero VOC Interior Latex Primer (spot prime bare areas).
 - b. 2 coats ProMar 200 Zero VOC Latex, eggshell.
- C. CMU Substrates – Epoxy System: Refer to Section 099600 "High Performance Coatings".
- D. Steel Substrates – Non-primed:
 - 1. The Sherwin-Williams Company.
 - a. 1 coat of Pro Industrial Pro-Cryl Universal WB Acrylic Primer.
 - b. 2 coats Pro Industrial WB Alkyd Urethane (semi-gloss).
- E. Steel Substrates – Pre-primed:
 - 1. The Sherwin-Williams Company.
 - a. 1 coat of Pro Industrial Pro-Cryl Universal WB Acrylic Primer.
 - b. 2 coats Pro Industrial WB Alkyd Urethane.
- F. Steel Hollow Metal Doors and Frames (including doors, frames, metal glass stops, vision lite frames, astragals and metal louvers):
 - 1. The Sherwin-Williams Company.
 - a. 1 coat of Pro Industrial Pro-Cryl Universal WB Acrylic Primer.
 - b. **2 coats Industrial Enamel (Gloss)**
- G. Steel Substrates (exposed metal decking, bar joists and exposed over-head structure) – Dryfall.
 - 1. The Sherwin-Williams Company.
 - a. 2 coats Pro Industrial Waterborne Acrylic Dryfall, eggshell.
- H. Galvanized-Metal Substrates (where not specifically indicated to be painted):
 - 1. The Sherwin-Williams Company.
 - a. 1 coat of Pro Industrial Pro-Cryl Universal WB Acrylic Primer.
 - b. 2 coats Pro Industrial Acrylic Coating, Eggshell.
- I. Galvanized-Metal Ductwork Substrates:
 - 1. The Sherwin-Williams Company.
 - a. 1 coat of Pro Industrial Pro-Cryl Universal WB Acrylic Primer.
 - b. 2 coats Pro Industrial Waterborne Acrylic Dryfall, eggshell.
- J. Aluminum (Not Anodized or Otherwise Coated) Substrates:
 - 1. The Sherwin-Williams Company.
 - a. 1 coat of Pro Industrial Pro-Cryl Universal WB Acrylic Primer.
 - b. 2 coats Pro Industrial WB Alkyd Urethane
- K. Gypsum Board Wall Substrates – Latex System:
 - 1. The Sherwin-Williams Company.
 - a. 1 coat ProMar 200 Zero VOC Interior Latex Primer.
 - b. 2 coats ProMar 200 Zero VOC Latex, eggshell
- L. Gypsum Board Wall Substrates – Epoxy: Refer to Section 099600.
- M. Gypsum Board Wall and Ceiling Substrates indicated to receive Vinyl Wall Graphics – prepare per the wallcovering manufacturer's printed recommendations.
 - 1. The Sherwin-Williams Company.
 - a. 1 coat SuperPaint Interior Latex.

- N. Gypsum Board Wall and Ceiling Substrates indicated to receive Wall Covering – prepare per the wallcovering manufacturer's printed recommendations.
 - 1. The Sherwin-Williams Company.
 - a. 1 coat ProMar 200 Zero VOC Interior Latex Primer.
- O. Green Screen Paint System:
 - 1. Basis-of-Design Products: All primers and top coats shall be lead free.
 - a. Green Screen Wall Primer: Provide "Grey Bonding Primer" as manufactured by Pro Cyc.
 - b. Green Screen Wall Paint: Provide "Virtual Green Chroma Key Paint" as manufactured by Pro Cyc.
 - 2. Comparable products from other manufacturers will be considered when submitted to and accepted by Architect prior to bidding.

END OF SECTION 099123

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SECTION 099600 - HIGH PERFORMANCE COATINGS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes surface preparation and the application of high-performance coating systems on the following substrates:
 - 1. Exterior Substrates:
 - a. Concrete, vertical and horizontal surfaces.
 - b. Concrete masonry units (CMUs).
 - c. Steel.
 - d. Galvanized metal.
 - 2. Interior Substrates:
 - a. Concrete, vertical and horizontal surfaces.
 - b. Concrete masonry units (CMUs).
 - c. Steel.
 - d. Gypsum board.
- B. Related Requirements:
 - 1. Section 051200 "Structural Steel Framing" for shop priming of structural steel with primers specified in this Section.
 - 2. Section 055213 "Pipe and Tube Railings" for shop priming pipe and tube railings with coatings specified in this Section.
 - 3. Section 099113 "Exterior Painting" for general field painting.
 - 4. Section 099123 "Interior Painting" for general field painting.

1.2 DEFINITIONS

- A. Gloss Level 3 "Eggshell": 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- B. Gloss Level 5 "Semi-gloss": 35 to 70 units at 60 degrees, according to ASTM D 523.
- C. Gloss Level 6 "Gloss": 70 to 85 units at 60 degrees, according to ASTM D 523.
- D. Gloss Level 7 "High Gloss": More than 85 units at 60 degrees, according to ASTM D 523.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
 - 1. Indicate VOC content.
- B. Samples for Initial Selection: For each type of topcoat product indicated.
- C. Samples for Verification: For each type of coating system and each color and gloss of topcoat indicated.
 - 1. Submit Samples on rigid backing, 8 inches square.
 - 2. Apply coats on Samples in steps to show each coat required for system.
 - 3. Label each coat of each Sample.
 - 4. Label each Sample for location and application area.
- D. Product List: For each product indicated, include the following:
 - 1. Cross-reference to coating system and locations of application areas.
 - 2. Use same designations indicated on Drawings and in schedules.
 - 3. Color designations.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Coatings: One (1) gallon of each material and color applied.

1.5 QUALITY ASSURANCE

- A. Mockups: Apply mockups of each coating system indicated to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Architect will select one surface to represent surfaces and conditions for application of each coating system.
 - a. Wall and Ceiling Surfaces: Provide samples of at least 100 sq. ft.
 - b. Pipe and Tube Railings: Paint at one section of railing.
 - c. Other Items: Architect will designate items or areas required.
 - 2. Final approval of color selections will be based on mockups.
 - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
 - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
 - 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

- A. Apply coatings only when temperature of surfaces to be coated and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply coatings when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.
- C. Do not apply exterior coatings in snow, rain, fog, or mist.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers - Basis of Design Products: Subject to compliance with requirements, provide products by The Sherwin-Williams Company, or comparable products from other manufacturers submitted to and accepted by Architect and Owner prior to bidding.

2.2 HIGH-PERFORMANCE COATINGS, GENERAL

- A. Material Compatibility:
 - 1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.

2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
 3. Products shall be of same manufacturer for each coat in a coating system.
- B. VOC Content: For field applications, paints and coatings shall comply with VOC content limits of authorities having jurisdiction and the following VOC content limits for paints and paint colorants:
1. Paints and Coatings: Less than 50 g/L.
- C. Low-Emitting Materials: For field applications that are inside the weatherproofing system, 90 percent of paints and coatings 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."
- D. Colors: Where not indicated on Drawings, as selected by Architect from manufacturer's full range.
- E. Paint Systems: Refer to schedule at end of this Section.

2.3 SOURCE QUALITY CONTROL

- A. Testing of Coating Materials: Owner reserves the right to invoke the following procedure:
1. Owner may engage the services of a qualified testing agency to sample coating materials. Contractor will be notified in advance and may be present when samples are taken. If coating materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
 2. Testing agency will perform tests for compliance with product requirements.
 3. Owner may direct Contractor to stop applying coatings if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying coating materials from Project site, pay for testing, and recoat surfaces coated with rejected materials. Contractor will be required to remove rejected materials from previously coated surfaces if, on recoating with complying materials, the two coatings are incompatible.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
1. Concrete: 12 percent.
 2. Fiber-Cement Board: 12 percent.
 3. Masonry (Clay and CMUs): 12 percent.
 4. Gypsum Board: 12 percent.
- C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
- D. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
- E. Proceed with coating application only after unsatisfactory conditions have been corrected.
1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions applicable to substrates and paint systems indicated.
1. Prepare previously painted surfaces indicated to receive new paint finish in strict accordance with paint manufacturer's written recommendations.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of coatings, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce coating systems indicated.
- D. Concrete Substrates: Remove all surface contamination such as release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
1. Clean concrete by one of the following methods as recommended by paint manufacturer:
 - a. Clean surfaces with pressurized water. Use pressure range of 1500 to 4000 psi at 6 to 12 inches.
 - b. Abrasive blast clean surfaces to comply with SSPC-SP 7/NACE No. 4.
 2. Verify that chemical removal agents (if used) have been neutralized prior to installation of paint products.
- E. Masonry Substrates: Remove all surface contamination such as oil, grease, loose paint, mill scale, dirt, foreign matter, rust, mold, mildew, mortar, efflorescence and sealers. Wash surfaces with an abrasive cleanser and dull in one operation, or wash thoroughly and dull by sanding. Spot prime any bare areas with an appropriate primer.
1. Do not coat surfaces if moisture content, alkalinity of surfaces, or alkalinity of mortar joints exceeds that permitted in manufacturer's written instructions.
 2. Clean surfaces with pressurized water. Use pressure range of 100 to 600 psi at 6 to 12 inches.
- F. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer.
- G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied coatings.
- I. Aluminum Substrates: Remove loose surface oxidation.

3.3 APPLICATION

- A. Apply high-performance coatings according to manufacturer's written instructions.
1. Use applicators and techniques suited for coating and substrate indicated.
 2. Coat surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.
 3. Coat backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
 4. Do not apply coatings over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
- B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of the same material are to be applied. Tint undercoats to match color of finish coat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance.
- D. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Produce sharp glass lines and color breaks.

3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test coatings for dry film thickness.
1. Contractor shall touch up and restore coated surfaces damaged by testing.

2. If test results show that dry film thickness of applied coating does not comply with coating manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with coating manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from coating operation. Correct damage to work of other trades by cleaning, repairing, replacing, and recoating, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.

3.6 EXTERIOR HIGH-PERFORMANCE COATING SCHEDULE

- A. Concrete Substrates (Not subject to Pedestrian or Vehicular traffic):
 1. The Sherwin-Williams Company.
 - a. 1 coat Macropoxy 646-100
 - b. 1 coat Waterbased Acrolon 100 HS Acrylic Polyurethane.
- B. CMU Substrates:
 1. The Sherwin-Williams Company.
 - a. 1 coat Pro Industrial Heavy-Duty Block Filler (B42-150).
 - b. 1 coat Macropoxy 646.
 - c. 1 coat Pro-Industrial WB Alkyd Urethane.
- C. Structural and Miscellaneous Steel (including service piping):
 1. The Sherwin-Williams Company.
 - a. 1 coat Macropoxy 646-100.
 - b. 1 coat Waterbased Acrolon 100 HS Acrylic Polyurethane.

3.7 INTERIOR HIGH-PERFORMANCE COATING SCHEDULE

- A. Exposed Structural Steel Columns and Framing:
 1. The Sherwin-Williams Company.
 - a. 1 coat Macropoxy 646-100.
 - b. 1 coat Waterbased Acrolon 100 HS Acrylic Polyurethane.
- B. Steel Railings:
 1. The Sherwin-Williams Company.
 - a. 1 coat Macropoxy 646.
 - b. 1 coat Acrolon 218 HS Polyester Acrylic Polyurethane, semi-gloss.
- C. Concrete and CMU Substrates - Epoxy System (non-wet walls):
 1. The Sherwin-Williams Company.
 - a. 1 coat Loxon Block Surfacers, 18 mils wet, 8 mils dry.
 - b. 1 coat Pro Industrial Heavy-Duty Block Filler.
 - c. 2 coats Pro Industrial Pre-Catalyzed Waterbased Epoxy, 1150 Series, single-component, eggshell.
- D. Concrete and CMU Substrates - Epoxy System (wet areas):
 1. The Sherwin-Williams Company.
 - a. 1 coat KemCati Kote High Solids Epoxy Filler/Sealer.
 - b. 2 coats Pro Industrial Zero VOC Waterborne Catalyzed Epoxy, two-component, eggshell.
- E. Gypsum Board Wall Substrates – Epoxy:

1. The Sherwin-Williams Company.
 - a. 1 coat ProMar 200 Zero VOC Interior Primer.
 - b. 2 coats Pro Industrial Pre-Catalyzed Waterbased Epoxy, 1150 Series, single-component, eggshell.
- F. Gypsum Board Wall Substrates – Epoxy (wet areas):
 1. The Sherwin-Williams Company.
 - a. 1 coat ProMar 200 Zero VOC Interior Primer.
 - b. 2 coats Pro Industrial Zero VOC Waterborne Catalyzed Epoxy, two-component, eggshell.
- G. Gypsum Board Ceiling Substrates – Epoxy (wet areas):
 1. The Sherwin-Williams Company.
 - a. 1 coat Sherwin Williams Macropoxy 646-100.
 - b. 2 coats Pro Industrial Zero VOC Waterborne Catalyzed Epoxy, two-component, eggshell.

END OF SECTION 099600

SECTION 099646 - INTUMESCENT PAINTING

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes surface preparation and application of fire-retardant intumescent paint (099646.A01) to interior items and surfaces.
- B. Related Requirements:
 - 1. Section 099123 "Interior Painting" for primers and finish coats that may be used with intumescent paint finishes.
 - 2. Section 099600 "High Performance Coatings" for primers and finish coats that may be used with intumescent paint finishes.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples for Initial Selection: For each intumescent paint finish indicated.
- C. Samples for Verification: For each type of coating system and each color and gloss of intumescent paint finish indicated.
 - 1. Submit Samples on rigid backing, not less than 8 inches square.
 - 2. Apply coats on Samples in steps to show each coat required for system.
 - 3. Label each coat of each Sample.
 - 4. Label each Sample for location and application area.
- D. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.3 INFORMATIONAL SUBMITTALS

- A. Material Test Reports: For each intumescent paint.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that are from same production run (batch mix) as materials applied and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Coatings: One (1) gallon of each material and color applied.

1.5 QUALITY ASSURANCE

- A. Mockups: Apply mockups of each paint system indicated to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Architect will select one surface to represent surfaces and conditions for application of each coating system.
 - a. Wall and Ceiling Surfaces: Provide samples of at least 10 sq. ft.
 - b. Other Items: Architect will designate items or areas required.
 - 2. Final approval of color selections will be based on mockups.
 - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
 - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
 - 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

- A. Apply waterborne intumescent paints only when temperatures of surfaces to be painted and ambient air temperatures are between 50 and 90 deg F.
- B. Apply solvent-thinned intumescent paints only when temperatures of surfaces to be painted and ambient air temperatures are between 45 and 95 deg F.
- C. Do not apply intumescent paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.
- D. Allow wet surfaces to dry thoroughly and to attain temperature and conditions specified before starting or continuing coating operation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to products listed in the Exterior Intumescent Painting Schedule and Interior Intumescent Painting Schedule for the paint category indicated.

2.2 INTUMESCENT PAINT MATERIALS, GENERAL

- A. Surface-Burning Characteristics of Fire-Retardant Systems: As tested according to ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: 25 or less.
 - 2. Smoke-Developed Index: 50 or less.
- B. Product Characteristics
 - 1. Adhesion: 540 psi minimum per ASTM D4541.
 - 2. Durometer Hardness: Shore D of 70 minimum per ASTM D2240.
 - 3. Impact Resistance: 83 inch-lbs minimum per ASTM D2794.
 - 4. Abrasion Loss: 290 mg loss maximum per ASTM D4060.
- C. Material Compatibility:
 - 1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 - 2. For each material or coat, products and spreading rates shall be as recommended in writing by intumescent paint manufacturer for use on substrate indicated. Comply with requirements for fire-retardant coating classification and surface-burning characteristics indicated.
- D. Colors and Gloss: As selected by Architect from manufacturer's full range.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with manufacturer's requirements for surface treatments, shop-primed surfaces, maximum moisture content, and other conditions affecting performance of the Work.
- B. Begin coating no sooner than 28 days after substrate is constructed and is visually dry on both sides.
- C. Verify suitability of substrates, including surface conditions, and compatibility with existing finishes and primers.
- D. Proceed with coating application only after unsatisfactory conditions have been corrected and surfaces are dry.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions applicable to substrates and paint systems indicated.
 - 1. Prepare previously primed and previously painted surfaces indicated to receive new paint finish in strict accordance with paint manufacturer's written recommendations.
- B. Remove hardware and hardware accessories, plates, machined surfaces, light fixtures, and similar items already installed that are not to be coated. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and coating.
 - 1. After completing coating operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of coatings, including dust, dirt, oil, grease, and incompatible paints and encapsulants. Do not coat surfaces if surface moisture content or alkalinity exceeds that permitted in manufacturer's written instructions.
 - 1. Remove incompatible primers, and reprime substrate with compatible primers as required to produce coating systems indicated.
 - 2. Perform cleaning and coating application so dust and other contaminants from cleaning process do not fall on wet, newly coated surfaces.

3.3 APPLICATION

- A. General: Apply intumescent paints according to manufacturer's written instructions and to comply with requirements for listing and labeling for surface-burning characteristics specified.
 - 1. Use equipment and techniques best suited for substrate and type of material being applied.
 - 2. Coat surfaces behind movable items the same as similar exposed surfaces.
 - 3. Apply each coat separately according to manufacturer's written instructions.
- B. Apply coatings to prepared surfaces as soon as practical after preparation and before subsequent surface soiling or deterioration.
- C. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Produce sharp lines and color breaks.
 - 1. Pigmented Finishes: If undercoats or other conditions show through pigmented topcoat/overcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
 - 2. Clear Finishes: Produce a smooth surface film of even sheen using multiple coats.

3.4 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

- C. Protect work of other trades against damage from coating application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.

3.5 INTERIOR INTUMESCENT PAINTING SCHEDULE

- A. Steel Substrates:
 - 1. Pigmented, Fire-Retardant, Water-Based System:
 - a. Prime Coat: As recommended in writing by topcoat manufacturer.
 - b. Intermediate Coat: As recommended in writing by topcoat manufacturer.
 - c. Topcoat: Fire-retardant coating, latex, interior, flat.
 - 1) FireTex FX 5120 by Sherwin Williams.

END OF SECTION 099646

SECTION 099723 - CONCRETE AND MASONRY COATINGS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Decorative mineral stain for concrete and precast concrete.
- B. Related Requirements:
 - 1. Section 012300 "Alternates" for those alternates effecting work of this Section.
 - 2. Section 034100 "Precast Structural Concrete" for substrate.
 - 3. Section 071900 "Water Repellents and Sealers" for water repellent products applied to the unit masonry.
 - 4. Section 099113 "Exterior Painting".

1.2 REFERENCE STANDARDS

- A. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus 2019.
- B. ASTM C 744 - Standard Specification for Prefaced Concrete and Calcium Silicate Masonry Units.
- C. ASTM D522/D522M - Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings 2017.
- D. ASTM D714 - Standard Test Method for Evaluating Degree of Blistering of Paints 2002 (Reapproved 2017).
- E. ASTM D968 - Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive 2017.
- F. ASTM D1653 - Standard Test Methods for Water Vapor Transmission of Organic Coating Films 2013.
- G. ASTM D2243 - Standard Test Method for Freeze-Thaw Resistance of Water-Borne Coatings 1995 (Reapproved 2014).
- H. ASTM D2247 - Standard Practice for Testing Water Resistance of Coatings in 100% Relative Humidity 2015.
- I. ASTM D4803 - Standard Test Method for Predicting Heat Buildup in PVC Building Products 2018.
- J. ASTM D6904 - Standard Practice for Resistance to Wind-Driven Rain for Exterior Coatings Applied on Masonry 2003 (Reapproved 2013).
- K. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2020.
- L. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials 2016.
- M. ASTM G153 - Standard Practice for Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials 2013.
- N. ASTM G155 - Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Nonmetallic Materials 2013.
- O. SSPC-SP 2 - Hand Tool Cleaning 2018.
- P. SSPC-SP 3 - Power Tool Cleaning 2018.
- Q. SSPC-SP 6 - Commercial Blast Cleaning 2007.
- R. SSPC-SP 7 - Brush-Off Blast Cleaning 2007.

1.3 DEFINITIONS

- A. Application Ratio: A mixture of silicate stain and silicate dilution expressed as a ratio of one to the other to achieve the proper color transparency/translucency for the silicate stain.
- B. Cast-in-Place Architectural Concrete: Formed concrete that is exposed to view on surfaces of completed structure or building and that requires special concrete materials, formwork, placement, or finishes to obtain specified architectural appearance.
- C. 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.
- D. Design Reference Sample: Sample designated by Architect in the Contract Documents that reflects acceptable surface quality and appearance of cast-in-place architectural concrete.

1.4 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 application to attend, including the following:
 - a. Architect and Engineer.
 - b. Contractor's superintendent.
 - c. Concrete Subcontractor.
 - d. Manufacturer's representative for waterproofing admixture.
 - e. Precast Subcontractor.
 - f. Special concrete finish subcontractor.

1.5 ACTION SUBMITTALS

- A. See Section 013300 - Submittal Procedures for administrative requirements.
- B. Product Data: Provide data for each type of product indicated.
 - 1. Product characteristics.
 - 2. Preparation instructions and recommendations.
 - 3. Storage and handling requirements and recommendations.
 - 4. Installation/application instructions and methods.
- C. Verification Samples: To be provided on the specific materials to be treated when they are available in plant or on site.
- D. Samples: Submit two samples 36 inches by 36 inches in size illustrating colors available for selection.
- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- F. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.
- G. Maintenance Data: Include cleaning procedures and repair and patching techniques.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer, manufacturer, and testing agency.
- B. Material Certificates: For each of the following, signed by manufacturers:
 - 1. Cementitious materials.

- C. Material Test Reports: For the following, from a qualified testing agency indicating compliance with requirements
- D. Field quality-control reports.
- E. Minutes of preinstallation conference.

1.7 QUALITY ASSURANCE

- A. Maintain one copy of each referenced document that applies to application on site.
- B. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum seven years documented experience.
- C. Applicator Qualifications: Company specializing in performing the work of this section with minimum five years documented experience.
- D. Mockups: Prepare mockups of each required coating on each type of substrate required to demonstrate aesthetic effects, for preconstruction testing, and to set quality standards for materials and execution.
 - 1. Locate mockups on existing surfaces where directed by Architect.
 - a. Size: 25 sq. ft. each.
 - 2. For Decorative Concrete Masonry Unit Stain, obtain and install stain on separate samples for verification of installation methods prior to installation on finished masonry surfaces.
 - 3. Obtain Architect's acceptance of mockup before start of final unit of work.
 - 4. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 5. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to project site in supplier's or manufacturer's original wrappings and un-opened containers, labeled with manufacturer's name, material and product brand name, and lot number, if any.
- B. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
 - 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Protect packages and containers from weather, moisture, soiling and humidity.
 - 3. Remove rags and waste from storage areas daily.

1.9 FIELD CONDITIONS

- A. Limitations: Proceed with application only when the following existing and forecasted weather and substrate conditions permit coatings to be applied according to manufacturers' written instructions and warranty requirements:
 - 1. Masonry surfaces and mortar have cured for not less than 28 days.
 - 2. Building has been closed in for not less than 30 days before treating wall assemblies.
 - 3. Ambient temperature is above 55 deg F (13 deg C) and below 90 deg F (37.8 deg C) and will remain so for 24 hours, and 72 hours after installation of coating.
 - 4. Substrate is not frozen and substrate-surface temperature is above 40 deg F (4.4 deg C) and below 100 deg F (37.8 deg C).
 - 5. Rain or snow is not predicted within 24 hours.
 - 6. Not less than 24 hours have passed since surfaces were last wet.
 - 7. Windy conditions do not exist that might cause water repellent to be blown onto vegetation or surfaces not intended to be treated.

1.10 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agree(s) to repair or replace materials that fail to maintain colorfastness within specified warranty period.
 - 1. Warranty Period: 5 years from date of Substantial Completion.
 - 2. Warranty: Include coverage for bond to substrate.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Concrete and Precast Concrete Stains and Coatings:
 - 1. Basis-of-Design Products: Subject to compliance with requirements, provide Keim Mineral Coatings of America, Inc.; "KEIM Design Lasur", Sol-Silicate Pigmented Mineral Stain.
- B. Substitutions: Section 016000 - Product Requirements.

2.2 CONCRETE AND MASONRY COATINGS

- A. Provide high-build, weather resistant coating systems that meet the following minimum performance criteria, unless more stringent criteria are specified:
 - 1. Salt Spray Resistance: Passes when tested according to ASTM B117 for 2000 hours.
 - 2. Surface Burning Characteristics: Flame spread/Smoke developed index of 0/0, maximum, when tested in accordance with ASTM E84.
 - 3. Accelerated Outdoor Exposure: Passes when tested according to ASTM G153 for 5,000 hours.

2.3 CONCRETE AND PRECAST CONCRETE STAINS/COATINGS

- A. General Product Description: Stain shall be a highly vapor permeable water and weather resistant, sol-silicate based, mineral stain that provides a penetrating, thin-layer protective coating. Stain shall be non-film-forming, mineral matte finish.
 - 1. Stain shall be opaque.
 - 2. Stain shall be non-combustible, two-coat system comprised of a base coat and top coat.
 - 3. Silicate stain shall penetrate the surface and develop chemical and mechanical bonds forming a hard amorphous microporous layer.
 - 4. Stain shall not be affected by acids, UV exposure or air-borne pollutants.
 - 5. Stain shall not reduce substrate vapor permeability.

2.4 MATERIALS

- A. General: Provide complete systems formulated and recommended by manufacturer for the applications indicated, to match Architect's control sample.
- B. Materials: Silicate stain, base and topcoat shall be a sol-silicate based mineral stain meeting the following performance criteria and requirements:
 - 1. Exterior Material Schedule designation: PC2.
 - 2. DIN EN 1062 – Manufacturing Standard for Sol-Silicate Coating.
 - 3. DIN 4102-A2 – Non-Flammable Standard: Will not burn.
 - 4. ASTM E 96 – Vapor Permeability: Ranging between 75 to 85 perms.
 - 5. ASTM G 154 – Accelerated Weathering: Non fading, cracking or peeling.
 - 6. ASTM E 514 – Wind Driven Rain Test: At 62 mph, no water penetration.
 - 7. ASTM D 3273/D 3274 – Mildew Resistance: Passes.
 - 8. ASTM D 6886-12 – Standard Test Method for Individual Volatile Organic Compounds (VOCs): Zero (0) grams per liter VOC.
 - 9. Colors: As indicated on the Material Finish Legend.

2.5 MATERIALS

- A. Coatings - General: Provide complete systems formulated and recommended by manufacturer for the applications indicated, in the thicknesses indicated.
 - 1. Maximum volatile organic compound (VOC) content: As required by applicable regulations.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements and conditions affecting performance of the Work.
 - 1. Verify that surfaces are clean and dry according to stain/coating manufacturer's requirements. Check moisture content in three representative locations by method recommended by manufacturer.
 - 2. Inspect for previously applied treatments that may inhibit penetration or performance of stain/coatings.
 - 3. Verify that there is no efflorescence or other removable residues that would be trapped beneath the application of stain/coating.
 - 4. Before application, verify that surface to be treated is clean, dry and contains no frozen water.
 - 5. Verify that required repairs are complete, cured, and dry before applying stain/coating.
- B. Test pH level according to stain/coating manufacturer's written instructions to ensure chemical bond to silica-containing or siliceous minerals.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.
 - 1. Notify Architect and Construction Manager of unsatisfactory preparation before proceeding.
- D. Cementitious Substrates: Do not begin application until substrate has cured 28 days minimum and measured moisture content is not greater than 16 percent.
- E. Masonry: Verify masonry joints are struck flush.

3.2 PREPARATION

- A. General: Prepare surfaces in accordance with stain/coating manufacturer's written instructions.
- B. Clean surfaces of loose foreign matter.
- C. Mix products as recommended immediately prior to application.
- D. Remove substances that would bleed through finished coatings.
- E. Remove finish hardware, fixture covers, and accessories and store.
- F. Galvanized Surfaces: Remove surface contamination and oils and wash with solvent.
- G. Ferrous Metal:
 - 1. Solvent clean.
 - 2. Remove loose rust, loose mill scale, and other foreign substances using hand tools according to SSPC-SP 2, power tools according to SSPC-SP 3, or blast cleaning according to SSPC-SP 6 or -SP 7.
- H. Protect adjacent surfaces and materials not receiving coating from spatter and overspray; mask if necessary to provide adequate protection. Repair damage.

3.3 COATING APPLICATION

- A. Apply coatings in accordance with manufacturer's instructions, to thicknesses specified.

- B. Apply in uniform thickness coats, without runs, drips, pinholes, brush marks, or variations in color, texture, or finish. Finish edges, crevices, corners, and other changes in dimension with full coating thickness.

3.4 DECORATIVE CONCRETE AND MASONRY UNIT STAIN INSTALLATION

- A. Examination:
 - 1. Do not begin installation until substrates have been properly prepared.
 - 2. Verify that concrete surfaces have been cured at least 48 hours prior to starting concrete staining.
 - 3. Verify that surfaces to receive work have a neutral pH, are clean, dry and free of efflorescence.
 - 4. Notify Architect and Construction Manager of unsatisfactory preparation before proceeding.
- B. Preparation:
 - 1. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate.
 - 2. Clean surfaces thoroughly prior to installation. Allow surfaces to dry completely before applying coating.
 - 3. Verify that walls, masonry, concrete, stucco, block split faced and mortar that may have been treated with any form of chemical/acid wash are neutralized.
 - 4. Treat alkali or efflorescence with proper neutralizing compounds as recommended by masonry supplier before stain application.
 - 5. Before application, verify that masonry and concrete walls have a neutral pH.
 - 6. Before application, verify that surface to be treated is clean, dry and contains no frozen water.
 - 7. Mix products as recommended immediately prior to application.
- C. Installation:
 - 1. Install in accordance with manufacturer's instructions.
 - 2. Apply stain using airless spray pump to help control airborne particles or overspray. If site conditions prohibit spray application, apply by hand; utilizing brushes and rollers.
 - 3. Do not proceed with work when ambient temperatures are less than 41 degrees F or greater than 110 degrees F.
 - 4. Allow manufacturer's specified drying time for each coat before applying next coat.
 - 5. Verify color consistency. Recoat areas where blotches, blemishes, or imperfections are present.

3.5 CONCRETE AND PRECAST STAIN/COATING APPLICATION

- A. General: Apply two (2) coats of stains/coatings in strict accordance with manufacturer's written instructions and recommendations.
 - 1. Apply in full coverage evenly distributed coats to a smooth mineral matte finish without lap lines, voids, holidays and drips. Match approved mockup and Architect's control sample.
 - 2. Apply enough product to prevent shading and textural differences that contribute to "striping".
 - 3. Coverage Rate: As recommended by manufacturer and as necessary to match Architect's control sample, but not less than 425 sq. ft. per gallon.
 - 4. Allow 24 hours between coats.
- B. Apply in uniform thickness coats, without runs, drips, pinholes, brush marks, or variations in color, texture, or finish. Finish edges, crevices, corners, and other changes in dimension with full coating thickness.

3.6 FIELD QUALITY CONTROL AND PROTECTION

- A. Field Quality Control:
 - 1. Verify color consistency. Recoat any areas that are unacceptable as determined by Architect.
- B. Protection:
 - 1. Protect installed products until completion of project.
 - 2. Protect prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels as required.
 - 3. Protect shrubs, metal, wood trim, glass, asphalt, adjacent precast concrete surfaces, and other building hardware during application from overspray.
 - 4. Do not permit mist (if spraying) or liquid to drift on to surrounding properties or parking lots.
 - 5. Touch up, repair or replace damaged products before substantial completion.

3.7 CLEANING

- A. Immediately clean stain/coating from adjoining surfaces and surfaces soiled or damaged by stain/coating application as work progresses. Correct damage to work of other trades caused by stain/coating application, as approved by Architect.
- B. Comply with manufacturer's written cleaning instructions.
- C. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.
- D. Clean surfaces immediately of overspray, splatter, and excess material.
- E. After coating has cured, clean and replace finish hardware, fixtures, and fittings previously removed.

3.8 PROTECTION

- A. Protect finished work from damage.

END OF SECTION 099723

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SECTION 101100 - VISUAL DISPLAY UNITS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Markerboards (101100.A02 - MB).
- B. Related Requirements:
 - 1. Section 097723 "Fabric-Wrapped Panels" for tackable, fabric-covered panels mounted on walls.

1.2 PREINSTALLATION MEETINGS

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

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, finishes, and accessories for visual display units.
 - 2. Include electrical characteristics for motorized units.
- B. Shop Drawings: For visual display units.
 - 1. Include plans, elevations, sections, details, and attachment to other work.
 - 2. Show locations of panel joints. Show locations of field-assembled joints for factory-fabricated units too large to ship in one piece.
 - 3. Show locations and layout of special-purpose graphics.
 - 4. Include sections of typical trim members.
 - 5. Include wiring diagrams for power and control wiring.
 - 6. Show dimensioned layout and elevation of each area, indicate number of panels for each layout.
 - 7. Include illustrations of each type of mounting system.
- C. Samples for Initial Selection: For each type of visual display unit indicated, for units with factory-applied color finishes, and as follows:
 - 1. Samples of facings for each visual display panel type, indicating color and texture.
 - 2. Actual factory-finish color samples, applied to aluminum substrate.
 - 3. Include accessory Samples to verify color selected.
- D. Samples for Verification: For each type of visual display unit indicated.
 - 1. Visual Display Panel: Not less than 8-1/2 by 11 inches, with facing, core, and backing indicated for final Work. Include one panel for each type, color, and texture required.
 - 2. Trim: 6-inch-long sections of each trim profile.
 - 3. Display Rail: 6-inch-long section of each type.
 - 4. Accessories: Full-size Sample of each type of accessory.
 - 5. Sample of magnetic dry-erase board in color specified, not less than 12 inches square. Include sample of one mounting device.
- E. Product Schedule: For visual display units. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for surface-burning characteristics of tackboards.

- C. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For visual display units[and motorized units] to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver factory-built visual display surfaces, including factory-applied trim, completely assembled in one piece without joints, where possible. If dimensions exceed maximum manufactured panel size, provide two or more pieces of equal length as acceptable to Architect. When overall dimensions require delivery in separate units, prefit components at the factory, disassemble for delivery, and make final joints at the site.

1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install visual display units until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
- B. Field Measurements: Verify actual dimensions of construction contiguous with visual display units by field measurements before fabrication.
 - 1. Allow for trimming and fitting where taking field measurements before fabrication might delay the Work.

1.9 WARRANTY

- A. Special Warranty for Porcelain-Enamel Face Sheets: Manufacturer agrees to repair or replace porcelain-enamel face sheets that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Surfaces lose original writing and erasing qualities.
 - b. Surfaces exhibit crazing, cracking, or flaking.
 - 2. Warranty Period: Life of the building.
- B. Special Warranty for Glass Markerboard Panels: Manufacturer agrees to repair or replace glass markerboard panels that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Surfaces lose original writing and erasing qualities.
 - 2. Warranty Period: 10 years.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain each type of visual display unit from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: 25 or less.
 - 2. Smoke-Developed Index: 450 or less.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.3 MARKERBOARD ASSEMBLIES

- A. Porcelain-Enamel Markerboards (101100.A02 – MB): Balanced, high-pressure, factory-laminated markerboard assembly of three-ply construction consisting of backing sheet, core material, and porcelain-enamel face sheet. Units shall be 4'-0" tall, unless otherwise indicated.
 - 1. Basis of Design: Subject to compliance with requirements, provide Claridge, Inc.; "Series 1" markerboards or one markerboards of the following manufacturers meeting the specified product characteristics:
 - a. Marsh by PolyVision.
 - 2. MDF Core: 7/16 inch thick; with 0.005 inch thick, aluminum foil backing.
 - 3. Laminating Adhesive: Manufacturer's standard, moisture-resistant thermoplastic type.
 - 4. Writing Surface: Low Gloss Porcelain Enamel Steel surface recommended by manufacturer for projections.
 - a. Basis of Design: "LCS3" by Claridge Products.
 - 1) Color: White #100.
 - b. Maintenance: Manufacturer's cleaning recommendations shall allow the use of non-proprietary cleaners and shall include instructions for removal of permanent markers.
 - 5. Writing Surface: High Gloss Porcelain Enamel Steel surface recommended by manufacturer for projections.
 - a. Basis of Design: "LCS3HG" by Claridge Products.
 - 1) Color: White.
 - b. Maintenance: Manufacturer's cleaning recommendations shall allow the use of non-proprietary cleaners and shall include instructions for removal of permanent markers.
 - 6. Frames: Fabricated from not less than 0.062 inch thick, extruded aluminum; 1-1/4 to 1-1/2 inch flat style trim with mitered corners; factory applied.
 - a. Color: Satin Anodized Aluminum.
 - 7. Markertray: Manufacturer's standard, continuous:
 - a. Solid Type: Extruded aluminum with ribbed section and smoothly curved exposed ends.
 - 8. Map Rail: Provide the following accessories:
 - a. Display Rail: Continuous and integral with map rail; fabricated from cork approximately 1 to 1-1/2 inches wide.
 - b. End Stops: Located at each end of map rail.

2.4 MATERIALS

- A. Adhesives for Field Application: Mildew-resistant, nonstaining adhesive for use with specific type of panels, sheets, or assemblies; and for substrate application; as recommended in writing by visual display unit manufacturer.
 - 1. Adhesives shall have a VOC content of 50 g/L or less.
- B. Extruded Aluminum: ASTM B 221, Alloy 6063.
- C. Fiberboard: ASTM C 208 cellulosic fiber insulating board.
- D. Hardboard: ANSI A135.4, tempered.
- E. High-Pressure Plastic Laminate: NEMA LD 3.
- F. Natural-Cork Sheet: Seamless, single-layer, compressed fine-grain cork sheet; bulletin board quality; face sanded for natural finish with surface-burning characteristics indicated.
- G. Medium-Density Fiberboard: ANSI A208.2, Grade 130.

- H. Porcelain-Enamel Face Sheet: PEI-1002, with face sheet manufacturer's standard two- or three-coat process.

2.5 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.6 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance of the Work.
- B. Examine roughing-in for electrical power systems to verify actual locations of connections before installation of motorized, sliding visual display units.
- C. Examine walls and partitions for proper preparation and backing for visual display units.
- D. Examine walls and partitions for suitable framing depth where sliding visual display units will be installed.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions for surface preparation.
- B. Clean substrates of substances, such as dirt, mold, and mildew, that could impair the performance of and affect the smooth, finished surfaces of visual display boards.
- C. Prepare surfaces to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, defects, projections, depressions, and substances that will impair bond between visual display units and wall surfaces.
- D. Prepare recesses for sliding visual display units as required by type and size of unit.

3.3 INSTALLATION OF FACTORY-FABRICATED VISUAL DISPLAY BOARDS AND ASSEMBLIES

- A. Visual Display Boards: Attach concealed clips, hangers, and grounds to wall surfaces and to visual display boards with fasteners at not more than 16 inches o.c. Secure both top and bottom of boards to walls. Do NOT adhesively apply visual display boards to wall substrates.

3.4 CLEANING AND PROTECTION

- A. Clean visual display units according to manufacturer's written instructions. Attach one removable cleaning instructions label to visual display unit in each room.
- B. Touch up factory-applied finishes to restore damaged or soiled areas.
- C. Cover and protect visual display units after installation and cleaning.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain motorized, sliding visual display units.

END OF SECTION 101100

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SECTION 101400 - SIGNAGE

PART 1 GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Signage:
 - a. Flat Cut:
 - 1) Custom (101400.A31 - X01, X02).
 - b. Paint:
 - 1) Painted Graphic – Epoxy Paint (101400.A61 - S02, S03).
 - 2) Painted Graphics – Exterior (101400.A62 - X02).
- B. Related Sections include the following:
 - 1. Section 015000 "Temporary Facilities and Controls" for temporary Project identification signs and for temporary information and directional signs.
 - 2. Section 061000 "Rough Carpentry" for signage blocking.
 - 3. Section 096466 "Wood Athletic Flooring" for graphic to wood flooring.
 - 4. Section 097253 "Custom Digital Wall Covering" for graphic wall covering.
 - 5. Section 099123 "Interior Painting" for painting behind vinyl film signage.
 - 6. Section 099600 "High Performance Coatings" for painting of graphics on precast walls.
 - 7. Section 101423 "ADA and Code Signage" for related graphic substrate.
 - 8. Division 26 Section "Interior Lighting" and "Exterior Lighting" for illuminated signs.

1.2 DEFINITIONS

- A. ADA-ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines."
- B. Final Artwork: High resolution digital files to be used for production (including digital printing).
 - 1. Graphics shown in drawings are placeholders only.
 - 2. Final artwork to be supplied by Designer (or architect), after approval from Owner, to Signage contractor.
 - 3. Signage Contractor to use final art in creating shop drawings for approval by Designer,
- C. Signage Contractor: Contractor responsible for the fabrication and installation of signage unless responsibility for fabrication or installation is called out by others in the drawings.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Pre-installation Conference: Conduct conference at Project site.
 - 1. Review and finalize construction schedule including submittals, engineering, fabrication and installation. Verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 2. Review temporary protection requirements for during and after installation.
 - 3. Architect to work with Contractor to arrange the meeting. Architect to set agenda and run the meeting.
- B. Signage Contractor is responsible for obtaining all required signage permits.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Including but not limited to, the following:
 - 1. Manufacturer's technical product data for each type of product specified. Include data on physical characteristics, durability, fade resistance, flame resistance and manufacturing process.
 - 2. Product data shall show compliance with requirements for fire performance characteristics and physical properties.

- B. Shop Drawings: Submit shop drawings for fabrication and erection of signs and supports. Include plans, elevations, and large scale details of sign wording and lettering layout. Include large scale sections of typical members and other components.
 1. Show fabrication joints and fasteners. Show anchors, grounds, reinforcement, accessories, layout, and installation details including attachments to other work. Indicate materials and profiles of signage fittings, joinery, finishes, fasteners, anchorages, and accessory items.
 2. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
 3. Based on Message Schedule approved by Owner, provide sign layouts for all signs:
 - a. Indicate message line breaks.
 - b. Include large scale details of signs wording and lettering layout, pictograms (arrows and symbols), artwork, and Braille layout.
 - c. Include outline of sign face, character spacing, line spacing, and copy composition.
 - d. Submit product data simultaneously for overall review and comparison prior to fabrication.
 4. Include a panel map for each vinyl film sign to coordinate installation.
 5. Field Dimensions shall be obtained, reviewed, and accepted by signage manufacturer prior to submittal of shop drawings. Refer to Article 1.4.H. "Field Dimensions for Environmental Graphics."
 6. For signage required to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 7. Wiring Diagrams: For illuminated signs and illuminated characters. Include locations of transformers and disconnect switches.
 8. For signs supported by or anchored to permanent construction, provide setting drawings, full-size spacing templates, and directions for installation of anchor bolts and other appropriate anchors to be installed.
 9. Submit drawings in 11 inch by 17 inch format unless otherwise requested by the Architect.
 10. Submit all shop drawings as a single package by Signage Contractor.
- C. Sign Schedule: Use same designations indicated on Drawings.
- D. Samples for Initial Selection: Manufacturer's color charts consisting of actual units or sections of units showing the full range of colors available for the following:
 1. Sign Types:
 - a. Paint samples for all colors.
- E. Samples for Verification:
 1. Submit full-size samples of signage. Quantity and type shall be determined by Architect with intent of one sample per each signage type representative of all types of products indicated.
 - a. Sign Types:
 - 1) X02: 12" x 12" section of mascot head painted on aluminum.
 2. Submit 12-inch-long actual samples of each accessory required.
- F. Delegated-Design Submittal: For all signage unless otherwise noted.
 1. Signage Contractor is responsible for determining proper mounting, fastening and anchoring methods including the design of concrete bases, concrete footings, and anchorage to signage frame for all signs unless noted otherwise. Determination to account for surface material sign is being mounted upon.
 2. Drawings are for aesthetic and functional design intent, only. No instructions for structural appropriateness have been made. It is the responsibility of the signage contractor to ensure that all elements are fabricated for a stable and durable installation while adhering to the aesthetic details indicated.
 3. Professional Engineer Qualifications: A legally qualified professional engineer licensed in the State of Missouri who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for design and installations of signs, flagpoles, and miscellaneous support that is similar to those indicated for this Project in material, design, and extent. Include structural analysis calculations for signs indicated to comply with design loads; signed and sealed by the qualified professional engineer responsible for their preparation.
- G. Field Dimensions for Graphic Design:
 1. Provide field dimensions to Architect for graphic design of graphics.
 - a. Field dimensions shall be accepted by Architect prior to final art release.
 2. Include dimensions, locations, and graphic depictions of all disruptions within the field of wall surface indicated to receive graphic signage. Examples of disruptions of wall surface include, but are not limited to, the following:
 - a. Louvers, Vents, Ductwork, Thermostats.
 - b. Outlets, Light Switches, Light Fixtures, and Conduit.
 - c. Wall Base, Baseboards, Corner Guards, Expansion Joints, and Reveal Joints.

- d. Motion Sensors.
 - e. Fire Alarm Devices.
 - f. Fire Extinguishers and Fire Extinguisher Cabinets.
 - g. Furnitures.
 - h. ADA signage, Room Signage, and other Code required signage.
 - i. Doors and Windows.
 - j. Mullions, Frames, and Handles.
 - k. Televisions.
 - l. Other obstructions to wall or glazing surfaces not listed that would adversely affect wall graphic design.
- 3. Elevations and dimensions shall be drawing using a computer aided drafting program and submitted in a legible format.
 - 4. Dimensional Tolerance: 1/8-inch maximum.
 - 5. Dimensions shall be reviewed and accepted by signage manufacturer prior to submittal of shop drawings.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For fabricator.
- B. Warranty: Special warranty specified in this Section.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For signs to include in maintenance manuals. Include the following:
 - 1. Methods for maintaining wall covering.
- B. Warranty: Provide warranty documentation for signage.

1.7 QUALITY ASSURANCE

- A. Signage Contractor Qualifications: All sign fabrication within this section shall be performed by a signage contractor with the following:
 - 1. A minimum of five (5) years experience producing architectural signs, and a minimum of five (5) years experience producing compliant signs as specified in ANSI 117.1 (1986), Minimum Guidelines and Requirements for Accessible Design (MGRAD), Uniform Federal Accessibility Standards (UFAS) and American with Disabilities Act Accessibility Guidelines (ADAAG).
 - 2. A firm that employs skilled workers experienced in producing custom-fabricated products similar to those required for this Project and with at least seven years continuous experience under the current company name. Fabricator shall have a record of successful in-service performance, as well as sufficient production capacity to produce required units.
 - 3. Fabricator shall have completed at least seven (7) similar signage projects having similar requirements within the last four (4) years for each signage type.
 - 4. 3M-certified printer and 3M-certified installer. Subcontracting to a 3M-certified printer is acceptable.
- B. Uniformity of Manufacturer: For each separate type of sign and graphic image required, obtain signs from a single manufacturer.
 - 1. Manufacturer's name, trade name, or trademark shall not appear on any visible surface.
- C. Regulatory Requirements: Comply with applicable provisions in ADA-ABA Accessibility Guidelines. Comply with applicable provisions in ICC/ANSI A117.1.
- D. Fire Performance Characteristics: Provide wall coverings with the following surface burning characteristics as determined by testing identical products per ASTM E 84 by UL or other testing and inspecting organizations acceptable to authorities having jurisdiction. Identify wall coverings with appropriate markings of applicable testing and inspecting organization.
 - 1. Flame Spread: 5 or less.
 - 2. Smoke Developed: 25 or less.

- E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, National Electrical Code, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- F. Aesthetic Requirements: Provide copy with straight and true edges; space characters as indicated; reproduce type style accurately with square corners and even curves; provide uniform letters and symbols; and provide smooth finishes with no visible imperfections.
- G. ADA Accessibility Guidelines: Signage shall comply with the ADA Accessibility Guidelines where applicable. Characters and graphics, including but-not limited to, copy height, letter stroke symbols, materials, and finishes indicated on the Drawings are intended as guidelines for compliance. Implement each applicable ADA guideline. Should conflicts arise, notify the Designer before proceeding.
- H. Inspections: The Architect reserves the right to periodically visit the Signage Contractor's facilities to inspect and review layouts.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Use special care in handling to prevent twisting, warping, nicking, and other damage to signage. Store materials to permit easy access for inspection and identification.
 - 1. Keep aluminum off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect aluminum and packaged materials from corrosion and deterioration.
- B. Coordinate delivery and storage of sign materials with the Owner. Schedule delivery to minimize storage requirements.
- C. Store signage in a well-ventilated area, away from uncured concrete and masonry, and protected from weather, moisture, soiling, abrasion, extreme temperatures, and humidity. Materials stored at the Project Site without prior approval of the Owner, may have to be relocated at the sign Signage Contractor's expense.

1.9 PROJECT CONDITIONS

- A. Weather Limitations for Exterior Signage: Proceed with installation only when existing and forecasted weather conditions permit installation of signs in exterior locations to be performed according to manufacturers' written instructions and warranty requirements.
- B. Interior Environmental Limitations: Do not deliver and install glass graphics until spaces are enclosed and weathertight, wet work in spaces to receive murals is complete and dry, work above ceilings is complete, and temporary or permanent HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
 - 1. Maintain a constant temperature not less than 60 deg F in installation areas for at least 10 days before and 10 days after installation.
- C. Field Measurements: Verify recess openings by field measurements before fabrication and indicate measurements on Shop Drawings.

1.10 COORDINATION

- A. Signage Contractor is responsible for preparing a schedule indicating engineering, fabrication, delivery, installation, and final inspection of the work. Submit this schedule to the Architect and Owner for approval and coordination with other work at the Project Site.
- B. Installation:
 - 1. Coordinate installation with the Owner, Construction Manager, and other trades.
 - 2. For signs supported by or anchored to permanent construction, coordinate specific requirements for types and placement of anchorage devices and similar items to be used for attaching signs. Deliver such items to Project Site in time for installation.
 - 3. Signage Contractor is responsible for furnishing setting drawings, installation templates and directions for installing for appropriate blocking, anchorage devices, and electrical conduits.
 - 4. Signage Contractor to coordinate all appropriate blocking needed.

- C. Coordinate location of remote transformers with building construction. Ensure that any transformers are accessible after completion of work.

1.11 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Deterioration of metal and polymer finishes beyond normal weathering.
 - b. Deterioration of embedded graphic image colors.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 MATERIALS, GENERAL

- A. General: Use materials of size and thickness indicated or, if not indicated as required to produce strength and durability in finished product for use intended. Work to dimensions shown or accepted on shop drawings, using proven details of fabrication and support. Use type of materials shown or specified for various components of work.
- B. All materials shall be new stock, free from defects impairing strength, durability, and appearance. No fabrication or installation materials or procedures shall be used that will in any way change the usual quality or in any manner have an adverse effect on existing materials and surfaces.
- C. Graphic Content and Style: Provide sign copy that complies with requirements indicated in the Message Schedule on Drawings, and on artwork for size, style, spacing, content, mounting height and location, material, finishes, and colors of signage. All digital prints to be high resolution output.
- D. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. Provide materials without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
- E. Aluminum, General: Provide alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with strength and durability properties for each aluminum form required not less than that of alloy and temper designated below.
 - 1. Plate and Sheet: ASTM B 209, Alloy 5005-H32 or Alloy 6061-T6.
 - 2. Extrusions: ASTM B221, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
 - a. Basis-of-Design Product: Subject to compliance with requirements, provide SignComp Extrusions and Systems (877.784.0405) or approved comparable product.
 - 3. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with at least the strength and durability properties of alloy 6063-T5.
 - a. Mounting: Concealed studs, non-corroding for substrates encountered.
 - 4. Cutting: Computer guided lasers cut letters, logos or shapes.
 - 5. Construction: Cut letter returns from .063"coil (1", 1.5",2",3",4",5",6") to size based on the desired letter depth, bent to the contour of the laser cut faces to produce a hollow-backed letter with 90° angle edges. Inside joints are MIG welded with 1"-1.5" intervals. Finish exposed welds and surfaces smooth, flush, and blended to match adjoining surfaces.
 - a. For Exterior Applications: Provide weep holes to drain water at lowest part of exterior signage. Equip weeps with permanent baffles to block light leakage without inhibiting drainage.
 - 6. Performance: Welds are tested for strength. Finishes are Salt Fog tested to ASTM B-117-95 for corrosion resistance.
 - 7. Finishes:
 - a. Painted finish – DA sanded face & returns, primed, then sprayed; refer to "Coatings and Paintings" Paragraph.
 - b. Brushed finish – vertical grain, brushed face, then clear coated with low gloss acrylic polyurethane.

2.2 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- D. Acrylic Sheet Finishes
 - 1. Colored Coatings for Acrylic Sheet: For copy and background colors, provide colored coatings, including inks, dyes, and paints, that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and that are UV and water resistant for five years for application intended.
- E. Coatings and Paints: Inks, dyes, and paints that are recommended by manufacturer for optimum adherence to surface and are UV and water resistant for colors and exposure indicated.
 - 1. Industrial Paint Finish:
 - a. Basis of Design: Provide acrylic polyurethane "MAP-LVG Ultra Low VOC" by Matthews Paint Company or a comparable product submitted to and accepted by Architect with the following product characteristics.
 - 1) Finish: Satin.
 - b. Finished coated surface shall provide a minimum of 150 in/lbs of impact resistance on all exposed faces.
 - c. All edges and faces shall have a seamless finish unless indicated otherwise on drawings.
 - 2. Powder-Coat:
 - a. Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0.04 mm) Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and backing finish.

2.3 ACCESSORIES

- A. Mounting Methods: Use double sided vinyl tape and silicone adhesive fabricated from materials that are not corrosive to sign materials and mounting surface.
- B. Anchors and Inserts: Provide nonferrous-metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion-bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.
 - 1. Use concealed fasteners and anchors unless indicated to be exposed.
 - 2. Exposed Metal-Fastener Components, General:
 - a. Fabricated from same basic metal and finish of fastened metal unless otherwise indicated.
 - b. Fastener Heads: For nonstructural connections, use oval countersunk screws and bolts with tamper-resistant, Allen-head slots unless otherwise indicated.
- C. Visible studs shall have sleeves painted to match color specified by Architect.

2.4 FABRICATION

- A. General: Provide manufacturer's standard signs of configurations indicated.
 - 1. Welded Connections: Comply with AWS standards for recommended practices in shop welding. Provide welds behind finished surfaces without distortion or discoloration of exposed side. Clean exposed welded surfaces of welding flux and dress exposed and contact surfaces.
 - 2. Mill joints to tight, hairline fit. Form joints exposed to weather to exclude water penetration.
 - 3. Preassemble signs in the shop to greatest extent possible. Disassemble signs only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation, in location not exposed to view after final assembly.

4. Conceal fasteners if possible; otherwise, locate fasteners where they will be inconspicuous.
 5. Internally brace signs for stability and for securing fasteners.
 6. Provide rebates, lugs, and brackets necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.
 7. Castings: Fabricate castings free of warp, cracks, blowholes, pits, scale, sand holes, and other defects that impair appearance or strength. Grind, wire brush, sandblast, and buff castings to remove seams, gate marks, casting flash, and other casting marks before finishing
- B. Brackets: Fabricate brackets, fittings, and hardware for bracket-mounted signs to suit sign construction and mounting conditions indicated. Modify manufacturer's standard brackets as required.
1. Aluminum Brackets: Factory finish brackets with baked-enamel or powder-coat finish to match sign-background color unless otherwise indicated.

2.5 FLAT CUT

- A. General: Flat Cut
1. Custom (101400.A31 - X01, X02).
- B. Flat cut characters and shapes with uniform faces; square-cut, smooth, eased edges; precisely formed lines and profiles; and as follows:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. APCO Graphics, Inc.
 - b. R. K. Ramos Signage Systems.
 - c. ASI Sign Systems, Inc.
 - d. Dimensional Innovations.
 - e. Gemini Incorporated.
 - f. Metallic Arts.
 - g. Square One.
- C. Refer to Drawings for:
1. Sign Height, Width and Depth.
 2. Typeface and Character Spacing.
 3. Color.
 4. Mounting Position.
- D. Mounting: Furnish inserts and other anchorage devices to connect masonry work. Coordinate anchorage devices with supporting structure.
1. Fabricate anchorage devices that are capable of withstanding dead loads of units.
 2. Lettering shall be pin-mounted and stood off wall **1 inch** unless indicated otherwise.
 3. Exterior: Lettering shall be pin-mounted and stood off wall 1 inch unless indicated otherwise.
 4. Interior: Lettering shall be flush pin-mounted and adhesively attached to substrate.
- E. Refer to Article 2.1 "Materials" for material technical information.
- F. Refer to Article 2.2 "Finishes" for materials selected below.
- G. Material selection:
1. ALUMINUM
 - a. Fabricate flat-cut-out characters and shapes from aluminum sheet/plate of thickness as indicated on drawings.
 - b. Welding: Use welding method that is appropriate for metal and finish indicated and that develops full strength of members joined. Finish exposed welds and surfaces smooth, flush, and blended to match adjoining surfaces.
 - c. Finishes:
 - 1) Interior: Industrial paint finish.

2.6 PAINTED CUSTOM GRAPHICS

- A. Painted Graphic – Epoxy Paint (101400.A61 - S02, S03)
- B. Painted Graphics – Exterior (101400.A62 - X02)
- C. Contractor shall fabricate templates for installation of graphics artwork indicated on Construction Drawings. Paint products indicated shall be compatible for installation with template materials selected by signage fabricator.
 - 1. Artwork shall be furnished by the Owner, on disc by Architect for signage fabricator's use.
 - 2. Refer to Section 099600 "High Performance Coatings" for product requirements.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
- B. Verify that sign-support surfaces are within tolerances to accommodate signs.
- C. Verify that anchor inserts are correctly sized and located to accommodate signs.
- D. Verify that items provided under other sections of Work are sized and located to accommodate signs.
- E. Examine supporting members to ensure that surfaces are at elevations indicated or required to comply with authorities having jurisdiction and are free from dirt and other deleterious matter.
- F. Proceed with installation only after unsatisfactory conditions have been corrected.
- G. Field verify dimensions of all conditions.

3.2 INSTALLATION, GENERAL

- A. Preparation
 - 1. Acclimatize materials by removing them from packaging in the installation areas not less than 24 hours before installation.
 - 2. Follow manufacturer's printed instructions for surface preparation.
 - a. Prepare substrates to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, and defects.
 - b. Painted surfaces: Treat areas susceptible to pigment bleeding.
 - c. Metals: If not factory-primed, clean and apply rust inhibitive zinc primer.
 - d. Moisture content: maximum of 5 percent on new plaster, concrete, and concrete masonry units when tested with an electronic moisture meter.
 - e. Adhesion Test: Perform manufacturer's standard non-destructive adhesion test on substrate, prime or repaint all surfaces that fail adhesion test as recommended by manufacturer.
- B. Locate signs and accessories where indicated, using mounting methods of types described and complying with manufacturer's written instructions.
 - 1. Install signs level, plumb, and at heights indicated, with sign surfaces free of distortion and other defects in appearance.
 - 2. Interior Wall Signs: Install signs on walls adjacent to latch side of door where applicable. Where not indicated or possible, such as double doors, install signs on nearest adjacent walls. Locate to allow approach within 3 inches of sign without encountering protruding objects or standing within swing of door.
- C. Face Mounting: Mount plaques using exposed fasteners with rosettes attached through face of plaque into wall surface.
- D. Wall-Mounted Signs Mounted on Glass: Provide opaque sheet matching sign material and finish onto opposite side of glass to conceal back of sign.

- E. Wall-Mounted Signs on Smooth Surfaces: Comply with sign manufacturer's written instructions except where more stringent requirements apply.
 - 1. Silicone-Adhesive Mounting: Attach signs to irregular, porous, or vinyl-covered surfaces. Where signage is located on exterior surfaces, provide exterior rated adhesive as recommended by signage manufacturer for substrate indicated.
- F. Wall-Mounted Signs on Textured Surfaces: Comply with sign manufacturer's written instructions except where more stringent requirements apply. Mount characters using standard fastening methods to comply with manufacturer's written instructions for character form, type of mounting, wall construction, and condition of exposure indicated. Provide heavy paper template to establish character spacing and to locate holes for fasteners.
 - 1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.
 - a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place sign in position and push until flush to surface, embedding studs in holes. Temporarily support sign in position until adhesive fully sets.
 - b. Thin or Hollow Surfaces: Place sign in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.
- G. Vertical Tolerance: Set posts plumb within a tolerance of 1/16 inch in 3 feet (2 mm in 1m).
- H. Installation – Flat Cut
 - 1. Installation of panels:
 - a. Install panels in locations and mounting heights as indicated on Drawings. Attach using concealed system to wall surfaces unless otherwise indicated. Utilize mechanical fasteners appropriate for wall substrate. Keep perimeter lines straight, level, and plumb. Align panels with adjacent installations.
 - b. For textured substrates, install using 3M Textured Surface Applicator as recommended or required by manufacturer for best installation practices for a warranted installation.

3.3 CLEANING AND PROTECTION

- A. After installation, clean soiled sign surfaces according to manufacturer's written instructions. Protect signs from damage until acceptance by Owner.
- B. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes to components that cannot be successfully repaired by finish touchup or similar minor repair procedures.
- C. Remove temporary protective coverings and strippable films as signs are installed.
- D. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean conditions during construction and protect from damage until acceptance by Owner.

END OF SECTION 101400

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SECTION 101423 - ADA AND CODE SIGNAGE

PART 1 GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Wayfinding Panel Signage (101423.A01):
 - a. Interior Room signage.
 - b. Custom fabricated polymer plastic signage.
- B. Related Sections include the following:
 - 1. Section 012100 "Allowances" for interior room signage and exterior door signage.
 - 2. Section 015000 "Temporary Facilities and Controls" for temporary Project identification signs and for temporary information and directional signs.
 - 3. Section 101400 "Signage" for related graphics and signage.
 - 4. Division 26 Section "Interior Lighting" and "Exterior Lighting" for illuminated signs.

1.2 DEFINITIONS

- A. ADA-ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines."
- B. Signage Contractor: Contractor responsible for the fabrication and installation of signage unless responsibility for fabrication or installation is called out by others in the drawings.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Including but not limited to, the following:
 - 1. Manufacturer's technical product data for each type of product specified. Include data on physical characteristics, durability, fade resistance, flame resistance and manufacturing process.
 - 2. Product data shall show compliance with requirements for fire performance characteristics and physical properties.
- B. Shop Drawings: Show fabrication and installation details for signs.
 - 1. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
 - 2. Provide message list, typestyles, graphic elements, including tactile characters and Braille, and layout for each sign.
 - 3. Include fabrication and installation details, and attachments to other work.
 - 4. Include elevations, component details, and attachments to other work for wayfinding signage.
 - 5. Indicate materials and profiles of signage fittings, joinery, finishes, fasteners, anchorages, and accessory items.
 - 6. Field Dimensions shall be obtained, reviewed, and accepted by signage manufacturer prior to submittal of shop drawings.
- C. Samples for Initial Selection: Manufacturer's color charts consisting of actual units or sections of units showing the full range of colors available for the following:
 - 1. Aluminum.
- D. Samples for Verification:
 - 1. Sample from same flitch to be used for the Work, with specified finish applied.
 - 2. Submit full-size samples of wayfinding signage. Quantity and type shall be determined by Architect with intent of one sample per each signage type representative of all types of products indicated.
- E. Sign Schedule: Use same designations indicated on Drawings.

- F. Mockups/Field Samples: Build mockups/field samples to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For fabricator.
- B. Warranty: Special warranty specified in this Section.
- C. Provide written documentation that the braille translation included on the manufacturer's signage provided in this section has been evaluated by the American Foundation for the Blind, and is, in their opinion, correct and compliant with ADAAG.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For signs to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
- B. Fabricator Qualifications: A firm that employs skilled workers experienced in producing custom-fabricated products similar to those required for this Project and with at least seven years continuous experience under the current company name. Fabricator shall have a record of successful in-service performance, as well as sufficient production capacity to produce required units.
 - 1. Fabricator shall have completed at least seven (7) similar signage projects having similar requirements within the last four (4) years for each signage type.
- C. Source Limitations for Signs: Obtain each sign type indicated from one source from a single manufacturer.
- D. Regulatory Requirements: Comply with applicable provisions in ICC A117.1.
- E. Fire Performance Characteristics: Provide wall coverings with the following surface burning characteristics as determined by testing identical products per ASTM E 84 by UL or other testing and inspecting organizations acceptable to authorities having jurisdiction. Identify wall coverings with appropriate markings of applicable testing and inspecting organization.
 - 1. Flame Spread: 5 or less.
 - 2. Smoke Developed: 25 or less.
- F. Accessibility Guidelines: Signage shall comply with ICC A117.1 where applicable. Characters and graphics, including but-not limited to, copy height, letter stroke symbols, materials, and finishes indicated on the Drawings are intended as guidelines for compliance. Implement each applicable ADA guideline. Should conflicts arise, notify the Designer before proceeding.

1.7 PREINSTALLATION MEETINGS

- A. Pre-installation Conference: Conduct conference at Project site.
 - 1. Required parties include the contractor, sub-contractor and architect/designer.
 - 2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 3. Review temporary protection requirements for during and after installation.

1.8 PROJECT CONDITIONS

- A. Weather Limitations for Exterior Signage: Proceed with installation only when existing and forecasted weather conditions permit installation of signs in exterior locations to be performed according to manufacturers' written instructions and warranty requirements.
 - 1. **[[EXTERIOR]]**
- B. Interior Environmental Limitations: Do not deliver and install vinyl wall graphics until spaces are enclosed and weathertight, wet work in spaces to receive murals is complete and dry, work above ceilings is complete, and temporary or permanent HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
 - 1. Maintain a constant temperature not less than 60 deg F in installation areas for at least 10 days before and 10 days after installation.
- C. Lighting: Do not install vinyl wall graphics until permanent level of lighting is provided on the surfaces to receive murals.
- D. Ventilation: Provide continuous ventilation during installation and for not less than the time recommended by the vinyl wall graphics manufacturer for full drying and curing.
- E. Field Measurements: Verify recess openings by field measurements before fabrication and indicate measurements on Shop Drawings.

1.9 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install ADA and Code Signage units until building is enclosed and weatherproof, wet work is complete and dry, and HVAC system is operating and maintaining temperature at 70 deg F for not less than 72 hours before beginning installation and for the remainder of the construction period.

1.10 DELIVERY, STORAGE AND HANDLING

- A. Use special care in handling to prevent twisting, warping, nicking, and other damage to signage. Store materials to permit easy access for inspection and identification.
- B. Store signage in a well-ventilated area, away from uncured concrete and masonry, and protected from weather, moisture, soiling, abrasion, extreme temperatures, and humidity.

1.11 COORDINATION

- A. Coordinate placement of anchorage devices with templates for installing signs.
- B. For signage furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.12 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Deterioration of metal and polymer finishes beyond normal weathering.
 - b. Deterioration of embedded graphic image colors.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Accessibility Standard: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1 for signs.

2.2 MATERIALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. Provide materials without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
- B. Aluminum, General: Provide alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with strength and durability properties for each aluminum form required not less than that of alloy and temper designated below.
 - 1. Plate and Sheet: ASTM B 209, Alloy 3003-H14, Alloy 5005-H32 or Alloy 6061-T6.
 - 2. Castings: ASTM B 26/B 26M, of alloy and temper recommended by sign manufacturer for casting process used and for use and finish indicated.
 - 3. Extrusions: ASTM B221, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
- C. Acrylic Sheet: ASTM D 4802, category as standard with manufacturer for each sign, Type UVF (UV filtering).
- D. PETG (Polyethylene Terephthalate Glycol) Sheet: ASTM D 5047-17 category as standard with manufacturer for each sign.
 - 1. Tensile Strength: 7,700 lbf/sq. in. per ASTM D 638.
 - 2. Flexural Modulus of Elasticity: 310,000 lbf/sq. in. per ASTM D 790.
- E. Photopolymer Sheet: Manufacturer's recommended photopolymer for producing integral non-laminated raised copy.
- F. Polycarbonate Sheet: Of thickness indicated, manufactured by extrusion process, ASTM C 1349, Appendix X1, Type II (coated, mar-resistant, UV-stabilized polycarbonate), coated on both surfaces with abrasion-resistant coating:
 - 1. Impact Resistance: 16 ft-lbf/in. per ASTM D 256, Method A.
 - 2. Tensile Strength: 9000 lbf/sq. in. per ASTM D 638.
 - 3. Flexural Modulus of Elasticity: 340,000 lbf/sq. in. per ASTM D 790.
 - 4. Heat Deflection: 265 deg F at 264 lbf/sq. in. per ASTM D 648.
 - 5. Abrasion Resistance: 1.5 percent maximum haze increase for 100 revolutions of a Taber abraser with a load of 500 g per ASTM D 1044.
- G. Expanded PVC Sheet: Subject to compliance with requirements, provide "Sintra" by 3A Composites.
 - 1. Material: Moderately expanded closed-cell polyvinyl chloride.
 - 2. Color: As selected by Architect from manufacturer's full range.
- H. Paints and Coatings for Sheet Materials: Inks, dyes, and paints that are recommended by manufacturer for optimum adherence to surface and are UV and water resistant for colors and exposure indicated.

2.3 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples

and are assembled or installed to minimize contrast.

D. Aluminum Finishes

1. Clear Anodic Finish: Manufacturer's standard Class 1 clear anodic coating, 0.018 mm or thicker, over a satin (directionally textured) mechanical finish, complying with AAMA 611.

E. Acrylic Sheet Finishes

1. Colored Coatings for Acrylic Sheet: For copy and background colors, provide colored coatings, including inks, dyes, and paints, that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and that are UV and water resistant for five years for application intended.

2.4 ACCESSORIES

- A. Mounting Methods: Use double sided vinyl tape and silicone adhesive fabricated from materials that are not corrosive to sign materials and mounting surface.

- B. Anchors and Inserts: Provide nonferrous-metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion-bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

1. Use concealed fasteners and anchors unless indicated to be exposed.
2. Exposed Metal-Fastener Components, General:
 - a. Fabricated from same basic metal and finish of fastened metal unless otherwise indicated.
 - b. Fastener Heads: For nonstructural connections, use oval countersunk screws and bolts with tamper-resistant, Allen-head slots unless otherwise indicated.

2.5 FABRICATION

- A. General: Provide manufacturer's standard signs of configurations indicated.

1. Mill joints to tight, hairline fit. Form joints exposed to weather to exclude water penetration.
2. Preassemble signs in the shop to greatest extent possible. Disassemble signs only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation, in location not exposed to view after final assembly.
3. Conceal fasteners if possible; otherwise, locate fasteners where they will be inconspicuous.
4. Provide rebates, lugs, and brackets necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.

- B. Sign Message Panels: Construct sign-panel surfaces to be smooth and to remain flat under installed conditions within a tolerance of plus or minus 1/16 inch (1.5 mm) measured diagonally from corner to corner.

1. Increase panel thickness or reinforce with concealed stiffeners or backing materials as needed to product surfaces without distortion, buckles, warp, or other surface deformations.

2.6 WAYFINDING PANEL SIGNAGE – ROOM SIGNAGE (101423.A01)

- A. General: Panel signs shall be acrylic or photopolymer signs with insert window, with an overall thickness of approximately 5/16 inch. Existing signs were constructed as follows:

1. Provide back sheet of 1/8 inch thick acrylic with first surface painted.
2. Provide 1/16 inch spacer for insert window.
3. Provide 1/8 inch thick photopolymer with first surface painted.
4. Provide painted edges for solid appearance.
5. Provide white raised numbers and braille, unless otherwise indicated or required by code.

- B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Ad Trends.
2. APCO Signs.
3. ASI Sign Systems, Inc.
4. Fast Signs.
5. Gemini.
6. Howard Industries.

7. Innerface Architectural Signage, Inc.
 8. Modulex.
 9. Nova Polymers.
 10. Star Signs.
 11. Take Form.
 12. 2/90 Sign Systems.
- C. Interior Panel Signs: Provide smooth sign panel surfaces constructed to remain flat under installed conditions within a tolerance of plus or minus 1/16 inch measured diagonally from corner to corner.
- D. Changeable Message Inserts: Fabricate signs to allow insertion of changeable messages in the form of slide-in inserts.
- E. Tactile and Braille Sign: Manufacturer's standard process for producing text and symbols complying with ADA-ABA Accessibility Guidelines and with ICC/ANSI A117.1. Text shall be accompanied by Grade 2 Braille. Produce precisely formed characters with square-cut edges free from burrs and cut marks; Braille dots with domed or rounded shape.
1. Raised-Copy Thickness: Not less than 1/32 inch.
- F. Subsurface Copy: Apply minimum 4-mil- thick vinyl copy to back face of clear acrylic sheet forming panel face to produce precisely formed opaque image. Image shall be free of rough edges.
- G. Colored Coatings for Acrylic Sheet: For copy background colors, provide colored coatings, including inks, dyes, and paints, that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and are UV and water resistant for five years for application intended.
1. Color: As selected by Architect from manufacturer's full range.
- H. Sign Types – General: There will be one type with tactile/Braille to match existing interior signage to best extent possible as acceptable to Architect.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
- B. Verify that sign-support surfaces are within tolerances to accommodate signs.
- C. Verify that anchor inserts are correctly sized and located to accommodate signs.
- D. Verify that items provided under other sections of Work are sized and located to accommodate signs.
- E. Examine supporting members to ensure that surfaces are at elevations indicated or required to comply with authorities having jurisdiction and are free from dirt and other deleterious matter.
- F. Proceed with installation only after unsatisfactory conditions have been corrected.
- G. Field verify dimensions of all conditions.

3.2 INSTALLATION, GENERAL

- A. Locate signs and accessories where indicated, using mounting methods of types described and complying with manufacturer's written instructions.
 1. Install signs level, plumb, and at heights indicated, with sign surfaces free of distortion and other defects in appearance.
 2. Interior Wall Signs: Install signs on walls adjacent to latch side of door where applicable. Where not indicated or possible, such as double doors, install signs on nearest adjacent walls. Locate to allow approach within 3 inches of sign without encountering protruding objects or standing within swing of door.

- B. Wall-Mounted Signs Mounted on Glass: Provide opaque sheet matching sign material and finish onto opposite side of glass to conceal back of sign.
- C. Wall-Mounted Signs on Smooth Surfaces: Comply with sign manufacturer's written instructions except where more stringent requirements apply.
 - 1. Silicone-Adhesive Mounting: Attach signs to irregular, porous, or vinyl-covered surfaces. Where signage is located on exterior surfaces, provide exterior rated adhesive as recommended by signage manufacturer for substrate indicated.
- D. Wall-Mounted Signs on Textured Surfaces: Comply with sign manufacturer's written instructions except where more stringent requirements apply. Mount characters using standard fastening methods to comply with manufacturer's written instructions for character form, type of mounting, wall construction, and condition of exposure indicated. Provide heavy paper template to establish character spacing and to locate holes for fasteners.
 - 1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.
 - a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place sign in position and push until flush to surface, embedding studs in holes. Temporarily support sign in position until adhesive fully sets.
 - b. Thin or Hollow Surfaces: Place sign in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.
- E. Vertical Tolerance: Set posts plumb within a tolerance of 1/16 inch in 3 feet (2 mm in 1m)

3.3 CLEANING AND PROTECTION

- A. After installation, clean soiled sign surfaces according to manufacturer's written instructions. Protect signs from damage until acceptance by Owner.
- B. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes to components that cannot be successfully repaired by finish touchup or similar minor repair procedures.
- C. Remove temporary protective coverings and strippable films as signs are installed.
- D. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean conditions during construction and protect from damage until acceptance by Owner.

END OF SECTION 101423

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SECTION 102113 - TOILET COMPARTMENTS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Solid-polymer toilet compartments configured as toilet enclosures (102113.A01).
- B. Related Sections:
 - 1. Section 061000 "Rough Carpentry" for blocking.
 - 2. Section 102800 "Toilet, Bath, and Laundry Accessories" for toilet tissue dispensers, grab bars, and similar accessories.

1.2 COORDINATION

- A. Coordinate requirements for blocking, reinforcing, and other supports concealed within walls.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: For toilet compartments and urinal screens. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Show layout and size of each toilet compartment.
 - 2. Show layout and size for each urinal screen.
 - 3. Show locations of cutouts for compartment-mounted toilet accessories.
 - 4. Show locations of centerlines of toilet fixtures.
 - 5. Show locations of floor drains.
- C. Samples for Initial Selection: For each type of unit indicated. Include Samples of compartment material involving texture and color selection.
- D. Samples for Verification: For the following products, in manufacturer's standard sizes unless otherwise indicated:
 - 1. Each type of material, color, texture, and finish required for units, prepared on 6-inch- square Samples of same thickness and material indicated for Work.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For toilet compartments to include in maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has five years of similar installations.
- B. Source Limitations: For products listed in the Part 2 articles, obtain products from single source from single manufacturer.

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication.

1.7 WARRANTY

- A. Guarantee entire installation for a period of two years from date of project Substantial Completion against defects in material and workmanship. Guarantee covers repair or replacement, with no costs to the Owner, of any and all items which become defective within the 10-year period.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire Performance: Tested in accordance with, and pass the acceptance criteria of, NFPA 286.
- B. ~~Surface Burning Characteristics: Comply with ASTM E 84 requirements for Class "C" or better; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.~~
 - 1. ~~Flame Spread Index:~~
 - a. ~~Class A flame spread/smoke developed 25 or less.~~
 - b. ~~Class B flame spread/smoke developed rating 75 or less.~~
 - c. ~~Class C flame spread/smoke developed rating 200 or less.~~
 - 2. ~~Smoke Developed Index: 450 or less.~~
- C. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1 for toilet compartments designated as accessible.

2.2 SOLID-POLYMER TOILET COMPARTMENTS (102113.A01)

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Scranton Products, Hiney Hiders toilet enclosure units or comparable product by one of the following:
 - 1. Accurate Partitions Corporation.
 - 2. Bradley Corporation; Mills Partitions.
 - 3. General Partitions Mfg. Corp.
 - 4. Hadrian.
 - 5. Partition Systems Incorporated of South Carolina (PSISC).
- B. Toilet-Enclosure Style: Floor-mounted overhead braced.
- C. Door, Panel, Screen, and Pilaster Construction: Solid, high-density polyethylene (HDPE) panel material, seamless, with eased edges, "no-sightline system" and with homogenous color and pattern throughout thickness of material.
 - 1. Material Thicknesses:
 - a. Doors, Pilasters, Panels and Screens: 1 inch.
 - 1) Edge condition: Eased edges, except shiplap at latch stile of door to pilaster to eliminate sightline into toilet compartment.
 - b. Panels: Not less than 1 inch.
 - c. Compartments shall incorporate a lap joint at latch stile of doors and adjacent pilaster, and continuous hinges at hinge stile of door and adjacent pilaster to eliminate sightlines into stalls.
 - 2. Heat-Sink Strip: Manufacturer's standard continuous, extruded-aluminum or stainless-steel strip fastened to exposed bottom edges of solid-plastic components to hinder malicious combustion.
 - 3. Pilaster shoes shall be 3 inches (76 mm) high, one-piece molded HDPE secured to the pilaster with a stainless-steel tamper resistant Torx head sex bolt.
 - 4. Color and Pattern: One color, pattern and texture in each room.
 - a. Color and Pattern: As selected by Architect from manufacturer's full range.
- D. Brackets (Fittings):
 - 1. Full-Height (Continuous) Type: Manufacturer's standard design; extruded aluminum or stainless steel.

2.3 HARDWARE AND ACCESSORIES

- A. Hardware and Accessories: Manufacturer's standard design, heavy-duty operating hardware and accessories.
 - 1. Material: Clear-anodized aluminum or stainless steel.
 - 2. Hinges: Provide heavy-duty, continuous stainless steel hinges with cover. Hinges shall be spring-loaded, self-closing type that can be adjusted to hold doors open at any angle up to 90 degrees.
 - 3. Latch and Keeper: Manufacturer's standard surface-mounted latch unit designed for emergency access and with combination rubber-faced door strike and keeper. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible.
 - a. Coordinate design of door and latch to provide "no-sight line" configuration.
 - b. Latch and Keeper: Manufacturer's standard stainless-steel surface-mounted latch unit designed for emergency access and with combination rubber-faced door strike and keeper. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible. Intent is to match existing.
 - 4. Coat Hook: Manufacturer's standard combination hook and rubber-tipped bumper, sized to prevent in-swinging door from hitting compartment-mounted accessories.
 - 5. Door Bumper: Manufacturer's standard rubber-tipped bumper at out-swinging doors.
 - 6. Door Pull: Manufacturer's standard unit at out-swinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible.
- B. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile and in manufacturer's standard finish.
- C. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel or chrome-plated steel or brass, finished to match the items they are securing, with vandal-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless steel, hot-dip galvanized steel, or other rust-resistant, protective-coated steel.

2.4 MATERIALS

- A. Aluminum Castings: ASTM B 26/B 26M.
- B. Aluminum Extrusions: ASTM B 221.
- C. Stainless-Steel Sheet: ASTM A 666, Type 304, stretcher-leveled standard of flatness.
- D. Stainless-Steel Castings: ASTM A 743/A 743M.
- E. High density polyethylene (HPDE), fabricated from polymer resins compounded under high pressure, forming single thickness panel.

2.5 FABRICATION

- A. Fabrication, General: Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories where required for attachment of toilet accessories.
- B. Floor-Mounted Overhead-Braced Units: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters to suit floor conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.
 - 1. Each pilaster over 3 inches wide shall be anchored to floor with a minimum of two (2) anchors to prevent twisting.
 - 2. Overhead Bracing shall not be installed over open stall areas. At areas where additional overhead support is necessary, consult with architect to provide alternate means of support.
- C. Door Size and Swings: Unless otherwise indicated, provide 24-inch- wide, in-swinging doors for standard toilet compartments and 36-inch- wide, out-swinging doors with a minimum 32-inch- wide, clear opening for compartments designated as accessible.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for fastening, support, alignment, operating clearances, and other conditions affecting performance of the Work.
 - 1. Confirm location and adequacy of blocking and supports required for installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.
 - 1. Maximum Clearances:
 - a. Pilasters and Panels: 1 inch.
 - b. Panels and Walls: 1 inch.
 - 2. Brackets: Secure panels to walls and to pilasters with continuous brackets.
 - a. Locate wall brackets so holes for wall anchors occur in masonry or tile joints.
 - b. Align brackets at pilasters with brackets at walls.
- B. Floor-Mounted, Overhead-Braced Units: Secure pilasters to floor and level, plumb, and tighten. Set pilasters with anchors penetrating not less than 1-3/4 inches into structural floor unless otherwise indicated in manufacturer's written instructions. Secure continuous head rail to each pilaster with no fewer than two fasteners. Hang doors to align tops of doors with tops of panels and adjust so tops of doors are parallel with overhead brace when doors are in closed position.

3.3 ADJUSTING

- A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.
- B. Clean exposed surfaces of compartment systems using materials and methods recommended by manufacturer and provide protection as necessary to prevent damage during remainder of construction period.

3.4 FINAL PROTECTION

- A. Provide final protection and maintain conditions the ensure toilet compartments and screens are without damage and deterioration at time of Substantial Completion.
- B. If any damage occurs, replace unit(s), unless repairs acceptable to Architect can be made.
- C. Should damage occur to partition, door or pilaster in shipping, those damaged items shall be replaced within 30 days.

END OF SECTION 102113

SECTION 102238 - OPERABLE PANEL PARTITIONS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Manually operated, acoustical single panel partitions (102238.A01 - H1).
- B. Related Requirements:
 - 1. Section 055000 "Metal Fabrications" for supports that attach supporting tracks to overhead structural system.
 - 2. Section 092900 "Gypsum Board" for fire-rated assemblies and sound barrier construction above the ceiling at track.

1.2 DEFINITIONS

- A. NIC: Noise Isolation Class.
- B. NRC: Noise Reduction Coefficient.
- C. STC: Sound Transmission Class.

1.3 PREINSTALLATION MEETINGS

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

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For operable panel partitions.
 - 1. Include plans, elevations, sections, details, and attachments to other work.
 - 2. Indicate stacking and operating clearances. Indicate location and installation requirements for hardware and track, blocking, and direction of travel.
 - 3. Include imposed loads on supporting structure.
 - 4. Include setting drawings showing embedded items and cutouts required for other work, including support beam punching template.
 - 5. Electrical and communications Sections for electrical service and connections for motor operators, controls, and limit switches and for system disconnect switches.
- C. Samples for Initial Selection: For each type of exposed material, finish, covering, or facing.
 - 1. Include Samples of accessories involving color selection.
 - 2. Include Samples representative of custom printing capability for Custom Digital Printed Plastic Laminate.
- D. Samples for Verification: For each type of exposed material, finish, covering, or facing, prepared on Samples of size indicated below:
 - 1. Textile Facing Material: Full width by not less than 36-inch-long section of fabric from dye lot to be used for the Work, with specified treatments applied. Show complete pattern repeat.
 - 2. Vinyl Facing Material: Full width by 36-inch-long section of vinyl facing showing complete pattern repeat.
- E. Schedule: Submit schedule of door units using same room/opening designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Partition track, track supports and bracing, switches, turning space, and storage layout.
 - 2. Suspended ceiling components.
 - 3. Structural members to which suspension systems are attached.
 - 4. Size and location of initial access modules for acoustical tile.
 - 5. Items penetrating finished ceiling, including the following:
 - a. Lighting fixtures.
 - b. HVAC ductwork, outlets, and inlets.
 - c. Speakers.
 - d. Sprinklers.
 - e. Smoke detectors.
 - f. Access panels.
 - 6. Plenum acoustical barriers.
 - 7. Include plans, elevations, sections, attachment details and numbered panel installation sequence.
 - 8. Indicate stacking and operating clearances. Indicate location and installation requirements for hardware, track motor drive and drive box.
 - 9. Include diagrams for power, signal, and control wiring.
- B. Delegated-Design Submittal: For operable panel partitions.
 - 1. Include design calculations for restraints, anchors, and bracing to structure above.
- C. Setting Drawings: For embedded items and cutouts required in other work, including support-beam, mounting-hole template.
- D. Qualification Data: For qualified Installer.
- E. Field quality-control reports.
- F. Sample Warranty: For manufacturer's special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For operable panel partitions to include in maintenance manuals.
 - 1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
 - a. Panel finish facings and finishes for exposed trim and accessories. Include precautions for cleaning materials and methods that could be detrimental to finishes and performance.
 - b. Seals, hardware, track, track switches, carriers, and other operating components.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same production run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Panel Finish-Facing Material: Furnish full width in quantity to cover both sides of two panels when installed.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer and as follows:
 - 1. Installer shall have not less than 5 years of continuous experience, under the current company name, installing specified or similar systems.
 - 2. Installer shall have successfully completed no fewer than 5 comparable scale projects using specified or similar systems.

- B. Preparation of the opening shall conform to the criteria set forth per ASTM E557 Standard Practice for Architectural Application and Installation of Operable Partitions.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Protectively package and sequence panels in order for installation. Clearly mark packages and panels with numbering system used on Shop Drawings. Do not use permanent markings on panels.
- B. Protect panels during delivery, storage and handling to comply with manufacturer's recommendations and as required to prevent damage.

1.10 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of operable panel partitions that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Faulty operation of operable panel partitions.
 - b. Deterioration of metals, metal finishes, and other materials beyond normal use.
 - 2. Partition Warranty Period: Two (2) years from date of Substantial Completion.
 - 3. Suspension System Warranty Period: Five (5) years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design structural anchoring and bracing of stacking racks, drive box and motors and tracks to structure above.
- B. Acoustical Performance: Provide operable panel partitions tested by a qualified testing agency for the following acoustical properties according to test methods indicated:
 - 1. Sound-Transmission Requirements: Operable panel partition assembly tested for laboratory sound-transmission loss performance according to ASTM E 90, determined by ASTM E 413, and rated for not less than the STC indicated.
 - 2. Noise-Isolation Requirements: Installed operable panel partition assembly, identical to partition tested for STC, tested for NIC according to ASTM E 336, determined by ASTM E 413, and rated for 11 dB less than STC value indicated.
 - 3. Noise-Reduction Coefficient (NRC) rating: Installed operable panel partitions assembly shall be according to ASTM C423.
- C. Fire-Test-Response Characteristics: Provide panels with finishes complying with one of the following as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
 - 1. Surface-Burning Characteristics: Comply with ASTM E 84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 450 or less.
 - 2. Fire Growth Contribution: Complying with acceptance criteria of local code and authorities having jurisdiction when tested according to NFPA 265 Method B Protocol or NFPA 286.
- D. Fire Resistance: Provide fire-rated operable panel partition assemblies including pass doors complying with NFPA 80, based on testing according to UL 10B for fire-rated door assemblies.
 - 1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.

2.2 MANUAL OPERABLE ACOUSTICAL SINGLE PANELS (102238.A01 - H1).

- A. Operable Acoustical Panels: Partition system shall consist of, but not be limited to: series of individual flat panels, manually operated, top supported with automatic floor seals and fixed tops seals. System shall also include: panel finish facing, suspension system, and accessories.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Modernfold, Inc.; "Acousti-Seal Encore."
 - 2. Comparable products from the following manufacturers, which meet or exceed specified requirements, will be considered when submitted to and accepted by Architect prior to bidding:
 - a. Hufcor, Inc.
 - b. Kwik Wall.
 - c. Panelfold, Inc.
- B. Panel Operation: Manually operated, individual panels.
- C. Panel Construction: As required to support panel from suspension components and with reinforcement for hardware attachment. Fabricate panels with tight hairline joints and concealed fasteners. Fabricate panels so finished in-place partition is rigid; level; plumb; aligned, with tight joints and uniform appearance; and free of bow, warp, twist, deformation, and surface and finish irregularities.
- D. Dimensions: Fabricate operable acoustical panel partitions to form an assembled system of dimensions indicated and verified by field measurements.
 - 1. Panel Width: Standard widths.
- E. Acoustics STC: Not less than 56.
- F. Hanging Weight - STC dependent: 8 to 12 lbs/sq.ft.
- G. Panel Thickness - Nominal: 4 inches (108 mm)
- H. Panel Materials:
 - 1. Steel Frame: Steel sheet, manufacturer's standard, but not less than 18 gauge nominal minimum thickness for uncoated steel. Frame shall have overlapped and welded corners. Top channel of frame shall be reinforced.
 - 2. Steel Face/Liner Sheets: Tension-leveled steel sheet, manufacturer's standard minimum nominal thickness for uncoated steel. Panel face sheets shall be lock-formed and welded directly to frame for unitized construction.
- I. Panel Closure: Manufacturer's standard unless otherwise indicated.
 - 1. Initial Closure: Flexible, resilient PVC, bulb-shaped acoustical seal.
 - 2. Final Closure: Constant-force, lever-operated mechanical closure expanding from panel edge to create a constant-pressure acoustical seal. Lever shall be removable.
- J. Hardware: Manufacturer's standard as required to operate operable panel partition and accessories; with decorative, protective finish.
 - 1. Hinges: Manufacturer's standard full leaf butt hinges. Hinges shall connect directly to panel frame with welded hinge anchor plates within panel.
- K. Seals
 - 1. General: Provide seals that produce operable panel partitions complying with performance requirements and the following:
 - a. Manufacturer's standard seals unless otherwise specified.
 - b. Seals made from materials and in profiles that minimize sound leakage.
 - c. Seals fitting tight at contact surfaces and sealing continuously between adjacent panels and between operable panel partition perimeter and adjacent surfaces, when operable panel partition is extended and closed.
 - 2. Vertical Seals: Deep-nesting, interlocking metal astragals mounted on each edge of panel, with continuous PVC acoustical seal.
 - 3. Horizontal Top Seals:
 - 4. Continuous-contact, extruded-PVC seal exerting uniform constant pressure on track.
 - 5. Horizontal Bottom Seals: PVC-faced, mechanical, retractable, constant-force-contact seal exerting uniform constant pressure on floor when extended, ensuring horizontal and vertical sealing and resisting panel

movement.

- a. Mechanically Operated for Acoustical Panels: Extension and retraction of bottom seal by operating handle or built-in operating mechanism, with operating range not less than 1-1/2 inches between retracted seal and floor finish.

2.3 PANEL FINISH FACINGS

- A. General: Provide finish facings for panels that comply with indicated fire-test-response characteristics and that are factory applied to operable panel partitions with appropriate backing, using mildew-resistant nonstaining adhesive as recommended by facing manufacturer's written instructions.
 1. Apply one-piece, seamless facings free of air bubbles, wrinkles, blisters, and other defects, with no gaps or overlaps. Horizontal butted edges and seams are not permitted. Tightly secure and conceal raw and selvage edges of facing for finished appearance.
 2. Where facings with directional or repeating patterns or directional weave or matching grain are indicated, mark facing top and attach facing in same direction.
 3. Match facing pattern 72 inches above finished floor.
- B. Panel Edges: Provide exposed panel trim of a consistent color as selected by Architect from manufacturer's standard offering.
- C. Project Specific Facing Selections:
 1. Provide the following facing materials.
 - a. Music Side: Carpet.
 - b. Gym Side: Vinyl.

2.4 SUSPENSION SYSTEMS

- A. Tracks: Steel with adjustable steel hanger rods for overhead support, designed for operation, size, and weight of operable panel partition indicated. Size track to support partition operation and storage without damage to suspension system, operable panel partitions, or adjacent construction. Limit track deflection to no more than 0.10 inch between bracket supports. Provide a continuous system of track sections and accessories to accommodate configuration and layout indicated for partition operation and storage.
 1. Basis-of-Design Products:
 - a. Track shall be Moderco; #45-T, aluminum track.
 2. Panel Guide: Aluminum guide on both sides of the track to facilitate straightening of the panels; finished with factory-applied, decorative, protective finish.
 3. Head Closure Trim: As required for acoustical performance; with factory-applied, decorative, protective finish.
- B. Carriers: Trolley system as required for configuration type, size, and weight of partition and for easy operation; with ball-bearing wheels.
 1. Trolley shall have steel tired ball bearing wheels.
- C. Aluminum Finish: Mill finish or manufacturer's standard, factory-applied, decorative finish unless otherwise indicated.
- D. Steel Finish: Manufacturer's standard, factory-applied, corrosion-resistant, protective coating unless otherwise indicated.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine flooring, structural support, and opening, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of operable panel partitions.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare openings to receive operable panel partitions in accordance with ASTM E 557 "Standard Practice for Architectural Application and Installation of Operable Partitions."

3.3 INSTALLATION

- A. General: Comply with ASTM E 557 except as otherwise required by operable panel partition manufacturer's written installation instructions. The complete installation of the operable wall systems shall be by a certified factory-trained installers for their respective products and be in strict accordance with the approved shop drawings and manufacturer's standard printed specifications, instructions, and recommendations.
- B. Install operable panel partitions and accessories after other finishing operations, including painting, have been completed in area of partition installation.
- C. Install panels from marked packages in numbered sequence indicated on Shop Drawings.
- D. Broken, cracked, chipped, deformed, or unmatched panels are not acceptable.
- E. Broken, cracked, deformed, or unmatched gasketing or gasketing with gaps at butted ends is not acceptable.
- F. Light-Leakage Test: Illuminate one side of partition installation and observe vertical joints and top and bottom seals for voids. Adjust partitions for alignment and full closure of vertical joints and full closure along top and bottom seals. Perform test and make adjustments before NIC testing.

3.4 FIELD QUALITY CONTROL

- A. NIC Testing: Owner may engage a qualified testing agency to perform tests and inspections.
 - 1. Testing Extent: Testing agency shall test one of each type of operable panel partition installation.
 - 2. Testing Methodology: Perform testing of installed operable panel partition for noise isolation according to ASTM E336, determined by ASTM E413, and rated for not less than NIC indicated. Adjust and fit partitions to comply with NIC test method requirements.
- B. An operable panel partition installation will be considered defective if it does not pass tests and inspections.

3.5 ADJUSTING

- A. Adjust operable panel partitions, hardware, and other moving parts to function smoothly, and lubricate as recommended by manufacturer.
- B. Verify that safety devices are properly functioning.

3.6 CLEANING

- A. Clean soiled surfaces of operable panel partitions to remove dust, loose fibers, fingerprints, adhesives, and other foreign materials according to manufacturer's written instructions.

3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain operable panel partitions.

END OF SECTION 102238

SECTION 102600 - WALL AND DOOR PROTECTION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Corner Guards (102600.A03).
- B. Related Requirements:
 - 1. Section 012300 "Alternates" for description of alternates affecting work of this Section.
 - 2. Section 087100 "Door Hardware" for metal armor, kick, mop, and push plates.
 - 3. Section 092900 "Gypsum Board" for corner trim included in gypsum board installation.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, impact strength, dimensions of individual components and profiles, and finishes.
 - 2. Include fire ratings of units recessed in fire-rated walls and listings for door-protection items attached to fire-rated doors.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of actual units or sections of units showing the full range of colors available for each type of impact-resistant wall-protection unit indicated.
 - 1. Include Samples of accent strips and accessories to verify color selection.
 - 2. Digital Protective Wallcovering – submit a sample of each wall graphic type in the form of small-scale color proofs for each graphic or mural.
- C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
 - 1. Corner Guards: 12 inches long.

1.3 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each impact-resistant wall protection unit to include in maintenance manuals.
 - 1. Include recommended methods and frequency of maintenance for maintaining optimum condition of plastic covers under anticipated traffic and use conditions. Include precautions against using cleaning materials and methods that may be detrimental to plastic finishes and performance.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
- B. Include mounting and accessory components. Replacement materials shall be from same production run as installed units.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain impact-resistant wall protection units from single source from single manufacturer.
- B. Product Options: Drawings indicate size, profiles, and dimensional requirements of impact-resistant wall protection units and are based on the specific system indicated. Refer to Section 01 40 00 "Quality Requirements."
 - 1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

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

1.6 MOCKUPS

- A. Mockups/Field Samples: Build mockups/field samples, to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
 - 1. Field Samples: Build field sample/mockup of typical wall areas as shown on Drawings.
 - a. Note: Mockup shall be a field sample of corner guard, baseboard, and adjacent areas in Project. Architect and manufacturer's representative will observe installation of first corner guard installation at Architect's selected location.
- B. Field testing shall be performed on field sample areas according to requirements in "Field Quality Control" Article.
- C. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store impact-resistant wall protection units in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.
 - 1. Maintain room temperature within storage area at not less than 70 deg F during the period plastic materials are stored.

1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install impact-resistant wall protection units until building is enclosed and weatherproof, wet work is complete and dry, and HVAC system is operating and maintaining temperature at 70 deg F for not less than 72 hours before beginning installation and for the remainder of the construction period.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Surface Burning Characteristics: Comply with ASTM E 84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: 25 or less.
 - 2. Smoke-Developed Index: 450 or less.

2.2 CORNER GUARDS (102600.A03):

- A. Basis of Design: Subject to compliance with requirements, provide "LG Series - LG-250" by CS Acrovyn or a comparable product with the following criteria proposed to and accepted by Architect prior to bidding.
 - 1. Material: Impact resistant Clear Polycarbonate of 16 ft. lbs/inch tested per ASTM D-256.
 - 2. Length of legs: 2 1/2 inch.
 - 3. 1/32 inch (1.0 mm) radius cover.
 - 4. Height: From top of base to ceiling unless otherwise indicated on the drawings.

2.3 MATERIALS

- A. Plastic Materials: Chemical- and stain-resistant, high-impact-resistant plastic with integral color throughout; extruded and sheet material as required, thickness as indicated.
- B. Fasteners: Aluminum, nonmagnetic stainless-steel, or other noncorrosive metal screws, bolts, and other fasteners compatible with items being fastened. Use security-type fasteners where exposed to view.

- C. Adhesive: As recommended by protection product manufacturer.
- D. PVC Plastic: ASTM D 1784, Class 1, textured, chemical and stain-resistant, high-impact-resistant PVC or acrylic-modified vinyl plastic with integral color throughout.
 - 1. Impact Resistance: Minimum 25.4 ft-lbf/in. of notch when tested according to ASTM D 256, Test Method A.
 - 2. Chemical and Stain Resistance: Tested according to ASTM D 543 and ASTM D 1308.
 - 3. Self-extinguishing when tested according to ASTM D 635.
 - 4. Flame-Spread Index: 25 or less.
 - 5. Smoke-Developed Index: 450 or less.

2.4 FABRICATION

- A. Fabricate impact-resistant wall protection units to comply with requirements indicated for design, dimensions, and member sizes, including thicknesses of components.
 - 1. Provide surfaces free of chips, dents, and other imperfections.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Complete finishing operations, including painting, before installing impact-resistant wall protection system components. Before installation, clean substrate to remove dust, debris, and loose particles.

3.3 INSTALLATION AND CLEANING

- A. General: Install impact-resistant wall protection units plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.
 - 1. Install cornerguards using adhesive method of installation. Clean excess adhesive from wall substrate.
 - 2. Install wall protection units in locations and at mounting heights indicated on Drawings.
- B. Immediately after completion of installation, clean plastic covers and accessories as recommended by corner guard manufacturer.

END OF SECTION 102600

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SECTION 102800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

TOILET, BATH, AND LAUNDRY ACCESSORIES

1.1 SUMMARY

- A. Section Includes:
 - 1. Public-use washroom accessories.
 - a. Toilet Tissue Dispenser (102800.A01).
 - b. Paper Towel Dispenser (102800.A02).
 - c. Waste Receptacle 102800.A03).
 - d. Soap Dispenser (102800.A05).
 - e. Grab Bar (102800.A06).
 - f. Sanitary Napkin Dispenser Unit (SND) (102800.A07).
 - g. Sanitary Napkin Receptor Unit (SNR) (102800.A08).
 - h. Mirror Unit (102800.A10).
 - 2. Public-use shower room accessories:
 - a. Coat Hook (102800.A15).
 - 3. Accessories:
 - a. Diaper Changing Station (102800.A20).
 - b. Coat Hook (102800.A25).
- B. Related Sections:
 - 1. Section 061000 "Rough Carpentry" for blocking required behind fixtures and accessories.
 - 2. Section 102113 "Toilet Compartments".
 - 3. Section 102116 "Shower & Dressing Compartments".
 - 4. Division 26 for electrical requirements for illuminated mirror units and warm air dryers.
- C. Owner will furnish, and contractor install the following accessories:
 - 1. Toilet tissue dispensers.
 - 2. Paper towel dispensers.
 - 3. Soap dispensers.
 - 4. Waste receptacles.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include the following:
 - 1. Construction details and dimensions.
 - 2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
 - 3. Material and finish descriptions.
 - 4. Features that will be included for Project.
 - 5. Manufacturer's warranty.
 - 6. Include electrical characteristics.
- B. Samples: Full size, for each accessory item to verify design, operation, and finish requirements.
 - 1. Approved full-size Samples will be returned and may be used in the Work.
- C. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
 - 1. Identify locations using room designations indicated.
 - 2. Identify products using designations indicated.

1.3 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For toilet and bath accessories to include in maintenance manuals.

- B. Warranty: Sample of special warranty.

1.4 QUALITY ASSURANCE

- A. Source Limitations: For products listed together in the same Part 2 articles, obtain products from single source from single manufacturer.

1.5 COORDINATION

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.
 - 1. Where cutouts are required in other work, provide templates, substrate preparation instructions, and directions for preparing cutouts and for installation of anchorage devices.
- B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.6 WARRANTY

- A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, visible silver spoilage defects.
 - 2. Warranty Period: 15 years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 MATERIALS

- A. Stainless Steel: ASTM A 666, Type 304, 0.031-inch minimum nominal thickness unless otherwise indicated.
- B. Brass: ASTM B 19, flat products; ASTM B 16/B 16M, rods, shapes, forgings, and flat products with finished edges; or ASTM B 30, castings.
- C. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.036-inch minimum nominal thickness.
- D. Galvanized-Steel Sheet: ASTM A 653/A 653M, with G60 hot-dip zinc coating.
- E. Galvanized-Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.
- F. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.
- G. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).
- H. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.
- I. ABS Plastic: Acrylonitrile-butadiene-styrene resin formulation.

2.3 PUBLIC-USE WASHROOM ACCESSORIES

- A. Basis-of-Design Product: Subject to compliance with requirements, provide products specified from Bobrick Washroom Equipment, Inc. or comparable products by one of the following:
 - 1. American Specialties, Inc.
 - 2. Bradley Corporation.
- B. Toilet Tissue Dispenser (102800.A01 - TTD) – Provided by Owner, Installed by Contractor.
- C. Paper Towel Dispenser (102800.A02 - PTD) – Provided by Owner, Installed by Contractor.
- D. Waste Receptacles – Fully Recessed (102800.A03 - WR) – Provided by Owner, Installed by Contractor.
- E. Grab Bars – GB, VGB, FGB (102800.A06):
 - 1. Bobrick:
 - a. B-6806.99; 36" 42" & 18" at Accessible Toilet Stalls.
 - b. B-6806.99; 18" & B-5861.99 at Shower.
 - c. B-6806.99; Series Wall-to-Floor Bar w/ bottom rail at DFs w/out Alcove.
 - d. FGB: B-4998.99 at Accessible Toilet and Shower Stall.
 - 2. Bradley:
 - a. 832-2 Series; 36" 42" & 18" at Accessible Toilet Stalls.
 - b. 832-2 Series; 18" & 16"x30" Horizontal Two-Wall Bar at Shower Stall.
 - c. 832-2 Series; Wall-to-Floor Bar w/ bottom rail at DFs w/out Alcove.
 - d. FGB: 8370-107-2 at Accessible Toilet and Shower Stall.
 - 3. ASI:
 - a. 3800-P Series; Type 01 36" 42" & 18" at Accessible Toilet Stalls.
 - b. 3800-P Series; Type 01 18" & Type 60 at Shower Stall.
 - c. 3800-P Series; Type 75 at Drinking Fountains without Alcove.
 - d. FGB: 3413-P at Accessible Toilet and Shower Stall.
- F. Sanitary-Napkin Receptor Unit (102800.A08 - SNR):
 - 1. Basis of Design Products:
 - a. Bradley: Model 4721-15 & 4722-15.
 - b. ASI: Model 0473-1A & 0472-1.
 - 2. Mounting: Surface.
 - 3. Door or Cover: Self-closing, disposal-opening cover and hinged face panel with tumbler lockset.
 - 4. Receptacle: Removable.
 - 5. Material and Finish: Stainless steel, No. 4 finish (satin).
- G. Mirror Unit (102800.A10 – M1, M2, M3):
 - 1. Basis-of-Design Products:
 - a. Bobrick Washroom Equipment, Inc.; B-290 Series.
 - b. ASI: Model 0600.
 - 2. Types:
 - a. M1 – Shall be 18-inches wide x 36-inches height.
 - 3. Frame Stainless-steel channel, in No.4 satin finish.
 - 4. Hangers: Produce rigid, tamper- and theft-resistant installation, using method indicated below.
 - a. Concealed wall hanger bracket of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.
 - b. One-piece, galvanized-steel, wall-hanger device with spring-action locking mechanism to hold mirror unit in position with no exposed screws or bolts.
 - 5. Glazing: Provide polished tempered glass mirror in locker rooms and gym facilities. Provide polished non-tempered glass mirror in other locations unless noted otherwise.
 - 6. Sizes: As indicated on Drawings.
- H. Coat Hook (102800.A15 - CH):
 - 1. Basis-of-Design Product: Bobrick Washroom Equipment, Inc.; B-542 Series.
 - 2. Description: Single hook pin model with concealed mounting. Unit shall be 1-15/16 inch in diameter.
 - 3. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

2.4 CHILDCARE ACCESSORIES

- A. Source Limitations: Obtain childcare accessories from single source from single manufacturer.
- B. Diaper-Changing Station (102800.A20 - DCS):
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide, Koala Kare Products; Model KB200-01SS. Comparable products from other manufacturers meeting specified requirements will be considered when submitted to and accepted by Architect prior to bidding.
 - 2. Description: Horizontal unit that opens by folding down from stored position and with child-protection strap.
 - 3. Mounting: Surface mounted, with unit projecting not more than 4 inches from wall when closed.
 - 4. Operation: By pneumatic shock-absorbing mechanism.
 - 5. Material and Finish: HDPE in manufacturer's standard grey color with stainless steel veneer inset in front surface having a No. 4 finish (brushed satin).
 - 6. Unit shall have Microban antimicrobial additive embedded into the bed surface.
 - 7. Unit shall conform to ASTM F 2285-04 "Standard Safety performance Specification for Diaper Changing Tables for Commercial Use".
 - 8. Warranty: Manufacturer's Five years limited warranty.

2.5 UNDER-LAVATORY GUARDS

- A. Under-lavatory Guard (102800.A21):
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Plumberex Specialty Products, Inc.
 - b. Truebro by IPS Corporation.
 - 2. Description: Insulating pipe covering for supply and drain piping assemblies that prevents direct contact with and burns from piping; allow service access without removing coverings.
 - 3. Material and Finish: Antimicrobial, molded plastic, white.

2.6 CUSTODIAL ACCESSORIES

2.7 FABRICATION

- A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.
- B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
- B. Grab Bars: Install to withstand a downward load of at least 250 lbf when tested according to ASTM F 446.

3.2 ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
- B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION 102800

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SECTION 104300 - EMERGENCY AID SPECIALTIES

PART 1 GENERAL

1.1 SUMMARY

- A. Section
 - 1. First aid cabinets.
 - 2. Accessories.
- B. RELATED REQUIREMENTS
 - 1. Section 034100 "Precast Structural Concrete" for recessed cabinets.
 - 2. Section 061000 Rough Carpentry: Wood blocking product and execution requirements.
 - 3. Division 26 for electrical connection.

1.2 REFERENCE STANDARDS

- A. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems 2013a (Reapproved 2017).

1.3 PREINSTALLATION MEETINGS

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

1.4 ACTION SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, finishes, and accessories for visual display units.
- C. Shop Drawings: Indicate locations of cabinets and cabinet physical dimensions.
- D. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.
- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- F. Maintenance Data: Include test schedules and recertification requirements.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for surface-burning characteristics of tackboards.
- C. Sample Warranties: For special warranties.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For visual display units[and motorized units] to include in maintenance manuals.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver factory-fabricated units completely assembled in one piece. If dimensions exceed maximum manufactured unit size.
- B. Deliver factory-built visual display surfaces, including factory-applied trim, completely assembled in one piece without joints, where possible. If dimensions exceed maximum manufactured panel size, provide two or more pieces of equal length as acceptable to Architect. When overall dimensions require delivery in separate units, prefit components at the factory, disassemble for delivery, and make final joints at the site.

1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver units until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
- B. Field Measurements: Verify actual dimensions of construction contiguous with visual display units by field measurements before fabrication.
 - 1. Allow for trimming and fitting where taking field measurements before fabrication might delay the Work.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain each type of unit from single source from single manufacturer.

2.2 FIRST AID CABINETS

- A. Basis-of-Design Product for First Aid Cabinets: Subject to compliance with requirements, provide Uline "H-6470 Uline ANSI Approved First Aid Kit - Class B, 50 person" as specified hereinafter. Comparable products from manufacturers listed below will also be considered:
 - 1. Must meet requirements for ANSI/ISEA Z308.1-2009.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance of the Work.
- B. Examine roughing-in for electrical power systems to verify actual locations of connections before installation of units.
- C. Examine walls and partitions for proper preparation and backing for units.
- D. Examine walls and partitions for suitable framing depth where units will be installed recessed.
- E. Verify rough openings for cabinet are correctly sized and located.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.

- B. Wall Signs:
 - 1. Location: Where shown.
 - 2. Apply on walls after field painting is completed and has been accepted.
- C. Cabinet Lettering:
 - 1. Location: Face of door framing.

3.3 ADJUSTING AND CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.
- B. Adjust cabinet doors to operate smoothly without binding. Verify that alarms and integral locking devices operate properly.
- C. On completion of cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.
- D. Touch up marred finishes. Replace cabinets that cannot be restored to factory-finished appearance. Use materials and procedures recommended by cabinet manufacturer.

3.4 CLOSEOUT ACTIVITIES

- A. See Section 017800 - Closeout Submittals for closeout submittals.
- B. See Section 017900 - Demonstration and Training for additional requirements.
- C. Demonstrate proper operation of AED to Owner's designated representative.

END OF SECTION 104300

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SECTION 104413 - FIRE EXTINGUISHER CABINETS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Fire protection cabinets for the following:
 - a. Portable fire extinguishers.
 - 1) Provide fire extinguishers for each fire extinguisher cabinet, except where indicated as bracket-mounted.
- B. Related Requirements:
 - 1. Section 104416 "Fire Extinguishers."

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire protection cabinets.
 - 1. Fire Protection Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.
- B. Shop Drawings: For fire protection cabinets. Include plans, elevations, sections, details, and attachments to other work.

1.3 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For fire protection cabinets to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Fire-Rated, Fire Protection Cabinets: Listed and labeled to comply with requirements in ASTM E 814 for fire-resistance rating of walls where they are installed.

1.5 COORDINATION

- A. Coordinate size of fire protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.
 - 1. Coordinate sizes and locations of fire protection cabinets with wall depths

1.6 SEQUENCING

- A. Apply vinyl lettering on field-painted, fire protection cabinets after painting is complete.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.
 - 1. Finish: Baked enamel, TGIC polyester powder coat, HAA polyester powder coat, epoxy powder coat, or polyester/epoxy hybrid powder coat, complying with AAMA 2603.

- a. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - b. Color: As selected by Architect from manufacturer's full range.
- B. Tempered Break Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 1.5 mm thick.

2.2 FIRE PROTECTION CABINET (104413.A01)

- A. Cabinet Type: Suitable for fire extinguisher.
 - 1. Basis of Design Products: Subject to compliance with requirements provide Larsen's Manufacturing Company; Architectural Series products from:
 - a. Larsen's Manufacturing Company; Architectural Series.
 - b. Amerex.
 - c. J. L. Industries, Inc., a division of Activar Construction Products Group.
 - d. Potter Roemer LLC.
 - e. Comparable products from other manufacturers may be used when submitted to and accepted by Architect prior to bidding.
 - 2. 104413.A03 - Steel Cabinet, Non-rated, Semi-recessed. 2-1/2" Rolled.
 - a. Type 03: Semi-recessed Non-rated Cabinets: Larsen's Manufacturing Company; Architectural Series, Model 2409-6R.
 - 3. 104413.A04 - Steel Cabinet, Non-rated, Surface Mounted.
 - a. Type 04: Surface Mounted Non-rated Cabinets: Larsen's Manufacturing Company; Architectural Series, Model 2409-SM.
 - 4. 104413.A23 - Steel Cabinet, Fire-rated, Semi-recessed. 2-1/2" Rolled.
 - a. Type 23: Semi-recessed Mounted Fire-rated Cabinets: Larsen's Manufacturing Company; Architectural "Flame-Shield" Series, Model FS-2409-6R.
 - 5. 104413.A41 - Fire Hose Cabinet.
 - 6. 104413.A42 - Fire Valve Cabinet.
- B. Cabinet Construction:
 - 1. Type #: Nonrated.
 - 2. Type #: 2-hour fire rated.
 - a. Fire-Rated Cabinets: Construct fire-rated cabinets with double walls fabricated from 0.0428-inch-thick, cold-rolled steel sheet lined with minimum 5/8-inch- thick, fire-barrier material. Provide factory-drilled mounting holes.
- C. Cabinet Material: Steel sheet.
 - 1. Shelf: Same metal and finish as cabinet.
- D. Semi-recessed Cabinet: Cabinet box partially recessed in walls of sufficient depth to suit style of trim indicated; with one-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend). Provide where walls are of insufficient depth for recessed cabinets but are of sufficient depth to accommodate semi-recessed cabinet installation.
 - 1. Rolled-Edge Trim: 2-1/2-inch backbend depth.
- E. Surface Mounted Cabinet: Cabinet box fully exposed and mounted directly on wall.
- F. Cabinet Trim Material: Same material and finish as door.
- G. Door Material: Aluminum.
- H. Door Style: Vertical duo panel with frame.
- I. Door Glazing: Tempered break glass, clear.
- J. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
 - 1. Provide projecting door pull and friction latch.
 - 2. Provide continuous hinge, of same material and finish as trim, permitting door to open 180 degrees.
- K. Accessories:

1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
2. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated.
 - a. Identify fire extinguisher in fire protection cabinet with the words "FIRE EXTINGUISHER."
 - 1) Location: Applied to cabinet door.
 - 2) Application Process: Pressure-sensitive vinyl letters.
 - 3) Lettering Color:
 - (a) Red.
 - 4) Orientation: Vertical.
- L. Cabinet Finish:
 1. Field painted cabinets.
 2. Manufacturer's standard baked-enamel paint for the following:
 3. Interior of cabinet to match exterior.
 4. Door and Trim: Match fire extinguisher door face finish.

2.3 FABRICATION

- A. Fire Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
 1. Weld joints and grind smooth.
 2. Provide factory-drilled mounting holes.
- B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles selected.
 1. Fabricate door frames of one-piece construction with edges flanged.
 2. Miter and weld perimeter door frames.
- C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.4 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces of fire protection cabinets from damage by applying a strippable, temporary protective covering before shipping.
- C. Finish fire protection cabinets after assembly.
- D. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.5 STEEL FINISHES

- A. Surface Preparation: Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning". After cleaning, apply a conversion coating suited to the organic coating to be applied over it.
- B. Baked-Enamel or Powder-Coat Finish: Interior box finish, immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils.
 1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine walls and partitions for suitable framing depth and blocking where semi-recessed cabinets will be installed. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare recesses for semi-recessed fire protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

- A. General: Install fire protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.
- B. Fire Protection Cabinets: Fasten cabinets to structure, square and plumb.
 - 1. Fasten mounting brackets to inside surface of fire protection cabinets, square and plumb.
 - 2. Fire-Rated, Cabinets:
 - a. Install cabinet with not more than 1/16 inch tolerance between pipe OD and knockout OD. Center pipe within knockout.
 - b. Seal through penetrations with firestopping sealant as specified in Division 07 Section "Penetration Firestopping."
- C. Identification: Apply vinyl lettering at locations indicated.

3.4 ADJUSTING AND CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as fire protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.
- B. Adjust fire protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly. On completion of fire protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.
- C. Touch up marred finishes, or replace fire protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire protection cabinet and mounting bracket manufacturers.
- D. Replace fire protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 104413

SECTION 104416 - FIRE EXTINGUISHERS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.5 COORDINATION

- A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Six years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

- A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet and mounting bracket indicated.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Amerex Corporation.
 - b. JL Industries, Inc.; a division of the Activar Construction Products Group.
 - c. Larsens Manufacturing Company.
 - d. Potter Roemer LLC.
 - e. Comparable products from other manufacturers may be used when submitted to and accepted by Architect prior to bidding.
 - 2. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B, and bar coding for documenting fire-extinguisher location, inspections, maintenance, and recharging.

- B. Multipurpose Dry-Chemical Type (104416.A01): UL-rated 3-A:40-B:C, 5 lbs. nominal capacity, with mono-ammonium phosphate-based dry chemical in manufacturer's standard enameled container.
 - 1. Basis of Design Product: Subject to compliance with requirements provide Amerex B402.
- C. Multipurpose Dry-Chemical Type (104416.A01): UL-rated 4-A:80-B:C, 10 lbs. nominal capacity, with mono-ammonium phosphate-based dry chemical in manufacturer's standard enameled container.
 - 1. Basis of Design Product: Subject to compliance with requirements provide Amerex B456.
- D. Wet-Chemical Type (104416.A02) Bracket Mounted: UL-rated 2-A:1-B:C:K, 1.6 gal. nominal capacity, with potassium acetate-based chemical in stainless-steel container, with pressure indicating gage.

2.3 MOUNTING BRACKETS

- A. Mounting Brackets: Manufacturer's standard galvanized steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Examine fire extinguishers for proper charging and tagging.
 - 1. Remove and replace damaged, defective, or undercharged fire extinguishers.
- B. Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.
 - 1. Mounting Brackets: 48 inches above finished floor to top of fire extinguisher.
- C. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION 104416

SECTION 114000 - FOOD SERVICE EQUIPMENT

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 the work of this Section. As defined, the Coordinating Trade shall be solely responsible for assigning and dividing the work among the Trades as necessary to accomplish the requirements of the Contract Documents.
- B. Related Sections: Refer to the following Sections and their Sub-Sections for materials, installation, and code requirements related to surrounding surfaces, mechanical and electrical rough-ins and connections to Food Service Equipment specified here-in. Refer to Part 1.6/B - Coordination, "Architectural, Plumbing, Mechanical, Electrical, and Food Service Requirements" within this Section for related work to be completed by the Trades responsible for the following Divisions.
 - 1. Divisions 02 through 14 (excluding Section 114000) and Architectural drawings for materials, construction, installation, and code requirements related to adjacent/surrounding/abutting construction at food service equipment.
 - 2. Section 033000 "Cast-in-Place Concrete" for the following:
 - a. Exterior pads for walk-in condensing units
 - 3. Division 22 Sections for service rough-ins; drain traps; atmospheric vents; valves, pipes, and fittings; and other materials required to complete food service equipment installation.
 - 4. Division 26 Sections for connections to fire alarm systems, wiring, disconnect switches, and other electrical materials required to complete foodservice equipment installation.
 - 5. Division 27 Sections for data, voice, and audio-video communication systems.
 - 6. Divisions 28 Sections for electronic safety and security systems.

1.2 SUMMARY

- A. This Section includes equipment for the food service facilities indicated in the drawings. The extent of food service equipment work is indicated on drawings and by the provisions of this Section, including schedules and equipment lists associated with either the drawings or this section.
- B. Upon request, the successful bidding Provider of Food Service Equipment shall be required to provide an itemized breakdown of cost for each individual equipment item. Owner will use the list, when necessary, for value engineering only.
- C. Installation shall include uncrating, setting-in-place, cleaning and leveling of new equipment, so it is ready for fittings / controls installation & utility connections by other Trades. Installation shall also include removal, relocating, modifying (when specified), cleaning (of construction generated soils & debris), re-installing and leveling of current equipment designated to be relocated, as hereinafter specified, so it is ready for fittings and controls installation & utility connections by other Trades. Currently installed equipment is presently in operation within the existing kitchen. The Owner will relocate all small wares, utensils, etc. Coordinate moving of all existing equipment required to be relocated in order to perform the work of this Section with Owner, Architect, and other Trades. Currently installed equipment requiring temporary storage during construction shall be relocated by the Provider of Food Service Equipment and stored in a space provided by the Owner within the facility. Equipment designated for relocation is the responsibility of the Provider of Food Service Equipment during construction and any damage to such will be its responsibility. Disconnection of currently installed equipment from electrical, mechanical, and plumbing service shall be done by other Trades. Plumbing, mechanical, and electrical connections to new and relocated equipment shall be done by other Trades.
- D. Removal of currently installed equipment, installation of relocated / new equipment, and phasing of this work must be coordinated with the Owner.
- E. The Provider of Food Service Equipment, before submitting its bid and having reviewed the plans and specifications, shall be fully satisfied as to its obligations as stated in these specifications, as shown on the drawings, and as otherwise required for a completed and properly operating installation at project completion. No allowance will be made to the Provider of Food Service Equipment for any error or obvious oversight on its part not called to the attention of the Food Service Consultant at least ten (10) days prior to bidding.
- F. Provide as part of the Contract, a qualified food service equipment project foreman at the job site, during all phases of construction relating to this contract. Foreman shall have the technical expertise to handle all phases of

equipment installation. Foreman shall coordinate roof curb installation, recessed floor slab layout, roughing-in equipment, equipment installation and connections, with all other Trades at job. Foreman shall answer questions and determine locations for making required cut outs, etc., for satisfactory final installation. Discrepancies between food service requirements and plumbing, mechanical and electrical work shall be immediately forwarded to Architect/Food Facilities Consultant in writing.

- G. The specifications and drawings are complementary, and what is called for by the one shall be binding as if called for by all. Verification of quantities is the responsibility of the Provider of Food Service Equipment.
- H. Connection Plan drawings reflect point of connection locations on equipment and not rough-in locations.
- I. Definitions:
 - 1. Reference to Food Facility Consultant, whenever used in these specifications, shall mean mha Food Facility Consultants, LLC; 7840 Conser Street; Overland Park, KS 66204; phone 785-266-5696; email mike@mhaconsulting.com.
 - 2. These specifications are in abbreviated form and contain incomplete sentences. Omissions of words or phrases such as "The provider of food service equipment shall", "Shall", "shall be" "as noted on drawings", "according to the drawings", "a", "an", "the" and "all" are intentional. Omitted words and phrases shall be supplied by inference.
 - 3. "By Alternate" refers to a designated equipment item which shall be provided by the Food Service Equipment Provider upon acceptance of an Alternate as described in Division 01 of this specifications.
 - 4. "By Base Bid" refers to required equipment which may be substituted with the acceptance of an item designated as "By Alternate".
 - 5. "By Owner" refers to Owner-Furnished Equipment; equipment/items to be relocated/provided by the Owner or its supplier and is outside the contractual obligations of this project.
 - 6. "Contract Documents" consists of the agreement between the Owner and Trade(s) (prime and secondary) and all requirements therein related to Section 114000 Food Service Equipment including but not limited to: conditions of the contract (Division 01, general and supplementary); all specifications; all drawings; all addenda issued prior to receiving of bids; all modifications, all change orders and all construction change directives.
 - 7. "Coordinating Trade" or "Trade responsible for coordinating all construction" refers to the person/entity/contractor solely responsible for supervising and directing the work as identified in the Owner/Contractor agreement.
 - 8. "EC" refers to the Electrical Trade.
 - 9. "Electrical Trade" refers to the person/entity/contractor solely responsible for providing the electrical work associated with installation and equipment connection.
 - 10. "Equipment" means food service equipment unless otherwise designated.
 - 11. "Existing" items are currently installed in the kitchen area being remodeled. They remain in their current installation location with no alteration except where noted as "MODIFIED". Removal/reinstallation, as necessary for other construction processes (i.e. new floors, etc.), is the responsibility of the food service equipment provider to determine and administer.
 - 12. "FSC", "Food Service Equipment Provider", "Provider of Food Service Equipment" and "Trade responsible for food service equipment" refer to the trade or entity solely responsible for providing, supplying and installing food service equipment specified herein (Section 114000) and as shown on the Food Service (FS) drawings.
 - 13. "Foreman" within this section, means the Provider of Food Service Equipment and its Foreman, unless otherwise indicated.
 - 14. "Future" designates equipment which is a basis for design and which the Owner will be procuring at a subsequent date. Equipment designated as such is not required (Not In Contract) and reference to "Provide" shall be interpreted to mean these items and their components/accessories/configurations will be provided as specified herein when the Owner chooses to do so.
 - 15. "GC" refers to the Coordinating Trade.
 - 16. "Install" means assemble/set in place and/or mount equipment ready for installation by other Trades of fittings and accessories supplied by the Food Service Equipment Provider as well as connections/interconnections by other Trades.
 - 17. "Installer" refers to the Trades (Coordinating, Mechanical, Plumbing and Electrical) and their sub-Trades who are responsible for unpacking, setting in place, leveling, caulking, connecting and cleaning equipment which has been "Supplied By Owner".
 - 18. "MC" refers to the Mechanical Trade.
 - 19. "Mechanical Trade" refers to the person/entity/contractor solely responsible for providing the mechanical work associated with installation and equipment connection.
 - 20. "Modified" refers to an alteration /change to be made by the Food Service Contractor to an existing or relocated item of food service equipment, as specified.
 - 21. "Other Trades" refers to Trades other than those responsible for providing food service equipment as specified in 114000.
 - 22. "PC" refers to the Plumbing Trade.

23. "Plumbing Trade" refers to the person/entity/contractor solely responsible for providing the plumbing work associated with installation and equipment connection.
24. "Provide" means to acquire and install.
25. "Provider" refers to the Trade responsible for acquiring and installing items designated as "Required".
26. "Relocated" refers to equipment to be moved, by the Food Service Equipment Provider, from its currently installed location, as described.
27. "Required" or "Req'd" designates an obligation by the Food Service Equipment Provider to supply/provide the designated equipment item/service as specified.
28. "Scrap" items become the property of the Food Service Equipment Provider for removal from the site and disposal.
29. "Salvage" items remain the property of the Owner and are to be removed from the existing kitchen and provided to the Owner at an Owner designated location for their removal from the site.
30. "Standard," "Standard Construction," "Specification of Standard," "Standard Specification(s)" refer to construction techniques, materials, methods and configurations specified in Part 2.2/B "Specification of Standard for Custom Fabricated or Modified Equipment" within this Section.
31. "Supply" means to acquire and relinquish to other Trades for installation.
32. "Trade" refers to the person/entity/contractor solely responsible for providing the construction activity associated with the use of the term.
33. "Vendor" refers to an Owner contracted supplier, outside the contractual obligations of this project, who will provide the designated equipment at the direction of the Owner.

1.3 SUBMITTALS

- A. Rough-in Plans: Dimensioned rough-in plans and diagrams prepared for this project must be submitted within thirty (30) days after receipt of Contract. Submit dimensioned Electrical, Plumbing, and Mechanical rough-in plans FOR ALL UTILITIES SHOWN ON THE CONNECTION PLAN, inclusive of rough-ins associated with utilities not directly associated with equipment provided by the Food Service Equipment Provider (i.e. convenience outlets, future/by Owner equipment, etc.). The utility rough-in plan shall be a "rough-in" plan and not a "point-of-connection" plan. It shall include the following for all shown/specified as Required, By Base Bid and By Owner equipment:
 1. Equipment identification on all equipment and rough-in plans, equipment and rough-in list stainless steel schedules and notes shall reference the same Item No. designated on the contract document FS plans, and as designated here-in.
 2. A Food Service Equipment Plan which clearly shows equipment locations with dimensionally correct equipment outlines and clearances and architecturally related notes and dimensions, as required for general building construction and equipment installation, shall be included. Plan equipment shall be designated with its item number. An equipment schedule with item number, quantity, description, and remarks/notes shall be provided.
 3. Two (2) separate plans, one each for plumbing/mechanical and electrical, which clearly show lateral and longitudinal dimensions of electrical receptacle stainless steel switches/junction boxes, water lines, waste lines, floor sink/drains/troughs, and hood location and as required for rough-in of utilities by other Trades. Floor sinks/drains shall be located so as to be accessible, allowing easy removal of the grate, and located not to be in conflict with table legs, cabinet toe bases or other non-mobile equipment.
 4. Lateral, longitudinal and height dimensions locating rough-in points for utility connections from fixed points (i.e. wall, columns, etc.). Where walls are directly adjacent to equipment, all Mechanical and Electrical rough-ins shall occur within those walls to minimize floor obstructions. Floor penetrating rough-in locations at island equipment locations (e.g., tables, sinks, etc.) shall be located under equipment adequately so as not to be exposed to ready abuse or present a hazard to the equipment user. Conduit stub ups at back-to-back tables shall occur between the tables, centered on the backsplashes and a minimum of 6 inches in from the table ends.
 5. Utility connection sizes, loads, characteristics, etc., for equipment at its rough-in points. Include additional notes, as necessary, to explain connection requirements to the Trade(s) responsible for making final connections.
 6. Utility sizing and locations in accordance with exact equipment to be provided/supplied and its installation.
 7. Diagrams showing proper assemblage, installation, and inter-connection/connection of parts provided /supplied by the Food Service Equipment Provider and installed by other Trades.
 8. Wall, roof, floor, and ceiling openings required for complete installation of equipment. Show dimensions /location of through wall openings for pass through cabinets.
 9. Notes explaining special or unusual conditions which affect the work of other Trades.
 - a. Note location of in wall blocking for wall supported equipment, shelving, cabinets, hand sinks, hand sink pedals.
 10. Schedules of symbols and abbreviations.
- B. Fabrication Drawings: Before start of equipment fabrications, submit Fabrication Drawings for custom built equipment including plans, elevations, and Sections. Fabrication Drawings shall be at a scale not less than 1" = 1'-0" and in full detail, complete with detail notes, materials listings with gauges, fixtures and fittings, and finishes. Drawings shall accurately represent the equipment as it is to be fabricated including: dimensions for all sizes and

locations; all punched holes; all coves; edge, backsplash and rim configurations; all underbracing, mounting brackets, support brackets; legs, casters and cross rails; disposer and work/scrap/wash sink bowls; undershelves and elevated shelves with in-wall blocking designated; drawers and enclosures; dish table configurations; exhaust ducts; chases, cabinet bases; receptacle boxes; field joints; etc. as specified herein and as shown.

- C. Product Data: Provide Buy-out Equipment Specification books containing manufacturer's technical product data and installation instructions on all non-custom, standard, manufactured equipment. Buy-out Equipment Specification books shall include the following for each equipment item, arranged by item number in the book:
1. A cover sheet listing the following:
 - a. Item Number
 - b. Quantity
 - c. Manufacturer and model number
 - d. Description
 - e. Electrical voltage/phase/amperage/wattage, NEMA plug configuration,
 - f. Options, accessories, and components as required by the contract documents and as necessary for proper operation and for accurately procuring the equipment.
 2. Manufacturer's standard catalog specification sheets with specifications, features, utility connection locations and requirements as necessary for the installing Trade(s) to make final connections. Where multiple equipment options /models /products exist on a specification sheet, highlight, or otherwise clearly mark, the specific item(s) proposed for delivery and installation.
 3. Submit color samples or swatches for buy-out equipment when selection is required.
- D. Unintentional approval of submitted incorrect/incomplete Shop Drawings and Specification sheet books shall not waive obligation of the Food Service Equipment Provider to provide/supply equipment, materials and construction methods as shown and specified herein.
- E. Operation and Maintenance Data: At minimum, furnish to the Owner three (3) sets of bound maintenance and parts manuals for all items of standard manufacture. Assemble manuals in book form, arranged by item number. Provide an index in the front listing Item No., Description as shown on Food Service Drawings and Manufacturer. Manuals shall also include copies of operating and maintenance instructions, adjustment and testing instructions, parts listing, and other applicable information necessary for proper maintenance and care of equipment. When available, provide equipment manufacturer's operation and maintenance videos in CD or DVD format. At least (1) one copy of the completed manual shall be available at the Owner demonstration for reference by the demonstrator and Owner.
- F. Authorized Service Agencies: At minimum, furnish to the Owner three (3) lists of local and/or nearby service agencies which have been authorized, by previous agreement with the provider of food service equipment, to make emergency service calls for each piece of custom built or buy-out food service equipment having mechanical or electrical components provided/supplied under this Contract. **Provide a minimum of two (2) service agencies, for each piece of equipment, from which the Owner may select.** List shall include specific equipment name, model no. and serial no., each authorized service agent's name, address, and phone number.
- G. Warranties: At minimum, provide to the Owner three (3) equipment warranty books. Provide at the front of each book a warranty listing in columnar form of all equipment used on the project. In landscape format, using Microsoft Word or similar word processing software, develop the warranty listing as follows:
1. Provide a header at the top of each page of the warranty listing, designating the Project Name, Food Service Equipment Provider Company Name, Project Manager, Address and Phone Number. Below this project information, in bold letters, designate the "Warranty Initiation Date _____" (Refer to 1.10 Service and Warranties).
 2. Below the header, designate across the top of each page, columns for Item No., Description, Manufacturer, Model No., Serial No., Warranty Period and Comments. Comments column used to designate specifics (where they apply) such as "year labor, 3 years materials" For items having multiple components with varying warranties, list each component and its information, on a separate line below the specific item number. Fill in all columns for each item.
 3. Additionally, provide in each warranty book a CD-R containing the warranty listing saved in an ASCII DOS Text format. CD-R shall be clearly labeled with project name and "KITCHEN EQUIPMENT WARRANTIES". Provide CD-R in a protective sleeve secured to the inside of the front leaf of the warranty book.
 4. Behind the warranty listing provide, in order by item number, the manufacturer's standard warranty certificates. Designate the item number on each certificate and fill in all appropriate information as required by the equipment manufacturer. Food Service Equipment Provider is responsible for submitting to the manufacturer all appropriate information for initiating warranties.

1.4 QUALITY ASSURANCE

- A. Mechanical, plumbing, and electrical custom fabricated and buy-out equipment, work, materials, and installation shall meet applicable regulations and codes, including but not limited to:
1. ADA (Americans with Disabilities Act): Foodservice serving line equipment shall be accessible to the physically challenged.
 2. AGA (American Gas Association): Provide gas burning equipment which complies with and is listed by the AGA.
 3. ANSI (American National Standards Institute) Standards: electric powered and gas-burning appliances, plumbing fittings including anti-siphonage water fittings and compressed gas piping shall meet applicable standards of the American National Standards Institute.
 4. ASHRAE15, "Safety Code for Mechanical Refrigeration."
 5. ASME (American Society of Mechanical Engineers): Provide steam-generating and direct-steam heating equipment that is fabricated and labeled to comply with ASME Boiler and Pressure Vessel Code.
 6. BISSC (Baking Industry Sanitation Standards Committee) Standards: Provide bakery equipment that complies with BISSC's "Sanitation Standards for the Design and Construction of Bakery Equipment and Machinery."
 - a. Provide BISSC-certified equipment.
 7. Clean Air Act for Stationary Refrigeration and Air Conditioning. (Protection of the Ozone, Recycling and Emission Reduction Program).
 8. Energy Independence and Security Act of 2007: Walk-in refrigerators/freezers and their refrigeration systems shall comply.
 9. Health Codes: National, State and Local which have jurisdiction, including, but not limited to the following:
 - a. Kansas Department of Agriculture, Kansas Food Code 2012.
 - b. City and local jurisdictional health and sanitation requirements.
 10. IMC (International Mechanical Code).
 11. IPC (International Plumbing Code).
 12. Montreal Protocol for installation and use of non-CFC content refrigerants and reduced HCFC content refrigerants.
 13. NEC (National Electric Code).
 14. NEMA (National Electric Manufacturers Association); Electrically operated buy-out and custom fabricated equipment shall conform to latest standard of National Electric Manufacturers Association.
 15. NFPA (National Fire Protection Association) Codes: equipment shall be manufactured and installed in accordance with applicable standards of the National Fire Protection Association (NFPA) codes including:
 - a. NFPA 54 - National Fuel Gas Code.
 - b. NFPA 70 - National Electrical Code.
 - c. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.
 - d. NFPA 17A - Standard for Wet Chemical Extinguishing Systems. Provide, for each equipment item protected by the hood fire suppression system and mounted on casters, four (4) caster centering guides, one at each equipment caster with the equipment setting in its protected location. This will identify the proper location for equipment during operation. Owner should acknowledge in a written statement that the casters /legs of movable equipment under the hood are to be setting within the caster centering guides before equipment is operated.
 16. NSF (National Sanitation Foundation) Standards: Provide equipment that bears NSF Certification Mark or UL Classification Mark certifying compliance with applicable NSF/ANSI standards.
 17. SNAP (Significant New Alternatives Policy): Refrigerants, foam blowing agents, their use and installation must be compliant with the Environmental Protection Agencies SNAP program for the safe and smooth transition away from ozone depleting compounds through the use of alternative refrigerants.
 18. UL (Underwriters Laboratories) Certification: Provide electric and fuel-burning equipment and components that are evaluated by UL for fire, electric shock, and casualty hazards according to applicable safety standards and that are UL certified for compliance and labeled for intended use.
 - a. UL 2162 for solid fuel-fired ovens.
 - b. UL 710 for commercial exhaust hoods
 19. USC Foundation for Cross-Connection Control and Hydraulic Research Standards: anti-siphonage/back flow preventers must be on the "List of Approved Backflow Prevention Assemblies" that is published by the Foundation for Cross-Connection Control and Hydraulic Research, University of Southern California.
- B. Provider of Food Service Equipment Qualifications: The company or its sub-Trades shall:
1. Be regularly engaged in the supplying and installation of food service equipment of types, capacities, and sizes required by this contract, whose products have been in satisfactory use in similar service for not less than 5 years.
 2. Have technical personnel experienced in all aspects of procuring and installing the food service equipment specified here-in.
 3. Have the financial ability to handle this project and be able to provide documentation supporting their capacity to the Owner's satisfaction.

4. Be regularly engaged in the manufacture of custom built food service equipment with the necessary facilities, manufacturing equipment and personnel to draw and manufacture food service equipment of the highest quality in accordance with the best accepted practices of the industry.
 5. Have successfully completed installations of similar size and complexity.
 6. Have expertise in field welding, finishing, and adjustment of equipment to fit field conditions with a neat and uniform installation per the best accepted practices of the industry.
- C. When requested by the Food Facility Consultant, bidding Provider of Food Service Equipment and its sub-Trades shall provide qualification information including a list of previous similar projects and their locations, the monetary size of each project contract and an Architect/Food Facility Consultant/Owner reference contact for each contract.

1.5 PROJECT CONDITIONS

- A. Delivery, Storage, Handling: New equipment shall be delivered in factory-fabricated containers designed to protect equipment and finish until final approval. Coordinate size of access and route to place of installation. Make arrangements to receive equipment at the project site. The Provider of Food Service Equipment is responsible for determining when construction activities are sufficiently complete to begin installations without risking damage to the equipment and for protection of the equipment until final approval.
- B. Site Visits: Food Service Equipment Provider shall visit site to:
1. Direct, check, and verify location of all rough ins before floor slabs are poured
 2. Coordinate floor drain /sink locations and elevations
 3. Coordinate recessed floor pits for walk-in installation
 4. Check framing and take all field measurements
 5. Make templates of field wall/floor conditions for accurate fabrication of equipment
 6. Supply and provide equipment to fit job conditions
 7. Direct Coordinating Trade(s)
 8. Oversee installation of wall reinforcement/blocking for equipment secured on the wall
- C. Equipment shall be consistent with these specifications and accompanying Drawings.
- D. All questions concerning this contract shall be directed to the Architect/Food Facilities Consultant.
- E. Install work as shown on Drawings. Examine job conditions and advise Architect/Food Facility Consultant in writing, before starting work, if any changes are required because of discrepancies between Specifications and Drawings and actual conditions.
- F. All equipment shall fit space provided and job conditions. Conditions causing major or unusual alteration to specified equipment shall be brought to the Architect's/Food Facilities Consultant's attention in writing, before equipment is constructed or installed. Minor adjustments of equipment to fit field conditions, including added length, are the responsibility of the Provider of Food Service Equipment and not grounds for an additional charge.
- G. It is the purpose of these Drawings and Specifications to procure Food Service Equipment, both special fabricated items and items of general manufacture that conform to the best operating policies of the industry. These items have been selected as preferred items as a result of past experiences in functional design, construction, material and in maintenance and repair.
- H. The bidding Food Service Equipment Provider is responsible for providing a bid amount for each piece of equipment shown or specified. If equipment specified has been discontinued, bidder shall submit a comparable piece for approval at least 10 days prior to the bid date. Manufacturer discontinuance does not relieve the bidder from providing a comparable piece of equipment.
- I. Buy-out or equipment of standard manufacture shall be of latest model or succeeding model at time of delivery and include all standard accessories as designated in the latest catalog.
- J. Non serial numbered equipment and equipment which does not require field measurement for accurate fabrication may be purchased following approval of shop Drawings and stored in its factory provided packaging/crating in a bonded warehouse (per the requirements of Division 01) until the installation date. Installed equipment shall be new without damage or physical deterioration. Warranties on all operational equipment items shall comply with 1.7 Warranty, paragraph D - Initiation of Warranty.
- K. All equipment, except that designated as "Relocated" and "Existing", shall be provided with parts and accessories that are new and without previous use, and shall meet all conditions required for this project.
- L. Equipment price increases not included in bidder's proposal will not be allowed after the bid opening.

1.6 COORDINATION

- A. Coordinate the work of this contract with the work of other Trades at the project site and schedule the work with overall project progress.
1. Verify Coordinating Trade is aware of clearance/air gap requirements around the perimeter of the walk-in cooler / freezer units as indicated on the drawings.
- B. Architectural, Plumbing, Mechanical, Electrical, and Food Service Requirements
1. It is the intent of this specification that the Food Service Equipment Provider will provide and supply all foodservice equipment and associated accessories, with the Trades responsible for mechanical, plumbing, and electrical work installing said accessories and providing all necessary materials and labor for all rough-in, inter-connections and final connections necessary for the proper operation of the equipment. The Food Service Equipment Provider shall oversee proper connections to the equipment.
 2. The Trade(s) responsible for work in Architectural Divisions 02 through 14 (excluding Section 114000) will furnish materials, labor, and construction for surfaces adjacent to, surrounding, or abutting food service equipment specified herein, including, but not limited to, the following:
 - a. Walls, ceilings, floors, and their related finishes.
 3. Plumbing Trade's Responsibility: Furnish labor and material to rough-in, interconnect, and make connections and interconnections to equipment as here-in specified and as shown and noted on the contract document Drawings including, but not limited to, items designated as "G", "H", "C", "D", "IW". Provide complete, ready for use installation of items designated as "BY PC" and "BY PLUMBING TRADE". Test food service equipment internal piping systems for possible leaks incurred during shipping. Install hard piping and reducer fittings necessary to extend piping to connection points on the equipment. The Trade responsible for plumbing work shall install and connect equipment accessories supplied by the Provider of Food Service Equipment including, but not limited to, the following:
 - a. Wall sleeves for routing of refrigeration lines through walls, as located by Trade responsible for food service equipment.
 - b. Walk-in evaporator condensate lines
 - c. Miscellaneous fittings required for proper operation of equipment shown and specified, unless noted otherwise.
 - d. The Plumbing Trade's responsibility includes but is not limited to providing floor sinks and drains; piping for water, waste, and gas; shut-off and stop valves; grease traps and interceptors, "P" traps, unions, back flow prevention devices (except as provided within this Section, ref. specific equipment items) etc., as required for proper operation of the equipment. Plumbing work shall comply with Divisions 21 and 22 of the specifications.
 4. Mechanical Trade's Responsibility: The Trade responsible for mechanical work will furnish labor and material to rough-in, inter-connect, and make connection to equipment as here-in specified and shown/noted on the contract document Drawings. Mechanical work shall comply with Division 23 of the specifications and shall include items designated "BY MC" and "BY MECHANICAL TRADE."
 5. Electrical Trade's Responsibility: The Trade responsible for electrical work will rough-in, inter-connect, and make connection /interconnection to equipment as herein specified and shown/noted on the contract document Drawings including but not limited to: connections to control/J-boxes designated as "EC" on the connection plan; provide final and ready for use installation of items designated "ER", "BY EC" and "BY ELECTRICAL TRADE"; inspect and tighten loose electrical connections caused by shipping. The Trade responsible for electrical work will install and/or connect/interconnect equipment accessories supplied by the Provider of Food Service Equipment including but not limited to:
 - a. All remote condensing units, evaporators, and related time clocks and accessories.
 - b. All walk-in box related solenoids, contactors, controls, lights, door heaters, threshold heaters, vent heaters, thermostats, etc.
 - c. Miscellaneous components required for proper operation of equipment shown and specified, unless noted otherwise.
 - d. The Electrical Trade's responsibility will include but is not limited to conduit, wiring, fittings, switches, line and disconnect switches, etc., as required for proper operation of the equipment. Electrical work shall comply with Division 26 of the specifications.
 6. Food Service Contractor Responsibility: The Provider of Food Service Equipment shall supply for installation by other Trades the accessories noted in the work of other Trades above and as specified herein. The Provider of Food Service Equipment will provide /install the following food service equipment, ready for installation of accessories and utility connections /interconnections by the Plumbing, Mechanical and Electrical Trades:
 - a. Walk-in boxes, condensing units, evaporators, and refrigerant piping
- C. The manufacturer of food service equipment shall pre-wire or wire all new food service equipment and accessories to the designated "EC" control or junction box on the equipment for installation of accessories and connection /interconnection by the Trade responsible for electrical work, unless noted otherwise. The manufacturer of food service equipment shall extend plumbing and mechanical systems to a designated utility

connection point on all new equipment for installation of accessories and final connection by the Trade(s) responsible for plumbing and mechanical work, unless noted otherwise.

- D. Supply each motor driven appliance or electrical heating unit with suitable starter of correct type or control switch in accordance with the UL listing. Provide motors with overload protection. All other line switches, fittings, and connections shall be furnished and installed by the Trade responsible for electrical work, except as otherwise specified.
- E. Internal wiring, electrical devices, controls, switches, etc., built into or forming an integral part of custom fabricated equipment shall be furnished and installed by the Trade responsible for electrical work. Said work shall be installed in electrical outlet/switch boxes provided in/on the equipment by the Provider of Food Service Equipment. All wiring /conduit above 34 inches AFF shall be routed in chases or shelf supports or otherwise concealed from view.
- F. Electrical cord lengths shall be suitable for installation conditions. Neatly coil and fasten excess cord length in place with approved nylon cable straps, clamps, or equally suitable device to insure against accident or damage to cords. Coil and strap excess cord length on all equipment.
- G. The Provider of Food Service Equipment shall verify and coordinate all plug types to assure proper mating with receptacles provided by the Trade responsible for electrical work.

1.7 WARRANTY

- A. The Food Service Equipment Provider shall fully guarantee /warranty all work and materials for a minimum period of one (1) year from date of acceptance.
- B. Provide five (5) year warranty for motor-compressor at each remote or self-contained condensing unit supplied with buy-out or custom fabricated refrigeration equipment provided under this Contract.
- C. Extended warranties and conditions of service on items of standard manufacture, as established by manufacturer of such equipment, shall apply where extending beyond warranty and conditions of service set forth in these Specifications. Provide manufacturer's written warranty to the Owner when any guarantee or warranty extends beyond the above-mentioned one (1) year warranty period.
- D. Initiation of warranty period shall occur on the First Day of Effective Use of equipment by the Owner. First Day of Effective Use will be the first day, following substantial completion acceptance, that the kitchen is used to produce a full meal. Equipment start-up and testing by the Food Service Equipment Provider, its subcontractors, service agents or other parties /Trades responsible for setup or connections, will not start the warranty period. Substantial Completion Acceptance of food service equipment shall not be interpreted to be the initiation of the warranty period unless it falls within 30 days prior to the First Day of Effective Use. Food Service Equipment Provider shall notify Food Service Consultant/Architect in writing at least 10 days prior to bid date of Manufacturers who are not accepting of this policy. Rejection of this policy is grounds for disallowance of manufacturer's equipment. Manufacturer's equipment which is bid is understood to be in acceptance of this policy.
- E. Immediately upon written notice from Owner, and as directed, the Provider of Food Service Equipment agrees to repair or replace, without cost to Owner, defects in workmanship of materials not due to abuse appearing within above mentioned time. Trips to job for servicing of equipment under guarantee shall be made without charge, but such trips shall be made only at the direction of Owner or Owner's previously identified agent.

1.8 REFRIGERATION REQUIREMENTS

- A. Walk-in refrigerators/freezers and their refrigeration systems shall comply with the Energy Independence and Security Act of 2007, Section 312.
- B. The Food Service Equipment Provider shall supply and install, ready for all connections, all remote compressors and accessories for Food Service Equipment as specified herein. The Trades responsible for electrical and plumbing work will rough-in, inter-connect and connect-up equipment and accessories.
- C. The Food Service Equipment Provider shall do all "Refrigeration Installation".
- D. "Refrigeration Installation" shall include uncrating and setting-in-place of compressors and accessories, installation of refrigerant lines and refrigeration accessories, initial charge of refrigerant for each system, system(s) start-up, testing and temperature adjustment.
- E. Installation Requirements:

1. Refrigeration system manufacturer shall size refrigerant lines to operate units at the temperatures required. Refrigerant piping to remote compressors shall be field installed (non-pre-charged) Type "L" copper, labeled ACR, with wrought copper fittings and sweat solder joints. Make connections with silver solder having melting point of not less than 1000 deg F. Run and test refrigeration systems and piping prior to application of insulation. After successfully testing, evacuate system and charge per manufacturer's recommendations.
 2. Insulate suction lines per applicable code requirements for composite smoke and fire hazard. Insulation shall be 3/4-inch "Armaflex AP", black, flexible, elastomeric tubing with flame spread rating of 25 or less and smoke developed rating of 50 or less. Cover fittings with "Armaflex AP" blanket and wrap with vapor proof tape. "Armaflex" blanket shall be neatly applied with no buckles or gaps using the manufacturer's recommended adhesive and installation procedures. Seal seams weather tight with longitudinal seams at bottom of pipe.
 3. Protect "Armaflex AP" installed outside the building envelope with PVC sleeving sealed with vapor barrier adhesive and strapped at 18 inches O.C. and at each 90 deg. fitting with non-removable plastic strapping.
 4. Support exterior vertical and horizontal refrigerant lines at 6'-0" O.C. maximum with adjustable hangers and supports secured to the building structure to prevent movement. Exterior piping shall be routed tight to exterior vertical surfaces at a maximum of 6 inches above horizontal surfaces. Support interior refrigerant lines at maximum 6'-0" O.C. horizontally and 10'-0" O.C. vertically with adjustable hangers and supports secured to the building structure to prevent movement. Insulate hangers and supports from direct contact with cold surfaces using 1-inch plastic foam inserts, premolded pipe insulation or wood blocking of same insulating value as adjacent insulation. Protect insulation with insulation shields supporting the lower 180 deg. of pipe insulation.
- F. Provide initial charge of refrigerant for each refrigeration system. Provide initial charge of lubricating oil, for compressor unit, in accordance with manufacturer's recommendation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. The food service equipment bid shall quote only the manufacturers listed within the specification or addenda. Hereinafter, where specific mention is made of catalog number of any particular manufacturer or Trade name, it shall be understood that such mention is made for purpose of establishing type, design and/or quality of material and equipment desired. Food Facilities Consultant will review equipment submitted by other than specified manufacturers for acceptance as an equivalent to the specified equipment if submitted no later than 10 days prior to the bid date. All equipment submitted must meet or exceed the quality, design, and function of the specified equipment. The food service equipment bidder requesting review of the alternative manufacturer shall submit complete construction details, brochures and comparison sheets to the equipment specified. If the submitted equipment varies in size from the specified or will require any changes in the shown mechanical, electrical, ventilation or structural building systems, the bidder shall call these to the Architect's/Food Facility Consultant's attention in considering the submitted equipment. The bidder making such submission shall cover all costs for any modifications to equipment, mechanical, plumbing, electrical, ventilation or structural systems which may be necessary. Such equipment will be either approved, approved with requisites, or rejected and noted as such in the last addenda issued. Only equipment which is specified or approved as equivalent by addenda may be bid.

2.2 MATERIALS

- A. Sealants:
1. Sealant for Low Temperature Conditions; Adhesive sealant for low temperature use shall be Kason Industries; Model 3700; Rubbaseal Silicone Sealant. Premium grade, fully NSF certified silicone adhesive sealant; waterproof; air-cures overnight; tack-free in 15 minutes; standard temperature formula serviceable from -80 deg F to 450 deg F. (-62 deg to 232 deg C).
 2. Elastomeric Joint Sealant: ASTM C 920; Type S (single component), Grade NS (nonsag), Class 25, Use NT (nontraffic) related to exposure, and Use M, G, A, or O as applicable to joint substrates indicated.
 3. Cylindrical Sealant Backing: ASTM C 1330, Type C, closed-cell polyethylene, in diameter larger than joint width.

2.3 LIST OF EQUIPMENT

- A. Following is a detailed list of all equipment in the new food service area to be a part of this contract or provided by the Owner. All electrical equipment is 60 Hz. All items utilizing electrical power shall be UL or CSA listed.
- B. Refer to accompanying Food Service Equipment Drawings for equipment quantities and utility configurations required.

- C. Use of the terms "standard", "standard construction", "specification of standard" refer to construction techniques, materials, methods, and configurations specified in "Specification of Standard for Custom Fabricated or Modified Equipment" within this Section.
- D. Reference 1.2 - SUMMARY for terminology definitions.
- E. Equivalent manufacturers listed in this specification must provide equipment of similar size, configuration, construction, and capability with similar utility requirements to the specified primary manufacturer allowing its use without changes to the plan, the equipment's location or the plumbing /mechanical /electrical service designated within the contract documents. Listed equivalent manufacturers are responsible for verifying they comply with these requirements before submitting a bid.

**ITEM NO. A1 - WALK-IN COOLER / FREEZER
REQUIRED**

- A. General: Furnish all labor, materials, and equipment for complete installation of sectional walk-in cooler/freezer boxes as shown on drawings and specified herein. Boxes shall include lights, thermometers, and all accessories for complete first class installation. Provide condensing units, evaporators, refrigerant piping and refrigerant as specified. Comparable product manufacturers listed below must provide equipment of exact same dimensional size and comparable construction with similar utility requirements to the Basis-of-Design Product. Use of comparable product manufacturer's equipment shall not require changes to the plan, the equipment's location or to the plumbing / electrical utility services designated within the contract documents. Comparable product manufacturers are responsible for verifying they comply with these requirements before submitting a bid.
- B. Basis-of-Design Product: Subject to compliance with requirements, provide walk-in boxes as manufactured by Kolpak or a comparable product by one of the following:
 - 1. American Panel
 - 2. Bally
 - 3. Imperial Brown
 - 4. Norlake
 - 5. Masterbilt
- C. Energy Compliance: Walk-in coolers and freezers of less than 3,000 square feet shall comply with the Energy Independence & Security Act of 2007.
- D. Size: Design layout and overall size of walk-in boxes as shown on plans and as specified. Walk-in shall consist of two (2) storage compartments being separated by a common insulated wall. Each compartment shall be completely free of the other for use and operation. Boxes shall be installed on an existing concrete slab; see detail on drawings. Provide exterior ramp.
 - 1. Overall size: 9'-8" wide x 15'-5" long x 8'-6" high from underside of floor panels to top of ceiling panels.
 - 2. Cooler interior dimensions: 9'-0"W x 7'-2 1/2"L
 - 3. Freezer interior dimensions: 9'-0"W x 7'-2 1/2"L
- E. Field Measurement: Provider of walk-in shall field measure locations of walls / columns and other building constraints. Notify architect / food facility consultant of constraints which will require a reduction in walk-in box size before ordering.
- F. Floor Panels: Provide walk-in with minimum R-28, 4" thick insulated floor panels designed to withstand uniformly distributed loads of 1000 lbs. per square foot minimum and be suitable for light rolling cart traffic. Floor panels will be set on an existing concrete slab. Provide floor panels in maximum lengths and widths to minimize joints and avoid mid floor panel corners. Top of insulated floor panels shall be .100 smooth aluminum. Provide over the top of the smooth aluminum a floor wear surface of 1/8" aluminum tread plate meeting ASTM B632. Stagger joints in tread plate and offset them from insulated floor panel joints by a minimum of 18". Secure tread plate to insulated panels per manufacturer's recommendations. The composite tread plate and floor panel construction shall support minimum 400 lb point loading from casters.
 - 1. Interior Base Molding: At perimeter walls, provide a continuous 4"H embossed aluminum base molding with coved toe lapping onto the tread plate in accordance with NSF requirements. Secure base molding with water resistant adhesive and seal to floor tread plate.
- G. Wall & Ceiling Panels: Construct all exterior and interior panel surfaces exposed to view of .040 stucco-embossed aluminum with 4" U.L. fire rated flame retardant type urethane rigid insulation blown / expanded in between. Panel surfaces not exposed to view shall be 26 gauge Galvalume steel. Interior and exterior panel surfaces shall be roll-formed to provide a flange that extends into foam insulation for additional strength and adhesion. NSF listed gaskets shall be foamed-in-place to the male side of all panels, on both interior and exterior, for air-tight joints. Gaskets shall be impervious to stains, grease, oils, mildew, etc. Polyurethane insulation shall meet ASTM E84 flame spread of less than 25 and shall have a thermal conductivity (K factor) of .133 BTU/hr/ft² per degrees Fahrenheit/inch and an overall coefficient of heat transfer (U factor) of not more than .03. "R" factor shall be 31 or

greater. Insulation shall be blown using a non-CFC content blowing agent. Construct panels without internal wood or metal structural members and with 100% (excluding skins) polyurethane insulation. Foam hard rail construction is not acceptable. Provide 12"x12" 90 degree angled sections at all corners. Food service contractor shall provide penetrations thru insulated cabinet exterior and shall be responsible for sealing them.

1. Code Compliance: Provide verification, as required by the Authority Having Jurisdiction (AHJ), that the box complies with the code requirements for use of foam plastic insulation in buildings and structures. Cost of the verification shall be borne by the provider of the walk-in box.
 2. Assembly: Assembly of walk-in shall be accomplished by cam locks ("Posi-Locs"). Cam locks shall be foamed-in-place and activated by a hex wrench provided by the manufacturer. Access ports to locking devices shall be covered by snap caps. Access ports shall be on interior to allow assembly of walk-in from the inside.
 3. Exterior Wainscot: On exposed-to-view exterior of walk-in box panels, provide a 36"H wainscot of .100" mill finish aluminum tread plate, mechanically secured and sealed thereto.
 4. Floor Angle: At exposed exterior sides of the walk-in, provide at the floor a continuous 3" x 3" x .040 embossed aluminum angle matching exterior wall panel finish. Set angle in sealant at the floor and wall panels, and secure to floor and wall panels at 12" O.C.
- H. Freezer Pressure Relief: Provide pressure relief port in freezer wall. Factory-wire relief port to J-box at door section when possible.
- I. Entrance Doors and Door Panels: Doors shall be 36" x 78" swing-type, hinged and located as shown on plan. Set each door within an in-fitting door frame with vinyl frame and heavy gauge steel backup. Mount hardware to jig-located heavy plates. Provide door frame with a retainer to accommodate heater cable, alarm, and light management controls. Provide freezer door with pre-wired heater wires around perimeter of opening. Provide vapor proof light fixture and safety release on interior. PVC retainer on top and both sides of door shall contain a replaceable magnetic core gasket. Provide a double blade adjustable wiper gasket built into bottom of door. Deadbolt-locking handle shall have concealed fasteners, with entire locking system mounted to door frame using deadbolts extending across door face into door handle preventing access even if door handle is removed. Each doors shall be flush type, finished in and out to match the wall in which it is located.
1. Exterior Ramp: Provide manufacturer's standard 36" exterior ramp at cooler door.
 2. Closers: Provide each door with an automatic door closer that firmly closes door when shut to within 1 inch of full closure. All doors shall self-close.
 3. Heater Wires: Provide anti-sweat heater wires around perimeter of door openings and doors. Factory-wire heater wires to j-box at door section.
 - a. If non-heat controlled antisweat heater(s) are used at entry or reach-in door(s), the total door rail, glass and frame heater shall draw no more than 7.1 watts per square foot of door opening (for freezers) and 3.0 watts per square foot of door opening (for coolers).
 - b. If heat controlled antisweat heater(s) are used at entry or reach-in door(s), and the total door rail, glass, and frame heater power draw is more than 7.1 watts per square foot of door opening (for freezers) and 3.0 watts per square foot of door opening (for coolers), the antisweat heat controls shall reduce the energy use of the antisweat heater in a quantity corresponding to the relative humidity in the air outside the door or to the condensation on the inner glass pane.
 4. Hinges: Provide three (3) spring loaded, positively closing door hinges at each door.
 5. Sill Plate: Provide 14 gauge stainless steel sill plate with non-skid stripping.
 6. Alarm and Light Management System: Provide each compartment with an alarm & light management system. System shall have touch pad control with LED temperature display; high / low temperature alarms with delays and battery back-up. Features shall include the following:
 - a. Keypad-set high and low alarm points with adjustable 0 to 255 minute delays
 - b. Alarm resets when temperature returns to normal
 - c. Visual "HA" or "LA" will flash on the display along with the actual temperature
 - d. 8A "dry contacts" terminal used to trigger remote alarm devices
 - e. Door Open alarm with adjustable delay from 0 to 255 minutes
 - f. Visual and audible door open alarm
 - g. Light(s) controlled from the key pad
 - h. Light timer can turn off lights automatically in one to 255 minutes (adjustable)
 - i. Light(s) can be turned on by opening door; able to control up to 2000 watts of lighting
 - j. Bright red LED temperature readout from -40 to 230deg F
 - k. Adjustable display update time from one second to 4½ minutes.
 7. Junction Box: On the exterior of the door section, adjacent to the door latch side, provide a box for the walk-in alarm & light management system. Pre-wire system to a junction box & wall light fixture at the interior latch side upper corner of the door opening; conceal wiring in conduit within the insulated panel.
 8. Window: Provide a window in each door, minimum 14" x 14", centered at 60"AFF. Freezer door window shall be of triple pane glass with either heat-reflective treated glass or gas fill with heated frame. Cooler door window shall be double or triple pane glass with heat-reflective treated glass or gas fill. Windows shall be field replaceable.
 9. Locks: Provide each door with a cylinder operation dead bolt lock with safety release on inside. All doors shall be keyed alike. Provide five (5) keys.

10. Wainscoting: On exposed-to-view exterior and interior of walk-in doors and door panels, provide 36"H wainscoting constructed of .100 mill finish aluminum tread plate. Mechanically secure tread plate to door and seal thereto.
- J. Interior lighting
1. Door Lights: Provide, centered over door opening on the interior of each compartment, a Kason 1803 LED fixture with lamp, globe, and nightlight, or equivalent Jelly Jar light fixture with comparable LED bulb. 3 year limited warranty. cULus Listed US; NSF & RoHS compliant.
Dimensions, overall: 7-3/4" x 5-3/4"
 - a. Lumens: 1100
 - b. Lumens/Watt: 86
 - c. Amps: 130mA @ 120v, 50/60Hz
 - d. Watts: 11 W
 - e. CRI: 85
 - f. Temperature Ratings: -20°F to 90°F
 - g. Color temperature: 4000K
 - h. Life expectancy rating: 25,000+ hours
 2. Ceiling Lights: Supply for installation (by EC) where shown, two (2) Kason Industries model 1810LC LED surface mounted light fixtures (one each compartment), supplied with polycarbonate housing and lens. 5 year limited warranty on the light engine; LM-79 tested, LM-80. cULus listed; NSF listed.
 - a. Dimensions, overall: 46-7/16"L x 4-23/32"W x 3-9/32"H
 - b. Lumens: 4550
 - c. Voltage: 120-277 VAC
 - d. Lumens/Watt: 110
 - e. Amps: 0.4 @ 120VAC
 - f. Watts: 40 W
 - g. Power factor: 0.99
 - h. CRI: 84
 - i. Temperature Ratings: -40°F to 104°F
 - j. Color temperature: 4000K
 - k. Life expectancy rating: 50,000+ hours
- K. Structural Design: Structurally design ceiling sections to span area shown, without dip or bulge, in horizontal planes and provide exterior ceiling suspension beams where required.
- L. Vertical Trim: Provide vertical trim angle/flat strips and closures of same material and gauge as walk-in exterior wall surface(s), where walk-in is adjacent to interior or exterior walls, jambs and/or columns. Crimp all angle trim strip edges down slightly to hug adjacent surfaces. Attach trim strips with 1/8" aluminum pop rivets, using only minimum number required to give neat installation.
- M. Filler Panels: Provide filler panels of the same material and gauge as walk-in exterior wall surface at exposed edges along top of walk-in to finish ceiling. Each filler panel shall align with adjacent panels without gaps, tin-panning, or irregularities in appearance and shall extend full length of box plus wall closure trim. Panels shall fit tightly within ceiling and box face mounted channels. Provide closed outside corner trim where applicable.

**ITEM NO. A2 – CONDENSING UNIT / EVAPORATOR; -10°F FREEZER
REQUIRED**

- A. Furnish all labor, materials, and equipment for complete installation of walk-in freezer refrigeration system. System shall include expansion valve, solenoid valve, temperature control, sight glass, drier, head pressure control, cables, pilot lights, evaporator, air cooled condensing unit, low ambient kit, weather hood, crank case heater, accessories and all other required parts and refrigeration specialties for complete first class installation. Refrigerant shall be R448a and EPA (Environmental Protection Agency) SNAP (Significant New Alternates Policy) compliant for Remote Condensing Units (Split Systems). Install condensing unit, evaporator, non-precharged refrigerant piping and refrigerant as specified hereinafter. See Refrigeration Requirements paragraph of these specifications. Equivalent manufacturers, if approved, must provide equipment of similar dimensional size, and comparable construction and same or higher BTUH capacities with similar utility requirements to the refrigeration system on which this specification is based. Use of equivalent manufacturer's equipment shall not require major changes to the plan, the equipment's location or to electrical service designated within the contract documents. Any minor changes required are the responsibility of the provider to coordinate with other trades and all costs associated with changes shall be covered by the provider. Listed Equivalent manufacturers are responsible for verifying they comply with these requirements before submitting a bid.
1. Provide pre-fitted walk-in freezer refrigeration system for remote installation as located on drawings, including all standard parts, refrigeration specialties, factory sized refrigeration lines, air-cooled condensing unit, head pressure control valves and other items necessary for a complete and properly operating system. Hang evaporators with double nutted nylon bolts. Provide (5) year compressor warranty.
 2. Basis of Design:

- a. Condensing Unit: Kolpak model PC199LZOP-2E, 14,595 BTUH rating, with air cooled, 2HP scroll type compressor.
 - b. Evaporator: Kolpak model EL26-077-2EC-PR-4, 7,700 BTUH rating for freezer to operate at -10°F.
 - c. System Capacity: 7,413 BTUH
- B. Walk-in refrigerators of less than 3,000 square feet shall comply with the Energy Independence & Security Act of 2007.
- 1. Evaporator fan motors of under 1 horsepower and using less than 460 volts shall have electronically commutated motors (brushless direct current motors); or 3-phase motors.
- C. Condenser fan motors of under 1 horsepower shall use electronically commutated motors, permanent split capacitor-type motors or 3-phase motors.
- D. Condensing unit shall be mounted on an exterior concrete housekeeping pad (by others) and located as shown on the plan. Refer to Architectural and Landscape Site Plans for additional applicable information.
- E. Extend evaporator condensate drain line as shown. Extend drain line with copper tubing having minimum diameter of 5/8" radius or per manufacturer's recommendations. Run lines with minimum slope of 1/4" per foot.
- 1. Condensate Line Heater Wire: Wrap freezer evaporator condensate line with electric heater wire and insulation to prevent freezing of condensate. Provide heat tape with integral 30mA nominal ground fault equipment protection circuit interrupter. Heat tape and insulation shall be by the Food Service Contractor.
- F. It is the intention of this specification for a complete freezer refrigeration system, including all refrigeration specialties and all other parts, devices, and accessories required for a complete and properly functioning system, furnished and installed whether or not each item is specifically mentioned in the specifications.

**ITEM NO. A3 - CONDENSING UNIT / EVAPORATOR; +35°F COOLER
REQUIRED**

- A. Furnish all labor, materials, and equipment for complete installation of walk-in cooler refrigeration system. System shall include expansion valve, solenoid valve, temperature control, sight glass, drier, head pressure control, cables, pilot lights, evaporator, air cooled condensing unit, low ambient kit, weather hood, crank case heater, accessories and all other required parts and refrigeration specialties for complete first class installation. Refrigerant shall be R448a. Install condensing unit, evaporator, non-precharged refrigerant piping and refrigerant as specified hereinafter. See Refrigeration Requirements paragraph of these specifications. Equivalent manufacturers, if approved, must provide equipment of similar dimensional size and comparable construction and same or higher BTUH capacities with similar utility requirements to the refrigeration system on which this specification is based. Use of equivalent manufacturer's equipment shall not require major changes to the plan, the equipment's location or to electrical service designated within the contract documents. Any minor changes required are the responsibility of the provider to coordinate with other trades and all costs associated with changes shall be covered by the provider. Listed Equivalent manufacturers are responsible for verifying they comply with these requirements before submitting a bid.
- 1. Provide pre-fitted walk-in cooler refrigeration system for remote installation as located on drawings, including all standard parts, refrigeration specialties, factory sized refrigeration lines, air-cooled condensing unit, and other items necessary for a complete and properly operating system. Hang evaporators with double nutted nylon bolts. Provide (5) year compressor warranty.
 - 2. Basis of Design
 - a. Condensing Unit: Kolpak model PC49MOP-2E, 8,650 BTUH rating, 0.5HP air cooled hermetic type compressor
 - b. Evaporator: Kolpak model AM16-052-1EC-PR-4, 5,200 BTUH rating, for cooler to operate at +35°F.
 - c. System Capacity: 6,129 BTUH
- B. Walk-in coolers of less than 3,000 square feet shall comply with the Energy Independence & Security Act of 2007.
- 1. Evaporator fan motors of under 1 horsepower and using less than 460 volts shall have electronically commutated motors (brushless direct current motors); or 3-phase motors.
 - 2. Condenser fan motors of under 1 horsepower shall use electronically commutated motors, permanent split capacitor-type motors, or 3-phase motors.
- C. Condensing unit shall be mounted on an exterior concrete housekeeping pad (by others) and located as shown on the plan. Refer to Architectural and Landscape Site Plans for additional applicable information.
- D. Extend evaporator condensate drain line as shown with copper tubing having minimum diameter of 5/8" radius or per manufacturer's recommendations. Run line with minimum slope of 1/4" per foot.
- E. It is the intention of this specification for a complete refrigeration system, including all refrigeration specialties and all other parts, devices and accessories required for a complete and properly functioning system, furnished and installed whether or not each item is specifically mentioned in the specifications.

**ITEM NO. B1 - SHELVING; EPOXY WIRE
REQUIRED**

- A. General: Provide the following storage system shelving as manufactured by Intermetro Industries Corp. Shelving design and model numbers are based on Metro Super Erecta Shelf epoxy coated wire shelving with all standard parts and accessories necessary for a complete installation.
- B. Each unit comprised of the following:
 - 1. Four (4) 74PK3 posts (74.5"H)
 - 2. Four (4) 1842NK3 shelves (nominal dimensions: 18"W x 42"L). Install with shelves at 6" - 28" - 50" - 66" AFF

**ITEM NO. B2 - SHELVING; EPOXY WIRE
REQUIRED**

- A. General: Provide the following storage system shelving as manufactured by Intermetro Industries Corp. Shelving design and model numbers are based on Metro Super Erecta Shelf epoxy coated wire shelving with all standard parts and accessories necessary for a complete installation.
- B. Each unit comprised of the following:
 - 1. Four (4) 74PK3 posts (74.5"H)
 - 2. Four (4) 2136NK3 shelves (nominal dimensions: 21"W x 36"L). Install with shelves at 6" - 28" - 50" - 66" AFF
- C. Provide "S" clips at units setting perpendicular to one another in order to eliminate interior corner posts.

**ITEM NO. B3 - SHELVING; EPOXY WIRE
REQUIRED**

- A. General: Provide the following storage system shelving as manufactured by Intermetro Industries Corp. Shelving design and model numbers are based on Metro Super Erecta Shelf epoxy coated wire shelving with all standard parts and accessories necessary for a complete installation.
- B. Each unit comprised of the following:
 - 1. Four (4) 74PK3 posts (74.5"H)
 - 2. Four (4) 2142NK3 shelves (nominal dimensions: 21"W x 42"L). Install with shelves at 6" - 28" - 50" - 66" AFF
- C. Where applicable, provide "S" clips at units setting perpendicular to one another in order to eliminate interior corner posts.

**ITEM NO. B4 – RACK; DUNNAGE
REQUIRED**

- A. Provide New Age 2004 Dunnage Rack, 36"W x 20"D x 12"H, all welded aluminum construction, 1-1/2" x 1-3/4" x 0.070 tubing, welded aluminum caps on feet, weight capacity 3000 lbs., NSF, Made in USA.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. The Provider of Food Service Equipment must examine roughed-in mechanical and electrical services, installation of floors, walls, columns, and ceilings, and other conditions under which food service work is to be installed and must verify dimensions of services and substrates before fabricating work. Notify Coordinating Trade of unsatisfactory locations and dimensions of other work and of unsatisfactory conditions for proper installation of food service equipment. Do not proceed with fabrication and installation until unsatisfactory dimensions and conditions have been corrected in manner satisfactory to installer.
- B. Set each item of non-movable, non-mobile and non-portable equipment securely in place, level, plumb, and adjusted to correct height. Adjust counter tops and other work surfaces to a level tolerance of 1/16-inch maximum offset, and maximum variation from level or indicated slope of 1/16-inch per foot. Dish tables shall slope to the dish machine, disposal, or trough for positive drainage.
- C. Install equipment with access and maintenance clearances that comply with manufacturer's written installation instructions and requirements of authorities having jurisdiction.

- D. Install closure-trim strips and similar items requiring fasteners in a bed of sealant.
- E. Install joint sealant in joints between equipment and abutting surfaces with continuous joint backing unless Item specification indicates otherwise. Produce airtight, watertight, vermin-proof, easily cleanable, sanitary joints.
- F. Punch List Inspection Requirements: Food Service Equipment is not ready for punch list inspection until the following have been completed for ALL EQUIPMENT.
 - 1. All set in place per plan (mobile and stationary).
 - 2. All equipment unpacked and assembled with all protective packaging, papers and films removed.
 - 3. All sealants and sound deadening applied.
 - 4. All plumbing, mechanical and electrical connections completed.
 - 5. All equipment with cord /plug sets plugged in.
 - 6. All operational equipment turned on and tested for operation.
 - 7. All cleaned of dirt/dust/debris and fabrication markings.
 - 8. All packing /packaging and installation fittings removed from the food service areas.
 - 9. All equipment completed per these specifications and food service Drawings.
 - 10. Requests for a punch list inspection prior to completion of these requirements will not be honored. Punch list inspections made by the Food Facility Consultant based on false representation of completion by the Provider of Food Service Equipment or Coordinating Trade will be billed to the Food Service Equipment Provider for time, travel, meals, and related visit expenses.

3.2 CLEANING AND PROTECTING

- A. Remove all debris from equipment and site, accumulated by delivery and installation of all equipment in this Contract.
- B. Restoration: After completion of installation, and completion of other major work in food service areas, remove protective coverings, if any, and clean food service equipment, internally and externally. Restore exposed and semi-exposed finishes to remove abrasions and other damages; polish exposed metal surfaces and touch-up painted surfaces. Replace work which cannot be successfully restored.
- C. Final Cleaning: Clean and sanitize food service equipment and leave in condition ready for use in food service. Cover food service equipment with 4-mil polyethylene film as protective cover.

3.3 DEMONSTRATION

- A. Testing: Delay start-up of food service equipment until utilities services have been tested, balanced, and adjusted for pressure, voltage, and similar considerations; and until water and steam lines have been cleaned and treated for sanitation. Before testing, lubricate each equipment item in accordance with manufacturer's recommendations. The Food Service Equipment Provider, with its own personnel or those of a service agency, shall turn on and test all functions of each item of operational equipment, **PRIOR TO THE SUBSTANTIAL COMPLETION PUNCH LIST INSPECTION AND OWNER DEMONSTRATION**, in order to assure that it is operating properly, and that controls and safety devices are functioning. Repair or replace equipment, **PRIOR TO THE SUBSTANTIAL COMPLETION PUNCH LIST INSPECTION AND OWNER DEMONSTRATION**, which is found to be defective in its operation, including units which are below capacity or operating with excessive noise or vibration.
- B. Instruct Owner's operating personnel in the proper operation and maintenance procedures for each new item of operational food service equipment. **PRIOR TO THE SUBSTANTIAL COMPLETION PUNCH LIST INSPECTION AND OWNER DEMONSTRATION**, start and burn-off all equipment as necessary. Food Service Equipment Provider shall demonstrate full operation and prepare a minimum of one food item (on cooking equipment) with each piece of operational equipment for demonstration and proper installation verification to the Owner. Menu and food will be by the Owner. Refer to Division01 Section.

END OF SECTION 114000

SECTION 116100 - THEATRICAL LIGHTING EQUIPMENT

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 Platform equipment:
 - 1. Platform Lighting System and Instrument Product Information
 - 2. Dimming and Switching
 - 3. Lighting Control Console and Accessories
 - 4. Architectural Control
 - 5. Theatrical Control Network
 - 6. Lighting Instruments
 - 7. Distribution Equipment
 - 8. Emergency Lighting Transfer Switch
- B. Related work in other sections:
 - 1. Structural Steel, miscellaneous metals: Division 5
 - 2. Platform floor: Section 09 60 00
 - 3. Electrical Hookup; Load Wire, Terminations, and Conduit for Platform Lighting and Control: Division 26
 - 4. Theatrical Rigging and Curtains: Section 11 61 33

1.3 SUBMITTALS

- A. Comply with the requirements of the Liberty School Districts and Section 01 30 00.
- 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, construction methods, equipment and types, locations and materials.
- D. Submittals: Show system layouts, 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, light fixtures or controls.

1.4 QUALITY ASSURANCE

- A. Theatrical Contractor: All items of work included in this specification shall be furnished and installed by experienced Platform 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. If products are known to be discontinued within a year of system turn on, or are introduced with technology advances, new software, product upgrades, or replaced with newer models, it is the responsibility of the manufacture to make these conditions know to the owner and consultant. Any equipment substitutions will be by the discretion of the owner and consultant and must be approved in writing by the owner and consultant before the substitution will be allowed.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Coordinate storage of all equipment, hardware, and accessories with other contractors to assure that storage does not inhibit work by other trades.
- 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 lighting components, electrical 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. Electrical distribution boxes and hardware shall be laid flat and blocked clear of the floor, in a manner to prevent damage while being stored.

1.6 SCOPE

- A. The theatre lighting contractor will be responsible for all of the new equipment outlined in this specification and accompanying drawings. The intention of the specification and drawings is to furnish and install complete and safely operating theatrical and architectural lighting systems with all components that conform to building conditions. Refer to "TH" plates for a responsibility matrix and coordination schedule.

PART 2 - PRODUCTS

2.1 PLATFORM LIGHTING SYSTEM AND INSTRUMENT PRODUCT INFORMATION

- A. Furnish and install all dimming and controls, distribution, and lighting equipment as indicated in the bill of materials. The installation will conform to the National Electric Code.
- B. The Theatrical Contractor shall have the manufacturer of the Platform light control and dimmer system arrange to have an engineering representative on the job site after the installation has been complete and prior to energizing of the system to test and adjust the system and further to instruct persons designated by the Owner in the operation and maintenance of the system. The manufacturer shall furnish such engineering service within 14 days of the request.
- C. Acceptable manufactures of Relay equipment:
1. Electronic Theatre Controls, Sensor IQ
- D. Acceptable manufactures of Architectural Lighting Control:
1. Electronic Theatre Controls, Unison Paradigm
- E. Acceptable manufactures of Auditorium Control equipment:
1. Electronic Theatre Controls, Ion Xe 20
- F. Acceptable manufactures of Theatrical Lighting Fixtures:
1. LED Ellipsoidal Spotlights.
 - a. Altman PHX LED 150W Profile
 - b. Electronic Theatre Controls, ColorSource Spot V
 - c. Vari-lite, Acclaim LED PLE RGBL
 2. LED wash luminaires.
 - a. Altman Lighting Spectra PAR 100.
 - b. Electronic Theatre Controls, ColorSource PAR.
 - c. Vari-Lite, VL800 Event PAR, RGBA.
 3. LED Flood Lights (works).
 - a. Altman LED Worklight.
 4. LED Strip Lights.
 - a. Electronic Theatre Controls, ColorSource Linear.
 - b. Vari-Lite, Aurora LED Strip, 4 cell.
 5. LED Cyclorama Lighting.
 - a. Altman, Spectra Cyc 100.
 - b. Chauvet, Ovation C-805FC.
 - c. Electronic Theatre Controls, ColorSource CYC.
 - d. Vari-Lite, Acclaim LED Cyc.
 6. Moving Head Fixtures
 - a. Electronic Theatre Controls, Lonestar.
 - b. Vari-Lite, VL 1600.
- G. Acceptable manufactures of Theatrical Distribution equipment:
1. Electronic Theatre Controls
 2. Performance Electric
 3. SSRC, Inc.
- H. 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.

- I. If required by the Owner, provide working samples of substitute equipment, including lamps for any lighting fixtures, 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.
- J. It shall be understood that the cost of any additions or revisions of wiring required by the use of substitute equipment shall be the responsibility of the bidder making the substitution.

2.2 DIMMING AND SWITCHING

A. Wall Mount Relay Panel

- 1. General.
 - a. The installation rack shall be Sensor IQ as manufactured by Electronic Theatre Controls, Inc. Or Equal. The Sensor IQ breaker panel shall be UL508, UL67, and UL924 Listed, and shall be so labeled when delivered.
 - b. The Sensor IQ shall consist of a main enclosure with 48 pole breaker subpanel, integral control electronics for low voltage subpanel for data terminations and provision for up to three accessory cards and provision for up to three accessory cards.
 - c. Breakers shall be UL489 listed and shall be labeled when delivered.
- 2. Mechanical
 - a. It shall be constructed of 16-gauge steel. All panel components shall be properly treated, primed and finished in fine-textured, scratch resistant paint.
 - b. The 120/208V enclosure shall be 64" high by 20" wide and 5.64" deep and weigh no more than 86 pounds.
 - c. The enclosure shall be capable of being mounted on the surface of a wall or recessed between standard width (16" on center) wall studs.
 - d. Choice of outer panels shall be available for flush or recess mount applications. This outer panel shall ship complete with a locking door to limit access to electronics, breakers, and local relay overrides.
 - 1) Optional center-pin reject security screws shall be available for all accessible screws.
 - 2) Flush mount door shall extend 1" beyond all panel edges to hide wall cut-out.
 - e. The unit shall provide interior cover to allow access only to class 2 wiring and prevent direct access to touch live components breakers and relays.
 - f. The panel shall support 48 single pole branch circuits. Branch circuits shall range from 15A to 30A capable of holding full rated load for minimum of three hours continuously.
 - 1) Two and three-pole circuits shall be supported at decreased density where each pole constitutes one of the available single-pole circuits. Mixing of circuits in any combination shall be supported.
- 3. User Interface
 - a. The user interface shall contain a graphical display with button pad to include 0-9 number entry, up, down back arrow navigation and enter.
 - b. Test shortcut button shall be available for local activation of preset, sequence and set level overrides.
 - c. The user interface shall have a power status LED indicator (Blue), a DMX status LED indicator (Green), a network status LED indicator (Green) and an LED indicator (red) for errors.
 - d. Interface shall allow the backlight to timeout and shall provide user editable options to shut off backlight completely as well as adjust screen contrast.
 - e. Ethernet interface (when installed) shall default to automatic IP through link local and DHCP. Upon receiving IP address, the address of the Network Interface Card (NIC) shall display in the about menu. Static address and settings shall also be possible.
 - f. USB memory stick interface for uploads of setup and software updates
- 4. Functional
 - a. Pack setup shall be user programmable. The control panel shall provide the following relay setup features (per circuit):
 - 1) Type (1 pole, 2 pole, or 3 pole).
 - 2) Name.
 - 3) Circuit.
 - 4) DMX address.
 - 5) sACN address.
 - 6) Space.
 - 7) Circuit Modes.
 - a) Normal (priority and HTP based activation).
 - b) Latch-lock.

- c) Fluorescent.
 - d) DALI.
- 8) "On" threshold level.
- 9) "Off" threshold level.
- 10) Include in UL924 emergency activation.
- 11) Allow Manual.
- b. Breaker panels shall support discrete addressing of each breaker. Panels that are restricted to use of start address with sequential addressing, and cannot assign each 0-10V output control to any internal circuit shall not be acceptable.
- c. The panel shall be capable of switching 6 poles on or off at once, or in a user-selectable delay per breaker using a period of 0.1 to 60 seconds, in 0.1 second increments.
- d. Control electronics shall report the following information per branch circuit:
 - 1) Breaker state.
 - 2) Relay state.
 - 3) Current draw.
 - 4) Voltage.
 - 5) Energy usage over time.
- e. Built in Control shall include:
 - 1) From the control panel, stations, or timed events it shall be possible to record up to 16 presets per space for up to 8 spaces per panel.
 - a) Presets shall be programmable by recording current levels (as set by DMX), by entering levels on the face panel directly, manually selecting relay state on each relay, or a combination of both methods.
 - 2) From the control panel, stations, or timed events it shall be possible to record up to 16 zones per space.
 - 3) Indication of an active preset shall be visible on the LCD display.
 - 4) One 16-step sequence per space for power up and power down routines.
 - 5) The panel shall have a UL924-listed contact input for use in Emergency Lighting systems. The panel shall respond to the contact input by setting relays to "on", while setting non-emergency relays "off". Each relay can be selected for activation upon contact input.
 - 6) Data lose behavior.
 - a) Control electronics shall respond directly to control stations for zone, preset, and sequence control. Systems that require secondary control systems for this functionality are not acceptable.
 - b) After power loss, electronics shall be capable of holding the system in its previous state until new level data (DMX, architectural presets, sequences and zones, or local overrides) is received to make each breaker change state.
- f. The control of lighting and associated systems via timed and Astronomical clock controls.
 - 1) The breaker panel shall allow the activation of presents, sequences, and zone programming of up to 50 time clock events via a built in real and astronomical clock.
 - 2) System time events shall be programmable via the face panel.
 - a) Time clock events shall be assigned to system day types. Standard day types include: everyday, weekday, weekend, Sunday, Monday, Tuesday, Wednesday, Thursday, Friday and Saturday.
 - b) Time clock events shall be activated based on sunrise, sunset, time of day or periodic event.
 - c) System shall automatically compensate for regions using a fully configurable daylight saving time.
 - d) Presets shall be assigned to events at the time clock.
 - 3) The time clock shall support event override.
 - a) It shall be possible to override the timed event schedule form the face panel of the time clock.
 - 4) The time clock shall support timed event hold.
 - a) It shall be possible to hold a timed event from the face panel of the processor.
 - b) Timed event hold shall meet California Title 24 requirements.
- g. The panel shall receive ESTA DMX512-A control protocol. Addressing shall be set via the user interface button keypad. Any switch may be patched to any DMX channel.
 - 1) 2,500V of optical isolation shall be provided between the DMX512 inputs and the control electronics as well as between control and power components.
 - 2) The breakers shall respond to control changes (DMX or Stations) in less than 25 milliseconds. DMX512 update speed shall be 40Hz.
 - 3) Setting changes shall be able to be made across all, some, or just one selected breaker in a single action from the face panel.
 - 4) Initial Panel setup.

- a) The breaker panel shall automatically detect the type of breaker or dimmer installed in each location without need for manual configuration of the physical arrangement.
- b) Quick rack setup shall be available to apply address settings across all circuits for rack number, DMX Start Address, sACN universe, and sACN start address.
 - 1] Emergency Setup Menu shall provide optional delays when emergency is activated or deactivated, and option to turn off non-emergency circuits shall be available. Record function shall allow circuits that are turned on to be added to the emergency setting.

5. Electrical

- a. Breaker Panels shall be available to support:
 - 1) 120/208V three phase 4-wire plus ground.
 - 2) 120/240V single phase 3-wire plus ground.
 - 3) 277/480V, 230/400V and 240/415V three phase. 4-wire plus ground.
- b. The individual breakers shall be mechanically latching.
- c. The breaker shall be capable of switching 30A.
- d. Max Feed size: 400 amp.
- e. Main circuit breaker options:
 - 1) Main breaker shall be optionally available for purchase.
 - 2) Main breaker shall be field installable.
 - 3) Main breakers options: 400 amp at 120V.

| Operating Voltage | MCB Option | SCCR Rating | Input Lug Wire Sizing |
|-------------------|---------------|---------------------|---|
| Main Lug | 100A, 200A | 22kA, 65kA | 2x200kcmil or (500kcmil with kit) |
| | 400A | 65kA | 600kcmil |
| Main Breaker | 100A, 200A | 22kA, 65kA | 300kcmil |
| | 400A | 65kA | 600kcmil |
| Branch Breaker | 10A, 20A, 30A | 22kA (65kA series) | 6-18AWG solid or stranded class B, C, K dual conductor 10,12, OR 14 AWG |
| GND/Neutral | NA | NA | 6-14AWG |

- 6. Breaker remote switching ratings.
 - a. Mechanical 250,000 cycles.
 - b. 24AResistive 100,000 cycles.
 - c. 16A Ballast (HID) 75,000 cycles.
 - d. 16A Electronic LED 75,000 cycles.
 - e. 15A Tungsten 45,000 cycles.
 - f. 30FLA @ 180 LRA Motor Load 50,000 cycles.
 - g. Isolation: 4000V RMS.
 - h. State: Latching.
 - i. Current reporting accuracy: 5%.

7. Breaker

- a. Bus connection type: Stab on
- b. 1, 2, or three poles
- c. UL489 listed
- d. 15 amp, 20 amp, or 30 amp
- e. High inrush trip curve (matches all Sensor breakers)
- f. Integral current sensing, position and trip sensing
- g. Control and status provided by contact pads directly at bottom of the breaker case. No external wires or connections required for control or feedback

8. SCCR.

- a. System SCCR rating shall be a minimum of 22kA at 120V.
- b. System SCCR ratings shall be rated at:

| operating voltage | MCB option | SCCR rating |
|-------------------|------------|-------------|
| 120/208V | 100A, 200A | 22kA, 65kA |
| | 400A | 65kA |

9. Accessories.

- a. The following accessories shall be optionally available:
 - 1) Network Interface over streaming ACN (sACN).
 - 2) Low voltage 0-10V Dimming Control.
 - 3) Contact Input Option.
 - 4) Ride-Thru Option.
 - 5) Main Breakers as shown in Section G.2.

10. Thermal

- a. The panel shall be convection cooled.
- b. The panel shall operate safely in an environment having an ambient temperature between 32°F (0°C) and 104°F (40°C), and humidity between 5-95% (non-condensing).

B. Sensor Relay Modules.

1. General.

- a. The Relay modules shall be the ETC Relay modules as manufactured by Electronic Theatre Controls, Inc., or equal. The relay modules shall be designed for dependable, economical service in theatrical, architectural, and video applications for use with theatrical and architectural lighting and motorized equipment.
 - 1) Relay modules shall be compatible with both Sensor Dimming Systems and Unison Dimming Systems.
- b. Relay module configuration shall be dual channel, 100/140V, 15A or 20A, as noted on the Electrical Drawings.
- c. Relay modules shall be fully plug-in and factory wired. The modules shall consist of a heavy duty, die-cast aluminum chassis with integral face panel. No tools shall be required for module removal and insertion. All parts shall be properly treated, primed and finished in fine-texture, scratch resistant, gray epoxy powder coat. With the exception of the circuit breaker, the module shall contain no moving parts. Each module shall be labeled with the manufacturer's name, catalog number and rating. Modules constructed of molded plastic for structural support are not equivalent and are not acceptable. Relay modules shall be UL and cUL listed power control devices with a minimum AIC rating of 10,000A.
- d. Modules shall have a fully magnetic circuit breaker for each channel. Relay modules shall be rated for a minimum of 100,000 full load activations.
- e. Modules shall have Signal and Load LED indicators for each channel.
- f. Relay modules shall be available with ETC Advanced Features providing load and status information.

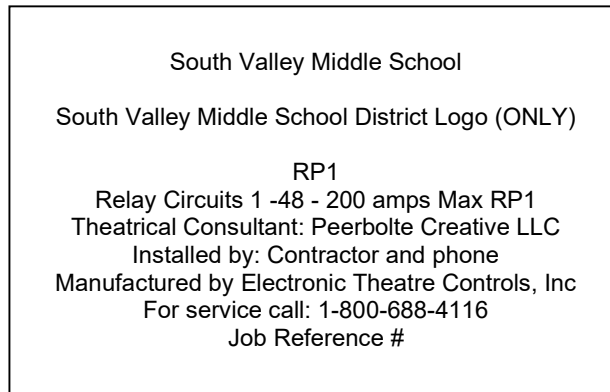
C. The systems shall consist of the following:

1. Provide for Discovery One (1) Sensor IQ-48 Relay Rack with surface-mount locking door.
 - a. A lamicoid 8" wide x 8" tall, sign shall be affixed to the front of RP1. The font on the sign shall be 1/4" tall and shall be Arial or similar. The sign shall contain the following information:

| |
|--|
| Discovery Middle School |
| Discovery Middle School District Logo (ONLY) |
| RP1 |
| Relay Circuits 1 -48 - 200 amps Max RP1 |
| Theatrical Consultant: Peerbolte Creative LLC |
| Installed by: Contractor and phone |
| Manufactured by Electronic Theatre Controls, Inc |
| For service call: 1-800-688-4116 |
| Job Reference # |

- b. Provide Forty-eight (48) 20 amp 120v single pole breakers.
- c. Provide One (1) 200 amp 120/208v 25kA main breaker.
- d. Provide One (1) IQ-Net, network control card.
- e. Provide One (1) IQ-LVD, 0-10v dimmer card.

- f. Provide One (1) IQ-RTO, Ride Through Option Card.
- 2. Provide for South Valley One (1) Sensor IQ-48 Relay Rack with surface-mount locking door.
 - a. A lamicoid 8" wide x 8" tall, sign shall be affixed to the front of RP1. The font on the sign shall be 1/4" tall and shall be Arial or similar. The sign shall contain the following information:



- b. Provide Forty-eight (48) 20 amp 120v single pole breakers.
- c. Provide One (1) 200 amp 120/208v 25kA main breaker.
- d. Provide One (1) IQ-Net, network control card.
- e. Provide One (1) IQ-LVD, 0-10v dimmer card.
- f. Provide One (1) IQ-RTO, Ride Through Option Card.

2.3 LIGHTING CONTROL CONSOLE AND ACCESSORIES

A. ION Xe 20

1. General

- a. The lighting control console shall be a microprocessor-based system specifically designed to provide complete control of Platform, studio, and entertainment lighting systems. The console shall be the Ion Xe 20 as manufactured by Electronic Theatre Controls, Inc., or equal.
- b. The system shall provide control of either 2,048 or 12,288 outputs on a maximum of 32,768 control channels, which may be any number from 1 to 99,999. Systems that require external co-processing to control 12,288 outputs shall not be acceptable. Output shall be distributed over a 10/100 MB Ethernet network using Net3/ACN, ETCNet2, Avab and/or Artnet (multi-cast) protocols. The user shall be able to control the application of protocols at an individual address level.
- c. The system shall support full bi-directional RDM communication with compatible devices via Net3 DMX/RDM Gateways. RDM communication shall adhere to ANSI standard E1.20-2006 Entertainment Technology – RDM – Remote Device Management Over DMX512 Networks. Supported RDM features shall include:
 - 1) Discovery and Identification of RDM capable devices
 - 2) Setting of start addresses, operating modes and additional settings as exposed by connected devices and controllable via RDM
 - 3) Viewing of Sensor data as provided by connected devices
 - 4) Error reporting as provided by connected device
- d. A maximum of 10,000 cues, 1000 groups, 1000 presets, 4 x 1000 palettes (Intensity, Focus, Color and Beam), 99,999 macros, 1000 effects, 1000 curves, 1000 Color Paths and 1000 snapshots may be contained in non-volatile electronic memory and stored to an onboard solid-state hard drive or to any USB storage device.
- e. Recorded cue lists may be played back simultaneously on a maximum of 200 faders. Channels shall respond to cue information by last instruction with discrete rate control provided for all cues. The console may be placed in Tracking or Cue Only mode by the user as a system default and overridden on individual record actions as required. HTP/LTP intensity flags, assert, proportional, intensity master or manual master fade control. Priority and Background Priority may be placed on each cue list. It shall also be possible for a cue list to contribute to playback background states or to withhold such contributions.
- f. A Master Playback fader pair shall be provided. The motorized fader pair may execute crossfades or all-fades, with IFCB cue level timing,

- g. Twenty (20) faders shall be user configurable across 100 pages and provide additional playback faders (up to 200), additive or inhibitive submasters (up to 999), and grand master control. Associated displays provide content identification. Presets and IFCB palettes may be loaded to faders for playback control, either individually or in user-defined lists. Virtual fader control is also provided.
- h. A high-resolution level wheel shall be provided to control intensity for selected channels and scrolling within selected displays. Four pageable encoders shall be provided for control of non-intensity parameters. Non-intensity encoders toggle between coarse and fine control. The expand function for frame table devices shall provide a graphic representation of all images and colors in the associated device for instant selection. A graphic shutter representation shall provide additional control of shutter parameters. The display shall also provide an indication of the current value for the associated parameter, based on channel selection. A high-resolution rate wheel, which may also be used for fader paging shall be provided.
- i. Control and programming features for automated fixtures shall also include: a standard library of fixture profiles, the ability to copy and edit existing profiles and create new profiles, patch displays including channel and output addressing, 16-bit fade resolution, color characterization allowing color mixing and storing in Hue and Saturation or native device values.
- j. System information, including playback status, live output and blind values for all record targets shall be displayed on a maximum of two external high resolution monitors, which may also be multi-touch touch-screens. All displays may also be routed to the integral touch screen. Every display shall support three user-definable workspaces. Each of these workspaces shall provide individually configured frames, with size/scaling controls. Any Windows 7 compatible display may be used.
- k. Control surface buttons shall be backlit. This backlighting provides indication of functional states. Backlight shall be user controllable, and shall automatically dim after a defined period of inactivity.
- l. A detachable alphanumeric keyboard shall be provided. The keyboard shall allow labeling of all show content. The central touch screen shall also repaint to access an integrated virtual alphanumeric keyboard.
- m. A fully integrated Virtual Media Server feature shall allow user to map images and animations to a rig array. 40 such maps may be created, each with 12 layers. Systems that rely on external hardware or software for this functionality shall not be acceptable.
- n. User-definable, interactive displays may be created. These displays, which can be used in live and blind operating modes, allow graphical layout of channels, desk buttons and programming tools. Standard symbols are provided, and the user may import their own symbols or graphics. Each symbol may be individually defined with data feedback characteristics. Non-interactive status information, such as a mirror of other user's command lines, may also be included in the display. A graphical browser is provided for fast selection of these views. Multiple zoom factors and placements may be stored and recalled for each display.
- o. Console software upgrades shall be made by the user via flash drive. It shall be possible to install software updates in all consoles, processor units and remotes from one device over the network.
- p. The console operating software shall be loaded into program execution memory from the internal hard drive when the console is powered. In the event of an uncontrolled shutdown, the console shall return to its last output state when power is restored. Devices requiring a UPS to provide such protections shall not be acceptable.
- q. Integrated dimmer monitoring features shall be provided to allow indication of dimming system status, error states and dimmer load monitoring. Adjustment of dimmer configuration from the console shall also be supported.
 - 1) Communications with the dimming system shall utilize ANSI E1.17 2006 - Entertainment Technology - Architecture for Control Networks.
- r. Integrated RDM device features shall be provided. The console shall discover and patch RDM devices. The console shall monitor RDM devices to allow indication of RDM device online/offline status error states. The console shall be capable of changing settings of RDM devices such as the DMX start address.
 - 1) Communications with the RDM devices shall utilize ANSI E1.20 2006 – Remote Device Management.
- s. Synchronized backup shall be provided via another full console on the network, an ETC nomad/Puck, or by use of a remote processor unit. The backup console/RPU shall maintain synchronized playback with the master and shall take over control of the lighting system upon loss of communication with the master. Use of two RPUs to service and backup system output is also supported.
- t. Network configuration tools shall be provided from within the desk.
- u. Show data may be created and modified on a personal computer, using either Windows 7 or higher or a Macintosh platform running OS 10.11 or later via a free offline editing application. The program shall run natively on Apple operating systems. Applications requiring PC emulation programs shall not be acceptable.

- 1) Offline software application shall be able to connect to a control system via the network and view or modify current show data in an independent display environment, using an ETC nomad key.
- 2) When connected without the key, the computer shall operate in Mirror Mode, with the device to be mirrored selectable by the user.
- v. A maximum of 99 users may access and interact with show data simultaneously. Each user shall have an individual workspace. User identification may be assigned to more than one control device, allowing users to work in tandem, or allowing a designer/ALD to mirror the current display format, mode and command line of the associated programmer. Partitioned control allows discrete control of channel/parameter groupings by user. Partitioned control may be easily enabled and disabled with no need to merge show data from multiple users.
- w. The system shall support up to 32 individual simultaneous Time Code inputs or Event lists using Show Control Gateways.
- x. A context sensitive on-line Help feature shall explain and provide an example of the operation of each feature of the system.
2. Controls and Playback
 - a. Manual Control and Programming Section
 - 1) The console keyboard shall be grouped by function. Major groupings shall be record target functions, numeric keys, level assignment functions, display navigation functions and controls, as well as non-intensity parameter controls.
 - 2) The command keypad shall be fully interactive with direct selects and other virtual controls, which provide "one touch" selection of channels, groups, palettes, presets, effects, snapshots and macros.
 - 3) Non-intensity parameters may be set numerically via an extensible keypad on the central LCD. This control shall be fully interactive with the moving light encoder controls and the virtual controls. The LCD touch screen associated with the encoders shall display the current encoder function. The touch screen shall also access available modes for each parameter type, min and max values for each parameter as applicable, as well as home position on a parameter basis. Each encoder shall support shift functions for fine control. The range of motion of coarse control may be set by the user. Tactile feedback shall indicate full and half frame positioning of certain controls.
 - 4) Only those parameters available for control in the active lighting system shall be displayed for control. Displays shall condense or lowlight parameters not available to selected channels. Alternatively, the encoders may be placed in a state allowing parameters not applicable to the current selection to be suppressed.
 - 5) Lamp controls provide direct access to luminaire functions such as striking and dousing arc lamps and calibrating entire fixtures or individual mechanisms of fixtures, as provided by the luminaire manufacturer. User access to these features is normalized across all manufacturers for ease of use. Use of a "control channel" for accessing these functions shall not be required and systems requiring use of control channels for these functions shall not be acceptable.
 - 6) Fan functions shall be provided both via command line operation and through encoder controls.
 - 7) Highlight shall be supported, with user definable highlight values. Lowlight conditions may be defined for selected, but not specified channels. Rem Dim commands, at specific levels by channel, may be optionally and automatically called with the highlight command.
 - 8) Advanced color control functions provide color mixing in any of six different color spaces. Gel matches are provided via gel picker or by command line control. Tinting tools allow adjusting the color mix irrespective of the native mixing system. Spectrum tools support adjusting the output of additive color systems with more than three emitter types, allowing the X/Y coordinate to be held while adjusting the recipe that achieves that mix. Color Path tools allow the user to control the live fade of fixtures through the color space.
 - 9) The Virtual Media Server function shall allow the user to create layouts of devices, identified as pixel maps. Media content (images, movies, text and procedurally generated effects) may then be applied, manipulated and stored. Stock content is provided and the user may import imagery and animations of their own.
 - 10) Macros may be set to run as default. Default macros called manually shall post to the command line, but executed via cue lists shall run in the background. The user may override this behavior by defining the macro to always execute in the foreground or background, regardless of the recall method. Startup, Shutdown and Disconnect macros may also be defined.
 - b. Playback Section
 - 1) The playback faders shall consist of a motorized Master Fader pair and 20 additional playbacks.
 - 2) Up to 200 cue playback faders may be defined on the fader array. Each playback shall have an associated 60mm motorized potentiometer and definable buttons.

- 3) Faders may be grouped for playback, with sliders and button action defined by the user.
 - 4) It shall be possible to instantaneously halt an active cue, back to the previous cue, manually override the intensity fade or manually override the entire fade.
 - 5) It shall be possible for a cue list to contribute to the background state or for the contents of each cue list to be withheld from such.
 - 6) Playback faders shall have the following associated controls:
 - a) Freeze, which halts the output of the fader
 - b) Stop Effect, which stops the action of an effect
 - c) Filter, to assign filter states to a fader
 - d) Go To Cue 0, to reset a cue list
 - e) Off, to turn off the contents of a playback, releasing control to the background state or to set to null.
 - f) Assert, to replay an active cue
 - g) Release, to release control to the background and reset the cue list.
 - h) Timing disable, channel filters, parameter filters, priority and background priority status may also be defined.
 - i) The potentiometer shall be configurable as a proportional master, an intensity master, or manual master. Support for rate, effect rate, effect size and Master Only controls is also provided. Filtered manual timing masters may be configured.
 - j) Rate override and fader paging are supported with a wheel encoder and associated controls.
 - c. Submasters
 - 1) Up to 999 proportional, fully overlapping additive or inhibitive submasters may be defined. Submasters shall have colored LEDs to indicate submaster status. Each submaster may have fade up, dwell and down fade times. Submasters may be set to priority and background priority status.
 - 2) Submasters may be set to HTP or LTP intensity. Non-intensity parameters on submasters shall be LTP only.
 - 3) Exclusive mode for a submaster shall prohibit the live contribution of that submaster from storing to cues or other submasters. Shield mode prohibits access of associated channels from any other playback or manual control operations.
 - 4) A submaster potentiometer may be defined as proportional, master only or intensity master. When set as an intensity master, a mark and unmark feature is supplied.
 - 5) Motorized faders shall set submasters to required positions as fader pages are changed.
 - 6) The submaster blind buffer shall be linked directly to live playback.
 - 7) It shall be possible to set submaster values directly from the command line.
 - 8) Submasters may be set to fade to background or to minimum value when the fader is returned toward zero.
 - 9) Submaster values may contribute to the background state or withheld from such.
 - d. Grand Master Faders
 - 1) The location of the Grand Master shall be user definable. The grand master shall have associated blackout and blackout enable buttons.
 - 2) Blackout shall send all associated intensity outputs to zero. Non-intensity outputs shall not be affected.
 - 3) Motorized faders shall set grand masters to required positions as fader pages are changed.
3. Display Controls
- a. Format shall change the view of selected displays.
 - b. It shall be possible for the user to choose which parameter categories or parameters they wish to display.
 - c. Flexichannel shall change which channels are viewed in selected displays, based on a variety of different criteria.
 - 1) All channels
 - 2) Patched channels
 - 3) Show channels
 - 4) Active/Moved channels
 - 5) Selected channels
 - 6) Manual Channels
 - 7) View channels (user identified list)
 - 8) Channels with discrete timing
 - d. Expand shall extend the selected view sequentially across connected displays.
 - e. [Time] depressed shall display discrete timing data. [Data] suppressed shall display absolute values of referenced data. These functions may be latched
 - f. Displays may also be toggled to show stored data currently manually overridden, the source of the current parameter data, output level, patch assignment, part structure and referenced marking data.

- g. Playback status displays are provided with a variety of different formats. Indications are provided per cue for live moves (lights fading from zero and also moving non-intensity parameters) and dark moves (inactive lights which have stored non-intensity parameter moves).
 - h. Display content including which of the workspaces is in focus on any of the three monitors and what views are docked in those workspaces may be instantly recalled using snapshots.
4. Operating Modes
- a. Live Mode
 - 1) Channel lists may be constructed using the +, -, and Thru keys as well as the direct selects. Channel selection and deselection is fully interactive, regardless of the method used.
 - 2) Levels may also be set with the keypad, level wheel and non-intensity encoders. "Selected" channels shall be those last addressed and under keypad control. Controls are provided for single button access to the last selected channel list, all channels with manual levels and all active channels.
 - 3) Channels may be set at a user defined default level using the Level key. +% and -% keys adjust channels quickly by user definable values.
 - 4) Channels and/or channel parameters may be captured. Capture mode shall allow the user to selectively capture channel data at specific levels. Captured data shall be indicated on the Live display.
 - 5) Sneak shall be used to restore specified channels to background states, default values, or to send them to specified values, in user specified times.
 - 6) Selected channels may be set at a level or held to current values while all other channels are set to zero using Rem Dim. Toggling Rem Dim shall restore all unselected channels to original levels. The Rem Dim level shall be user definable via the command line or with a default setup value.
 - 7) Channels may be recorded into groups for fast recall of commonly used channels. 1000 groups shall be available. Groups shall store selection order. The Offset function supports rapid creation of ordered groups, including reverse and random order.
 - 8) Parameter settings may be stored to Intensity, Focus, Color and Beam Palettes and to Presets. All referenced data may be stored to whole numbers or to up to 99 decimal places between each whole number.
 - 9) The following conditions may be placed on a channel or channel parameter to be included with a cue record action.
 - a) Discrete fade time and/or delay
 - b) Block flag
 - c) Assert flag
 - d) IFCB Filters, which may be set at a parameter level.
 - e) Release and Restore
 - 10) 999 cue lists may be stored. Cues may be recorded in any order. Up to 99 decimal cues may be inserted between any two whole number cues. Each cue may contain a maximum of twenty parts.
 - 11) It shall be possible to record cues and cue parts with the following information:
 - b. Blind
 - 1) The Blind display allows viewing and modification of all record targets without affecting Platform levels.
 - 2) Record target data may be displayed in a summary view, a detailed table orientation or a spreadsheet view, which allows quick data comparisons, move and replace functions.
 - 3) Changes to blind data shall be automatically stored. Range selection of both record targets and channels shall be supported.
 - c. Patch Display
 - 1) Patch shall be used to display and modify the system control channels with their associated library data.
 - 2) Each channel may be provided with a proportional patch level, curve, label, swap and invert functions, as well as keywords to service Query.
 - 3) Accessing library data to patch multiple parameter fixtures may be accomplished entirely from the command line. Use of a pointing device to patch to moving lights shall not be required.
 - 4) Offset functions in patch shall allow selection of channel ranges and shall allow the user to establish a "custom" footprint for any device output.
 - 5) Custom color wheels, color scrolls and gobo wheels shall be defined in patch. These devices shall be created with a simple table and graphical user interface supported by images of major manufacturers.
 - 6) RDM discovery and device monitoring shall be supported.
 - 7) Copy to and Move functions shall be supported in patch.
 - d. Setup/Browser
 - 1) Setup shall access system, show and desk configurations.

- 2) It shall be possible to partially import Eos show files. Users shall be able to select as much or as little of the show file as required, with renumber tools.
 - 3) It shall be possible to import ASCII and Lightwright data files. It shall be possible to export as ASCII or .csv.
 - 4) Setup shall also access show data storage, import, export, print to .pdf and clear functions, as well as show data utilities.
 - 5) The system shall support programming and playback of real time clock events, including cue, submaster and macro execution at specific times of specified days or at a time based on astronomical events.
 - 6) A control screen shall be provided for network configuration, selecting date/time, software update controls, selecting functional language and/or keyboard for labeling option, as well as other system level tools.
 - 7) Available languages for prompts, advisories and help messages shall include English, Bulgarian, German, Spanish, French, Italian, Japanese, Korean, Russian, Chinese, simplified and Chinese, traditional.
 - 8) Supported keyboards shall include American, United Kingdom, French, German, Italian, Korean, Norwegian, Russian, Slovakian, Turkish, Swiss, Swedish, Finnish and Bulgarian.
5. Dimmer Monitoring and Configuration
- a. The lighting control system shall provide communication with an ETC Sensor+, Sensor3 or FDX dimming system for remote monitoring and configuration of show specific functions from within the software application.
 - b. Circuit level configuration and monitoring functions shall include but not be limited to:
 - 1) Control mode (dimmable, switched, latch-lock, always on, off or fluorescent).
 - 2) Curves
 - 3) Control threshold
 - 4) Min and Max Scale Voltage
 - 5) Preheat
 - 6) Scale load
 - c. Rack status messages shall include but not be limited to:
 - 1) State of UL924 panic closure
 - 2) DMX port error/failure
 - 3) Network error/failure
 - 4) A, B, C Phase below 90 or above 139 volts and headroom warning
 - 5) Ambient temperatures out of range
 - d. Circuit status shall include but not be limited to:
 - 1) Module type and location
 - 2) Output level
 - 3) Control Source
 - 4) Overtemp
 - e. Advanced circuit feedback shall include but not be limited to:
 - 1) Load higher or lower than recorded value
 - 2) DC detected on output
 - 3) SCR failed on/off
 - 4) Breaker trip
 - 5) Module has been removed
 - 6) Load failure
 - 7) Shutdown due to Overtemp
6. Interface Options
- a. The console shall support a variety of local interfaces.
 - 1) AC input.
 - 2) USB (five ports for connecting devices such as a Alphanumeric keyboard, mouse, touch screens, USB Flash drive, etc.)
 - 3) Two (2) Ethernet (one port
 - 4) Two Display Port output connectors, supporting Windows 7 compliant monitors as 1280x1024 resolution minimum. Touchscreen/multi-touch support of any/all of these monitors is provided.
 - 5) Contact Closure trigger via D-Sub connector
 - 6) 4 DMX/RDM ports
 - 7) Alternative Contact Closure trigger through Gateway
 - 8) OSC Transmit/Receive
 - 9) MIDI In/Out, MSC and MIDI Notes through Gateway
 - 10) SMPTE Timecode through Gateway
7. Accessories
- a. Touch Focus Remote
 - b. iRFR and iRFR Preview (applications for iPhone, iPod Touch and iPad units)
 - c. aRFR (application for Android devices)

- d. Net3 Remote Video Interface 3
- e. 20 Fader or 40 Fader non-motorized fader wings
- f. 10 Fader or 20 Fader motorized fader wings
- g. Gateways
 - 1) Net3/ETCNet 2 to DMX/RDM Gateways (one to four ports)
 - 2) MIDI/SMPTE Gateway
 - 3) I/O Gateway with 12 analog inputs, 12 SPDT contact outputs, RS-232 interface
- 8. Synchronized Backup
 - a. An optional Backup system shall consist of one of the following combinations of devices:
 - 1) Two networked Consoles.
 - 2) One (or more) Console with one Remote Processor Unit (RPU)
 - 3) One (or more) Consoles with two Remote Processor Units (RPU's)
 - 4) ETCnomad/Puck
- 9. Physical
 - a. All operator controls and console electronics for a standard system shall be housed in a single desktop console, not to exceed 30" wide, 15" deep, 4.5" high, weighing 16.6 pounds. Console power shall be 90 – 240V AC at 50 or 60Hz, supplied via a detachable locking power cord.
- 10. Optional Portable Access Unit
 - a. General
 - 1) The portable access unit shall be a wired or wireless remote control device that allows access to console programming and playback functions. The device shall be an 8-inch, Android-based industrial tablet with a capacitive multi-touch display. The Console shall be the ETCpad.
 - 2) The ETCpad is compatible with all Eos Family products, including RVIs, RPUs, ETCnomad and ETCnomad Puck.
 - 3) The ETCpad connects hardware to an ETCNet 3 system using an RJ45 and wirelessly via a WPA (provided separately).
 - b. Physical
 - 1) The unit provides a power switch and power/battery indicator
 - 2) One Micro HDMI, one USB 2.0 and one Micro SIM are provided.
 - 3) The operating temperature is 14-122 F (-10 thru 50C). Charging temperature range is 32-104F (0 thru 40C).
 - 4) The unit is 5.59" (142mm) H x 9.44" (240mm) W x .57" (14.5mm) D and weighs 1.32 pounds (.6 kgs).
 - 5) The device ships with a charging/cable adaptor and hand strap.
 - c. Accessories
 - 1) Shoulder Strap
 - 2) EETI Stylus Pen
 - 3) Battery Pack with Meter
 - 4) Multi-Tablet Charger
 - 5) Office Dock
 - 6) VESA Dock
- 11. Optional Accessories
 - a. Portable Access Unit
 - b. iRFR and iRFR Preview (applications for iPhone, iPod Touch and iPad units)
 - c. aRFR (application for Android devices)
 - d. Net3 Remote Video Interface 3
 - e. 20 Fader or 40 Fader non-motorized fader wings
 - f. 10 Fader or 20 Fader motorized fader wings
 - g. Gateways
 - 1) Net3/ETCNet 2 to DMX/RDM Gateways (one to four ports)
 - 2) MIDI/SMPTE Gateway
 - 3) I/O Gateway with 12 analog inputs, 12 SPDT contact outputs, RS-232 interface
- 12. Synchronized Backup
 - a. An optional Backup system shall consist of one of the following combinations of devices:
 - 1) Two networked Consoles.
 - 2) One (or more) Console with one Remote Processor Unit (RPU)
 - 3) One (or more) Consoles with two Remote Processor Units (RPU's)
 - 4) ETCnomad/Puck
- 13. Physical
 - a. All operator controls and console electronics for a standard system shall be housed in a single desktop console, provided others. Console power shall be 90 – 240V AC at 50 or 60Hz, supplied via a detachable locking power cord.

- K. Provide the following for Discovery:
 - 1. Provide One (1) Ion Xe 20 lighting control console with 1024 outputs.
 - 2. Provide One (1) Keyboard and Mouse.
 - 3. Provide One (1) Dust cover for the console.
 - 4. Provide One (1) Littlite (or equal) XR Series 24" Gooseneck Work lights.
 - 5. Provide Two (2) 19" Touchscreen Display Port Flat Panel Monitors with appropriate cables.
 - 6. Provide an Uninterruptible power supply capable of powering console and monitors for 30 minutes.
 - 7. Provide all necessary network, DMX, power cables, connectors and any other required items for a working system. DMX cables shall be 25' in length.
 - 8. Console and accessories stored in rolling cabinet supplies by AV contractor.
- L. Provide the following for South Valley:
 - 1. Provide One (1) Ion Xe 20 lighting control console with 1024 outputs.
 - 2. Provide One (1) Keyboard and Mouse.
 - 3. Provide One (1) Dust cover for the console.
 - 4. Provide One (1) Littlite (or equal) XR Series 24" Gooseneck Work lights.
 - 5. Provide Two (2) 19" Touchscreen Display Port Flat Panel Monitors with appropriate cables.
 - 6. Provide an Uninterruptible power supply capable of powering console and monitors for 30 minutes.
 - 7. Provide all necessary network, DMX, power cables, connectors and any other required items for a working system. DMX cables shall be 25' in length.
 - 8. Console and accessories stored in rolling cabinet supplies by AV contractor.

2.4 ARCHITECTURAL CONTROL

- A. The Architectural Control Processor shall be the Unison Paradigm P-ACP Series Control Processor as manufactured by Electronic Theatre Controls, Inc.
- B. Mechanical.
 - 1. The Architectural Control Processor (ACP) assembly shall be designed for use in DRd Series Dimming Enclosures and ERn Series Control Enclosures.
 - 2. The processor shall utilize microprocessor based, solid state technology to provide multi-scene lighting and building control.
 - 3. ACP module electronics shall be contained in a plug-in assembly. The module shall be housed in a formed steel body and contain no discrete wire connections. No tools shall be required for module removal or insertion.
 - 4. The ACP shall be convection cooled.
 - 5. The ACP User Interface shall utilize a backlit liquid crystal display capable of graphics and eight lines of text. It shall also provide:
 - a. The ACP shall provide an alpha-numeric keypad for data entry and navigation.
 - b. The ACP shall provide a touch-sensitive control wheel for navigation.
 - c. The ACP shall provide shortcut buttons to assist in navigation, selection, and data entry.
 - d. The ACP keypad, buttons, and wheel shall be backlit for use in low-light conditions. The backlight shall have a user selectable time out, including no time out.
 - 6. The ACP shall provide a front-panel RJ45 jack for Ethernet connection to the processor for configuration, live control, and web-browser-based system access. The Ethernet port shall be secured behind the locking door.
 - 7. The ACP shall provide a Secure Digital (SD) Removable Media slot on the front panel for transfer of configuration data. The SD slot shall be secured behind the locking door.
 - 8. The ACP shall provide a Universal Serial Bus (USB) port on the front panel for transfer of configuration data. The USB port shall be secured behind the locking door.
 - 9. Architectural Lighting System configuration and program information shall be stored in flash memory, which does not require battery backup.
 - a. The ACP shall provide a Compact Flash (CF) Card as backup flash memory and storage.
 - b. The CF Card is stored in the back of the ACP, and can be accessed only by removing the ACP.
 - c. The ACP data can be exchanged by inserting the CF card into another ACP.
- C. Electrical.
 - 1. The ACP shall require no discrete wiring connections; all wiring shall be terminated into Dimming or Control Enclosure.
 - 2. The ACP shall require low-voltage power supplied by the Dimming or Control enclosure and shall be hot-swap capable.
 - 3. The ACP shall support Echelon LinkPower communications with remote devices, including button stations, button/fader stations, Touchscreen stations, sensors, and third party LonMARK compliant products.

- a. The LinkPower network shall utilize polarity-independent, low-voltage Class II twisted pair wiring, type Belden 8471 (unshielded) or Belden 8719 (shielded) or equivalent. One # 14 AWG drain wire will be required for system not using grounded metal conduit. Touchscreen stations, interface stations and portable stations connectors will also require (2) #16 AWG wires.
 - b. The LinkPower network shall be topology free. Network wiring may be bus, loop, home run, star or any combination of these.
 - c. Link power wiring shall permit a total wire run of 1640 ft. (500m) without a repeater. Repeater option modules shall be available to increase wiring maximums in increments of 1640 ft. (500m).
 - d. Link power wiring between stations shall not exceed 1313 ft. (400m).
 4. The ACP shall support 10/100BaseTX, auto MDI/MDIX, 802.3af compliant Ethernet networking using TCP/IP, ESTA BSR E1.17 Advanced Control Networks (ACN) and ESTA BSR E1.31 (sACN) Protocols for internal communication and integration with third-party equipment.
 5. The ACP shall support EIA-RS232 serial protocol for bi-directional command and communication with third-party equipment.
 6. The ACP shall support two discrete ESTA DMX512A ports, configurable as input or output ports. When used in a Dimming Enclosure, the second port is always an output port.
 7. The ACP shall provide four onboard dry contact closure inputs for integration with third-party products.
 8. The ACP shall provide four onboard contact closure outputs, rated at 1A@30VDC, for integration with third-party equipment.
- D. Functional Capacity.
1. Shall support 1024 channels of control.
 2. Shall support 2 physical DMX ports, each of which may be configured as an input or output.
- E. Functional System.
1. Runtime application shall utilize support Net3 system interoperability.
 2. System shall support the use of Network Time Protocol for real time clock synchronization.
 3. System shall support remote firmware upload an over Ethernet connection from a connected PC running the Light Designer software or another connected processor.
 4. System shall support local firmware upload from removable media (SD Card, USB Flash Drive).
- F. Functional Diagnostics.
1. Shall output an Event log.
 2. Standard log shall store a fixed-length history of recent activity.
 3. Separate critical log shall only store important messages (such as boot-up settings).
- G. Functional Configuration Data.
1. Configuration Data can be uploaded over an Ethernet connection from a PC running Light Designer application.
 2. Configuration Data can be retrieved from another Paradigm Processor.
 3. A Paradigm Processor shall make its configuration data available for retrieval by another Processor as a backup/recovery mechanism.
 4. Configuration Data shall be stored on solid-state media that can be removed to facilitate transfer between Processor units.
 5. Configuration Data may be loaded to and from removable media access provided on front panel.
 6. Configuration Data for the entire System shall be available for download from any single Processor.
 7. Shall store configuration data for Dimming enclosure processors and shall make available for download.
- H. Functional Scalability.
1. Adding additional Processors to a System shall proportionately increase its overall capabilities up to a maximum System size.
 2. The maximum number of Processors configured as a System shall be at least 12.
 3. Multiple Processors shall utilize the Ethernet network to remain time synchronized and share control information.
 4. Multiple Processors shall utilize the Ethernet network to maintain configuration data synchronization as modifications are made.
 5. Failure of a single Processor shall not prohibit continuing operation of the remaining processors.
 6. It shall be possible for multiple Systems to coexist on the same physical network with logical isolation between Systems.
- I. Functional Local User Interface.
1. Shall provide access to Processor setup (IP address).
 2. Shall provide access to Processor status and diagnostics.
 3. Where the Processor is installed within a Dimming enclosure, shall provide access to dimming enclosure setup, status and diagnostics.

4. Shall provide control functionality for Control Channels, Zones, Fixtures, Groups, Presets, Macros, Walls and Sequences within the current configuration.
 5. Shall provide functionality to schedule astronomical and real time events (add/edit/delete).
 6. Shall allow for display of local DMX information.
 7. Shall allow for transfer of log files to local removable media.
 8. Shall allow to perform firmware upgrades for connected Dimming enclosures.
 9. Shall allow for transfer of configuration to and from Dimming enclosures using removable media.
 10. Shall allow for transfer of configuration to and from LCD Stations using removable media.
 11. Shall allow for binding of Stations.
- J. Functional Access Controls.
1. There shall be 2 user accounts - Administrator and User with separate password protection.
 2. Account and password settings shall be local to each Processor.
 3. Access Controls shall be applied to certain areas of the Paradigm Local Interface and Web Interface User.
- K. Functional Web User Interface.
1. Shall be an internal web server accessible via Ethernet port.
 2. Shall support common web browsers on Windows and Mac platforms.
 3. Shall provide functionality to Activate and Deactivate Presets.
 4. Shall provide functionality to schedule timed events (add/delete).
 5. Shall display status information.
 6. Shall display log files.
 7. Shall allow for configuration of Processor settings (date, time).
 8. Shall allow for upload and download of configuration data.
 9. There shall be links to other web-enabled devices in the System, including other Paradigm Processors.
- L. Functional Stations.
1. Stations shall be connected to a Paradigm Processor via a LinkPower network or Ethernet.
 2. Station discovery and binding shall be accomplished from the Local User Interface or Light Designer.
- M. Functional Net3 and ACN Devices.
1. Net3 Devices shall be connected to and controlled from Paradigm Processors via Ethernet.
 2. Paradigm Processors shall provide DMX-Net3 gateway functionality.
 3. It shall be possible to send and receive Macro triggers defined within the System configuration via Net3.
 4. There shall be support for Streaming ACN on up to 24 universes per Processor.
- N. Functional Operation.
1. When contained in a dimming enclosure, a snapshot of the dimming enclosure output data shall be stored in persistent memory so that hardware can access it for immediate output on boot.
 2. DMX output refresh rate shall be configurable.
 3. There shall be support for 16-bit DMX Attributes.
 4. DMX inputs may be patched to DMX and Streaming ACN outputs as external sources.
 5. Streaming ACN inputs shall be patched to DMX outputs (gateway) as external sources.
 6. Where there are multiple external sources then priority and HTP shall be used to perform arbitration.
 7. External and internal sources shall be arbitrated based on user-selection of standard or custom rules.
 8. On Preset Record, the values of Attributes within the Preset shall be updated to reflect the current output.
 9. The total output may be the combination of many different Presets running concurrently.
 10. There shall be no hard limit on number of concurrent cross fades.
 11. Multiple Presets controlling the same Attribute shall first interact based on priority and second based on Latest Takes Precedence (LTP) or Highest Takes Precedence (HTP).
 12. LTP and HTP operation shall be supported simultaneously and interact (at the same priority) using HTP.
 13. Settings due to LTP Presets may be automatically discarded from operation when overridden.
 14. It shall be possible to specify that a Preset or Attribute Control will persist when overridden.
 15. A Preset may be designated as an HTP Override and shall cause HTP values to be discarded.
 16. It shall be possible to modify the rate of a Preset (Cross fades, Effects) from a Control within the System.
 17. Each Preset shall have a status that can be Activated, Deactivated or Altered.
 18. Preset status may be set based on matching levels in the current output as an option.
 19. On startup the System shall be capable of automatically executing timed events within the previous 24 hours to synchronize its initial output state with the current time of day.
- O. Serial Input/Output.
1. RS232 shall support 8-bit word length, parity selection and 1 or 2 stop bits.
 2. RS232 shall support baud rates from 4800 to 115,200 bps.
 3. Serial input and output messages are fully customizable.
 4. Serial output messages can be generated by any Control or Event.

- P. The Touchscreen Control Stations shall be the Unison Paradigm Touchscreen P-LCD Series Control Stations as manufactured by Electronic Theatre Controls, Inc.
1. All touchscreen stations shall support default and fully graphical control pages.
 2. The Touchscreen station shall operate using graphic buttons, faders and other images on at least 30 separate programmable control pages.
 3. Touchscreen stations shall also allow programming of page pass-code, lock out and visibility levels.
- Q. Mechanical.
1. Touchscreen stations shall consist of a seven inch, backlit liquid crystal display (LCD) with a minimum resolution of 800 by 400 pixels and 12-bit color depth with a touch interface.
 2. Touchscreen bezels shall be constructed of aluminum and shall have no visible means of attachment.
 - a. The bezel shall install and remove without the use of tools.
 - b. The bezel shall provide two working positions for the Touchscreen: service and operating.
 3. The Touchscreen shall have a protective overlay over the display.
 - a. The overlay shall reduce wear.
 - b. The overlay shall reduce glare.
 4. The manufacturer shall provide back boxes for all LCD stations.
 - a. Flush back box dimensions shall be 7.94" wide x 5.33" high x 3.25" deep.
 - b. Surface back box dimensions shall be 8.3" wide x 5.6" high x 2.55" deep.
- R. Electrical.
1. Touchscreens shall be powered entirely by the System network.
 2. Touchscreens shall connect to the System using an Ethernet network with Power over Ethernet (POE) or the Unison control station Echelon® Link power network. Ethernet network shall be 10/100BaseTX, auto MDI/MDIX, 802.3af compliant and shall utilize Unshielded Twisted Pair (UTP) Category 5 wiring.
 3. Echelon® Link power network.
 - a. Link power shall utilize low-voltage Class II unshielded twisted pair, type Belden 8471 or equivalent, and one #14 ESD drain wire (when not installed in grounded metal conduit).
 - b. Touchscreen stations shall also require (2) #16 AWG stranded wires for 24Vdc operating power. 24Vdc wiring shall be topology free.
 - c. Network wiring may be bus, loop, home run, star or any combination of these.
 - d. Network insulation displacement connectors shall be provided with all stations.
- S. Functional System.
1. The Touchscreen shall support configuration firmware upload from a Paradigm Processor as proxy.
 2. The Touchscreen shall support configuration or firmware upload from local removable media.
- T. Functional Setup Mode.
1. There shall be a setup display that is separate from any user-defined configuration.
 - a. It shall be possible to view and modify connectivity settings.
 - b. It shall be possible to view status information.
 - c. It shall be possible to view and modify LCD screen settings.
 - d. It shall be possible to perform Touchscreen calibration.
 - e. It shall be possible to view and modify audio settings.
 - f. The appearance of the setup display shall be standard and not editable.
 - g. The setup display may be invoked from within the user-defined configuration and/or physical button on the Touchscreen.
 - h. There shall be a default protected method to invoke the setup display.
- U. Functional Configurations.
1. It shall be possible to have multiple configurations stored within an LCD Station.
 2. Only one configuration may be active on the LCD Station.
 3. It shall be possible for Touchscreen Stations connected via the Echelon® Link power network to select a configuration automatically based on the configuration of the physical connection.
 4. Where multiple configurations are stored there shall be a boot menu to allow selection of a configuration.
 5. Each configuration shall be identified as a different Station within the System.
- V. Functional Operation.
1. The Unison Paradigm Control System shall be designed to allow control of lighting and associated systems via Touchscreen controls. System shall allow the control of presets, sequences, macros and time clock events.
 2. System presets shall be programmable via Button, Button/Fader, Touchscreen, or LightDesigner software.
 - a. Presets shall have a discrete fade time, programmable from zero to 84,600 seconds with a resolution of one hundred milliseconds.

- b. Presets shall be selectable via Touchscreen stations.
 - 3. System macros and sequences shall be programmable via LightDesigner system software.
 - a. Macro and sequence steps shall provide user selectable steps, and allow the application of conditional logic.
 - b. Macro and sequences shall be activated by button, time clock event or LightDesigner software.
 - 4. System time clock events shall be programmable via the Touchscreen, LightDesigner system software, the processor user interface, or the internal web server.
 - a. Time clock events shall be assigned to system day types. Standard day types include: anyway, weekday, weekend, Sunday, Monday, Tuesday, Wednesday, Thursday, Friday and Saturday. System shall support programming of additional custom or special day types.
 - b. Time clock events shall be activated based on sunrise, sunset, time of day or periodic event. System shall automatically compensate for regions using a fully configurable daylight saving time.
 - 5. Touchscreen stations shall be designed to operate standard default or custom system functions. Components shall operate default functions unless re-assigned via LightDesigner, the Windows-based configuration program.
 - a. Optional button functions include: preset selection, manual mode activation, record mode activation, station lockout, raise, lower, macro activation, and cue light, or room join/separate.
 - b. Optional fader functions include master control, individual channel control, fade rate control or preset master control.
 - 6. Touchscreen stations shall allow programming of station and component electronic lockout levels via Light Designer.
 - 7. It shall be possible to adjust LCD contrast and brightness.
 - 8. It shall be possible to program the station to dim during periods of inactivity.
- W. The system shall consist of the following for Discovery:
- 1. Provide One (1) ERn2 Rack Mount Paradigm Control Enclosure with P-ACP processor, P-SPM Station Power Module, ERn-RPS Redundant Power Supply, and UBPO Battery Pack. Enclosure to be mounted in the equipment rack listed in network section below.
 - 2. Provide One (1) Flush Mounted LCD Station. Install at Platform manager location as shown on drawing.
 - 3. Provide Two (2) Flush Mounted Four-preset and Off Pushbutton Stations. Install as indicated on TH drawings.
 - 4. Provide Three (3) Flush Mounted Single-button Pushbutton Entry. Install as indicted on TH drawings
 - 5. Provide all custom back boxes required for the Architectural Control System unless previously noted. Boxes to be installed by Electrical Contractor.
 - 6. Provide programming for the controls based on notes to be provided by the consultant.
 - 7. Provide all cable required for the proper operation of the Architectural lighting control system. Cable to be pulled by the Electrical Contractor.
- X. The system shall consist of the following for South Valley:
- 1. Provide One (1) ERn2 Rack Mount Paradigm Control Enclosure with P-ACP processor, P-SPM Station Power Module, ERn-RPS Redundant Power Supply, and UBPO Battery Pack. Enclosure to be mounted in the equipment rack listed in network section below.
 - 2. Provide One (1) Flush Mounted LCD Station. Install at Platform manager location as shown on drawing.
 - 3. Provide Two (2) Flush Mounted Four-preset and Off Pushbutton Stations. Install as indicated on TH drawings.
 - 4. Provide Three (3) Flush Mounted Single-button Pushbutton Entry. Install as indicted on TH drawings
 - 5. Provide all custom back boxes required for the Architectural Control System unless previously noted. Boxes to be installed by Electrical Contractor.
 - 6. Provide programming for the controls based on notes to be provided by the consultant.
 - 7. Provide all cable required for the proper operation of the Architectural lighting control system. Cable to be pulled by the Electrical Contractor.

2.5 THEATRICAL CONTROL NETWORK

- A. Opto Splitter/Repeater
 - 1. General
 - a. The Pathway Installation Repeater shall permit star-wiring of DMX512 signals and shall isolate DMX transmitters and DMX receivers from common mode voltages, ground loop currents and other electrical faults.
 - b. Each Installation Repeater shall have one input port and four, eight, twelve or sixteen output ports. No in-line processing of the input signal is permitted to ensure the highest reliability.
 - c. DMX signal splitting shall be provided using 4-output DIN-rail mounted modules for easy expansion and/or servicing.

- d. The system shall be capable of repeating simplex protocols other than DMX512, provided they meet the electrical requirements of EIA-RS422 or RS485.
 2. Physical
 - a. Enclosures shall be surface-mount NEMA 1 enclosure types, and shall be constructed from 18 gauge steel, finished in satin black powder epoxy, with a non-louvered, surface cover.
 - b. Dimensions shall be and shall be 10.25"w x 23.25"h x 4.5"d for twelve or sixteen output models.
 - c. Enclosures shall be provided with ½" and ¾" conduit knockouts, appropriate internal voltage barriers, and shall be clearly labeled as "Pathway eDIN System".
 3. Electrical
 - a. The power supply shall be a field-replaceable, wide-range input (115/240VAC, 50/60 Hz), UL-listed switching power supply. There shall be no power switch to reduce the chance of accidental shut-off.
 - b. There shall be 2500-volt electrical isolation between all input and output sections.
 - c. The input and each output shall be capable of withstanding the continuous application of up to 250V without damage to internal components. Input and output protection shall be of the self-resetting type, rated for 250V. Replaceable fuses are not acceptable.
 4. Field Connections
 - a. All internal field wiring connections shall be clearly labeled according to their function.
 - b. Connections for all data input, output and pass-thru ports, and DC power shall be two-part, Phoenix-type screw terminal strips, capable of accepting #26 to #14 gauge solid or stranded wire.
 - c. A direct, passive data pass-thru connection shall be provided to allow daisy-chaining of additional modules or Installation Repeaters.
 - d. The power supply connections shall be capable of accepting up to #12 gauge solid or stranded wire. A suitable terminal shall be provided for ground wire connection.
 5. Features
 - a. Each repeater module shall incorporate LED indicators for DC power input, isolated DC power, and DMX input.
 - b. An LED per output port shall indicate active DMX output for that port.
 - c. A labeled DMX termination switch shall be provided. DIP switches or the like shall not be acceptable.
 6. Compliance
 - a. The Installation Repeater shall be compliant with ANSI E1.11 DMX512-A (2004), USITT DMX512 (1990) or any EIA 422/485-based protocol.
 - b. The Installation Repeater shall be ETL-listed.
 - c. The Installation Repeater shall be compliant with the RoHS 2002/95/EC directive.
- B. Multi Box Plug In Stations
1. The Multi Box Plug-in Stations shall consist of the appropriate connectors required for the system in use. These stations shall be available with DMX input or output, Remote Focus Unit, ETCNet, ETCLink or architectural control connectors. Custom control connectors shall be available.
 2. The following standard components shall be available for Remote Plug-in Stations:
 - a. 5-Pin male XLR connectors for DMX input.
 - b. 5-Pin female XLR connectors for DMX output.
 3. Station faceplates shall be .08" aluminum, finished in fine texture, scratch-resistant black powder coat. Silk-screened graphics shall be white.
 4. The station panel shall mount into an industry standard back box, depending on size and quantity of connectors. A terminal block shall be supplied for contractor terminations.
 5. Line Voltage Connections.
 - a. Enclosures shall be code gauge steel with receptacles in place and ready for connection to building wiring.
 - b. Wire receptacles in connector strips to terminal blocks. Identify wires and terminals with numbers corresponding to circuit schedule.
 - c. The terminal blocks shall be molded barrier type with tubular screw clamp suitable for connecting to multi-conductor feed or incoming wire. Two terminals per circuit shall be provided to accept 18-8 AWG (10/20/30A), 18-4 AWG (50A), or 10-1/0 AWG (60/100A) wire.
 - d. Identification of load receptacles: designate each receptacle with white characters in correspondence with the circuit schedule.
 - 1) Outlets: Number with 3/4" characters below receptacles.
 - e. Load receptacle devices - except where noted - shall be 20A Parallel Blade U-Ground "Edison" receptacle/body/plug: 2 pole + ground.
 - f. Provide internal barrier between line voltage and low voltage portions of the box.
- C. Provide the following for Discovery:
1. Provide One (1) Wall mount 19" Equipment Rack with a lockable door, Middle Atlantic or similar.
 2. Provide One (1) Response Mk2 DIN Rail 4-port gateway- 4 Input. Mount in equipment rack.
 3. Provide One (1) Response Mk2 DIN Rail 1-port gateway- 1 out. Mount in equipment rack.

4. Provide DIN rail, Power Supply and internal wiring required for the DIN Rail Gateways.
 5. Provide One (1) Opto splitter 1in 16out. Mount in equipment rack.
 6. Provide Four (4) Flush-mount single gang DMX-output stations. Install as shown on TH drawings
 7. Provide Four (4) Flush-mount single gang DMX-input stations. Install as shown on TH drawings.
 8. Provide all cable, patch bays, power supplies, patch cables for the correct wiring and operation of the Theatrical Control Network. Cable to be pulled by the Electrical Contractor.
 9. Provide all cable, patch bays, power supplies, brush panels, blank panels, patch cables for the correct wiring and operation of the Theatrical Control Network. Cable to be pulled by the Electrical Contractor.
- D. Provide the following for South Valley:
1. Provide One (1) Wall mount 19" Equipment Rack with a lockable door, Middle Atlantic or similar.
 2. Provide One (1) Response Mk2 DIN Rail 4-port gateway- 4 Input. Mount in equipment rack.
 3. Provide One (1) Response Mk2 DIN Rail 1-port gateway- 1 out. Mount in equipment rack.
 4. Provide DIN rail, Power Supply and internal wiring required for the DIN Rail Gateways.
 5. Provide One (1) Opto splitter 1in 16out. Mount in equipment rack.
 6. Provide Four (4) Flush-mount single gang DMX-output stations. Install as shown on TH drawings
 7. Provide Four (4) Flush-mount single gang DMX-input stations. Install as shown on TH drawings.
 8. Provide all cable, patch bays, power supplies, patch cables for the correct wiring and operation of the Theatrical Control Network. Cable to be pulled by the Electrical Contractor.
 9. Provide all cable, patch bays, power supplies, brush panels, blank panels, patch cables for the correct wiring and operation of the Theatrical Control Network. Cable to be pulled by the Electrical Contractor.

2.6 LIGHTING INSTRUMENTS

- A. All fixtures are manufactured as specified. Lamps are manufactured General Electric, Phillips, Sylvania, USHIO or approved equal.
- B. All fixtures are to be delivered to the job site complete with pipe clamps and safety cables. Pattern holder, color frame, lamp, DMX and PowerCON cable when applicable. All lamps are to be correctly installed by the contractor and all fixtures are to be properly aligned.
- C. Moving Head Fixture
1. General
 - a. The fixture shall be a high-intensity white-light fixture with Cyan, Magenta, and Yellow subtractive color mixing and framing shutters.
 - b. All LED moving light fixtures shall be provided by a single manufacturer to ensure compatibility.
 - c. The fixture shall be UL 1573 listed for Platform and studio use and comply with EN60598-2-17 standard per CE certification
 - d. The fixture shall comply with the USITT DMX-512A standard
 2. The fixture shall be able to be either truss mounted or set upright on a stable surface. Fixture shall be suitably designed for operation over or under mounted on a truss perpendicular to the ground as well as outrigger parallel to the ground.
 3. Fixture shall have 540 degrees of pan and 270 degrees of tilt.
 4. The Fixture shall have a rotating gobo wheel consisting of a minimum of seven (7) coated glass images + open. It shall be possible to rotate each image clockwise or counterclockwise continuously, step clockwise or counterclockwise continuously, or alternatively rotate to an indexable fixed position.
 5. The luminaire shall have a motorized zoom system. The beam angle range shall be within seven (7) to fifty-five (55) degrees. It shall be possible to focus the beam to a hard edge throughout the total beam angle range.
 6. The luminaire shall have a minimum of fourteen (14) leaf iris.
 7. LED Emitters
 - a. All LEDs used in the fixture shall be high brightness and proven quality from established and reputable LED manufacturers.
 - b. Manufacturer of LED emitters shall utilize an advanced production LED binning process to maintain color consistency.
 - c. The luminaire shall have a minimum output of up to 15000 lumens.
 8. Electrical
 - a. The fixture shall be equipped with a 100V to 240V 50/60Hz auto-sensing internal power supply
 - 1). Fixture shall draw a maximum of 6.2 amps at 100V and 2.5 amps at 240 V.
 - b. The fixture shall support power in and thru operation
 - 1). Power in shall be via Neutrik® PowerCon™ True1 input connector
 - c. Power thru shall be via Neutrik® PowerCon™ True1 output connector
 - d. The fixture requires power from a non-dimmer source
 - f. Power supply outputs shall have self-resetting current-limiting protection
 - g. Power supply shall have power factor correction greater than 0.95 from 100 VAC to 240 VAC.
 9. Control and User interface

- 1). Ethernet compatible with support for ANSI1.31 Streaming ACN and ArtNet protocols
- 2). Fixture must provide an internal ethernet switch that supports both active and passive data pass-through.
- 3). Fixtures shall support protocol conversion from Ethernet to DMX output and also conversion from DMX input to Ethernet output.
- 4). The fixture shall be USITT DMX 512A-compatible via In and Thru 5-pin XLR connectors
- 5). The fixture shall be compatible with the ANSI RDM E1.20 standard
 - a). All fixture functions shall be accessible via RDM protocol for modification from suitably equipped control console
 - b). Temperature sensors within the luminaire shall be viewable in real time via RDM.
- 6). The fixture shall be equipped with multi-line color LCD display for easy-to-read status reports and configuration changes.
 - a). Display must have a feature to battery power the menu structure when the fixture is unplugged to allow fixture settings to be adjusted, including DMX.
10. The fixture shall be rated IP20.
11. When the fixture is stationary, and at full intensity, the fixture may not produce noise in excess of 33 dBA.
12. Fixture warranty shall be Five (5) years for light engine and Two (2) years for complete fixture.

D. Provide the following Fixtures for Discovery:

1. Provide Four (10) ETC ColorSource Spot #CSSPOTSDB, LED Ellipsoidal Spotlights, with #419LT 19 degree lens tubes. The fixtures shall utilize 5-pin xlr connectors for DMX In and Thru. Provide each fixture complete with pipe clamp, color frame, safety cable, pattern holder, soft focus diffuser, and a 5' Male Edison to Power Con input cord. Hang circuit and focus as directed by Consultant.
2. Provide Ten (10) ETC ColorSource Spot #CSSPOTSDB, LED Ellipsoidal Spotlights, with #426LT 26 degree lens tubes. The fixtures shall utilize 5-pin xlr connectors for DMX In and Thru. Provide each fixture complete with pipe clamp, color frame, safety cable, pattern holder, soft focus diffuser, and a 5' Male Edison to Power Con input cord. Hang circuit and focus as directed by Consultant.
3. Provide Twelve (12) ETC ColorSource Spot #CSSPOTSDB, LED Ellipsoidal Spotlights, with #436LT 36 degree lens tubes. The fixtures shall utilize 5-pin xlr connectors for DMX In and Thru. Provide each fixture complete with pipe clamp, color frame, safety cable, pattern holder, soft focus diffuser, and a 5' Male Edison to Power Con input cord. Hang circuit and focus as directed by Consultant.
4. Provide Fifteen (15) ETC ColorSource PAR #CSPARDB, LED wash luminaries with Deep Blue array. Provide each fixture complete with pipe clamp, safety cable, color frame, medium round lens, and a 5' male Edison to Power Con power input cord. Hang circuit and focus as directed by Consultant.
5. Provide Six (6) ETC ColorSource Linear #CSLINEAR1DB, LED strip light with Deep Blue array. Provide each fixture complete with CSLMR.5 medium round lens, CSLMLV.5 medium linear vertical lens and a 5' male Edison to Power Con power input cord.
6. Provide Eight (8), Altman 3000K LED work lights, each complete with pipe clamp, safety cable, male parallel blade U-Ground "Edison" connector. Hang circuit and focus as directed by Consultant.
7. Provide Twelve (12), ETC ColorSource CYC LED, Cyc lights: each complete with hanging bracket, pipe clamp, safety cable, and 5' Male Edison connector to PowerCon power input cord. Hang circuit and focus on the fourth electric as directed by Consultant.
 - a. Provide Seventy-Eight (78) 5 pin DMX cables in the following lengths with male connector on one end and a female connector on the other.
 - 1) Provide Sixty (60) 5' cables
 - 2) Provide Eighteen (18) 10' cables
 - b. Provide Eighteen (18) PowerCON cables in the following lengths with male connector on one end and a female connector on the other.
 - 1) Provide Eighteen (18) 10' cables
 - c. Provide Twelve (12) True1 TOP cables in the following lengths with male connector on one end and a female connector on the other.
 - 1) Provide Twelve (12) 10' cables.
 - d. Provide Four (4) Sterilite 4 Gallon Latching Black Stacker Totes, for cable storage. Each tote shall be labeled, indicating the appropriate cable sizes and quantity for storage.
 - e. All Power and Data cables shall be provided with a Hook & Loop strap permanently affixed to the cable in lengths as required to properly secure the cable, minimum 8".
 - f. All Power and Data Cables shall be provided with colored boots indicating lengths. The color codes shall match the coding system utilized by the AV contractor. Coordinate boot colors with the AV systems.
8. Provide Two (2) ETC High End System Lonestar, LS-UB-MI2550A1200-B. Provide each fixture complete with two (2) Mini Claw, safety cable, one (1) 10' DMX cable and a 5' Male Edison to Power Con input cord. Hang, circuit and focus as directed by the Consultant.

E. Provide the following Fixtures for South Valley:

1. Provide Four (10) ETC ColorSource Spot #CSSPOTSDB, LED Ellipsoidal Spotlights, with #419LT 19 degree lens tubes. The fixtures shall utilize 5-pin xlr connectors for DMX In and Thru. Provide each fixture complete with pipe clamp, color frame, safety cable, pattern holder, soft focus diffuser, and a 5' Male Edison to Power Con input cord. Hang circuit and focus as directed by Consultant.
2. Provide Ten (10) ETC ColorSource Spot #CSSPOTSDB, LED Ellipsoidal Spotlights, with #426LT 26 degree lens tubes. The fixtures shall utilize 5-pin xlr connectors for DMX In and Thru. Provide each fixture complete with pipe clamp, color frame, safety cable, pattern holder, soft focus diffuser, and a 5' Male Edison to Power Con input cord. Hang circuit and focus as directed by Consultant.
3. Provide Twelve (12) ETC ColorSource Spot #CSSPOTSDB, LED Ellipsoidal Spotlights, with #436LT 36 degree lens tubes. The fixtures shall utilize 5-pin xlr connectors for DMX In and Thru. Provide each fixture complete with pipe clamp, color frame, safety cable, pattern holder, soft focus diffuser, and a 5' Male Edison to Power Con input cord. Hang circuit and focus as directed by Consultant.
4. Provide Fifteen (15) ETC ColorSource PAR #CSPARDB, LED wash luminaries with Deep Blue array. Provide each fixture complete with pipe clamp, safety cable, color frame, medium round lens, and a 5' male Edison to Power Con power input cord. Hang circuit and focus as directed by Consultant.
5. Provide Six (6) ETC ColorSource Linear #CSLINEAR1DB, LED strip light with Deep Blue array. Provide each fixture complete with CSLMR.5 medium round lens, CSLMLV.5 medium linear vertical lens and a 5' male Edison to Power Con power input cord.
6. Provide Eight (8), Altman 3000K LED work lights, each complete with pipe clamp, safety cable, male parallel blade U-Ground "Edison" connector. Hang circuit and focus as directed by Consultant.
7. Provide Twelve (12), ETC ColorSource CYC LED, Cyc lights: each complete with hanging bracket, pipe clamp, safety cable, and 5' Male Edison connector to PowerCon power input cord. Hang circuit and focus on the fourth electric as directed by Consultant.
 - a. Provide Seventy-Eight (78) 5 pin DMX cables in the following lengths with male connector on one end and a female connector on the other.
 - 1) Provide Sixty (60) 5' cables
 - 2) Provide Eighteen (18) 10' cables
 - b. Provide Eighteen (18) PowerCON cables in the following lengths with male connector on one end and a female connector on the other.
 - 1) Provide Eighteen (18) 10' cables
 - c. Provide Twelve (12) True1 TOP cables in the following lengths with male connector on one end and a female connector on the other.
 - 1) Provide Twelve (12) 10' cables.
 - d. Provide Four (4) Sterilite 4 Gallon Latching Black Stacker Totes, for cable storage. Each tote shall be labeled, indicating the appropriate cable sizes and quantity for storage.
 - e. All Power and Data cables shall be provided with a Hook & Loop strap permanently affixed to the cable in lengths as required to properly secure the cable, minimum 8".
 - f. All Power and Data Cables shall be provided with colored boots indicating lengths. The color codes shall match the coding system utilized by the AV contractor. Coordinate boot colors with the AV systems.
8. Provide Two (2) ETC High End System Lonestar, LS-UB-MI2550A1200-B. Provide each fixture complete with two (2) Mini Claw, safety cable, one (1) 10' DMX cable and a 5' Male Edison to Power Con input cord. Hang, circuit and focus as directed by the Consultant.

2.7 DISTRIBUTION EQUIPMENT

- A. Enclosures shall be code gauge steel with receptacles in place and ready for connection to building wiring.
- B. Wire receptacles in connector strips to terminal blocks. Identify wires and terminals with numbers corresponding to circuit schedule.
- C. The terminal blocks shall be molded barrier type with tubular screw clamp suitable for connecting to multi-conductor feed or incoming wire. Two terminals per circuit shall be provided to accept 18-8 AWG (10/20/30A), 18-4 AWG (50A), or 10-1/0 AWG (60/100A) wire.
- D. Identification of load receptacles: designate each receptacle with white characters in correspondence with the circuit schedule.
 1. Connector strips: Number with 2" characters above receptacles on both sides except where noted otherwise.
 2. Outlet Boxes: Number with 3/4" characters below receptacles.
- E. Load receptacle devices - except where noted - shall be 20A Platform pin receptacle/body/plug: 2 pole + ground.

- F. Connector Strips and outlet boxes shall be furnish with all necessary hardware; straps, U- bolts, etc., for mounting connector strips to rigged 1 1/2" pipe, wall or supporting steel as specified.
1. Prime and paint all metal parts black enamel.
 2. Connector strip shall be code gauge steel with removable cover section ns.
- G. Provide the following for Discovery:
1. Two (2) 8' 0" raceway in one section, with 2 circuits and One (1) DMX-OUT to serve as the left and right FOH electric. Two (2) circuits shall be wired into 4 evenly spaced flush mount 20 Amp parallel blade U-Ground "Edison" connectors and labeled R1-R2 or R6-R7 on both sides of the raceway. The Edison connectors shall be labeled R1-R2, and R1-R2 or R6-R7, and R6-R7 from Platform left to right. The DMX jack shall be installed House Right end of raceway and labeled DMX-OUT. Each label shall be placed above the associated connectors or pigtails on both sides of the raceway. The terminal strip shall be placed at the Platform right end of the distribution strip. Provide pipe brackets (ETC Type 21 or similar) to allow single batten configuration for use as the first electric on Platform. A 8' 6" long, 1-1/2" schedule 40 pipe batten shall be provided and installed for each electric, as part of section 11 61 33, in order to hang the lights from the rigged electric. The Theatrical Lighting Contractor shall provide the appropriate gridiron junction boxes and the appropriate multi-wire feeder cable of correct length in one continuous piece with strain relief and support devices on both ends. The Electrical Contractor shall provide the appropriate load wire from the relay rack.
 2. One (1) 16' 0" raceway in one section, with 3 circuits and One (1) DMX-OUT to serve as the center FOH electric. Three (3) circuits shall be wired into 12 evenly spaced flush mount 20 Amp parallel blade U-Ground "Edison" connectors and labeled R3-R5 on both sides of the raceway. The Edison connectors shall be labeled R3-R5, R3-R5, R3-R5, and R3-R5 from Platform left to right. The DMX jack shall be installed House Right end of raceway and labeled DMX-OUT. Each label shall be placed above the associated connectors or pigtails on both sides of the raceway. The terminal strip shall be placed at the Platform right end of the distribution strip. A 16' 6" long, 1-1/2" schedule 40 pipe batten shall be provided and installed for each electric, as part of section 11 61 33, in order to hang the lights from the rigged electric. The Theatrical Lighting Contractor shall provide the appropriate gridiron junction boxes and the appropriate multi-wire feeder cable of correct length in one continuous piece with strain relief and support devices on both ends. The Electrical Contractor shall provide the appropriate load wire from the relay rack.
 3. Provide One (1) 47' 0" raceway in one section, with 6 circuits and Two (2) DMX-OUT to serve as the first electric onPlatform. Five (5) circuits shall be wired into 20 evenly spaced flush mount 20 Amp parallel blade U-Ground "Edison" connectors and labeled R8-R12 on both sides of the raceway. One (1) circuit shall be wired into 4 evenly spaced flush mount 20Amp parallel blade U-Ground "Edison" connectors and labeled WL25 on both sides of the raceway The Edison connectors shall be labeled R8-R12, R8-R12, R8-R12 & R8-R12 from Platform left to right. The DMX jacks shall be installed Platform left and right end of raceways and labeled DMX-OUT. The maximum length of allowable extension cable shall be listed below the jack. Each label shall be placed above the associated connectors or pigtails on both sides of the raceway. The terminal strip shall be placed 5' 0" from the Platform left end of the distribution strip. Provide pipe brackets (ETC Type 21 or similar) to allow single batten configuration for use as the first electric on Platform. A 47' 4" long, 1-1/2" schedule 40 pipe batten shall be provided and installed for each electric, as part of section 11 61 33, in order to hang the lights from the rigged electric. The Theatrical Lighting Contractor shall provide the appropriate gridiron junction boxes and the appropriate multi-wire feeder cable of correct length in one continuous piece with strain relief and support devices on both ends. The Electrical Contractor shall be responsible for all load wire termination and appropriate load wire from the relay rack.
 4. Provide One (1) 47' 0" raceway in one section, with 6 circuits and Two (2) DMX-OUT to serve as the second electric onPlatform. Five (5) circuits shall be wired into 20 evenly spaced flush mount 20 Amp parallel blade U-Ground "Edison" connectors and labeled R13-R17 on both sides of the raceway. One (1) circuit shall be wired into 4 evenly spaced flush mount 20Amp parallel blade U-Ground "Edison" connectors and labeled WL26 on both sides of the raceway The Edison connectors shall be labeled R13-R17, R13-R17, R13-R17, & R13-R17 from Platform left to right. The DMX jacks shall be installed Platform left and right end of raceways and labeled DMX-OUT. The maximum length of allowable extension cable shall be listed below the jack. Each label shall be placed above the associated connectors or pigtails on both sides of the raceway. The terminal strip shall be placed 5' 0" from the Platform left end of the distribution strip. Provide pipe brackets (ETC Type 21 or similar) to allow single batten configuration for use as the first electric on Platform. A 47' 4" long, 1-1/2" schedule 40 pipe batten shall be provided and installed for each electric, as part of section 11 61 33, in order to hang the lights from the rigged electric. The Theatrical Lighting Contractor shall provide the appropriate gridiron junction boxes and the appropriate multi-wire feeder cable of correct length in one continuous piece with strain relief and support devices on both ends. The Electrical Contractor shall be responsible for all load wire termination and appropriate load wire from the relay rack.
 5. Provide One (1) 47' 0" raceway in one section, with 6 circuits and Two (2) DMX-OUT to serve as the third electric onPlatform. Five (5) circuits shall be wired into 20 evenly spaced flush mount 20 Amp parallel blade U-Ground "Edison" connectors and labeled R18-R22 on both sides of the raceway. One (1) circuit shall be wired into 4 evenly spaced flush mount 20Amp parallel blade U-Ground "Edison" connectors and labeled WL27 on both sides of the raceway The Edison connectors shall be labeled R18-R22, R18-R22, R18-R22, &

- R18-R22 from Platform left to right. The DMX jacks shall be installed Platform left and right end of raceways and labeled DMX-OUT. The maximum length of allowable extension cable shall be listed below the jack. Each label shall be placed above the associated connectors or pigtails on both sides of the raceway. The terminal strip shall be placed 5' 0" from the Platform left end of the distribution strip. Provide pipe brackets (ETC Type 21 or similar) to allow single batten configuration for use as the first electric on Platform. A 47' 4" long, 1-½" schedule 40 pipe batten shall be provided and installed for each electric, as part of section 11 61 33, in order to hang the lights from the rigged electric. The Theatrical Lighting Contractor shall provide the appropriate gridiron junction boxes and the appropriate multi-wire feeder cable of correct length in one continuous piece with strain relief and support devices on both ends. The Electrical Contractor shall be responsible for all load wire termination and appropriate load wire from the dimmer rack.
6. Provide Two (2), wall boxes with 1 circuit each. One (1) circuit shall be wired into 1 flush mount 20 amp Parallel Blade U-Ground "Edison" connectors. Label the Edison connectors R24 or R25 in location as indicated. The Theatrical Contractor shall provide the wall boxes and the appropriate back boxes. The Electrical Contractor shall be responsible for all conduct, load wire termination and appropriate load wire from the relay rack.
 7. Provide One (1), wall boxes with 2 circuits each. Two (2) circuits shall be wired into 2 flush mount 20 amp Parallel Blade U-Ground "Edison" connectors. Label the Edison connectors R28 and R29 in locations as indicated. The Theatrical Contractor shall provide the wall boxes and the appropriate back boxes. The Electrical Contractor shall be responsible for all conduct, load wire termination and appropriate load wire from the relay rack.
- H. Provide the following for South Valley:
1. Two (2) 8' 0" raceway in one section, with 2 circuits and One (1) DMX-OUT to serve as the left and right FOH electric. Two (2) circuits shall be wired into 4 evenly spaced flush mount 20 Amp parallel blade U-Ground "Edison" connectors and labeled R1-R2 or R6-R7 on both sides of the raceway. The Edison connectors shall be labeled R1-R2, and R1-R2 or R6-R7, and R6-R7 from Platform left to right. The DMX jack shall be installed House Right end of raceway and labeled DMX-OUT. Each label shall be placed above the associated connectors or pigtails on both sides of the raceway. The terminal strip shall be placed at the Platform right end of the distribution strip. Provide pipe brackets (ETC Type 21 or similar) to allow single batten configuration for use as the first electric on Platform. A 8' 6" long, 1-½" schedule 40 pipe batten shall be provided and installed for each electric, as part of section 11 61 33, in order to hang the lights from the rigged electric. The Theatrical Lighting Contractor shall provide the appropriate gridiron junction boxes and the appropriate multi-wire feeder cable of correct length in one continuous piece with strain relief and support devices on both ends. The Electrical Contractor shall provide the appropriate load wire from the relay rack.
 2. One (1) 16' 0" raceway in one section, with 3 circuits and One (1) DMX-OUT to serve as the center FOH electric. Three (3) circuits shall be wired into 12 evenly spaced flush mount 20 Amp parallel blade U-Ground "Edison" connectors and labeled R3-R5, R3-R5, R3-R5, and R3-R5 from Platform left to right. The DMX jack shall be installed House Right end of raceway and labeled DMX-OUT. Each label shall be placed above the associated connectors or pigtails on both sides of the raceway. The terminal strip shall be placed at the Platform right end of the distribution strip. A 16' 6" long, 1-½" schedule 40 pipe batten shall be provided and installed for each electric, as part of section 11 61 33, in order to hang the lights from the rigged electric. The Theatrical Lighting Contractor shall provide the appropriate gridiron junction boxes and the appropriate multi-wire feeder cable of correct length in one continuous piece with strain relief and support devices on both ends. The Electrical Contractor shall provide the appropriate load wire from the relay rack.
 3. Provide One (1) 47' 0" raceway in one section, with 6 circuits and Two (2) DMX-OUT to serve as the first electric on Platform. Five (5) circuits shall be wired into 20 evenly spaced flush mount 20 Amp parallel blade U-Ground "Edison" connectors and labeled R8-R12 on both sides of the raceway. One (1) circuit shall be wired into 4 evenly spaced flush mount 20Amp parallel blade U-Ground "Edison" connectors and labeled WL25 on both sides of the raceway The Edison connectors shall be labeled R8-R12, R8-R12, R8-R12 & R8-R12 from Platform left to right. The DMX jacks shall be installed Platform left and right end of raceways and labeled DMX-OUT. The maximum length of allowable extension cable shall be listed below the jack. Each label shall be placed above the associated connectors or pigtails on both sides of the raceway. The terminal strip shall be placed 5' 0" from the Platform left end of the distribution strip. Provide pipe brackets (ETC Type 21 or similar) to allow single batten configuration for use as the first electric on Platform. A 47' 4" long, 1-½" schedule 40 pipe batten shall be provided and installed for each electric, as part of section 11 61 33, in order to hang the lights from the rigged electric. The Theatrical Lighting Contractor shall provide the appropriate gridiron junction boxes and the appropriate multi-wire feeder cable of correct length in one continuous piece with strain relief and support devices on both ends. The Electrical Contractor shall be responsible for all load wire termination and appropriate load wire from the relay rack.
 4. Provide One (1) 47' 0" raceway in one section, with 6 circuits and Two (2) DMX-OUT to serve as the second electric on Platform. Five (5) circuits shall be wired into 20 evenly spaced flush mount 20 Amp parallel blade U-Ground "Edison" connectors and labeled R13-R17 on both sides of the raceway. One (1) circuit shall be wired into 4 evenly spaced flush mount 20Amp parallel blade U-Ground "Edison" connectors and labeled

- WL26 on both sides of the raceway The Edison connectors shall be labeled R13-R17, R13-R17, R13-R17, & R13-R17 from Platform left to right. The DMX jacks shall be installed Platform left and right end of raceways and labeled DMX-OUT. The maximum length of allowable extension cable shall be listed below the jack. Each label shall be placed above the associated connectors or pigtails on both sides of the raceway. The terminal strip shall be placed 5' 0" from the Platform left end of the distribution strip. Provide pipe brackets (ETC Type 21 or similar) to allow single batten configuration for use as the first electric on Platform. A 47' 4" long, 1-½" schedule 40 pipe batten shall be provided and installed for each electric, as part of section 11 61 33, in order to hang the lights from the rigged electric. The Theatrical Lighting Contractor shall provide the appropriate gridiron junction boxes and the appropriate multi-wire feeder cable of correct length in one continuous piece with strain relief and support devices on both ends. The Electrical Contractor shall be responsible for all load wire termination and appropriate load wire from the relay rack.
5. Provide One (1) 47' 0" raceway in one section, with 6 circuits and Two (2) DMX-OUT to serve as the third electric on Platform. Five (5) circuits shall be wired into 20 evenly spaced flush mount 20 Amp parallel blade U-Ground "Edison" connectors and labeled R18-R22 on both sides of the raceway. One (1) circuit shall be wired into 4 evenly spaced flush mount 20Amp parallel blade U-Ground "Edison" connectors and labeled WL27 on both sides of the raceway The Edison connectors shall be labeled R18-R22, R18-R22, R18-R22, & R18-R22 from Platform left to right. The DMX jacks shall be installed Platform left and right end of raceways and labeled DMX-OUT. The maximum length of allowable extension cable shall be listed below the jack. Each label shall be placed above the associated connectors or pigtails on both sides of the raceway. The terminal strip shall be placed 5' 0" from the Platform left end of the distribution strip. Provide pipe brackets (ETC Type 21 or similar) to allow single batten configuration for use as the first electric on Platform. A 47' 4" long, 1-½" schedule 40 pipe batten shall be provided and installed for each electric, as part of section 11 61 33, in order to hang the lights from the rigged electric. The Theatrical Lighting Contractor shall provide the appropriate gridiron junction boxes and the appropriate multi-wire feeder cable of correct length in one continuous piece with strain relief and support devices on both ends. The Electrical Contractor shall be responsible for all load wire termination and appropriate load wire from the dimmer rack.
 6. Provide Two (2), wall boxes with 1 circuit each. One (1) circuit shall be wired into 1 flush mount 20 amp Parallel Blade U-Ground "Edison" connectors. Label the Edison connectors R24 or R25 in locations as indicated. The Theatrical Contractor shall provide the wall boxes and the appropriate back boxes. The Electrical Contractor shall be responsible for all conduct, load wire termination and appropriate load wire from the relay rack.
 7. Provide One (1), wall boxes with 2 circuits each. Two (2) circuits shall be wired into 2 flush mount 20 amp Parallel Blade U-Ground "Edison" connectors. Label the Edison connectors R28 and R29 in location as indicated. The Theatrical Contractor shall provide the wall boxes and the appropriate back boxes. The Electrical Contractor shall be responsible for all conduct, load wire termination and appropriate load wire from the relay rack.

2.8 EMERGENCY LIGHTING TRANSFER SWITCH

A. Emergency Lighting Transfer Switch.

1. General.
 - a. The Emergency Lighting Transfer System (ELTS2) shall provide automatic transfer of branch circuits from normal to emergency power when normal power fails. Each system shall consist of power transfer switches and a control circuitry interconnected to provide complete, automatic protection.
 - b. The ELTS shall transfer designated lighting load branch circuits from dimmers or secondary control outputs to a second power source in the event of a loss of power to the dimmer rack, a normal system failure, or activation of fire alarm.
 - c. The system shall comply with ANSI / UL1008 Transfer Switch Equipment, ANSI / NFPA 110 Standard for Emergency and Standby Power Systems, and ANSI / NFPA 70 (NEC), including Article 700, 701 and 702 safety standards. Emergency transfer systems that do not comply with the below stated NEC articles and sections shall not be permitted.
 - 1) Satisfies requirements of the National Electrical Code (NFPA 70):
 - a) Article 700 – Emergency Systems
 - b) Article 701 – Legally Required Standby Systems
 - c) Article 702 – Optional Standby Systems
 - d) Section 518.3(C) – Assembly Occupancies
 - e) Section 520.7 – Theatres and Similar Locations
 - f) Section 540.11(C) – Motion Picture Projection Rooms
 - d. Emergency Transfer equipment shall comply with the US seismic requirements of the International Building Code (IBC) for equipment in the emergency life-safety chain and be approved for seismic applications. Seismic certification shall include installation applications for Roof, Grade, Below Grade, and Intermediate Level installation in the USA with an Ss level of 3.42 and SDS level of 2.28. Emergency transfer equipment that does not meet or exceed the seismic acceptance criteria for non-structural components and systems per the applicable building code or as set forth in the ICC AC-156 shall not be acceptable.

- 1) The following building codes are addressed under this certification.
 - a) IBC 2000 – referencing ASCE 7-98 and ICC AC-156
 - b) IBC 2003 – referencing ASCE 7-02 and ICC AC-156
 - c) IBC 2006 – referencing ASCE 7-05 and ICC AC-156
 - d) IBC 2009 – referencing ASCE 7-05 and ICC AC-156
- e. The ELTS shall be a self-contained system for up to 12 circuits at 20 amps and available for single or three phase power (120/208V, 120/240V or 277/480V). The unit shall be available with either discrete emergency branch circuit feeds from an external circuit breaker panel (by others) or emergency main feed with built-in branch circuit distribution and over current protection.
2. Transfer Switch.
 - a. The switch shall be a UL 1008 LISTED, electrically operated and mechanically held (maintained) transfer switch.
 - b. The switch shall be positively locked and unaffected by voltage variations or momentary outages so constant contact pressure is maintained and temperature rise at the contacts is minimized.
 - c. The switch shall be mechanically interlocked to ensure only one of the two possible positions, either Normal or Emergency.
 - d. Each switch shall be configured as guaranteed break-before-make.
 - e. Built-in fuses shall provide up to 65000A Short Circuit Current Rating (SCCR) on connected emergency circuits.
 - f. Built-in fuses class G shall be provided on each output for compliance with NEC Section 700.27 Coordination – larger upstream breakers cannot be tripped by downstream branch circuit faults.
 - g. Switch contacts shall withstand transfer without welding, with 180° phase displacement between Normal and Emergency power sources, both sources energized and with 80% load.
 - h. Transfer switch contacts shall be rated for mixed loads, including electric discharge lamps and tungsten filament lamps.
 - i. Transfer switches shall be rated for 6000 cycles at full tungsten load.
3. Control Circuit.
 - a. The control circuitry shall direct the operation of the transfer switch.
 - b. User configurable timing delays shall be provided for power transfer between:
 - 1) Loss of normal power and the transfer to emergency up to 10 seconds.
 - 2) Restoration of normal power and the transfer from emergency back to normal power up to 60 seconds.
 - c. A normally closed dry contact closure fire alarm input shall be provided.
 - d. Transfer switch shall support connections for up to 5 Remote Stations which can manually switch between normal and emergency power.
4. Operation.
 - a. Transfer to alternate supply will occur when normal supply voltage drops below 80V when used at 120V, or 185V for the A phase and 80V for the B and C phase when used at 277V.
 - b. A self-supervising isolated signal input shall be provided for connection to the facility fire alarm. The ELTS2 shall automatically transfer the loads to the Emergency power source when the facility fire alarm is activated as part of a normally-closed loop.
 - c. A key-operated switch shall be provided to manually control the ELTS2. All automatic functions shall override this control. Two indicator lights shall be provided to show the position of the transfer switch.
 - d. All automatic functions shall override remote control functions. Any combination of open or shorted wiring to remote stations shall not affect automatic functions, or disable the local switch.
5. Remote Stations (Option, not included).
 - a. Optional remote control stations shall be available for the ELTS2. Each remote control station shall contain a 3-position key switch. The left and right positions shall be momentary and the switch shall always return to the center position.
 - b. The faceplate shall be labeled Normal for the left switch position, Emergency for the right switch position and Auto for the center position.
 - c. The faceplate shall contain two LEDs to confirm transfer switch position.
 - d. Each remote station shall mount in a standard, two-gang wall box (4" x 4" x 3.5").
 - e. Remote stations shall not be incorporated into or mounted onto other equipment.
 - f. All wiring to remote stations shall be by 5-conductor, Class 2 wiring (24V DC). A terminal strip shall be provided for contractor wiring.
6. Enclosure.
 - a. The ELTS2 shall be mounted in a NEMA 1 interior or NEMA 4 watertight type enclosure finished in textured epoxy paint. It shall be equipped with a hinged locking door. Material shall be no less than 14 gauge steel.
 - b. An enclosure containing no more than 12 (twelve) 20A circuits shall be 37"H x 24.3"W x 8.7"D.
 - c. The enclosure shall provide power distribution and branch circuit protection for all emergency power circuits. Systems requiring external emergency power circuit protection shall not be acceptable.
 - d. The enclosure shall be separate and independent of all other equipment. In no instance shall the

- ELTS2 be enclosed in a dimmer rack or in an enclosure containing other equipment.
 - e. The system shall be provided with an approved overlay mounted on the front of the enclosure, stating, "EMERGENCY LIGHTING TRANSFER SYSTEM".
 - f. The enclosure shall be provided with an approved label indicating that the system is UL1008 LISTED.
- B. Provide the following for Discovery:
 1. Provide One (1), ELTS2-1-D-120-4 Emergency Lighting Transfer Switch wired for Four (4) 20 amp switched circuits, and Four (4) 120v single phase emergency discrete feed. Provide with all equipment required to draw the sense circuit from the relay panel. Provide with contact closure to tie into the fire alarm system. Wiring from fire alarms are by others. Mount to wall in dimmer room.
 2. Provide One (1), EBDK Emergency Bypass Detection Kit, Mount to wall in dimmer room.
 3. Provide One (1), DEBC-6, 6 output DMX Emergency Bypass Controller. Mount to wall in dimmer room.
 4. Provide all required Tap Kits, wiring, hardware, and other equipment as required to allow for the proper operation of the emergency lighting systems in the auditorium.
- C. Provide the following for South Valley:
 1. Provide One (1), ELTS2-1-D-120-4 Emergency Lighting Transfer Switch wired for Four (4) 20 amp switched circuits, and Four (4) 120v single phase emergency discrete feed. Provide with all equipment required to draw the sense circuit from the relay panel. Provide with contact closure to tie into the fire alarm system. Wiring from fire alarms are by others. Mount to wall in dimmer room.
 2. Provide One (1), EBDK Emergency Bypass Detection Kit, Mount to wall in dimmer room.
 3. Provide One (1), DEBC-6, 6 output DMX Emergency Bypass Controller. Mount to wall in dimmer room.
 4. Provide all required Tap Kits, wiring, hardware, and other equipment as required to allow for the proper operation of the emergency lighting systems in the auditorium.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Inspect the areas and conditions where theatrical equipment will be installed. Notify the Architect and Owner 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 with the contractor and architect. Provide items to be installed 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 Platform technicians and licensed electrician.
 1. Provide all tools, accessories, connecting and attaching devices as required for a complete and properly functioning installation.
- B. Install equipment true and plumb, and securely anchored in place in accordance with the manufacture's recommendations.
- C. Properly test and demonstrate all equipment after installation.

3.3 PLATFORM LIGHTING CONTROLS

- A. Furnish all materials as indicated, including all necessary low voltage control cables, multi-feeder cable, strain reliefs, back boxes and grid iron junction boxes. Coordinate cable pickup with rigging contractor. The Electrical Contractor as part of Division 26 will perform the electrical service hookup and load circuit terminations.
- B. All system components shall arrive on the job site freight prepaid and completely pre-wired with all field connections clearly labeled. All equipment shall be UL listed and shall comply with National Electrical Code.
- C. The lighting system and controls shall be fully factory-tested prior to shipment and 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. Unspecified length warranty will not be acceptable.

- D. Furnish three sets of closeout documents and manuals in both printed and electronic formats. The document should include but not limited to; system layouts, maintenance procedures, operation, and tutorials. One additional electronic set is to be provided to consultant.
- E. Provide the services of a qualified technician to instruct the owner's personnel in the proper operation of the specified control system at a time acceptable to the owner after the final punch or two weeks after turn on, whichever is later; training time not to exceed four hours.
 - 1. Upon owner's request, up to 6 months after the initial training, provide the services of a qualified technician to instruct the owner's personnel on a follow up training session date to be determined by the district; training time to be two hours.

3.4 CLEAN-UP

- A. Upon completion of installation, remove all debris from the site. Leave work areas broom clean and ready for use.

END OF SECTION 116100

SECTION 116133 - THEATRICAL RIGGING AND 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 Platform equipment:
 - 1. Acceptable Manufacturers
 - 2. Dead Hung Platform Rigging
 - 3. Platform Curtains and Tracks
- B. Related work in other sections:
 - 1. Theatrical Lighting Equipment; Section 116100
 - 2. Platform Curtains for EPIC Elementary School; Section 116143

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 and accompanying documents as well as coordinating with the electrical contractor for the electrical materials and hook-up. 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 platform rigging system with on-platform and FOH lighting positions. 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 rigging equipment shall be manufactured by one of the following:
 - 1. H & H Specialties
 - 2. J. R. Clancy, Inc.
 - 3. Thern
- C. The curtain track equipment shall be manufactured by one of the following:
 - 1. Automatic Devices Company
 - 2. H & H Specialties
 - 3. Hall Stage
- D. Pipe and Drape
 - 1. Rose Brand
 - 2. Pipe and Drape USA
- 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 PLATFORM RIGGING

- A. Provide dead hung battens and tracks per school; Discovery and South Valley. Refer to "TH" drawings for reference.
 - 1. Provide Twenty-one (21) dead hung battens and tracks:
 - a. Provide and install lightweight framing (Unistrut or similar) to overhead structure as needed to support new dead hung battens and 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 battens and 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 nicropress sleeve. On the pipe end of the cable a 30" trim chain fabricated from 3/16" proof coil chain and fastened with a forged screw pin shackle, with safety wire. The trim chain shall be wrapped 1 ½ times around the pipe and fasten back to the eye of the cable. 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 dead hung battens shall be constructed of 1-½" schedule 40 black iron pipe. Joints shall be kept to a minimum and shall be accomplished by use of an internal pipe sleeve at least 18" long. One end of the sleeve shall be plug welded to the batten. The other end of the sleeve shall be drilled with two holes on the same axis for field connection using grade 5 bolts. Battens shall be thoroughly cleaned to remove grease and oil and shall have yellow end caps. The yellow end caps shall be labeled with the line set number and the batten capacity.
- F. 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.
- G. Provide Operating and Warning sign that is in compliance with ANSI Z535 indicating safe methods of operation of the rigging equipment. Mount to wall in a visible area approved by the owner. All signage must include the load limits of all line sets and electrics.
- H. Provide an Operations Manual for the rigging equipment including safe procedures and recommended operational practices for the installed system.
- I. Remove all debris from the site. Leave floors broom clean.

2.3 PLATFORM CURTAINS AND TRACKS

- A. Fabricate, deliver and install platform 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.
 - b. Fred Krieger Fabric: Prism synthetic velour, 22 ounces per linear yard, 62" wide.
 - c. Rose Brand: Encore synthetic velour, 22 ounces per linear yard, 64" wide.
 - 2. Mid and Up-Platform Travelers, Masking (Leg and Border Masking) Curtains, Color: Black.
 - 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. Platform 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
- 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 tread 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 Valance shall be fabricated to finish with 75% sewn in fullness with box pleats, 12" on center. The top shall have 3" poly webbing double stitched to the back. The curtain shall be stapled to the proscenium wall. The sides shall finish with a 2" turned back hem. The bottom shall finish with a 4" hem which shall contain #8 plated jack chain the entire length of the curtain.
- I. Forestage Grand Drapery shall be fabricated with 75% 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 2' 0" turned back hem. The bottom shall finish with a 6" hem, weighted with #8 plated jack chain the entire length.
- J. Mid and Up-Platform Traveler Curtains shall be fabricated with 50% 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. A CCF-2 fastener shall be used at every grommet to attach curtain to the track. Both the on and off platform sides shall be finished with a full 1'0" turned back hem. The bottom shall be finished with a full 6" hem, weighted with #8 plated jack chain the entire length.
- K. Border and Leg Masking curtains shall be fabricated to finish with 50% 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 2" turned back hem. The bottom shall finish with a 4" hem which shall contain #8 plated jack chain the entire length of the curtain.
- L. Curtain Bags shall be fabricated from canvas with a 3" poly webbing double stitched to the top. Four (4) #3 brass grommets shall be installed equally spaced 1" from the top of the bag. The bag shall have a solid canvas bottom double stitched to the sides for the full circumference. The grommets shall be used to attach the bag to the suspension cords, listed below, to protect the platform curtains.
- M. Provide the following Curtains and Track Schedule at Discovery and South Valley:
1. Provide One (1) Grand Valance, One (1) section total. Finish with 50% fullness, Encore velour, color to be determined by architect. Finish 51'0" wide x 4'0" high, install on pipe batten. Install at location 1 on the drawings.
 2. Provide One (1), Forestage (Grand) Drapery finished in two (2) sections total. Finish each section 26'0" wide x 22'0" high, 50% fullness, Encore velour, color to be determined by the Architect Installed on two lengths of #280 curtain track, each length to be 33'5" and 34'8" with a total track span of 66'3". Provided with all necessary hardware for endless line bi-parting operation with rear fold guides and an adjustable 5" floor pulley with detachable floor mount kit. Install at location 2 on the drawings.
 3. Provide One (1), Full platform, Mid Platform Traveler Curtain, finished in two (2) sections, total. Finish each section 26'0" wide x 22'0" high, 50% fullness, Encore velour. Color black. Installed on two lengths of #280 curtain track, each length to be 30'2" and 30'4" with a total track span of 58'2". The track shall be provided with all necessary hardware for endless line bi-parting operation with rear fold guides and an adjustable 5" floor pulley with detachable floor mount kit. Install at location 11 on the drawings.
 4. Provide One (1), Full platform, Up Platform Traveler Curtain, finished in two (2) sections total. Finish each section 26'0" wide x 22'0" high, 50% fullness, Encore velour. Color black Installed on two lengths of #280 curtain track, each length to be 30'2" and 30'4" with a total track span of 58'2". The track shall be provided with all necessary hardware for endless line bi-parting operation with rear fold guides and an adjustable 5" floor pulley with detachable floor mount kit. Install at location 20 on the drawings.
 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.
 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.
 7. Provide Three (3) masking borders, Three (3) section total. Finish with 50% fullness, Encore velour, color black. Finish 47'4" wide x 6'0" high, tied to batten. Install at location 8, 12 and 14 on the drawings.
 8. Provide One (1), seamless Muslin drop finished 51'0" wide x 22'0" high, no fullness. Color grey, installed with 1" bottom pipe in 10' sections that are coupled. Hang on Track at location 21 on the drawings.
 9. Provide Five (5) 58'3" scenery tracks. Each continuous 280 track complete with four (4) ADC 2861 Door Carriers. Hang on Track at locations 6, 13, 17, 18 and 20 on the drawings.
 10. Provide Seven (7) Curtain bags. Each bag shall be 36" in diameter x 8'0" tall. Two (2) ADC 1150 cords with a D ring on one end shall be hung from curtain tracks in line set numbers 2, 10, 19, and 21. The cords shall

- hang from the curtain track down to 8'4" AFF. Each D-ring shall have a CCF-2 fastener to connect the cord to the scenery bags.
11. Provide Eight (8) Curtain bags. Each bag will 24" in diameter x 8'0" tall. The Two (2) ADC 1150 cords with a D ring on one end shall be hung from curtain tracks in line set numbers 5, 8, 13, and 16. The cords shall hang from the curtain track down to 8'4" AFF. Each D-ring shall have a CCF-2 fastener to connect the cord to the scenery bags.
- N. Provide the following for the Scoreboard at Discovery and South Valley:
1. Scoreboard Drapery finished in two (2) sections total. Finish each section 4'6" wide x 5'0" high, 0% fullness, Banjo Cloth, Color to be determined by the Architect. Provide One (1) length of ADC Specifine Model 113, length to be 13'8". Wall mount track 3" above scoreboard. Provide with all necessary hardware for endless line bi-parting operation with an adjustable 7" floor pulley mounted to wall 10'0" AFF.
- O. Provide the following at Discovery and South Valley:
1. Provide 60'-0" of Rose Brand Pipe and Base 2.0 curtain supports.
 - a. Provide Seven (7) Uprights. The uprights shall be adjustable in height from 9-23' in three sections.
 - b. Provide Six (6) horizontals. The horizontals shall be adjustable from 6' to 10'
 - c. Provide Seven (7) Bases. Bases shall be 24 x 24 x 63#.
 2. Provide (6) 20'-0" tall and 10'-0" wide Synthetic velour panels
 3. Rolling storage cart for pipe and bases
 4. Rolling hamper for fabric panels.
- P. Provide to following for the FOH position at Discovery and South Valley:
1. Two (2) 8'-0" 1-1/2" schedule 40 black iron pipe hung with an ETC #21 bracket
 2. One (1) 16'-0" 1-1/2" schedule 40 black iron pipe hung with an ETC #21 Bracket.
 3. Hang in location as indicated on TH drawing.
- 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 two hours.
- 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 116133

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 Shackle (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.
 - b. Fred Krieger Fabric: Prism synthetic velour, 22 ounces per linear yard, 62" wide.
 - c. Rose Brand: Encore synthetic velour, 22 ounces per linear yard, 64" wide.
 - d. Approved equal.
 2. Masking Curtains, Color: Black.
 - 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 tread 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 116143 - STAGE CURTAINS

PART 1 GENERAL

1.1 SUMMARY

- A. General: The work covered by this Section shall include all labor, material, miscellaneous fittings, transportation and accessories to furnish and install the stage curtains and tracks as hereinafter specified and to make a complete installation.
- B. Section Includes:
 - 1. Stage curtains, scrims, and drops.
 - 2. Draw-curtain tracks.
 - 3. Curtain rigging.
- C. All items of work and material included in this specification shall be furnished by a single manufacturer and installed by experienced stage technicians in the employ of that manufacturer, so that there will be no division of responsibility for the proper operation of the equipment after installation.
- D. Related Requirements:
 - 1. Section 055000 "Metal Fabrications" for steel framing and supports for stage-curtain systems.
 - 2. Section 116133 "Theatrical Rigging and Curtains" for related work for Discovery Middle Scholl and South Valley Middle School.

1.2 PREINSTALLATION MEETINGS

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

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product and the following:
 - 1. Draw-Curtain Machines: Include rated capacities, operating characteristics, and electrical characteristics.
 - 2. Tracks: Capability of each track to support the weight and operation of curtains that it supports.
- B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.
 - 1. Include plans, elevations, sections, and attachment details of curtains.
 - 2. Include fabric assembly and hanging details.
 - 3. Dimension operating clearances.
 - 4. Include documentation of capacity of each batten, track, attachment, and rigging component to support loads.
 - 5. Wiring Diagrams: For power, signal, and control wiring.
- C. Samples for Initial Selection: For each type of stage curtain indicated. Include color charts showing full range of colors, textures, and patterns available, together with 12-inch-square Sample (any color) of each fabric type and seam.
- D. Samples for Verification: Full width by minimum 12-inch- ½ yard long section of each fabric from dye lot to be used for the Work, with specified treatments applied. Show complete pattern repeat. Mark top and face of fabric.
- E. Delegated-Design Submittal: For stage-curtain systems and attachments to structure, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Structural members to which tracks, battens, and other stage-curtain equipment will be attached.
 2. Locations of lighting fixtures and cabling, ductwork, piping, and sprinklers.
 3. Rigging equipment for stage equipment.
 4. Access panels.
- B. Qualification Data: For Installer and professional engineer.
- C. Product Certificates: For the following, from manufacturer:
1. Fabric: Provide name of flame-retardant chemical used, identification of applicator, treatment method, application date, allowable life span for treatment, and details of any restrictions and limitations.
 2. Rigging: Compliance of suspended tracks with requirements.
- D. Sample Warranty: For manufacturer's special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For stage curtains and rigging to include in operation and maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Minimum of 2 years experience, under the current company name, in the actual production of stage curtains similar to those required for this project.
- B. Theatrical 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. Minimum of 2 years experience with specified system.
1. Each Theatrical Contractor must furnish a written listing of at least five (5) installations that are equal to or surpass the scope of this project and that have been installed within the last five (5) years.
- C. Installer Qualifications: Manufacturer of stage curtains.

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Do not install stage curtains until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work at and above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- B. Field Measurements: Verify locations of supporting structural elements and construction contiguous with stage curtains and rigging by field measurements before fabrication and indicate measurements on Shop Drawings.

1.8 WARRANTY

- A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace components of stage-curtain systems that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, faulty operation of rigging.
 2. Warranty Period: Two years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 STAGE-CURTAIN SYSTEMS

- A. Description: Complete stage-curtain systems, including stage curtains, tracks, and rigging; with necessary accessories for support and operation.

- B. Source Limitations: Obtain stage-curtain systems from single manufacturer. Obtain each color, grade, finish, type, and variety of fabric from single source with resources to provide materials of consistent quality in appearance and physical properties.

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design stage-curtain systems, including comprehensive engineering analysis and attachments to building structure, using performance requirements.
- B. Structural Performance: Stage-curtain systems and attachments to structure shall withstand the effects of gravity and operational loads and the following loads and stresses:
 - 1. Design Loads: Weight of curtains and tracks.
- C. Fire-Test-Response Characteristics: Provide stage curtains meeting the following requirements as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. Flame-Propagation Resistance: Passes NFPA 701.
 - a. Permanently attach label to each fabric of curtain assembly indicating whether fabric is inherently and permanently flame resistant or is treated with flame-retardant chemicals and whether it requires retreatment after cleaning or after a designated time period of use.
 - b. Permanently attach 12-inch-square swatch of same fabric and dye lot for each fabric of a curtain assembly to the back of assembly for use as fire-resistance test strip.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.3 CURTAIN FABRICS

- A. General: Provide fabrics inherently and permanently flame resistant or chemically flame resistant by immersion treatment according to performance requirements indicated. Provide fabrics of each type and color from same dye lot.
- B. Grand Drape "Traveler Curtain" Fabric (116143.A01):
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Da Vinci Velvet Plus as manufactured by Dazian Creative Fabric Environments, or comparable products from KM Fabrics, Rose Brand or other manufacturers submitted to and accepted by Architect prior to bidding.
 - 2. Product Characteristics:
 - a. Width: 62 inches.
 - b. Fabric Content: 100 percent polyester.
 - c. Weight: 21 ounces, minimum per lineal yard.
 - d. Weight per square yard: 12.6 ounces, minimum.
 - e. Fire resistant properties: Inherently flame resistant and passes NFPA 701 Small Scale.
 - f. NRC Rating: 0.70.
 - 3. Color: As selected by Architect from full range of fabric manufacturer's standard colors.
 - a. Where color is not stated, the Owner reserves the right to select colors from standard selections, or, at his option request that custom dyed colors be used.
- C. Lining, where indicated shall be Denim, color Black as furnished by Frankel Associates, 47-10 Austell Place, Long Island City, NY 11101, or approved equal.
 - 1. The following Curtains shall be lined, in 75% fullness, utilizing the specified fabric:
 - a. Grand Drape "Traveler Curtain".
- D. All fabrics utilized for the Curtains hereinafter specified shall be made flame retardant to conform to ALL applicable building and safety codes. The Contractor shall furnish, before final approval is given, notarized flameproofing certificates, in duplicate, stating the flameproofing chemical used and that the immersion method of flameproofing was utilized as well as the fabric color and yardage. These certificates are to be originated by the firm having done the flameproofing and not by the Contractor.
- E. Curtain Hardware:

1. Curtain Track: Track shall be as manufactured by Automatic Devices Company, 2121 So. 12th Street, Allentown, PA 18103. Comparable track submitted to architect prior to bidding as manufactured by H & H Specialties, Hall Stage or Triple E Ltd will be considered.
2. Basis-of-Design Product: Model #280 Silent Steel.
3. Tracks shall be provided with all necessary hardware for endless line bi-parting operation with a floating floor block. The sand bag weighted floating floor block shall incorporate a chain sling on four (4) sides to support the weight of the sand bag. Designs not incorporating this chain sling will not be acceptable.

F. FABRICATION

1. Fabrication of all panels shall be a single piece for the entire height of the curtain. No splicing of fabric to achieve desired length will be acceptable.
2. All thread used shall be Tex 40 spun polyester for synthetic fabric curtains and shall match color of the fabric on which it is used. Thread shall not be lighter than #16 size.
3. All seams shall be sewn in straight and even lines. Bad stitching, missed stitching puckered seams and hems, will not be acceptable.
4. Grand Drape (Traveler Curtain) (116143.A01): Shall be fabricated with 75 percent sewn-in fullness with box pleats every 12 inches on center and as follows:
 - a. Top shall have 3 inch poly webbing double stitched to the back. It shall have #3 grommets at the center of each pleat, placed at 1 inch from the top.
 - b. A CCF-2 fastener shall be used at every grommet to attach curtain to track.
 - c. Sides shall be finished with a 2 feet turned-back hem.
 - d. Bottom shall be finished with 6 inch hem, weighted with #10 jack chain or equivalent lead tape weight for the entire length.
5. Linings, shall be so sewn as to prevent the face material and linings interacting to cause pulled or puckered seams. The face materials will hang true and straight at all times. The linings shall attach to the face material by means of 3/4 inch tabs of hook and loop Velcro. Monofilament plastic lining attachment will not be acceptable.
6. The Front Curtain and Concert Curtain shall have a minimum of 2'-0" facing at the center lap.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for supporting members, blocking, installation tolerances, clearances, and other conditions affecting performance of stage-curtain work.
 1. Coordinate work of this Section and work schedule with related work in other sections. Provide items to be installed by others in sufficient time to prevent delays.
- B. Examine inserts, clips, blocking, or other supports required to be installed by others to support tracks and battens.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Install stage-curtain system according to curtain and track manufacturer's written instructions.
- B. Field Measurements: Contractor shall check actual stage curtain openings by accurate field measurements before fabrication; show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying Work.
 1. Where field measurements cannot be made without delaying the Work, guarantee opening dimensions and proceed with fabricating stage curtains without field measurements. Coordinate stage construction to ensure that actual opening dimensions correspond to guaranteed dimensions.
- C. All equipment shall be new and of first quality. All work shall be performed by experienced stage technicians in a professional manner using the latest approved methods and stage techniques as established by custom and good engineering.
- D. Should any equipment be furnished which, due to any cause, is not in strict accordance with the Specifications, it shall be rejected; and the Contractor will make same satisfactory at no additional expense.

- E. Upon completion, remove all debris from site. Leave work areas broom clean.

3.3 TRACK INSTALLATION

- A. Ceiling-Mounted Track: Drill track at intervals not greater than manufacturer's written instructions for spacing, and fasten directly to structure.
- B. Beam-Mounted Track: Install track by suspending from beam clamps securely mounted to I-beam structure at track-support spacing, according to manufacturer's written instructions.
- C. Wall-Mounted Track: Install track by suspending from brackets securely mounted to wall construction at track-support spacing, according to manufacturer's written instructions.
- D. Batten-Hung Track: Install track by suspending from pipe batten with manufacturer's track clamp hangers attached to batten pipe clamps at track-support spacing, according to manufacturer's written instructions.
- E. Track-Support Spacing: According to manufacturer's recommendations for applied loads, but not exceeding the following dimensions between supports:
 - 1. Heavy-Duty Track: 72 inches.
 - 2. Medium-Duty Track: 48 inches.
 - 3. Curved Walk-Along Track: 48 inches, with additional supports at curves and splices.
- F. Install track for center-parting curtains with not less than 24-inch overlap of track sections at center, supported by track lap clamps.

3.4 CURTAIN INSTALLATION

- A. Track Hung: Secure curtains to track carriers with S-hooks.

3.5 PROTECTION

- A. The Contractor shall protect all existing work liable to damage under the Contract. Such protective devices shall be of suitable materials; all necessary repairs resulting from negligence on the part of the Contractor shall be made at the expense of the Contractor

END OF SECTION 116143

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SECTION 116623 - GYMNASIUM EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Overhead Backboard Supports (116623.A01).
 - 2. Wall-Mounted Backboard Supports (116623.A02).
 - 3. Rectangular Backboards (116623.A03).
 - 4. Fan-Shaped Backboards (116623. A04).
 - 5. Volleyball equipment (116623.A05).
 - 6. Wall/Safety pads (116623.A07).
 - 7. Scoreboards (116623.A10).
 - 8. Shot clocks and mounting supports.
 - 9. Scorer's Table, illuminated.
- B. Related Requirements:
 - 1. Section 051200 "Structural Steel".
 - 2. Section 055000 "Metal Fabrications" for backstop, exterior scoreboard and field timer supports.
 - 3. Section 061000 "Rough Carpentry
 - 4. Section 096466 "Wood Athletic Flooring" for game lines and markers.
 - 5. Section 116653 "Gymnasium Dividers."
 - 6. Division 26 Sections for electrical service for motor operators, controls, and other powered devices for motorized gymnasium equipment.
- C. Products Furnished but not Installed Under this Section:
 - 1. Volleyball sleeves to be cast in concrete slabs and footings: Refer to Section 033000.

1.2 DEFINITIONS

- A. NFHS: National Federation of State High School Associations.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. If applicable, include assembly, disassembly, and storage instructions for removable equipment.
 - 2. Motors: Show nameplate data, ratings, characteristics, and mounting arrangements.
- B. Shop Drawings: For each type of equipment specified.
 - 1. Include plans and layouts, elevations, sections, details, and attachments to other work.
 - 2. Include details of field assembly for removable equipment, connections, installation, mountings, floor inserts, attachments to other work, and operational clearances.
 - 3. Include transport and storage accessories for removable equipment.
- C. Samples for Initial Selection: For each type of athletic equipment, scoreboard and scorer's table.
 - 1. Color sample chips for each item requiring color selections.
- D. Samples for Verification: For the following products:
 - 1. Basketball Net: Full size.
 - 2. Volleyball Net: Minimum 12-inch length by full height, including one edge and net accessories.
 - 3. Pad Fabric: Wall padding not less than 3 inches square, with specified treatments applied. Mark face of material.
 - 4. Scorer's Table Padding: Padding vinyl facing fabric not less than 3 inches square.
 - 5. Batting cage mesh netting not less than 12 inches square.
- E. Wiring Diagrams: Submit wiring diagrams for each item of Gymnasium Equipment requiring electricity, clearly indicate power, signal, and control wiring. Clearly differentiate between manufacturer-installed wiring and field-

installed wiring. Indicate maximum and average power demands.

1.4 INFORMATIONAL SUBMITTALS

- A. Structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation including loads, point reactions, and locations for attachment of gymnasium equipment to structure.
- B. Setting Drawings: For cast-in floor volleyball sleeves to receive for post standards.
- C. Coordination Drawings: Coordination Drawings: Court layout plans, reflected ceiling plans, and other details, drawn to scale, and coordinated with ceiling-suspended gymnasium equipment, floor inserts, game lines, and markers applied to finished flooring, and coordinated with each other, using input from installers of the items involved:
 - 1. Structural members to which overhead-supported gymnasium equipment will be attached.
 - 2. Suspended ceiling components, if any.
 - 3. Items supported from building structure above the courts, including the following:
 - a. Air outlets and inlets.
 - b. Acoustical treatments or panels.
 - c. Access panels.
- D. Qualification Data: For Installer and professional engineer.
- E. Product Certificates: For each type of gymnasium equipment.
- F. Field quality-control reports.
- G. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For gymnasium equipment to include in emergency, operation, and maintenance manuals.
- B. Maintenance data for inclusion in Operating and Maintenance Manual specified in Section 017823 including detailed instructions indicating proper means for operating and maintaining each type of athletic equipment item and accessory required.

1.6 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Manufacturer shall have a minimum of ten (10) years continuous experience, under the current company name in the manufacturing of systems similar in complexity to those required for this Project.
- B. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer, in addition to the following:
 - 1. Installer shall have at least three (3) years successful experience installing products of similar type and quality as required on this project.
- C. Source Limitations: Obtain each type of gymnasium equipment through one source from a single manufacturer.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- E. Product/Material Qualifications: Manufacturer's catalog numbers are indicated for convenience in identifying equipment items. Unless otherwise indicated, catalog description for indicated number constitutes minimum standards of quality, design, and performance required for each item to be incorporated into the Project. Substitutions will be allowed, but must be submitted in accordance with the procedures set forth in Sections 012500 and 016000. All proposed substitutions/comparable products must be submitted to and accepted by the Architect prior to bidding.

1. It will be the responsibility of the Bidder to furnish with his Bid a list clarifying any deviations from these specifications written or implied, in order that a fair and proper evaluation be made. Those Bidders not submitting a list of deviations will be presumed to have Bid as specified.

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Do not install gymnasium equipment until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- B. Field Measurements: Check actual dimensions of construction affecting Athletic Equipment installation by accurate field measurements before fabrication; show recorded measurements on final shop drawings. Coordinate fabrications schedule with construction progress to avoid delay of Work.
 1. Verify position and elevation of floor inserts and layout for gymnasium equipment.

1.8 COORDINATION

- A. Coordinate installation of floor inserts with structural floors and finish flooring installation and with court layout and game lines and markers on finish flooring.
- B. Coordinate layout and installation of overhead-supported gymnasium equipment and suspension-system components with other construction including light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.
- C. Coordinate electrical requirements of athletic equipment with related trades.

1.9 WARRANTY

- A. Special Warranty for Basketball Equipment: Manufacturer agrees to repair or replace components of gymnasium equipment that fail in materials or workmanship within specified warranty period.
 1. Failures include, but are not limited to, the following:
 - a. Basketball backboard failures including glass breakage.
 - b. Faulty operation of motorized basketball backstops.
 2. Warranty Period: 1 year from date of Substantial Completion.
 - a. Volleyball equipment.
 - 1) Net.
 - 2) Judges's stand.
 - b. Wall Pads (Draper).
 3. Warranty Period: 5 years from date of Substantial Completion.
 - a. Wall Pads (Porter).
 4. Warranty Period: 25 years from date of Substantial Completion.

1.10 SERVICE GUARANTEE

- A. The Gymnasium Equipment Contractor shall guarantee service and repair to any defective equipment within 24 hours from notification by Owner for a period of one (1) year after substantial completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS, GENERAL

- A. Source Limitations: Obtain each type of gymnasium equipment from single source from single manufacturer.
- B. Note: Provide (3) three sets up nets and floor inserts, etc. per Middle Schools, but only provide (1) one judge's platform and association items per school.

2.2 BASKETBALL EQUIPMENT

- A. Basis-of-Design Product: Subject to compliance with requirements, provide products from Porter Athletic, Inc., or comparable products, submitted to and accepted by Architect prior to bidding from one of the following:
 - 1. Draper, Inc.
 - 2. Performance Sports Systems; a Gared Holdings company.
 - 3. Aalco Manufacturing Co.
- B. General: Provide equipment complying with requirements in NFHS's "NFHS Basketball Rules Book."
- C. Protruding fasteners or exposed bolt heads on front face of backboards are not permitted.
- D. Provide manufacturer's recommended connections complying with Section 055000 "Metal Fabrications" of size and type required to transfer loads to building structure.
- E. Overhead-Supported Backstops (116623.A01) provide backstops of the following types where indicated:
 - 1. Forward Fold, height adjustable, front-braced: Basis-of-Design – Porter Athletic, Inc.; Model 949.
 - 2. Forward Fold (Epic), height adjustable, front-braced: Basis-of-Design – Porter Athletic, Inc.; Model 950.
 - 3. Side Fold, height adjustable, side-braced: Basis-of-Design – Porter Athletic, Inc.; Model 955.
- F. System Description, General:
 - 1. Folding Type: Provide manufacturer's standard assembly for each type of backstop, with hardware and fittings to permit folding.
 - 2. Framing: Steel pipe, tubing, and shapes. Design framing to minimize vibration during play.
 - a. Center-Mast Frame: Welded with side sway bracing.
 - b. Finish: Manufacturer's standard or custom polyester powder-coat finish. Color shall be black.
 - 3. Goal Height Adjuster: Adjustable from 8 to 10 feet with gear-drive mechanism, locking in any position within adjustment range, with visible height scale attached to side of framing.
 - a. Basis-of-Design Product: Subject to compliance with requirements, provide Porter Athletic, Inc.
 - b. Operation: Electric with integral gear-drive motor, with limit switches preset to goal heights and the following:
 - 1) Wireless remote control.
 - c. Backstops to receive height adjusters are indicated on Drawings.
- G. Backstop Safety Device: Designed to limit free fall if support cable, chains, pulleys, fittings, winch, or related components fail; with mechanical automatic reset; 6000-lb load capacity; one per folding backstop.
 - 1. Retractor Device: For all forward fold, rear-braced backstops provide manufacturer's standard device designed to retract both support and safety cables, chains, and straps away from play of the basketball when backstop is in playing position; one per each folding backstop.
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide Porter Athletic, Inc.; Model 797.
- H. Backstop Electric Operators: Provide operating machine of size and capacity recommended by manufacturer for equipment specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, and remote controls. Coordinate wiring requirements and electrical characteristics with building electrical system.
 - 1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 2. Operator Type: Cable drum with grooved drum and cable tension device to automatically take up cable slack and retain cable in grooves.
 - 3. Operator Mounting: Manufacturer's standard.
 - 4. Motor Characteristics: Sufficient to start, accelerate, reverse, and operate connected loads at designated speeds within installed environment and with indicated operating sequence, and without exceeding nameplate rating or considering service factor. Comply with NEMA MG 1, and the following:
 - 5. Voltage: NEMA standard voltage selected to operate on nominal circuit voltage to which motor is connected.
 - 6. Horsepower: Model 713, 1 hp.
 - 7. Enclosure: Manufacturer's standard.
 - 8. Duty: Continuous duty at ambient temperature of 105 deg F (40 deg C) and at altitude of 3300 feet (1005 m) above sea level.
 - 9. Service Factor: 1.15 for open drip-proof motors; 1.0 for totally enclosed motors.
 - 10. Phase: One.
 - 11. Controller: Key operated winch, provide Porter Athletic, Inc; Model XELE00791112

12. Limit Switches: Adjustable switches, interlocked with motor controls and set to automatically stop basketball equipment at fully retracted and fully lowered positions.
 13. Basis-of-Design Products: Subject to compliance with requirements, provide the following products from Porter Athletic, Inc.
 - a. Electric Winch: Porter, Model 00707-000.
- I. Basketball Backboards (116623.A03):
1. Backboards: Provide rectangular, 72 by 42 inches width by height.
 - a. Basis-of-Design Product: Subject to compliance with requirements, provide Porter Athletic, Inc.; Model 208, Center Strut Rectangular Glass Backboard.
 - b. Backboard frame shall be welded, unitized construction, designed for direct goal mounting type structures.
 - c. Backboard Material: With predrilled holes or preset inserts for mounting goals, and as follows:
 - 1) Glass: Not less than 1/2-inch- thick, transparent tempered glass complying with ASTM C 1048 Kind FT (fully tempered) and with impact testing requirements in 16 CFR 1201 Category II or ANSI Z97.1 Class A for safety glazing. Provide glass with impact-absorbing resilient rubber or PVC gasket around perimeter in a fully welded, painted steel frame, with steel subframe, reinforcement, bracing, and mounting slots for mounting backboard frame to backboard support framing.
 - 2) Direct Mount: Designed for mounting backboard frame to center mast of backstop to maximize relief of stresses on backboard frame and glass.
 - d. Target Area and Border Markings: Permanently etched in white color, marked in pattern and stripe width according to referenced rules.
- J. Basketball Backboards (116623.A04):
1. Basis-of-Design Product: Subject to compliance with requirements, provide Porter Athletic, Inc.; Model Model #00234A-300 with Model #00245500 "Ultra-Flex goal.
- K. Goal Mounting Assembly: Compatible with goal, backboard, and support framing; with hole pattern that is manufacturer's standard for goal attachment.
1. Direct Mount: Designed for mounting goal directly and independently to center mast of backboard support framing so no force, transmitted by ring, is directly applied to backboard, and rigidity and stability of goal are maximized.
- L. Goal Mounting Assembly with Height Adjuster: Compatible with goal, backboard, height adjuster assembly to eliminate stress on backboard; with hole pattern that is manufacturer's standard for goal attachment.
1. Through Backboard Mount: Designed for mounting goal through backboard to height adjuster and mount height adjuster independently to center mast of backstop.
- M. Basketball Goals: Complete with flanges, braces, attachment plate, and evenly spaced loops welded around underside of ring.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Porter Athletic, Inc.; Model 256-500 "Torq-Flex Goal" with anti-whip net, made from white nylon cord not less than 120-gm thread and not more than 144-gm thread.
 2. Finish: Manufacturer's standard powder-coat finish.
- N. Backboard Safety Pads: Designed for backboard thickness indicated and extending continuously along bottom and up sides of backboard and over goal mounting and backboard supports as required by referenced rules and per manufacturer's standard design specified.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Porter Athletic, Inc.; Model 326.
 2. Attachment: Bolt on.
 3. Color: As selected by Architect from manufacturer's full range.

2.3 VOLLEYBALL EQUIPMENT

- A. Basis-of-Design Product: Subject to compliance with requirements, provide the following:
1. Porter Athletic, Inc.
 - a. Floor Inserts (116623.A05): Provide Model 00870-200 (brass) as selected by Architect. Floor insert shall include: cast aluminum recessed mounting flange, cork gasket, 5 inch diameter cover and floor sleeve.
 - 1) Cover shall be equipped with a swivel-type retainer pin.
 - 2) Provide special key for cover removal.

- b. Floor Inserts (116623.A05): Provide Model 00870-100 (chrome plated) as selected by Architect. Floor insert shall include: cast aluminum recessed mounting flange, cork gasket, 5 inch diameter cover and floor sleeve.
 - 1) Cover shall be equipped with a swivel-type retainer pin.
 - 2) Provide special key for cover removal.
 - c. Volleyball End Standards: Provide Powr-Rib II, Model 19719 with protective pads in color to be selected by Architect.
 - d. Volleyball Center Standards: Provide Powr-Rib II, Model 197219 with protective pads in color to be selected by Architect.
 - e. Winches: Provide Model WINH00113 "Powr-Select Winch" for type of standards specified.
 - f. Upright Pads for Standards: Provide Model 8390 "Official Upright Pads" for each end standard. Pads shall have 15 oz reinforced vinyl facing and 1-1/2 inch thick polyethylene filler. Color as selected by Architect.
 - g. Volleyball Net and Antennas: Provide Net Model 2295 "Universal Competition Net" with antennas Model 2296.
 - h. Net Chain: Provide Model "Fair Height Net Chain".
 - i. Judge's Platform: Provide Model 669100 "Free Standing Judge's Stand".
 - j. Protective Pads for Judge's Platform: Provide Model 6693 pads in color to be selected by Architect.
 - k. Boundary Marker with Antenna: Provide Model 00546-000.
 - l. Volleyball Transport System: Provide Model 956100 "Powr Volleyball Transport System".
- B. Accessories:
- 1. Provide non-corrosive floor anchors for portable volleyball equipment as recommended by equipment manufacturer to suit substrates involved.

2.4 WALL-MOUNTED SAFETY PADDING (116623.A07)

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Porter Athletics, Inc; "Firesafe", Series 5720; or comparable product by one of the following, meeting specified requirements, submitted to and accepted by Architect prior to bidding:
 - 1. Dollamur Sport Surfaces.
 - 2. Draper.
- B. Performance Characteristics:
 - 1. Impact and Shock Absorption: Units shall meet or exceed ASTM F 2440-04 requirements.
 - 2. Safety Pad Surface-Burning Characteristics: Shall meet NFPA 286 or another testing and inspecting agency acceptable to authorities having jurisdiction:
 - a. Unit shall meet Class A requirements for flame spread and smoke developed.
- C. Wall Pads: Panels will be constructed of 3" thick fire-retardant foam bonded to 7/16" oriented strand board, with 19 ounce vinyl-coated nylon fabric, folded and stapled securely to back of 7/16" plywood. Mount to wall with manufacturer's standard seamless Z-clips. Panels shall be self-edged and not have margins.
 - 1. Size: 2'-0" width x 5'-10" height.
 - 2. Installation Method: Manufacturer's standard, Z-clip installation.
 - 3. Vinyl Covering:
 - a. Face Weight: 19 ounces.
 - b. Heavy fire-retardant, high tensile, vinyl-coated polyester fabric material. Cover material shall have a tensile strength of 100 psi, minimum.
 - c. Cover material shall be mildew and rot resistant and fortified with an infection combating fungicide.
 - d. Vinyl Covering Color: As selected by Architect from manufacturer's full range for one color.
 - 4. Where cut-out occur within padding, provide manufacturer's wall pad sleeves and molded inserts for outlets and switches. Depth to match adjacent pad thickness. Color shall be gray.
 - 5. All cutouts in panels shall be made in field to fit job conditions. All cut edges will have factory furnished applied seal or field-installed sleeves.
 - 6. Where safety pads are indicated to be installed over doors, fabricate pads to be 1 inch less than door the door width to allow for unencumbered operation. Contractor's option to provide a single safety pad or two separate safety pads to cover the door.
- D. I-Beam Pads: Pads shall be 6 feet tall and 2 inches thick, covered with 14 oz, minimum, weight vinyl facing. Color of facing to match adjacent wall pads.
 - 1. Basis-of-Design Product: Provide Porter Athletics, Inc.; Model 3560, 3562 or 3563 to suit beam width.

- E. Stage Pads: Pads shall be rigidly backed and 2 inches thick, consisting of; 2-inch foam bonded to 7/1-inch thick wood board and covered with 19 oz vinyl facing. Color of facing as selected by Architect.
- F. Panels must be inspected before installed. CAUTION: To minimize wrinkles in fabric of installed panels, wall must be either perfectly plumb, or slightly convex (bowed out) over the area to be covered. If found to be concave (bowed in), install sufficient shims at mid-section of panels to provide plumb or convex wall profile.
- G. The installing Contractor shall be responsible for proper inspection and installation of all panels. Installation shall be made in accordance with current factory suggested procedures.
- H. Warranty: 5 years.

2.5 SCOREBOARDS (116623.A10)

- A. Basis of Design Products: Subject to compliance with requirements, provide ~~Fair-Play wireless and LED type scoreboards.~~ **Daktronics "Model BB-2103."**
 - 1. Comparable product of one of the following will be considered:
 - a. Nevco.
 - b. ~~Daktronics.~~
 - c. **Fair-Play.**
- B. Scoreboard Types:
 - 1. ~~Fair-Play Daktronics; Model BB-2125~~ **Model BB-2101** wireless and LED type scoreboard (116623.A10).
 - a. Product Characteristics:
 - 1) Overall Size: Approximately ~~10 feet wide by 4 feet high by 6 inch depth~~ **8 feet wide by 4 feet high by 6 inch depth.**
 - 2) Clock and Score Modules: ~~10 inches high, others 7 inches high.~~ **10 inches high and 13 inches high.**
 - 3) Time Remaining or Time Elapsed in minutes and seconds for periods up to 99 minutes or less. Period numbered 0 - 9. Bonus and Possession arrows. Home and Visitor team scores 0 - 199. All necessary painted captions for items listed in "display".
 - 4) Horn: #350 Federal horn.
 - 5) Cable shall be 1-2 wire.
 - 6) Unit weight: Approximately ~~400~~ **120** pounds.
 - 7) Scoreboard Cabinet: All aluminum, with metal thickness of at least 0.050 inches for front and sides. All service from front of cabinet with no special tools required for access.
 - (a) **Color as selected from standard manufacturers colors.**
 - 8) Lights: LED digits.
 - (a) Color as selected by Architect.
 - 9) Electronics: UL listed, solid state low voltage encased in completely "plug-in" packs for ease of service.
 - 10) Supply wall box and set of connectors for power supply and receiver.
 - 11) Spare Parts: Include a minimum of two of each type of fuse and ten lamps.
 - 12) Power Requirements: 120V, 50/60 Hz, single phase.
 - 13) Scoreboard system and accessories shall be listed as approved for electrical safety by ETL Testing laboratories.
 - 14) Wireless Control System: Manufacturer's standard. Provide receiver, antenna and controller.
 - 15) Color: ~~Black display with black~~ **Cabinet border striping as selected from standard manufacturers colors.**
 - (a) **Seperate colors for South Valley and Discovery Middle Schools**
 - 16) Warranty: Five year warranty and lifetime service. Provide warranty against defects in workmanship and materials for one year on a factory-exchange basis. Extend warranty for and additional four years on all electronic components. Supply a service and operations manual with system.

2.6 GYMNASIUM CONTROL EQUIPMENT AND RELAY SYSTEM

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Porter Athletics, Inc.; "Powr-Touch 2.5 System", including but not limited to, the following components for complete control of all motorized gymnasium equipment.

1. Comparable products from other manufacturers meeting specified requirements will be considered only when submitted to and accepted by Architect prior to bidding.
 - a. Costs for modifications to the electrical system for acceptance of comparable products/system and for system substitutions shall be borne by the Contractor without additional cost to the Owner.
- B. Gymnasium Legend: Provide a custom wall-mounted graphical representation of each gymnasium. Each graphical representation shall indicate locations of each piece of equipment to be operated throughout gymnasium with a numerical indicator which corresponds to numbers on the control keypad. Provide one legend per keypad.

2.7 MATERIALS

- A. Aluminum: Alloy and temper recommended by manufacturer for use and finish type indicated.
 1. Extruded Bars, Profiles, and Tubes: ASTM B 221.
 2. Cast Aluminum: ASTM B 179.
 3. Flat Sheet: ASTM B 209.
- B. Steel: Comply with the following:
 1. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
 2. Steel Tubing: ASTM A 500/A 500M or ASTM A 513, cold formed.
 3. Steel Sheet: ASTM A 1011/A 1011M.
- C. Support Cable: Manufacturer's standard galvanized-stranded-steel wire rope. Provide fittings complying with wire rope manufacturer's written instructions for size, number, and installation method.
- D. Support Chain and Fittings: For chains used for overhead lifting, provide Grade 80 heat-treated alloy steel chains, complying with ASTM A 391/A 391M, with commercial-quality, hot-dip galvanized steel connectors and hangars.
- E. General-Purpose Chain: For chains not used for overhead lifting, provide carbon steel chain, complying with ASTM A 413/A 413M, Grade 30 proof coil chain or other grade recommended by gymnasium equipment manufacturer. Provide coating type, chain size, number, and installation method complying with manufacturer's written instructions.
- F. Castings and Hangers: Malleable iron, complying with ASTM A 47/A 47M; grade required for structural loading.
- G. Softwood Plywood: DOC PS 1, exterior.
- H. Particleboard: ANSI A208.1; made with binder containing no urea formaldehyde.
- I. Equipment Wall-Mounted Board: Wood, neutral-color-painted finish, size, and quantity as required to mount gymnasium equipment according to manufacturer's written instructions.
- J. Anchors, Fasteners, Fittings, and Hardware: Manufacturer's standard corrosion-resistant or noncorrodible units; concealed; tamperproof, vandal- and theft-resistant design when within 8 feet of finished floor.
- K. Grout: Nonshrink, nonmetallic, premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout, complying with ASTM C 1107/C 1107 with minimum strength recommended in writing by gymnasium equipment manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for play court layout, alignment of mounting substrates, installation tolerances, operational clearances, accurate locations of connections to building electrical system, and other conditions affecting performance of the Work.
 1. Verify critical dimensions.
 2. Examine supporting structure, subfloors, and footings below finished floor.
 3. Examine wall assemblies, where reinforced to receive anchors and fasteners, to verify that locations of concealed reinforcements are clearly marked. Locate reinforcements and mark locations.
 4. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. General: Comply with manufacturer's written installation instructions and competition rules indicated for each type of gymnasium equipment. Complete equipment field assembly where required.
- B. Unless otherwise indicated, install gymnasium equipment after other finishing operations, including painting, are completed.
- C. Permanently Placed Gymnasium Equipment and Components: Install rigid, level, plumb, square, and true; anchored securely to supporting structure; positioned at locations and elevations indicated; in proper relation to adjacent construction; and aligned with court layout.
 - 1. Floor Insert Location: Coordinate location with application of game lines and markers, and core drill floor for inserts after game lines are applied.
 - 2. Floor Insert Elevation: Coordinate installed heights of floor insert with installation and field finishing of finish flooring and type of floor plate.
 - 3. Operating Gymnasium Equipment: Verify clearances for movable components of gymnasium equipment throughout entire range of operation and for access to operating components.
 - 4. Shot Clocks and Mounting Brackets: Install in locations indicated mounting to each backstop mast at Main Court, unless directed otherwise by Architect. Securely mount bracket to mast and shot clock to bracket in accordance with manufacturer's written instructions.
- D. Floor Insert Setting: Position sleeve in oversized, recessed voids in concrete slabs. Clean voids of debris. Fill void around sleeves with grout, mixed and placed to comply with grout manufacturer's written instructions. Protect portion of sleeve above subfloor from splatter. Verify that sleeves are set plumb, aligned, and at correct height and spacing; hold in position during placement and finishing operations until grout is sufficiently cured. Set insert so top surface of completed unit is flush with finished flooring surface.
- E. Wall Pads:
 - 1. Mount with bottom edge at 4 inches above finished floor.
 - 2. Preparation:
 - a. Inspect areas and conditions where wall padding and padded safety floor mats will be installed. Notify the Architect of any condition that would adversely affect the installation or subsequent utilization of the equipment. Do not proceed with installation until satisfactory conditions are corrected.
 - b. Coordinate wall padding and padded safety floor mats installation with work of other trades. Provide setting diagrams, dimensions, and templates for items that must be built in during other construction operations.
 - 3. Installation:
 - a. General: Install all wall padding and padded safety floor mats in accordance with the manufacturer's recommendations and approved shop drawings. Set wall padding plumb, true and level, and secure anchored in place.
 - b. Mount with bottom edge flush with floor padding.
 - c. Cutout Trim: Limit cuts in face of padding so that cuts are securely and fully concealed behind trim-kit flange.
 - 4. Protection: Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensures that wall padding is without damage or deterioration at time of Substantial Completion.
- F. Anchoring to In-Place Construction: Use anchors and fasteners where necessary to secure built-in and permanently placed gymnasium equipment to structural support and to properly transfer load to in-place construction.
- G. Connections: Connect electric operators to building electrical system.
- H. Removable Gymnasium Equipment and Components: Assemble in place to verify that equipment and components are complete and in proper working order. Instruct Owner's designated personnel in properly handling, assembling, adjusting, disassembling, transporting, storing, and maintaining units. Disassemble removable gymnasium equipment after assembled configuration is approved by Architect and Owner, and store units in location indicated on Drawings.
- I. Scoreboards: Mount where indicated on Drawings in strict accordance with manufacturer's written instructions.

3.3 ADJUSTING

- A. Adjust movable components of gymnasium equipment to operate safely, smoothly, easily, and quietly; free from binding, warp, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range; and lubricate as recommended in writing by manufacturer.
- B. Remove packaging and other debris from the project site.

3.4 CLEANING

- A. After completing gymnasium equipment installation, inspect components. Remove spots, dirt, and debris and touch up damaged shop-applied finishes according to manufacturer's written instructions.
- B. Replace gymnasium equipment and finishes that cannot be cleaned and repaired, in a manner approved by Architect, before time of Substantial Completion.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain gymnasium equipment.

END OF SECTION 116623

SECTION 116653 - GYMNASIUM DIVIDERS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Bottom roll-up gymnasium divider system (116653.A01).
- B. Related Sections:
 - 1. Section 055000 "Metal Fabrications" for gymnasium divider hoist beam.
 - 2. Division 26 Sections for electrical service for motor operators, controls, and other powered devices for motorized gymnasium dividers.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Motors: Show mounting arrangements and wiring diagram to power source and controls.
- B. Shop Drawings: For gymnasium dividers.
 - 1. Include plans showing alignment of curtains in relation to court layout.
 - 2. Include elevations, sections, details, and attachments to other work.
 - 3. Include system clearances, stacking requirements, and limits for fitting into adjacent construction.
 - 4. Include loads, point reactions, and locations for attachment of gymnasium dividers to structure.
 - 5. Include locations of divider curtain controllers.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Sample Warranty: For special warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For gymnasium dividers to include in operation and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer. Installer shall have at least seven years continuous experience under the current company name. Installer shall have a record of successful in-service installations.
 - 1. Installer shall have completed at least four similar installations having similar requirements within the last three (3) years.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.6 FIELD CONDITIONS

- A. Environmental Limitations: Do not install gymnasium dividers until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

- B. Field Measurements: Verify size of space, available clearances, obstructions, and position for gymnasium dividers.

1.7 COORDINATION

- A. Coordinate installation of overhead-supported gymnasium dividers and suspension-system components with other construction including light fixtures, HVAC equipment, fire-suppression-system components, partition assemblies and other ceiling-structure-mounted athletic equipment.
- B. Electrically Operated Dividers: Coordinate electrical requirements for type and location of power supply, conduit, wiring, and control boxes.

1.8 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of gymnasium dividers that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Faulty operation of gymnasium dividers.
 - b. Tearing or deterioration of fabric, seams, or other materials beyond normal use.
 - 2. Warranty Period: One year from date of Substantial Completion.

PART 2 PRODUCTS

2.1 GYMNASIUM DIVIDER CURTAIN SYSTEMS (116653.A01)

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Porter Athletic; Model 90675000 "Bottom Roll-up Gymnasium Divider Curtain" and with line shaft safety lock or comparable product by one of the following, submitted to and accepted by Architect prior to bidding:
 - 1. Draper, Inc.
 - 2. Jaypro Sports Construction Group.
 - 3. Performance Sports Systems; a Gared Holdings company.
- B. Divider Curtain System, General: Electrically operated with roll-up drive pipe, and as follows:
 - 1. Top Hem: Double-thickness mesh or solid vinyl pocket for continuous pipe batten.
 - 2. Outer Edge Hems: Manufacturer's standard, double turned and welded.
 - 3. Belts: Manufacturer's standard, 5-inch- wide polyester or polyurethane webbing or fabric belts, attached to top batten, passing under bottom batten, and terminating at drive pipe, with friction surface on one side of belt or other means of drawing up curtain by rolling at bottom batten. Hoist belts shall be spaced at not more than 25 feet on center.
 - 4. Support Chain and Fittings: Hardened alloy steel chain rated for lifting loads indicated, with commercial-quality, corrosion-resistant steel connectors and hangers.
 - 5. Curtain Battens and Drive Pipe: Fabricate from steel pipe or tubing with a minimum number of joints, as necessary for required lengths. Provide galvanized battens, or shop prime and shop finish with black paint.
 - a. Drive Pipe: 2-3/8-inch- nominal diameter zinc-plated steel pipe.
 - b. Top Batten: 1-1/2 to 1-5/8-inch- nominal diameter steel pipe. Top batten tube shall be supported from roller support assemblies on adjustable chains not exceeding 14 feet on center.
 - c. Bottom Batten: 4-1/2-inch- nominal diameter steel pipe. Tube shall be completely concealed within bottom section of the vinyl fabric.
 - 6. All metal parts shall be zinc-plated and powder coated. Color shall be black.
- C. Divider Curtains:
 - 1. Upper Curtain, Mesh: Provide open polyester type interlocking grid weave coated with polyvinyl chloride with an approximate 45 to 50 percent open area. Weight of material shall not be less than 8 oz/sq. yd.
 - 2. Basis-of-Design Product: Porter Athletics; "Fleximesh 8 OZ."
 - a. Mesh Color: As selected by Architect from manufacturer's full color range..
 - 3. Lower Curtain, Solid: Provide solid vinyl, polyester reinforced, 19 oz./sq. yd. with double-coated vinyl fabric, 8-foot height above floor.
 - 4. Basis-of-Design Product: Porter Athletics; "Flexivide 19 OZ"

- a. Fabric Color(s): As selected by Architect from manufacturer's full range for one color.
- 5. Divider Curtain Flame-Resistance Ratings: Upper and lower curtain shall both pass NFPA 701, inherently and permanently flame resistant.
 - a. Permanently attach label to each fabric of curtain assembly indicating whether fabric is inherently and permanently flame resistant or treated with flame-retardant chemicals, and whether it will require retreatment after designated time period or cleaning.
 - b. Curtain Fabrication: Fused seams and the following:
 - 6. Top Hem: Reinforce with double thickness mesh to receive continuous pipe batten.
 - 7. Bottom Hem for Roll-up Curtains: Floor-length curtains with hems 2 inches above finished floor and with manufacturer's standard roll-up tube and lifting tape.
- D. Accessories:
 - 1. Proof Coil Chain: Grade 30, No. 8, zinc plated, 3/16 inch (4.7 mm), ASTM A 413/A 413M.
 - 2. Line Shaft Safety Lock: Locks drive system when speed exceeds manufacturer's recommended speed.
 - 3. Audible Motion Alarm: Provide alarm with intermittent warning tone when curtain is raised or lowered.
- E. Divider Curtain Operator: Roll-up drive tube.
- F. Divider Curtain Electric Operator: Provide operating machine of size and capacity recommended by manufacturer for equipment specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, and wireless control system. Coordinate wiring requirements and electrical characteristics with building electrical system and wireless control system.
- G. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- H. Limit Switches: Adjustable switches, interlocked with motor controls and set to automatically stop dividers at fully extended and fully retracted positions.
 - 1. Operator Type: Electric motor, worm-gear running-in-oil drive, with chain and sprocket secondary drive.
 - 2. Motor Characteristics: Sufficient to start, accelerate, reverse, and operate connected loads at designated speeds within installed environment and with indicated operating sequence, and without exceeding nameplate rating or considering service factor. Comply with NEMA MG 1, and the following:
 - 3. Voltage: NEMA standard voltage selected to operate on nominal circuit voltage to which motor is connected.
 - 4. Horsepower: 3/4 hp, minimum.
 - 5. Enclosure: Totally enclosed.
 - 6. Duty: Continuous duty at ambient temperature of 105 deg F (40 deg C) and at altitude of 3300 feet (1005 m) above sea level.
 - 7. Service Factor: 1.15 for open dripproof motors; 1.0 for totally enclosed motors.
 - 8. Phase: One.
 - 9. Key Switch Control System: Manufacturer's standard.
 - 10. Locate control switches as directed by Architect.

2.2 MATERIALS

- A. Support Chain and Fittings: For chains used for overhead lifting, provide Grade 80 heat-treated alloy steel chains, complying with ASTM A 391/A 391M, with commercial-quality, hot-dip galvanized or zinc-plated steel connectors and hangers.
- B. General-Purpose Chain: For chains not used for overhead lifting, provide carbon steel chain, complying with ASTM A 413/A 413M, Grade 30 proof coil chain or other grade recommended by gymnasium divider manufacturer. Provide coating type, chain size, number, and installation method complying with manufacturer's written instructions.
- C. Anchors, Fasteners, Fittings, and Hardware: Manufacturer's standard corrosion-resistant or noncorrodible units; concealed.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for alignment of mounting substrates, installation tolerances, operational clearances, building electrical system connection types and locations, and other conditions affecting performance of the Work.
 - 1. Verify critical dimensions.
 - 2. Examine supporting structure.
 - 3. Examine wall assemblies, where reinforced to receive anchors and fasteners, to verify that locations of concealed reinforcements are clearly marked. Locate reinforcements and mark locations.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. General: Comply with manufacturer's written installation instructions.
- B. Unless otherwise indicated, install gymnasium dividers after other finishing operations, including painting, are completed.
- C. Gymnasium Dividers and Components: Install level, plumb, square, and true; anchored securely to supporting structure; positioned at locations and elevations indicated; in proper relation to adjacent construction; and aligned with court layout.
 - 1. Verify clearances for movable components of gymnasium dividers throughout entire range of operation and for access to operating components.
- D. Anchoring to In-Place Construction: Use anchors and fasteners where necessary to secure gymnasium dividers to structural support and to properly transfer load to in-place construction.
- E. Connections: Connect automatic operators to building electrical system.

3.3 ADJUSTING

- A. Adjust movable components of gymnasium dividers to operate safely, smoothly, easily, and quietly, free from binding, warp, distortion, uneven tension, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Lubricate hardware and moving parts.
- B. Limit Switch Adjustment: Set and adjust upper and lower limit controls.

3.4 CLEANING

- A. After completing gymnasium divider installation, inspect components. Remove spots, dirt, and debris and touch up damaged shop-applied finishes according to manufacturer's written instructions.
- B. Replace gymnasium divider components and finishes that cannot be cleaned and repaired, in a manner approved by Architect, before time of Substantial Completion.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain gymnasium dividers.

END OF SECTION 116653

SECTION 122413 - ROLLER WINDOW SHADES

PART 1 GENERAL

1.1 SUMMARY

- A. This Section includes the following types of roller shades:
 - 1. Manually operated roller shades with single rollers (122413.A01 - Type #).
- B. Related Sections include the following:
 - 1. Section 061000 "Rough Carpentry" for wood blocking and grounds for mounting roller shades and accessories.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, features, finishes, and operating instructions for roller shades.
- B. Shop Drawings: Show fabrication and installation details for roller shades, including shadeband materials, their orientation to rollers, and their seam and batten locations. Show location and type of each roller shade.
 - 1. Include elevations, sections details, and dimensions not shown in Product Data.
 - 2. Include operational clearances, attachments to and relationship to adjoining work.
- C. Samples for Initial Selection: For each type and color of shadeband material.
 - 1. Include Samples of accessories involving color selection.
 - 2. Include 4 inch square, actual samples of each type of shadeband material for Architect's selection.
- D. Samples for Verification: For each type of roller shade.
 - 1. Shadeband Material: Not less than 10 inches square. Mark interior face of material if applicable.
 - 2. Roller Shade: Full-size operating unit, not less than 16 inches wide by 36 inches long for each type of roller shade indicated.
 - 3. Installation Accessories: Full-size unit, not less than 10 inches long.
- E. Product Schedule: For roller shades. Use same designations indicated on Drawings.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Certificates: For each type of shadeband material.
- C. Product Test Reports: For each type of shadeband material, for tests performed by a qualified testing agency.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For roller shades to include in maintenance manuals. Include the following:
 - 1. Methods for maintaining roller shades and finishes.
 - 2. Precautions about cleaning materials and methods that could be detrimental to fabrics, finishes, and performance.
 - 3. Operating hardware.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.

- B. Source Limitations: Obtain roller shades through one source from a single manufacturer.
- C. Fire-Test-Response Characteristics: Provide roller shade band materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
 - 1. Flame-Resistance Ratings: Passes NFPA 701.
- D. Product Standard: Provide roller shades complying with WCMA A 100.1.
- E. Anti-Microbial Characteristics: 'No Growth' per ASTM G21 results for fungi ATCC9642, ATCC9644 AND ATCC9645.
- F. Field Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
 - 1. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver shades in factory packages, marked with manufacturer and product name, lead-free designation, and location of installation using same designations indicated on Drawings.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install roller shades until construction and wet and dirty finish work in spaces, including painting, is complete and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operable glazed units' operation hardware throughout the entire operating range. Notify Architect of discrepancies. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Product for Manually Operated Roller Shades: Subject to compliance with requirements, provide MechoShade Systems, Inc.; "Mecho/5" or a comparable product by one of the following:
 - 1. Draper Inc.
 - 2. Nysan Solar Control Systems.
- B. Source Limitations: Obtain roller shades from single source from single manufacturer.

2.2 MANUALLY OPERATED SHADES WITH SINGLE ROLLERS (122413.A01)

- A. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated.
 - 1. Bead Chains: Stainless steel with Shock Absorber System.
 - a. Loop Length: Full length of roller shade.
 - b. Limit Stops: Provide upper and lower ball stops.
 - 1) Provide limit stops with Shock Absorber System reducing chain stress, consisting of a 3/4" rubber sleeve, 3/8 inch stop beads and washers to prevent shade from being raised or lowered too far.
 - 2) Clutch mechanism: Fabricated from POM thermoplastic with welded 0.354 inch (9 mm) primary steel post with rotational bearing, overrunning design, and positive mechanical engagement of

- drive mechanism to tube. White or Black color as selected by Architect. Center bead chain placement for right or left hand operation and accommodates side channel with no adjustment of chain location.
- c. Chain-Retainer Type: Chain tensioner, jamb mounted.
- 2. Spring Lift-Assist Mechanisms: When recommended by roller shade manufacturer for proper operation of shade, provide manufacturer's standard for balancing roller-shade weight and lifting heavy roller shades.
 - a. Provide for shade bands that weigh more than 10 lb or for shades as recommended by manufacturer, whichever criteria are more stringent.
- B. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shade bands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shade bands for service.
 - 1. Roller Drive-End Location: Right side of inside face of shade or left side of inside face of shade as determined by Architect.
 - 2. Direction of Shadeband Roll: Regular, from back of roller.
 - 3. Shadeband-to-Roller Attachment: Manufacturer's standard method.
- C. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.
- D. Roller-Coupling Assemblies: Coordinated with operating mechanism and designed to join up to three inline rollers into a multiband shade that is operated by one roller drive-end assembly.
- E. Shadebands:
 - 1. Shadeband Material: Light-filtering fabric.
 - 2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
 - a. Types:
 - 1) Light filtering shades: Enclosed in sealed pocket of shadeband material.
 - b. Color and Finish: As selected by Architect from manufacturer's full range.
- F. Installation Accessories:
 - 1. Front Fascia: Aluminum extrusion that conceals front and underside of roller and operating mechanism and attaches to roller endcaps without exposed fasteners.
 - a. Shape: L-shaped.
 - b. Height: Manufacturer's standard height required to conceal roller and shadeband when shade is fully open.
 - 2. Exposed Headbox:
 - a. Description: Rectangular, extruded-aluminum enclosure including the following:
 - 1) Front fascia with integral bottom closure.
 - 2) Top and back covers.
 - 3) Endcaps.
 - b. Height: Manufacturer's standard height required to enclose roller and shadeband when shade is fully open, but not less than 3 inches, and not more than 8 inches.
 - 3. Endcap Covers: As required by manufacturer, provide to cover exposed endcaps.
 - 4. Installation Accessories Color and Finish: As selected from manufacturer's full range.

2.3 SHADEBAND MATERIALS

- A. Shadeband Material Flame-Resistance Rating: Comply with NFPA 701. Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- B. Light-Filtering Fabric: Visually transparent, woven non-raveling single-fabric, stain and fade resistant shadecloth.
 - 1. Basis-of-Design Product for Light Filtering Shadeband (Fabric): Subject to compliance with requirements, provide MechoShade Systems, Inc.; "ThermoVeil" Dense Basket Weave 1300 Series or Dense Linear Weave 1000 Series as determined by Architect, or comparable product from other roller shade manufacturers submitted to and accepted by Architect prior to bidding.
 - 2. Source: Roller-shade manufacturer.
 - 3. Type: Woven from extruded vinyl yarn comprised of 21 percent polyester and 79 percent reinforced vinyl.
 - 4. Thickness: 0.030 inch.
 - 5. Weight: Manufacturer's standard.
 - 6. Roll Width: Manufacturer's standard width up to 126 inches.

7. Orientation on Shadeband: As indicated on Drawings.
8. Openness Factor: 3 percent.
9. Color: As selected by Architect from manufacturer's full range.

2.4 MANUALLY OPERATED HONEYCOMB SHADES WITH CONTINUOUS CORD LOOP (122413.A03).

- A. Basis-of-Design Product for Manually Operated Honeycomb Shades: Subject to compliance with requirements, provide Hunter Douglas Architectural; "Duette Commercial 3/4 inch FR Opaque Honeycomb Shades" or a comparable product submitted to Architect prior to bidding.
- B. Lifting Mechanism: Provide white engineering plastic rotary clutch mechanism with continuous cord loop to activate and hold shade in place.
 1. Bead Chains: Stainless steel with Shock Absorber System.
 - a. Loop Length: Color coordinated braided polyester uniform cord length with polycarbonate cord tensioner for additional safety. Provide white nylon-covered polyester 2.45mm wide x 0.17"mm thick lift tape for heavy shades. Architect to select location of cord; at either side of individual shade unit or one side.
 - b. Limit Stops: Provide upper and lower ball stops.
 - 1) Provide limit stops with Shock Absorber System reducing chain stress, consisting of a 3/4" rubber sleeve, 3/8 inch stop beads and washers to prevent shade from being raised or lowered too far.
 - c. Cord-Retainer Type: Cord tensioner, side mounted.
 2. Spring Lift-Assist Mechanisms: When recommended by roller shade manufacturer for proper operation of shade, provide manufacturer's standard for balancing roller-shade weight and lifting heavy roller shades.
 - a. Provide for shade bands that weigh more than 10 lb or for shades as recommended by manufacturer, whichever criteria are more stringent.
 3. Provide shades with hold-down magnet assembly.
- C. Head and Sill Rail: Manufacturer's EasyRise type headrail measuring 2 inches by 1.875 inches by 0.050 inch thick constructed of aluminum alloy 6063. Internally fit with components required for specified performance and designed for smooth, quiet, trouble-free operation. Finish to be a textured matte that coordinates with the shade fabric. Sill rail measuring 1.875 inches by 0.460 inch x 0.469 inch thick constructed of aluminum alloy 6063 with standard polyester based finish color coordinated with fabric.
 1. Provide ends fitted with polycarbonate end caps white in color for headrail and coordinated colored with fabric for sill rail.
 2. Provide 3/4 inch magnet strip with foam.
- D. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.
 1. Manufacturer's standard nylon coated zinc-plated 1040 HR steel universal hidden brackets. Provide an unobtrusive appearance.
- E. Roller-Coupling Assemblies: Coordinated with operating mechanism and designed to join up to three inline rollers into a multiband shade that is operated by one roller drive-end assembly.
- F. Fabric: Permanent flame-resistant textured, non-woven polyester formed into opaque 3/4 inch hexagonal honeycomb cells in stacked tubular construction.
 1. Provide single cell construction; with each cell an independent piece of fabric and containing a metallized polyester film core.
 2. Finish: As selected by Architect from manufacturer's available contract colors, and as shown on the Material Finish Legend.
- G. Installation Accessories:
 1. Exposed Headbox:
 - a. Description: Rectangular, extruded-aluminum enclosure including the following:
 - 1) Front fascia with integral bottom closure.
 - 2) Endcaps.
 - b. Height: Manufacturer's standard height required to enclose roller and shadeband when shade is fully open, but not less than 3 inches, and not more than 8 inches.
 2. Endcap Covers: As required by manufacturer, provide to cover exposed endcaps.
 3. Installation Accessories Color and Finish: As selected from manufacturer's full range.

2.5 ROLLER SHADE FABRICATION

- A. Product Description: Roller shade consisting of a roller, a means of supporting the roller, a flexible sheet or band of material carried by the roller, a means of attaching the material to the roller, a bottom bar, and an operating mechanism that lifts and lowers the shade.
- B. Concealed Components: Non-corrodible or corrosion-resistant-coated materials.
 - 1. Lifting Mechanism: With permanently lubricated moving parts.
- C. Unit Sizes: Obtain units fabricated in sizes to fill window and other openings as follows, measured at 74 deg F:
 - 1. Shade Units Installed Outside Jambs: Width and length as indicated, with terminations between shades of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.
- D. Installation Brackets: Designed for easy removal and reinstallation of shade, for supporting headbox, roller, and operating hardware and for hardware position and shade mounting method indicated.
- E. Installation Fasteners: No fewer than two fasteners per bracket, fabricated from metal noncorrosive to shade hardware and adjoining construction; type designed for securing to supporting substrate; and supporting shades and accessories under conditions of normal use.
- F. Color-Coated Finish: For metal components exposed to view, apply manufacturer's standard baked finish complying with manufacturer's written instructions for surface preparation including pretreatment, application, baking, and minimum dry film thickness.
- G. Colors of Metal and Plastic Components Exposed to View: As selected by Architect from manufacturer's full range, unless otherwise indicated.
- H. Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.1, including requirements for flexible, chain-loop devices; lead content of components; and warning labels.
- I. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F:
 - 1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which shade is installed less 1/4 inch per side or 1/2-inch total, plus or minus 1/8 inch. Length equal to head-to-sill or -floor dimension of opening in which shade is installed less 1/4 inch, plus or minus 1/8 inch.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, accurate locations of connections to building electrical system, and other conditions affecting performance.
 - 1. Blocking at roller shade locations shall be confirmed to be 3/4 inch wood blocking or greater prior to installation.
 - 2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ROLLER SHADE INSTALLATION

- A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions and located so shade band is not closer than 4 inches to interior face of glass. Allow clearances for window operation hardware.
- B. Roller Shade Locations: Refer to Drawings.

3.3 ADJUSTING, CLEANING AND PROTECTION

- A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

- B. Clean roller shade surfaces after installation, according to manufacturer's written instructions.
- C. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that roller shades are without damage or deterioration at time of Substantial Completion.
- D. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain motor-operated roller shades.

END OF SECTION 122413

SECTION 123200 - MANUFACTURED WOOD CASEWORK

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Plastic-laminate-faced wood cabinets of stock design.
 - 2. Base Cabinet (123200.A01).
 - 3. ADA Sink Base (123200.A11).
 - 4. Microwave Base Cabinet (123200.A12).
 - 5. Cubicle Wall Cabinet (123200.A32).
- B. Related Sections:
 - 1. Section 061000 "Rough Carpentry" for wood blocking for anchoring manufactured wood casework.
 - 2. Section 064023 "Interior Architectural Woodwork" for custom plastic-laminate-clad casework, countertop brackets.
 - 3. Section 092116 "Non-Structural Metal Framing" for reinforcements in metal-framed partitions for anchoring casework.
 - 4. Section 096513 "Resilient Base and Accessories" for resilient base applied to manufactured wood casework.
 - 5. Section 123623 "Plastic Laminate Countertops".
 - 6. Section 123666 "Solid Surfacing Countertops".
 - 7. Section 123669 "Quartz Agglomerate Countertops".

1.2 DEFINITIONS

- A. Definitions in the AWI's, AWMAC's, and WI's "Architectural Woodwork Standards" apply to the work of this Section.
- B. Balanced Construction: Where exposed face of a panel is surfaced with high pressure plastic laminate and the opposite (back) surface shall receive a balanced product equal in thickness to the face of the panel.
 - 1. Note: Color for interior is not required to match color and pattern of exterior face laminate.
- C. Casework: Modular casework of this Section is that which is pre-manufactured to standard dimensions or sizes. Casework fabricated as part of Section 064023 "Interior Architectural Woodwork" is that which is custom fabricated to suit a particular project.
- D. Concealed Portions of Cabinets: Surfaces not usually visible after installation, including sleepers, web frames, dust panels, and ends and backs that are placed directly against walls or other cabinets.
- E. MDF: Medium-density fiberboard.
- F. Hardwood Plywood: A panel product composed of layers or plies of veneer, or of veneers in combination with lumber core, hardboard core, MDF core, or particleboard core, joined with adhesive, and faced both front and back with hardwood veneers.
- G. Exposed Portions of Cabinets: Surfaces visible when doors and drawers are closed, including bottoms of cabinets more than 48 inches above floor, and surfaces visible in open cabinets and behind glass doors.
 - 1. Ends of cabinets installed directly against walls or other cabinets shall not be considered as exposed.
- H. Semi-exposed Portions of Cabinets: Surfaces behind opaque doors, such as interiors of cabinets, shelves, dividers, interiors and sides of drawers, and interior faces of doors. Tops of cases 78 inches or more above floor are defined as semi-exposed.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated, submit data describing materials, fabrication, hardware accessories, and installation instructions.

- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Indicate types, sizes and finishes of cabinets and countertops.
 - 2. Indicate types and locations of hardware.
 - 3. Indicate locations and types of service fittings.
 - 4. Show fabrication details; including locations and sizes for cutouts and holes for plumbing fixtures, science equipment and other items installed in casework.
 - 5. Indicate locations of blocking and reinforcements required for installing casework.
 - 6. Include details of utility spaces showing supports for conduits and piping.
 - 7. Show installation details, including field joints and filler panels.
 - 8. Indicate locations of and clearances from adjacent walls, doors, windows, and other building components.
 - 9. As applicable, indicate manufacturer's catalog numbers for casework.
- C. Samples for Initial Selection: For cabinet finishes and for each type of top material indicated.
- D. Samples for Verification: 8-by-10-inch Samples for each type of finish, including top material.
 - 1. Exposed hardware, one unit for each type.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer. Furnish qualification data for Installer, if different from manufacturer.
- B. Keying Schedule: Include schematic keying diagram and index each key set to unique designations that are coordinated with the Contract Documents.
- C. Certifications: Submit documentation verifying use of "No added formaldehyde" and "marine grade plywood" were incorporated into the work of this Section, as acceptable to and when requested by Architect.
- D. Warranty: Sample of special warranty.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer with not less than seven years of successful experience, under the current company name, in producing manufactured casework similar to that required for this Project.
- B. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project. Installer must have completed projects of similar size and scope to this project in the last 5 years.
- C. Source Limitations: Obtain manufactured wood casework from single source from single manufacturer.
- D. Quality Standard: Unless otherwise indicated, comply with the AWI's and WI's "Architectural Woodwork Standards" for grades of casework indicated for construction, finishes, installation, and other requirements.
 - 1. Grade: Custom.
 - 2. Contract Documents contain selections chosen from options in quality standard and additional requirements beyond those of quality standard. Comply with those selections and requirements in addition to quality standard.
- E. Product Designations: Drawings indicate sizes, configurations, and finish material of manufactured wood casework. Other manufacturers' casework of similar sizes and door and drawer configurations, of same finish material, and complying with the Specifications may be considered as noted below. Refer to Section 012500 "Substitution Procedures" and Section 016000 "Product Requirements."
 - 1. Other manufacturers proposing comparable products shall submit the following for Architect's verification:
 - a. One full-size finished base cabinet complete with hardware, doors, and drawers.
 - b. One full-size finished wall cabinet complete with hardware, doors, and adjustable shelves.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver manufactured wood casework only after painting, utility roughing-in, and similar operations that could damage, soil, or deteriorate casework have been completed in installation areas. If casework must be stored in

other than installation areas, store only in areas where environmental conditions meet requirements specified in "Project Conditions" Article.

- B. Keep finished surfaces covered with polyethylene film or other protective covering during handling and installation.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install manufactured wood casework until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
- B. Field Measurements: Verify actual dimensions of construction contiguous with manufactured wood casework by field measurements before fabrication.
 - 1. Casework manufacturer is responsible for details and dimensions not controlled by job conditions. Show all required field measurements beyond manufacturer's control on shop drawings.
 - 2. Locate concealed framing, blocking, and reinforcements that support casework by field measurements before being enclosed, and indicate measurements on Shop Drawings.

1.8 COORDINATION

- A. Coordinate layout and installation of framing and reinforcements in walls and partitions for support of manufactured wood casework.
- B. Coordinate installation of laboratory casework with installation of fume hoods and other laboratory equipment.
- C. Coordinate layout and installation of work of this Section with electrical and plumbing contractors. Coordinate installation so as not to interfere with plumbing and electrical work associated with casework.
- D. Keying Conference: Conduct conference at Project site. Incorporate keying conference decisions into final keying requirements.

1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of manufactured wood casework that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Delamination of components or other failures of glue bond.
 - b. Warping of components.
 - c. Failure of operating hardware.
 - d. Deterioration of finishes.
 - 2. Warranty Period: Three years from date of Substantial Completion.

PART 2- PRODUCTS

2.1 PLASTIC LAMINATE FACED CASEWORK MANUFACTURERS

- A. Manufacturers for Plastic-Laminate-Faced Manufactured Casework: Subject to compliance with requirements, provide products by one of the following:
 - 1. Basis-of-Design Product: Casework as manufactured by Stevens Industries; Stevens Advantage.
 - 2. Other Manufacturers: Manufacturers list below are required to meet requirements set forth in this Section. Manufacturing procedures may need to be modified for compliance and technical data on casework construction must be submitted for verification. Other manufactures include, but are not limited to:
 - a. TMI Systems Design Corporation.
 - b. Case Systems.
 - c. Precision Craft.

2.2 PLASTIC-LAMINATE-CLAD CASEWORK

- A. Drawings indicate sizes, configurations, and finish material of manufactured wood casework from Stevens Industries. Models selected include, but are not limited to, the following:
 - 1. Base Cabinet (123200.A01): Provide casework in sizes as indicated on the drawings.
 - a. #10129 – 2 Door Base.
 - 2. Sink Base (123200.A10). Provide casework in sizes as indicated on the drawings.
 - a. #10479.
 - 3. ADA Sink Base (123200.A11). Provide casework in sizes as indicated on the drawings.
 - a. #10576.
 - 4. Wall Cabinet (123200.A31). Provide casework in sizes as indicated on the drawings.
 - 5. Finished End (123200.A82).
 - 6. End Panel (123200.A83).
 - 7. Cabinet Locks (123200.A91).
 - a. Drawer and Hinged Door Locks: Provide cam-type locks by COMPTON Timberline.
 - b. Provide a minimum of two keys per lock and six master keys.
 - c. Provide locks on all doors and drawers.
 - d. Inactive door shall receive barrel bolt and strike plate.
- B. Source Limitations: Obtain plastic-laminate-faced cabinets from single manufacturer.

2.3 MATERIALS, GENERAL

- A. Maximum Moisture Content for Lumber: 7 percent for hardwood and 12 percent for softwood.
- B. Softwood Plywood: DOC PS 1, with no added formaldehyde (NAUF).
- C. Particleboard: ANSI A208.1, Grade M-2, with no added formaldehyde (NAUF).
- D. MDF: ANSI A208.2, Grade 130, with no added formaldehyde (NAUF).
- E. Plastic Laminate: High-pressure decorative laminate complying with NEMA LD 3.
 - 1. Colors: Refer to Material Finish Legend on drawings for basis of design products.
- F. Thermoset Decorative Panels: Particleboard or MDF finished with thermally fused, melamine-impregnated decorative paper complying with LMA SAT-1.
- G. Edge Banding for Plastic Laminate: Rigid PVC extrusions, through color with satin finish, 3 mm thick at doors, drawer fronts and laminate countertops, 1 mm thick elsewhere.
 - 1. 3mm edge banding shall be machine-applied and set with hot-melt glue.
 - 2. Edge banding colors shall match a solid color of adjacent laminate surface, unless noted otherwise, as determined by Architect. Colors shall not be limited to casework manufacturer's standard stocked colors, but will be selected by Architect from any color group offered by Canplast, Rehau and Doellken-Woodtape.
- H. Edgebanding for Thermoset Decorative Panels: Unless otherwise specified, provide PVC or polyester edge banding complying with LMA EDG-1 and matching thermoset decorative panels.
- I. Adhesives: Use adhesives that meet the testing and product 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."

2.4 CABINET MATERIALS

- A. Exposed Cabinet Materials:
 - 1. Plastic Laminate: Grade HGS for horizontal surfaces and VGS for vertical surfaces.
 - 2. Unless otherwise indicated, provide specified edge banding on all exposed edges.
- B. Semiexposed Cabinet Materials:
 - 1. Plastic Laminate: Grade VGS.

- a. Provide plastic laminate for semi-exposed surfaces unless otherwise indicated.
 - 1) Color for backs of doors and drawers shall match a solid color of that of cabinet box interior, as determined by Architect. Facings shall be balanced as required by AWI construction guidelines for grade level indicated.
 - 2. Unless otherwise indicated, provide specified edge banding on all semi-exposed edges.
- C. Concealed Cabinet Materials:
 - 1. Thermoset decorative panels.

2.5 DESIGN, COLOR, AND FINISH

- A. Design: Provide manufactured wood casework of the following design:
 - 1. Flush overlay.
- B. Thermoset Decorative Panel Colors, Patterns, and Finishes: As selected by Architect from casework manufacturer's full range.
- C. Plastic-Laminate Colors, Patterns, and Finishes: As indicated by manufacturer's designations on Drawings.
- D. PVC Edgebanding Color: As selected from casework manufacturer's full range, including pre-formulated colors.
- E. Solid Surfacing: As noted on drawings. Where not specifically indicated, as selected by Architect from manufacturer's full range.

2.6 CABINET FABRICATION

- A. Plastic-Laminate-Faced Cabinet Construction: As required by referenced quality standard, but not less than the following:
 - 1. Assembly method for cabinets shall utilize "European" assembly screws (threaded steel dowel pins), similar to Hafele "Conformat". At manufacturer's option, alternate doweled assembly methods may be used if in accordance with AWI guidelines and requirements for grade level indicated.
 - 2. Cabinets boxes below sinks shall be fabricated from plywood and shall receive white plastic laminate on the interior.
 - 3. Bottoms and Ends of Cabinets, and Tops of Wall Cabinets and Tall Cabinets: 3/4-inch particleboard, plastic-laminate faced on exposed surfaces, thermoset decorative panels on semi-exposed surfaces.
 - 4. Shelves: Thermoset decorative panels; 3/4-inch thick for spans up to 32 inches and 1-inch thick for spans up to 48 inches.
 - 5. Open Shelves: 3/4-inch particleboard, plastic-laminate faced on exposed surfaces for spans up to 32 inches and 1-inch thick for spans up to 48 inches.
 - 6. Backs of Cabinets: 1/2-inch particleboard or 1/4-inch MDF, plastic-laminate faced on exposed surfaces, thermoset decorative panels on semi-exposed surfaces. Backs shall be captured in a 1/2-inch dado and set back 3/4-inch to accommodate 3/4-inch thick nailers.
 - 7. Drawer Fronts: 3/4-inch particleboard, plastic-laminate faced exposed face and balanced backer.
 - 8. Drawer Sub-fronts, Sides and Backs:
 - a. 1/2-inch single-species solid-wood or veneer-core hardwood (Birch) plywood, with glued dovetail or multiple dowel joints.
 - b. 1/2-inch, high density fiberboard, 55 pcf density minimum. All parts glued and mechanically fastened using thermosetting fasteners.
 - c. 1/2-inch, high density melamine composite panels. All parts glued and mechanically fastened using thermosetting fasteners.
 - d. Fabricate file drawers and lateral file drawers of width and depth necessary to accommodate hanging file rack system.
 - 9. Drawer Bottoms: 1/4-inch thermoset decorative panels glued and dadoed into front, back, and sides of drawers. Use 1/2-inch material for drawers more than 24 inches wide.
 - 10. Doors: 3/4-inch particleboard or MDF, plastic-laminate faced.
 - 11. Removable Backs: Provide backs that can be removed from within cabinets at utility spaces.
 - 12. Cabinets Bases: Bases shall be fabricated separate from cabinets (not integral). Fabricate from 3/4-inch exterior marine grade plywood or preservative-treated 2x4's with marine-grade plywood face. Fabricate in a ladder configuration with plywood fronts and back running continuous for the length of the cabinet. Provide ends, and provide additional runners centered in all cabinets greater than 24 inches wide.

- B. Filler Strips: Provide as needed to close spaces between cabinets and walls, between cabinets and floors, ceilings, and indicated equipment. Fabricate from same material and with same finish as cabinets.
 - 1. Provide top and bottom fillers and corner panels to close gaps and openings.

2.7 CASEWORK HARDWARE AND ACCESSORIES

- A. Hardware, General: Unless otherwise indicated, provide manufacturer's standard satin-finish, commercial-quality, heavy-duty hardware.
 - 1. Use threaded metal or plastic inserts with machine screws for fastening to particleboard except where hardware is through-bolted from back side.
 - 2. Provide caps on fasteners at cabinet interiors in color to match adjacent cabinet finish color.
- B. Butt Hinges: Chrome-plated, semiconcealed, 5-knuckle hinges complying with BHMA A156.9, Grade 1, with antifriction bearings and hospital tips. Provide 2 hinges for doors less than 48 inches high and 3 hinges for doors more than 48 inches high.
 - 1. If installed adjacent to casework specified in 064023 refer to architect to see which hinge type takes precedence.
- C. Pulls:
 - 1. Solid aluminum or chrome-plated wire pulls, fastened from back with two screws. Provide 2 pulls for drawers more than 24 inches wide.
 - a. Basis of Design: Provide Hafele "116.05.931" matt aluminum handle.
 - 1) Diameter: 128mm.
- D. Door Catches: Zinc-plated, dual, self-aligning, permanent magnet catch. Provide 2 catches on doors more than 48 inches high.
- E. Drawer Slides: BHMA A156.9, Type B05091.
 - 1. Heavy Duty (Grade 1HD-100): Side mounted; full-extension type; zinc-plated, steel ball-bearing slides. Provide with manufacturer's standard metal rear brackets as applicable.
 - a. Basis-of-Design: GSlide Corporation/Knape & Vogt Mfg. Co.; #GS4200.
- F. Hanging File Rails: Manufacturer's standard hanging file rail system. Provide integral system at all base cabinet drawers with dimensions that will accommodate hanging files.
 - 1. At 36" wide base file cabinets, provide rails on front and back for standard legal side filing. Provide two (2) removable crossbars per drawer for optional letter/legal front-to-back filing.
- G. Adjustable Shelf Supports: 2-pin locking plastic shelf rests complying with BHMA A156.9, Type B04013.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances, location of framing and reinforcements, and other conditions affecting performance of manufactured wood casework.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 CASEWORK INSTALLATION

- A. General: Install cabinets to comply with same grade as item to be installed.
- B. Install level, plumb, and true; shim as required, using concealed shims. Where manufactured wood casework abuts other finished work, apply filler strips and scribe for accurate fit, with fasteners concealed where practical.
- C. Base Cabinets: Set cabinets straight, level, and plumb. Adjust subtops within 1/16 inch of a single plane. Fasten cabinets to masonry or framing, wood blocking, or reinforcements in walls and partitions with fasteners spaced 24 inches o.c. Bolt adjacent cabinets together with joints flush, tight, and uniform. Align similar adjoining doors and drawers to a tolerance of 1/16 inch.

1. Where base cabinets are not installed adjacent to walls, fasten to floor at toe space with fasteners spaced 24 inches o.c. Secure sides of cabinets to floor, where they do not adjoin other cabinets, with not less than two fasteners.
- D. Wall Cabinets: Hang cabinets straight, level, and plumb. Adjust fronts and bottoms within 1/16 inch of a single plane. Fasten to hanging strips, masonry, or framing, blocking, or reinforcements in walls or partitions. Align similar adjoining doors to a tolerance of 1/16 inch.
 1. Fasten through back, near top and bottom, at ends, and not more than 16 inches o.c.
 2. Use toggle bolts at hollow masonry.
 3. Use expansion anchors at solid masonry.
 4. Use No. 10 wafer-head screws sized for 1-inch penetration at wood hanging strips.
 5. Use No. 10 wafer-head screws sized for 1-inch penetration into wood blocking.
 6. Use No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish at metal-framed partitions.
- E. Fasten cabinets to adjacent cabinets and to masonry, framing, wood blocking, or reinforcements in walls and partitions to comply with the AWI's, AWMAC's, and WI's "Architectural Woodwork Standards."
- F. Install hardware uniformly and precisely. Set hinges snug and flat in mortises unless otherwise indicated. Adjust and align hardware so moving parts operate freely and contact points meet accurately. Allow for final adjustment after installation.
- G. Adjust casework and hardware so doors and drawers operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.

3.3 INSTALLATION OF SHELVING

- A. Securely fasten shelf standards to masonry, partition framing, wood blocking, or reinforcements in partitions.
 1. Fasten shelf standards at ends and not more than 12 inches () o.c.
 2. Use toggle bolts at hollow masonry.
 3. Use expansion anchors at solid masonry.
 4. Use self-tapping sheet metal screws in metal framing or metal backing at metal-framed partitions. Do not use wall anchors in gypsum board.
 5. Use wood screws sized for 1-inch () penetration into wood blocking.
 6. Use toggle bolts at plaster on metal lath.
- B. Install shelf standards plumb and at heights to align shelf brackets for level shelves. Space standards not more than 36 inches o.c.
- C. Install shelving level and straight, closely fitted to other work where indicated.

3.4 CLEANING AND PROTECTING

- A. Repair or remove and replace defective work as directed on completion of installation.
- B. Clean finished surfaces, touch up as required, and remove or refinish damaged or soiled areas to match original factory finish, as approved by Architect.
- C. Protection: Provide 6-mil plastic or other suitable water-resistant covering over countertop surfaces. Tape to underside of countertop at a minimum of 48 inches o.c. Remove protection at Substantial Completion.

END OF SECTION 123200

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SECTION 123666 - SOLID SURFACING COUNTERTOPS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Solid surface material countertops (123666.A01).
 - 2. Solid surface material backsplashes and end splashes (123666.A03).
 - 3. Solid surface material sills (123666.A05).
- B. Related Requirements:
 - 1. Section 061000 "Rough Carpentry" for blocking as required.
 - 2. Section 064023 "Interior Architectural Woodwork" for custom casework.
 - 3. Section 079200 "Joint Sealants" for countertop sealants.
 - 4. Section 123200 "Manufactured Wood Casework" for premanufactured casework.
 - 5. Division 22 "Plumbing" for sinks and plumbing fittings.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated, submit data describing materials, fabrication, hardware accessories, and installation instructions.
- B. Shop Drawings: Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures, as applicable.
 - 1. Show locations and details of joints.
 - 2. Show direction of directional pattern, if any.
- C. Samples for Initial Selection: For each type of material exposed to view.
- D. Samples for Verification: For the following products:
 - 1. Countertop material, 6 inches square.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For fabricator.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For solid surface material countertops to include in maintenance manuals. Include Product Data for care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop with not less than seven years of experience, under the current company name, that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.
- B. Installer Qualifications: Fabricator of products or manufacturer's authorized representative who is trained and approved for installation of units required for this Project. Installer must have completed 7 projects of similar size and scope to this project in the last 5 years.
- C. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for fabrication and execution.
 - 1. Build mockup of typical countertop and sill as shown on Drawings.

2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Protect solid surfacing during transit, delivery, storage and handling to prevent damage, soiling and deterioration.
- B. Do not deliver solid surfacing, until painting, wet work, grinding and similar operations which could damage, soil or deteriorate solid surfacing which have been completed in installation areas

1.7 FIELD CONDITIONS

- A. Field Measurements: Where work of this Section is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work. Verify dimensions by field measurements before fabrication is complete.
 1. Locate concealed framing, blocking, and reinforcements that support casework by field measurements before being enclosed, and indicate measurements on Shop Drawings.

1.8 COORDINATION

- A. Solid surfacing subcontractor shall coordinate with the mechanical & electrical contractors to assure proper working clearances, receptacle/fixture locations, and all connection/fittings necessary to function properly.
- B. Coordinate locations of utilities that will penetrate countertops[,transaction counters] or backsplashes.
- C. Coordinate layout and installation of framing and reinforcements in walls and partitions for support of work of this Section.

PART 2 PRODUCTS

2.1 SOLID SURFACE COUNTERTOP MATERIALS

- A. Solid Surface Material: Homogeneous-filled plastic resin complying with ICPA SS-1.
 1. Type: Provide Standard type unless Special Purpose type is indicated.
 2. Colors and Patterns: As indicated by manufacturer's designations on Material Finish Legend.
- B. Particleboard: ANSI A208.1, Grade M-2, except at countertops with sinks, provide Grade M-2-Exterior Glue.
- C. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.

2.2 COUNTERTOP FABRICATION

- A. General: Provide countertops on all casework 60" or less in height. Provide back and end splashes when top abuts a wall, column or casework of a higher elevation. Splash shall be 4" high, unless otherwise noted. Splash shall terminate at face of adjoining casework. No back or end splash on free standing items, unless otherwise noted.
 1. Silicone clear caulk joint between backsplash and top.
 2. Solid surfacing subcontractor shall cut all necessary openings/holes in countertops for the various trades. Templates shall be provided by the various trades.
 3. At all Countertop cut openings, brush clear polyurethane on all exposed plywood.
- B. Fabricate countertops according to solid surface material manufacturer's written instructions and to the AWI/AWMAC/WI's "Architectural Woodwork Standards."
 1. Grade: Premium.
- C. Configuration:

1. Front: Straight, slightly eased at top.
 2. Backsplash: Straight, slightly eased at corner.
 3. End Splash: Matching backsplash, as applicable.
 4. Sills: Straight, slightly eased at top.
- D. Countertops: 1/2-inch- thick, solid surface material with front edge built up with same material.
- E. Backsplashes: 1/2-inch- thick, solid surface material.
- F. Fabricate in one piece, unless otherwise indicated. Comply with solid surfacing-material manufacturer's written recommendations for adhesives, sealers, fabrication, and finishing.
- G. Fabricate tops with shop-applied edges unless otherwise indicated. Comply with solid surface material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.
1. Fabricate with loose backsplashes for field assembly.
 2. Install integral sink bowls in countertops in the shop. Ease edge or chamfer edge at sink to countertop connection.
- H. Joints: Fabricate countertops (up to 10 feet in length) without joints.
- I. Joints: Fabricate countertops (greater than 10 feet in length) in sections for joining in field.
1. Joint Locations: Not within 18 inches of a sink or cooktop and not where a countertop section less than 36 inches long would result, unless unavoidable.
 2. Splined Joints: Where narrow strips of solid surface material between joints occur to form large openings, provide splined joints. Accurately cut kerfs in edges at joints for insertion of metal splines to maintain alignment of surfaces at joints. Make width of cuts slightly more than thickness of splines to provide snug fit.
- J. Cutouts and Holes:
1. Undercounter Plumbing Fixtures: Make cutouts for fixtures in shop, to best extent possible, using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.
 - a. Provide vertical edges, slightly eased at juncture of cutout edges with top and bottom surfaces of countertop and projecting 3/16 inch into fixture opening.
 - b. Provide 3/4-inch full bullnose edges projecting 3/8 inch into fixture opening.
 2. Counter-Mounted Plumbing Fixtures: Prepare countertops in shop for field cutting openings for counter-mounted fixtures. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.
 3. Fittings: Drill countertops in shop for plumbing fittings, undercounter soap dispensers, and similar items.
 4. Counter-Mounted Cooktops: Prepare countertops in shop for field cutting openings for cooktops. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.

2.3 INSTALLATION MATERIALS

- A. Adhesive: Product recommended by solid surface material manufacturer.
- B. Sealant for Countertops: Comply with applicable requirements in Section 079200 "Joint Sealants."
- C. Fasteners: Provide non-corrosive fasteners as required for complete installation of components and assemblies. Type and size shall be as required for conditions, materials and superimposed loads involved.
- D. Accessories: Comply with manufacturer's recommendations for hardware, non-corrosive fasteners, adhesives, sealers, fabrication and finishing.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine substrates to receive solid surface material countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install countertops level to a tolerance of 1/8 inch in 8 feet, 1/4 inch maximum. Do not exceed 1/64-inch difference between planes of adjacent units.
- B. Fasten subtops to cabinets by screwing through subtops into cornerblocks of base cabinets. Shim as needed to align subtops in a level plane.
- C. Secure countertops to subtops with adhesive according to solid surface material manufacturer's written instructions. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
- D. Bond joints with adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.
 - 1. Install metal splines in kerfs in countertop edges at joints as specified. Fill kerfs with adhesive before inserting splines and remove excess immediately after adjoining units are drawn into position.
 - 2. Clamp units to temporary bracing, supports, or each other to ensure that countertops are properly aligned and joints are of specified width.
- E. Install backsplashes and end splashes by adhering to wall and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.
- F. Install aprons to backing and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears. Fasten by screwing through backing. Predrill holes for screws as recommended by manufacturer.
- G. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.
 - 1. Seal edges of cutouts in particleboard and plywood subtops by saturating with varnish.
- H. Apply sealant to gaps at walls; comply with Section 079200 "Joint Sealants."

END OF SECTION 123666