PROJECT MANUAL - VOLUME #1

WAGGENER FARM PARK - PHASE 1

Berthoud, Colorado

100% DD
Job #: 2018.59
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1.01 EXISTING CONDITIONS
A. Certain information relating to existing surface and subsurface conditions and structures is available to Contractor, but are not part of the Contract Documents, as follows:

B. Geotechnical Report: Geotechnical Investigation Report, Community Park and Recreation Center - Waggener Farm, Town of Berthoud, Colorado; prepared by RockSol Consulting Group, Inc.; Project No. 542.01, dated August 21, 2019.
   1. A copy is included immediately following this Section.
   2. General Information:
      a. This report identifies properties of below grade conditions and offers recommendations for the design of foundations and other construction elements, prepared primarily for use of Architect and other design team consultants.
      b. Recommendations contained in this document shall not be construed as requirements of Contract Documents.
      c. Interpretation: Report is provided only for information and convenience. Owner and Architect disclaim responsibility for accuracy, true location and extent of subsurface conditions that have been evaluated and reported by others. Owner and Architect further disclaim responsibility for interpretation of report data by Contractor; including but not limited to projecting soil bearing values, rock profiles, soil stability, or presence, level, and extent of underground water or other potentially deleterious substances.
      d. Applicable Requirements: Specific and variable recommendations contained in this document are subject to acceptance by Owner for incorporation in Contract Documents prepared by Architect and other design team consultants. Comply with requirements specified in Contract Documents for earthwork, paving systems, and other applicable work scope items.

1.02 TESTED ASSEMBLY DATA
A. Tested assembly data for specified fire-resistive assemblies and systems is required to be provided as part of the building permit documents.
   1. This data is included in the Drawings.

B. Interpretation: Tested assembly data is provided for information and convenience. Owner and Architect disclaim responsibility for data that has been prepared by others. Owner and Architect further disclaim responsibility for interpretation of the data.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION
Geotechnical Investigation Report
Community Park and Recreation Center - Waggener Farm
Town of Berthoud, Colorado

Prepared for:

Barker Rinker Seacat Architecture
3457 Ringsby Court, Unit 200
Denver, Colorado 80216

Attention: Mr. Zach Bisek, AIA

Prepared by:

RockSol Consulting Group, Inc.
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Thornton, Colorado 80241

RockSol Project No. 542.01
August 21, 2019
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1.0 PROJECT PURPOSE AND DESCRIPTION

This report documents the geotechnical engineering investigation performed by RockSol Consulting Group, Inc. (RockSol) to assist with design of improvements to Waggener Farm Community Park and Recreation Center in Berthoud, Colorado. Proposed construction includes a recreation center, a paved parking lot, basketball and tennis sport courts, a sports field area, walkway and trail flatwork, restroom and shade structures and an irrigation pond. A Park Concept layout is shown below.

A site concept for the initial phase of the Park is shown in Appendix E of this report.

The scope of work for this geotechnical investigation included:

- Preparing a drilling program to perform a subsurface investigation and implementing the program to collect soil samples for laboratory testing.
- Performing laboratory tests and analyzing the data.
- Preparing a geotechnical report presenting the field and laboratory data obtained, geological conditions, pavement and gravel surfacing thickness recommendations and geotechnical recommendations for the proposed development.
2.0 PROJECT SITE CONDITIONS

The project site is located in the south half of Section 14, Township 4 North, Range 69, west of the 6th Principal Meridian in the Town of Berthoud in Larimer County, Colorado. The project site is bounded to the north by Bunyan Avenue, to the west by Berthoud Parkway, to the south by Mountain Avenue and to the east generally by homes on North 10th Street and by Turner Middle School and its adjoined sports field and other property. Developments near or adjacent to the site include agricultural fields to the north and west, residential developments on the east, west and south sides, and limited businesses. Loveland Reservoir is approximately 100 yards from the northwest corner of the site as well. In addition, a planned housing development exists in an agricultural field on the north side of Bunyan Avenue.

Topography at the site generally consists of flat to mild slopes trending southeast. Relatively steep but low-height slopes are present at the northwest portion of the site where the ground adjacent to the road descends to reach the Park elevation.

3.0 SUBSURFACE EXPLORATION

On May 14 and 15, 2019, RockSol drilled fourteen boreholes to evaluate subsurface conditions at the project site. The borehole locations are identified as B-1 through B-8 and P-1 through P-6, as shown on attached Figure 1, Borehole Location Map. Boreholes B-1 through B-7 were drilled at the approximate location of the proposed recreation center and outdoor pool. Borehole B-8 was drilled at the approximate location of the proposed restroom facility. Boreholes P-1 and P-5 were drilled to assist with pavement recommendations for the proposed recreation center parking. Borehole P-2 was drilled within the proposed sport courts area and P-5 was drilled at the proposed location of the sports field. Borings P-3 and P-6 were drilled within potential areas for future irrigation ponds.

A truck mounted CME-45 drill rig was used for drilling and sampling. The boreholes were advanced using 4-inch outside diameter solid stem augers to maximum depths ranging from approximately 10 feet to 15 feet below existing grades for boreholes P-1 through P-6 and to approximately 30 feet below existing grades for Boreholes B-1 through B-8. The boreholes were logged in the field by a representative of RockSol with the depth to groundwater noted at the time of drilling. Boreholes B-2, B-3, B-4, B-5, B-7, B-8, P-3, P-4 and P-6 were left open for 24 to 48 hours for a subsequent groundwater level measurement. The boreholes were backfilled with sand and pea gravel material at the completion of drilling and groundwater level checks.

Subsurface materials were sampled and resistance of the soil to penetration of the sampler was performed using modified California barrel and standard split spoon samplers. The modified California barrel sampler has an outside diameter of approximately 2.5 inches and an inside diameter of 2 inches. The standard split spoon sampler used had an outside diameter of 2 inches.
and an inside diameter of 1⅜-inches. Brass tube liners were used with the modified California barrel sampler. Brass tube liners are not used with the standard split spoon sampler.

Penetration Tests were performed at selected intervals using an automatic hammer lift system. The standard split spoon sampling method is the Standard Penetration Test (SPT) described by ASTM Method D-1586. Penetration Tests were also performed using the modified California barrel sampler with a standard hammer weighing 140 pounds falling 30 inches per ASTM D3550. The modified California Barrel sampling method is similar to the SPT test with the difference being the sampler dimensions and the number of 6-inch intervals driven with the hammer. It is RockSol’s experience that blow counts obtained with the modified California sampler tend to be slightly greater than a standard split spoon sampler. Penetration resistance values (blow counts) were recorded for each sampling event. Blow counts, when properly evaluated, indicate the relative density or consistency of the soils.

Depths at which the samples were taken, the type of sampler used, and the blow counts that were obtained are shown on the Boring Logs for each borehole. Individual Borehole Logs are included in Appendix A. Borehole ground surface elevations were obtained by interpolation from contours shown on a site topographic survey prepared by JVA, Inc. and provided by BRS.

4.0 LABORATORY TESTING

Soil samples retrieved from the borehole locations were examined by the project geotechnical engineer in the RockSol laboratory. Selected samples were tested and classified according to the Unified Soil Classification System (USCS). The following laboratory tests were performed in accordance with the American Society for Testing and Materials (ASTM), American Association of State Highway and Transportation Officials (AASHTO), and current local practices:

- Natural Moisture Content (ASTM D-2216)
- Percent Passing No. 200 Sieve (ASTM D-1140)
- Liquid and Plastic Limits (ASTM D-4318)
- Dry Density (ASTM D-2937)
- Soil Classification (ASTM D-2487, ASTM D-2488, and AASHTO M145)
- Gradation (ASTM D6913)
- Water Soluble Sulfate Content (CDOT CP-L 2103)
- Water Soluble Chloride Content (AASHTO T291-91)
- Standard Test Method for pH of Soils (ASTM D4972-01)
- Soil Resistivity (ASTM G187 - Soil Box)
- Swell Test (ASTM D-4546)
- Resistance (R)- Value: AASTO T190
- Unconfined Compression (ASTM D2166)

Laboratory test results were used to characterize the engineering properties of the subsurface material. For soil classification, RockSol conducted sieve analyses and Atterberg Limits tests. Lab testing was also performed on selected samples to determine the water-soluble sulfate content of subsurface materials to assist with cement type recommendations. Water Soluble Chloride Ion Content tests were performed by Colorado Analytical Laboratories and RockSol. R-Value testing was performed by Cesare, Inc. All other laboratory tests were performed by
RockSol. Laboratory test results are presented in Appendix B and are also summarized on the Borehole Logs presented in Appendix A.

5.0 SUBGRADE CHARACTERIZATION

5.1 Subsurface Materials

Subsurface conditions generally consist of clayey to silty sand, sandy gravel and sandy clay native soils overlying sedimentary bedrock. The sedimentary bedrock consisted of silty to clayey sandstone and claystone. Groundwater was encountered at approximate depths ranging from 5 feet to 9 feet below existing grades during drilling operations. See Table 5.1 for ground surface, groundwater, and bedrock elevations, where encountered. Descriptions of the surface and subsurface conditions encountered in the boreholes are provided below and are also summarized on the Borehole Logs presented in Appendix A.

<table>
<thead>
<tr>
<th>Borehole</th>
<th>Ground Surface Elevation (ft)</th>
<th>Top of Bedrock Elevation (ft)</th>
<th>Groundwater Elevation (ft)</th>
<th>Maximum Depth Drilled Elevation (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>B-1</td>
<td>5,060.2</td>
<td>5,037.2</td>
<td>5,055.2</td>
<td>5,031.2</td>
</tr>
<tr>
<td>B-2</td>
<td>5,060.2</td>
<td>5,047.2</td>
<td>5,054.0</td>
<td>5,030.8</td>
</tr>
<tr>
<td>B-3</td>
<td>5,059.3</td>
<td>5,046.3</td>
<td>5,054.1</td>
<td>5,030.0</td>
</tr>
<tr>
<td>B-4</td>
<td>5,059.6</td>
<td>5,036.6</td>
<td>5,054.9</td>
<td>5,030.0</td>
</tr>
<tr>
<td>B-5</td>
<td>5,058.9</td>
<td>5,038.9</td>
<td>5,053.9</td>
<td>5,029.5</td>
</tr>
<tr>
<td>B-6</td>
<td>5,058.8</td>
<td>5,037.8</td>
<td>5,053.8</td>
<td>5,028.8</td>
</tr>
<tr>
<td>B-7</td>
<td>5,058.2</td>
<td>5,039.2</td>
<td>5,053.6</td>
<td>5,028.7</td>
</tr>
<tr>
<td>B-8</td>
<td>5,054.9</td>
<td>5,046.9</td>
<td>5,049.4</td>
<td>5,025.5</td>
</tr>
<tr>
<td>P-1</td>
<td>5,058.8</td>
<td>-</td>
<td>5,051.8</td>
<td>5,048.8</td>
</tr>
<tr>
<td>P-2</td>
<td>5,055.2</td>
<td>-</td>
<td>5,047.2</td>
<td>5,045.2</td>
</tr>
<tr>
<td>P-3</td>
<td>5,046.9</td>
<td>-</td>
<td>5,041.8</td>
<td>5,031.9</td>
</tr>
<tr>
<td>P-4</td>
<td>5,054.1</td>
<td>5,047.1</td>
<td>5,046.3</td>
<td>5,044.1</td>
</tr>
<tr>
<td>P-5</td>
<td>5,055.9</td>
<td>-</td>
<td>5,050.9</td>
<td>5,045.9</td>
</tr>
<tr>
<td>P-6</td>
<td>5,047.7</td>
<td>-</td>
<td>5,041.0</td>
<td>5,032.7</td>
</tr>
</tbody>
</table>

Topsoil
Approximately 6 inches of sandy clay topsoil was encountered at the surface at each borehole location. The topsoil supported a moderate growth of weed vegetation and alfalfa crop.

Native Soils
Native soils encountered below the topsoil material generally consisted of soft to very stiff sandy clay with silt and gravel in parts and loose to dense silty to clayey sand and gravelly sand.

Bedrock
Sedimentary bedrock was encountered beneath the native soils at Boreholes B-1 through B-8 and Borehole P-4. Bedrock elevations ranged from approximately 5,037 feet to 5,047 feet. The bedrock generally consisted of hard to very hard silty to clayey sandstone and claystone. Bedrock was not noted in Boreholes P-1 through P-3, P-5 and P-6 to the maximum depths drilled, approximately 10 feet to 15 feet below existing grades.
Groundwater

Groundwater was encountered in the boreholes at depths ranging from approximately 5 feet to 9 feet (approximate elevations ranging from 5,042 feet to 5,055 feet) below existing grades. Water below the proposed recreation center building was consistently within 18 inches of 5,054 feet, indicating a fairly consistent water table elevation in that area. Water elsewhere throughout the site varied in elevation from 5,042 feet to 5,052 feet (approximately 5 feet to 9 feet below grade). Groundwater at this site is likely influenced primarily by Loveland Reservoir located approximately 600 feet to the northwest, Roberts Lake located approximately 300 feet east and a canal located on the north side of Bunyan Avenue/W CR 8. Groundwater levels at the site may be subject to seasonal change due to irrigation and other environmental factors. Groundwater levels are estimated to potentially fluctuate approximately 2 feet seasonally with the elevations obtained by RockSol likely close to an average, or typical depth.

5.2 Settlement and Expansive Soil Discussion

Based on the field and laboratory test data, the subgrade soils encountered within 3 feet of the surface exhibit low to very high swell potential (0.4 percent to 10.4 percent under 200 pounds per square foot (psf) surcharge pressure) while soils below four feet indicate little to no swell potential (0.0 percent to 0.6 percent) with low consolidation/settlement potential (-0.1 percent to -1.2 percent) under a 500-psf to 1,000-psf surcharge pressure. The elevated swell potential can be attributed to the existing soil type and a “desiccated” surficial condition due to the historic vegetation growth at the site.

Further discussion of swell potential and mitigation recommendations are presented in later sections of this report.

5.3 Cement Type/Sulfate Resistance Discussion

Cementitious material requirements for concrete in contact with site soils or groundwater are based on the percentage of water-soluble sulfate in either soil or groundwater that will be in contact with concrete constructed for this project. Mix design requirements for concrete exposed to water soluble sulfates in soils or water is considered by the American Concrete Institute (ACI) as shown in Table 5.2 and in the Building Code Requirements for Structural Concrete (ACI 318-08) (ACI Table 4.3.1).

<table>
<thead>
<tr>
<th>Exposure Class</th>
<th>Water-soluble sulfate (SO₄), in dry soil, percent</th>
<th>Sulfate (SO₄), in water, ppm</th>
<th>Water Cementitious Ratio, maximum</th>
<th>Cementitious Material Requirements (ASTM C150)</th>
</tr>
</thead>
<tbody>
<tr>
<td>S0</td>
<td>0.00 to &lt;0.10</td>
<td>0 to &lt;150</td>
<td>Not Applicable</td>
<td>No Restriction</td>
</tr>
<tr>
<td>S1</td>
<td>0.10 to &lt;0.20</td>
<td>151 to &lt;1,500</td>
<td>0.50</td>
<td>Type II</td>
</tr>
<tr>
<td>S2</td>
<td>0.20 to 2.0</td>
<td>1,500 to 10,000</td>
<td>0.45</td>
<td>Type V</td>
</tr>
<tr>
<td>S3</td>
<td>2.01 or greater</td>
<td>10,001 or greater</td>
<td>0.45</td>
<td>Type V plus pozzolan</td>
</tr>
</tbody>
</table>

The concentration of water-soluble sulfates measured in soil samples obtained from RockSol’s exploratory boreholes varied from less than 0.01 percent to 1.72 percent by weight. Based on the results of the water-soluble sulfate testing, Exposure Class S2 is recommended for concrete in contact with subgrade materials for the project. For Exposure Class S2, Type V cement is recommended. As an alternative, other available cement types such as Type III or Type 1 are
permitted if the C₃A content is less than 5 percent. A compressive concrete strength of 4,500 psi is recommended for the S2 Exposure Class.

5.4 Corrosion Resistance Discussion

Water soluble sulfate and chloride content, pH and electrical resistivity tests were performed and are summarized in Table 5.3. The electrical resistivity analyses were performed in the RockSol laboratory using the soil box method (ASTM G-187).

<table>
<thead>
<tr>
<th>Borehole Location</th>
<th>Sample Depth (ft)</th>
<th>Water Soluble Chloride (%)</th>
<th>Saturated Resistivity (ohm-cm) at Moisture content (%)</th>
<th>Water Soluble Sulfate (% by weight)</th>
<th>pH</th>
<th>CR Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>B-1</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B-2</td>
<td>14</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B-3</td>
<td>0-5</td>
<td>0.0111</td>
<td>690 Ohm-cm @ 20%</td>
<td>0.18</td>
<td>8.2</td>
<td>CR 2</td>
</tr>
<tr>
<td>B-4</td>
<td>2</td>
<td></td>
<td></td>
<td>0.01</td>
<td>8.2</td>
<td>CR 0</td>
</tr>
<tr>
<td>B-4</td>
<td>25</td>
<td></td>
<td></td>
<td>0.04</td>
<td>8.4</td>
<td>CR 0</td>
</tr>
<tr>
<td>B-6</td>
<td>14</td>
<td></td>
<td></td>
<td>0.00</td>
<td></td>
<td>CR 0</td>
</tr>
<tr>
<td>B-8</td>
<td>0-5</td>
<td>0.0072</td>
<td>680 Ohm-cm @ 22%</td>
<td>0.11</td>
<td>8.2</td>
<td>CR 2</td>
</tr>
<tr>
<td>P-1</td>
<td>0-5</td>
<td>0.0156</td>
<td>550 Ohm-cm @ 24%</td>
<td>0.31</td>
<td>8.2</td>
<td>CR 3</td>
</tr>
<tr>
<td>P-2</td>
<td>0-5</td>
<td>0.0066</td>
<td>520 Ohm-cm @ 23%</td>
<td>0.51</td>
<td>8.2</td>
<td>CR 4</td>
</tr>
<tr>
<td>P-3</td>
<td>0-5</td>
<td>0.0069</td>
<td>570 Ohm-cm @ 22%</td>
<td>1.72</td>
<td>8.1</td>
<td>CR 5</td>
</tr>
<tr>
<td>P-4</td>
<td>0-5</td>
<td>0.0069</td>
<td>470 Ohm-cm @ 26%</td>
<td>0.34</td>
<td>8.3</td>
<td>CR 3</td>
</tr>
<tr>
<td>P-5</td>
<td>0-5</td>
<td>0.0060</td>
<td>760 Ohm-cm @ 27%</td>
<td>0.06</td>
<td>8.4</td>
<td>CR 1</td>
</tr>
<tr>
<td>P-6</td>
<td>0-10</td>
<td>0.0057</td>
<td>620 Ohm-cm @ 22%</td>
<td>0.13</td>
<td>7.8</td>
<td>CR 2</td>
</tr>
</tbody>
</table>

Comparison of the test results of the sulfate, chloride, and pH testing performed with Table 1 - Guidelines for Selection of Corrosion Resistance Levels as presented in the CDOT Pipe Materials Selection Guide, dated April 30, 2015, suggests corrosion resistance (CR) levels of CR 0, CR 1, CR 2, CR 3, CR 4 and CR 5 are present within the project limits. Additional testing at specific structure locations may be performed to provide structure specific corrosion resistance recommendations. Of the three variables (water soluble sulfate, water soluble chloride, and pH) that are used in determining the CR level, the water-soluble sulfate content appears to be the predominant component affecting the CR level selection. In Table 5.3, we have used “bold” text to identify the test result variable that is contributing to the CR Level above 0. Based on available data, the proposed recreation center area should be considered as a CR 2 category while the remainder of the project site should be considered CR 5.

In addition, electrical resistivity analyses were performed in the RockSol laboratory using the soil box method (ASTM G-187). Comparison of the results of the electrical resistivity testing performed with Table 2 – Minimum Pipe Thickness For Metal Pipes Based On The Resistivity And pH Of The Adjacent Soil as presented in the CDOT Pipe Materials Selection Guide, effective April 30, 2015, suggests the minimum required gauge thickness for metal pipe material, if used for this project, is 0.052 inches (18 Gauge) Polymer Coated. Additional testing at specific structure locations should be performed to provide structure specific recommendations.

6.0 GEOLOGICAL SETTING

Based on information presented in the Geologic Map of the Berthoud Quadrangle, Larimer, Weld, and Boulder Counties, Colorado by Stephen M. Keller, Kassandra O. Lindsey and Matthew L. Morgan, dated 2017 (See Image 1 – Site Geology Map), the site is underlain by Eolian Sediment
which typically consists of yellowish-brown and olive-brown clayey silt, silt to fine sand and clayey silt to medium sand with minor coarse sand. This material is also described as loess. South of the site, much of the soil surrounding the Little Thompson River is Alluvium two (Qa₂) which consists of a combination of silt, sand, minor granules and pebbles. To the northeast and south, outcrops of the Upper Pierre Shale Member (Kpu) appear at or near the surface, typically consisting of a gray, friable, concretionary silty shale.

7.0 SEISMICITY DISCUSSION

Based on the subsurface conditions encountered, it is our opinion that the subject site meets criteria for Seismic Site Class D. Shear wave velocity testing was not performed by RockSol. Soil conditions necessary for Site Class E and F were not encountered in RockSol's boreholes.

If Seismic Site Class C is to be considered, RockSol recommends performing shear wave velocity testing, otherwise the use of Seismic Site Class D is considered appropriate. Seismic design parameters for Seismic Site Class D are discussed below.

7.1 Seismic Design Parameters

Seismic design parameters were obtained from the United States Geological Survey (USGS) Earthquake Design Maps using the 2015 International Building Code specifications. Interpolated values for Peak Ground Acceleration Coefficient (PGA), Spectral Acceleration Coefficient at Period 0.2 sec (Sₐ), and Spectral Acceleration Coefficient at Period 1.0 sec (S₁) were obtained
using the latitude and longitude for the site. The seismic acceleration coefficients obtained (data based on 0.05-degree grid spacing) are presented in Table 7.1.

### Table 7.1A – Seismic Acceleration Coefficients (IBC 2015)

<table>
<thead>
<tr>
<th>Community Park &amp; Recreation Center (Latitude/Longitude)</th>
<th>Peak Ground Acceleration (PGA)</th>
<th>Spectral Acceleration Coefficient - $S_{se}$ (Period 0.2 sec)</th>
<th>Spectral Acceleration Coefficient - $S_1$ (Period 1.0 sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(40.31°/-105.093°)</td>
<td>0.095</td>
<td>0.186</td>
<td>0.059</td>
</tr>
</tbody>
</table>

### Table 7.1B – Seismic Acceleration Coefficients (ASCE 7-16)

<table>
<thead>
<tr>
<th>Community Park &amp; Recreation Center (Latitude/Longitude)</th>
<th>Peak Ground Acceleration (PGA)</th>
<th>Spectral Acceleration Coefficient - $S_{se}$ (Period 0.2 sec)</th>
<th>Spectral Acceleration Coefficient - $S_1$ (Period 1.0 sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(40.31°/-105.093°)</td>
<td>0.106</td>
<td>0.196</td>
<td>0.057</td>
</tr>
</tbody>
</table>

The acceleration coefficients are then used to obtain Site Factors $F_{pga}$, $F_a$, and $F_v$ based on the defined Site Class as shown in Tables 1613.3.3(1) and 1613.3.3(2) of the IBC-2015. A summary of the Site Factor values obtained are shown in Table 7.2.

### Table 7.2 – Seismic Site Factor Values

<table>
<thead>
<tr>
<th>Community Park &amp; Recreation Center (Latitude/Longitude)</th>
<th>$F_{pga}$ (at zero-period on acceleration spectrum)</th>
<th>$F_a$ (for short period range of acceleration spectrum)</th>
<th>$F_v$ (for long period range of acceleration spectrum)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(40.31°/-105.093°)</td>
<td>1.6</td>
<td>1.6</td>
<td>2.4</td>
</tr>
</tbody>
</table>

Table 7.3 summarizes the Seismic Zone determination and horizontal response spectral Acceleration Coefficients ($S_{D1}$) and ($S_{DS}$) obtained for the proposed structures. Seismic Performance Zone determination is based on the value of the horizontal response spectral Acceleration Coefficient at 1.0 Seconds, $S_{D1}$, as determined by Eq. 16-40 of the IBC-2015 and the horizontal response spectral Acceleration Coefficient at 0.2 Seconds, $S_{DS}$, as determined by Eq. 16-39. Values for $S_1$ and $F_v$ are presented in Tables 7.1 and 7.2, shown above. The seismic performance zone was determined with IBC-2015 Tables 1613.3.5(1) and (2).

### Table 7.3 – Seismic Performance Zone

<table>
<thead>
<tr>
<th>Community Park &amp; Recreation Center (Latitude/Longitude)</th>
<th>Acceleration Coefficient at 1.0 seconds ($S_{D1}$)</th>
<th>Acceleration Coefficient at 0.2 seconds ($S_{DS}$)</th>
<th>Seismic Design Category (1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(40.31°/-105.093°)</td>
<td>0.094 (IBC 2015)</td>
<td>0.198 (IBC 2015)</td>
<td>B</td>
</tr>
<tr>
<td></td>
<td>0.09 (ASCE 7-16)</td>
<td>0.209 (ASCE 7-16)</td>
<td></td>
</tr>
</tbody>
</table>

Note (1): Seismic Design Category B (For Risk Categories I, II or III) is assigned when $0.067g \leq S_{D1} < 0.133g$ and $0.167g \leq S_{DS} < 0.33g$
8.0 GEOTECHNICAL ANALYSIS AND RECOMMENDATIONS

Based on the subsurface conditions encountered, information obtained from the laboratory test results and the type of structures proposed, shallow footing foundation systems may be considered for lightly loaded park structures such as the Restroom Building and Shade Structures provided limited foundation loading can be achieved. A deep foundation system is recommended for the Recreation Building and Swimming Pool. Recommendations for structure foundation type and geotechnical design parameters for the foundations and slab-on-grade construction is presented in this section.

8.1 Shallow Footing Foundation Recommendations

Based on the results of the field and laboratory test results, the proposed Restroom Building, Shade Structures, Picnic Pavilion, Playground Equipment, and low height retaining walls may be founded on shallow foundation systems. A maximum allowable bearing pressure of 1,500 pound per square foot (psf) is recommended based on the subsurface conditions encountered. Sufficient mass will need to be provided to resist uplift from wind forces for the shade structures. If soil cover over the foundation is used to help resist uplift from wind forces, a soil unit weight of 120 pound per cubic foot (pcf) is recommended, provided the soil is properly compacted.

A minimum embedment of 3 feet below finished exterior grade is recommended for a shallow concrete footing foundation system. RockSol estimates total movement for footings designed and constructed as discussed in this section will be less than 1-inch. Differential movements are estimated to be less than ½-inch. A representative of the geotechnical engineer should observe all footing excavations prior to concrete placement.

8.2 Deep Foundation Recommendations

To reduce settlement potential for the proposed Recreation Building and to provide axial support and uplift resistance for the swimming pool, deep foundation systems are recommended. For this report, parameters appropriate for drilled shafts are presented. Drilled shafts will provide support by embedment into sedimentary bedrock. Based on the subsurface conditions encountered in RockSol’s geotechnical investigation, it is anticipated that sedimentary bedrock will be encountered at an approximate elevation ranging from 5,037 feet to 5,047 feet. For axial end bearing resistance, a minimum shaft penetration into competent bedrock of 5 feet is recommended. For drilled shafts, a minimum pier length of 25 feet is recommended. Where required, the bedrock embedment length should be increased to provide adequate uplift resistance through side resistance. For uplift resistance, a minimum of 10 feet of bedrock penetration should be considered.

Drilled shaft diameters shall be sufficient to satisfy axial, bending, and lateral load resistance requirements. In addition, the shaft diameters shall be sufficient to allow for use of casing, if required, and placement of reinforcement with adequate concrete cover. Shaft diameters of 18-inches, or greater, are recommended by RockSol.

Based on our evaluation, recommended end bearing and side resistance values for the bedrock material are presented in Table 8.1.
Table 8.1 – Drilled Shaft Bearing Resistance Recommendations

<table>
<thead>
<tr>
<th>Location</th>
<th>Competent Bedrock Elevation (feet)</th>
<th>Allowable Bearing Resistances (ksf)</th>
</tr>
</thead>
</table>
| Recreation Building and Swimming Pool | 5,037 to 5,047                      | 46  
|                                  |                                    | 3.7                                 |

Side resistance in the soil zone above competent bedrock should be neglected.

Additional design and construction considerations are listed below.

(a) The construction of drilled shafts should follow the guidelines presented in the “CDOT Standard Specifications for Road and Bridge Construction (SSRBC), Section 503, 2017,” and subsequent revisions. CDOT uses the FHWA document “Drilled Shafts: Construction Procedures and LRFD Design Methods, FHWA-NHI-10-016, May 2010” as a basis for their specifications.

(b) During construction of the drilled shafts, casing or slurry will be required to support the excavation where groundwater exists and or where holes are unstable due to soil conditions. Caving conditions are anticipated in the native soils encountered at and below groundwater. Caving is not anticipated, may occur, in the bedrock material. If casing is used for the “dry method” placement, water pressure may result in seepage of water around the bottom of the casing resulting in erosion of the upper bedrock materials. “Wet condition” placement is anticipated to be required for drilled shafts. If casing is used and is set into the bedrock material, the minimum embedment/penetration depth into bedrock should initiate from the bottom of the casing.

(c) Prior to the placement of the concrete, the drilled shaft excavation, including the bottom should be cleaned of all loose material. For wet conditions (more than two inches of water), concrete placement by “tremie” methods should be used.

(d) Lateral load capacity of the drilled shafts should be evaluated. Geotechnical parameters for evaluation of lateral load capacity are provided in Table 8.2.

(e) All piers should be reinforced as required for resistance to axial, bending, lateral and uplift stresses.

(f) Drilled shafts should be constructed at least four shaft diameters center to center. For closely spaced drilled shafts, the axial and lateral capacities should be appropriately reduced. Group action of drilled shafts should be analyzed on an individual basis to assess the appropriate reduction.

(g) Void form material is not required below grade beams or other pier supported foundation elements as the materials anticipated at these elevations are characterized as non-expansive.
Table 8.2 - Drilled Shaft Lateral Resistance Parameters

<table>
<thead>
<tr>
<th>Borehole Material</th>
<th>L-Pile Soil Type</th>
<th>Undrained Shear Strength (Cohesion) (psf)</th>
<th>Angle of Internal Friction (degrees)</th>
<th>Subgrade Reaction Coefficient, (pci)</th>
<th>Strain Factor $\varepsilon_{50}$ (%)</th>
<th>Unit Weight (pcf)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Native) CLAY, sandy, above water table</td>
<td>Stiff clay w/o free water (#3)</td>
<td>500</td>
<td>0</td>
<td>500</td>
<td>0.01</td>
<td>125 (Total)</td>
</tr>
<tr>
<td>(Native) CLAY, sandy, below water table</td>
<td>Stiff clay w/ free water (#2)</td>
<td>250</td>
<td>0</td>
<td>100</td>
<td>0.02</td>
<td>63 (Submerged)</td>
</tr>
<tr>
<td>(Native) GRAVEL, sandy, below water table</td>
<td>Sand (#4)</td>
<td>0</td>
<td>38</td>
<td>60</td>
<td>--</td>
<td>65 (Total)</td>
</tr>
<tr>
<td>(Native) SAND, silty to clayey, below water table</td>
<td>Sand (#4)</td>
<td>0</td>
<td>32</td>
<td>60</td>
<td>--</td>
<td>65 (Submerged)</td>
</tr>
<tr>
<td>Claystone Bedrock</td>
<td>Stiff clay w/o free water</td>
<td>8,000</td>
<td>0</td>
<td>2,000</td>
<td>0.004</td>
<td>125 (Total)</td>
</tr>
<tr>
<td>Clayey Sandstone Bedrock</td>
<td>Stiff clay w/o free water</td>
<td>6,000</td>
<td>0</td>
<td>1,500</td>
<td>0.005</td>
<td>125 (Total)</td>
</tr>
</tbody>
</table>

Total unit weight indicated in the table above includes soil plus moisture content. Depths at which groundwater were encountered are indicated on the attached borehole logs.

8.2 Lateral Earth Pressure Parameters

To assist with retaining wall design, lateral earth pressure parameters are presented in Table 8.3 for the existing soils encountered in upper 5 feet. Also included are parameters for CDOT Class 1 Structure backfill material.

Table 8.3 – Lateral Earth Pressure Parameters

<table>
<thead>
<tr>
<th>Soil Type</th>
<th>Total Unit Weight (γ) pcf</th>
<th>Effective Friction Angle, $\varphi'$ (degrees)</th>
<th>Cohesion (psf)</th>
<th>Lateral Earth Pressure Coefficients (Notes 1 and 2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CDOT Class 1 Structure Backfill (CDOT Section 703.08)</td>
<td>125</td>
<td>34</td>
<td>0</td>
<td>0.28</td>
</tr>
<tr>
<td>(Native) CLAY, sandy</td>
<td>125</td>
<td>22</td>
<td>500</td>
<td>0.46</td>
</tr>
</tbody>
</table>

Note 1: Based on Rankine Theory of earth pressure.
Note 2: For horizontal backslope and foreslope.
Note 3: Full value, no reduction applied.
The lateral earth pressure coefficients presented above do not include hydrostatic pressure from water build-up which must be superimposed to calculate loads. The lateral earth pressures do not include surcharge loadings such as traffic, construction equipment or fill stockpiles at or near the top of walls. Compacted fill placed behind a retaining wall should be a granular material such as CDOT Class 1 structure backfill. Wall backfill should be compacted with light weight, hand operated equipment. The lateral earth pressure values provided in this report assume light weight hand operated compaction equipment will be used to compact backfill within 5 feet of the inside wall face.

8.3 Recreation Center Slab-on-Grade Construction Discussion

Based on the swell test results, slab-on-grade construction is considered appropriate for the proposed Park improvements with subgrade moisture conditioning or soil replacement to a depth of at least three feet below the slab-on-grade. If the existing subgrade soils are moisture conditioned, subexcavation to an approximate depth of two feet, moisture conditioning and re-compacting the in-place soils to an additional depth of 12 inches, and replacement of the sub-excavated soils with moisture conditioning and compaction is recommended.

RockSol recommends placement of at least 4-inches of properly compacted Class 6 Aggregate Base Course (ABC) beneath all slab-on-grade flatwork. The ABC should meet requirements for Class 6 ABC as defined in the “CDOT Standard Specifications for Road and Bridge Construction (SSRBC), Section 703.3, 2017 Edition.”

9.0 ROADWAY SURFACING AND PAVEMENT DESIGN RECOMMENDATIONS

Pavement thickness recommendations for the proposed Waggener Park parking lot and entrance/exit drive lanes are based upon the 2007 Larimer County Urban Area Street Standards (LUCASS) which is based on the 1993 AASHTO Guide for the Design of Pavement Structures. The Town of Berthoud recognizes LUCASS Standards for roadway pavement design and construction. Gravel surfacing recommendations are based on Federal Highway Administration guidelines presented in the Gravel Roads Construction and Maintenance Guide, dated August 2015. Cellular confinement roadway recommendations are based on requirements established by Grasspave2, a proprietary product.

9.1 Traffic Loading

For pavement design purposes, the Waggener Park parking lot and drive lanes were designated as a local residential roadway with an Equivalent Daily Load Application (EDLA) of 10 per day. For a 20-year design life, 10 EDLA will result in an 18,000-pound Equivalent Axle Load (18-kip ESAL) of 73,000. See Appendix E for a depiction of where gravel surface parking lots are considered and where a Service Lane and Fire Truck Loop is planned.

9.2 Subgrade Characterization

To assist with pavement design and roadway surfacing recommendations, RockSol obtained a bulk sample of the upper five feet at the pavement borehole (P-5) location for testing purposes. Classification testing indicates that the upper four to five feet of subgrade soil generally consists of a low to moderate plasticity sandy clay soil with an AASHTO A-6 soil classification with lesser amounts of A-7-6 soil.
An R-value test was performed on a sample of AASHTO soil type A-6 obtained from Borehole P-5. An R-Value test result of 9 was obtained. Based on the 2014 CDOT Pavement Design Manual correlation of R-Value to Resilient Modulus ($M_R$), the R-Value of 9 corresponds to an $M_R$ of 3,448 psi. The predominate subgrade soil type and the resulting R-Value test result indicate the on-site soils will provide poor subgrade support when very moist to wet.

Based on swell test results, the upper two to three feet of subgrade soil possess moderate to high swell potential. Swell tests were performed with a 200-psf surcharge. Swell percentages in the samples obtained at a depth of 2 feet ranged from 0.4 percent to 10.4 percent with an average of approximately 4.5 percent. Swell percentages in the samples obtained at a depth of 4 feet ranged from -1.2 percent (collapse) to 0.6 percent (swell) with an average of approximately -0.2 percent (collapse). The swell data indicates a significant reduction in swell potential between the depth of 3 to four feet below the existing ground surface. The likely cause of the swell reduction is the close proximity of groundwater. The swell potential of the upper subgrade soils is summarized below.

<table>
<thead>
<tr>
<th>Borehole ID</th>
<th>Depth, feet</th>
<th>Percent Swell</th>
</tr>
</thead>
<tbody>
<tr>
<td>B-1</td>
<td>2</td>
<td>6.4</td>
</tr>
<tr>
<td>B-1</td>
<td>4</td>
<td>-0.1</td>
</tr>
<tr>
<td>B-2</td>
<td>2</td>
<td>3.1</td>
</tr>
<tr>
<td>B-2</td>
<td>4</td>
<td>-0.2</td>
</tr>
<tr>
<td>B-3</td>
<td>2</td>
<td>1.5</td>
</tr>
<tr>
<td>B-3</td>
<td>4</td>
<td>-1.2</td>
</tr>
<tr>
<td>B-4</td>
<td>2</td>
<td>8.2</td>
</tr>
<tr>
<td>B-4</td>
<td>4</td>
<td>0.3</td>
</tr>
<tr>
<td>B-5</td>
<td>2</td>
<td>1.0</td>
</tr>
<tr>
<td>B-5</td>
<td>4</td>
<td>-0.8</td>
</tr>
<tr>
<td>B-6</td>
<td>2</td>
<td>2.7</td>
</tr>
<tr>
<td>B-6</td>
<td>4</td>
<td>-0.6</td>
</tr>
<tr>
<td>B-7</td>
<td>4</td>
<td>-0.9</td>
</tr>
<tr>
<td>B-8</td>
<td>2</td>
<td>5.7</td>
</tr>
<tr>
<td>B-8</td>
<td>4</td>
<td>-0.1</td>
</tr>
<tr>
<td>P-1</td>
<td>2</td>
<td>0.8</td>
</tr>
<tr>
<td>P-2</td>
<td>2</td>
<td>4.7</td>
</tr>
<tr>
<td>P-2</td>
<td>4</td>
<td>0.4</td>
</tr>
<tr>
<td>P-3</td>
<td>2</td>
<td>10.4</td>
</tr>
<tr>
<td>P-3</td>
<td>4</td>
<td>0.2</td>
</tr>
<tr>
<td>P-4</td>
<td>2</td>
<td>7.2</td>
</tr>
<tr>
<td>P-4</td>
<td>4</td>
<td>0.6</td>
</tr>
<tr>
<td>P-5</td>
<td>2</td>
<td>0.4</td>
</tr>
<tr>
<td>P-6</td>
<td>2</td>
<td>5.7</td>
</tr>
<tr>
<td>P-6</td>
<td>4</td>
<td>0.0</td>
</tr>
</tbody>
</table>

Due to the swell potential of the subgrade soils within three feet of the existing ground surface, RockSol recommends moisture conditioning of the upper three feet of the existing soils in areas where sports courts, turf fields, sidewalks, and structures will be constructed. Where parking lot and drive lane pavement is to be constructed, double application lime-treatment of the upper 12-inches
is recommended in addition to the moisture conditioning. The double application method will be required due to the water-soluble sulfate concentrations noted in our testing.

As an alternative to moisture conditioning to a depth of three feet and lime stabilization, replacement of the upper three feet of soils with a low to non-expansive soil with good support characteristics may be performed.

A maximum thickness of 6-inches should be observed for subexcavated and replaced soil. A maximum treatment of 12-inches should be observed for soil treated in-place.

If the existing subgrade soils are moisture conditioned, subexcavation to an approximate depth of two feet, moisture conditioning and re-compacting the in-place soils to an additional depth of 12 inches, and replacement of the sub-excavated soils with moisture conditioning and compaction is recommended. Prior to stabilization with lime treatment the moisture conditioned, and compacted subgrade soils will likely exhibit instability under heavy construction equipment.

9.3 Pavement Design Parameter Summary

A summary of the pavement design input parameters used to evaluate the pavement thickness requirements for Waggener Park are presented below.

<table>
<thead>
<tr>
<th>Pavement Design Parameter</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>20-Year Design Life ESAL’s</td>
<td>73,000</td>
</tr>
<tr>
<td>Subgrade Resilient Modulus, M_R</td>
<td>3,448 psi</td>
</tr>
<tr>
<td>Serviceability Loss, (ΔPSI)</td>
<td>2.5</td>
</tr>
<tr>
<td>Overall Standard Deviation, S_O</td>
<td>0.44</td>
</tr>
<tr>
<td>Reliability, (R)</td>
<td>80%</td>
</tr>
<tr>
<td>Standard Normal Deviate, (Z_R)</td>
<td>-0.841</td>
</tr>
<tr>
<td>Structural Coefficient of HMA</td>
<td>0.44</td>
</tr>
<tr>
<td>Structural Coefficient of ABC</td>
<td>0.11</td>
</tr>
<tr>
<td>Structural Coefficient of Lime Treated Subgrade</td>
<td>0.14</td>
</tr>
</tbody>
</table>

9.4 Flexible Pavement Section Thickness Recommendations

Flexible pavement design thickness was evaluated with the 1993 AASHTO Flexible Pavement Design Equation using a 20-year design life and with consideration of minimum allowable sections allowed by LUCASS. A summary of the pavement section thickness obtained from the AASHTO equation is presented in Table 9.3. A pavement design calculation sheet is presented in Appendix C.
Table 9.3 – Flexible Pavement Section Thickness (Without Chemical Stabilization)

<table>
<thead>
<tr>
<th>Pavement Area</th>
<th>Design Lane ESALs (20 year)</th>
<th>Minimum Asphalt Section Over Aggregate Base Course (Using the 1993 AASHTO Equation), inches</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parking Lot and Drive Lanes</td>
<td>73,000</td>
<td>6.0 (Asphalt Section) over 6 (Aggregate Base Course)</td>
</tr>
</tbody>
</table>

Table 9.4 – Flexible Pavement Section Thickness (With Chemical Stabilization)

<table>
<thead>
<tr>
<th>Pavement Area</th>
<th>Design Lane ESALs (20 year)</th>
<th>Minimum Asphalt Section Over Stabilized Subgrade (Using the 1993 AASHTO Equation), inches</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parking Lot and Drive Lanes</td>
<td>73,000</td>
<td>4.0 (Asphalt Section) over 12.0 (Lime Treated Subgrade)</td>
</tr>
</tbody>
</table>

Aggregate Base Course (ABC) should meet CDOT Class 6 Aggregate Base Course requirements for gradation, Atterberg Limits, and have a minimum R-Value of 72 and be moisture stable.

Subgrade compaction to at least 95 percent of AASHTO T99 (standard proctor) with moisture content controlled within a range from 2 percent below optimum moisture content to 2 percent above optimum moisture content. Proof-rolling per LUCASS 22.5.3 is recommended.

Lime treated subgrade should achieve a 7-day minimum compressive strength of 160 psi. A lime-treated subgrade design will be required prior to construction activities with a minimum acceptable lime percentage of 4 percent. For preliminary design, RockSol recommends a minimum lime percentage of 5 percent be considered for cost estimating purposes.

Flexible pavement grading SX is recommended for the pavement sections presented in Tables 9.3 and 9.4. Asphalt binder grade PG 58-28 is recommended for all lifts. Two lifts are considered appropriate.

9.5 Rigid Pavement Section Thickness Recommendations

As an alternative to flexible pavement, recommended rigid pavement sections are shown in Tables 9.5 and 9.6.

Table 9.5 – Rigid Pavement Section Thickness (Without Chemical Stabilization)

<table>
<thead>
<tr>
<th>Pavement Area</th>
<th>Design Lane ESALs (20 year)</th>
<th>Minimum Rigid Section Over Aggregate Base Course</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parking Lot and Drive Lanes</td>
<td>73,000</td>
<td>6.0 (PCCP Section) over 6.0 (Aggregate Base Course)</td>
</tr>
</tbody>
</table>

Note: PCCP = Portland Cement Concrete Pavement
### Table 9.6 – Rigid Pavement Section Thickness (With Chemical Stabilization)

<table>
<thead>
<tr>
<th>Pavement Area</th>
<th>Design Lane ESALs (20 year)</th>
<th>Minimum Rigid Section Over Stabilized Subgrade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parking Lot and Drive Lanes</td>
<td>73,000</td>
<td>6.0 (PCCP Section) over 12.0 (Lime Treated Subgrade)</td>
</tr>
</tbody>
</table>

PCCP pavement sections are based on 12-foot wide panels and a transverse joint spacing of 12-feet.

### 9.6 Gravel Surfaced Roadway and Parking Lot Section Recommendations

Gravel surfaced parking lot areas are being considered. The gravel surfaced parking lots will be limited to passenger vehicles with an infrequent, heavy trucks (maximum of 5 daily). For the gravel surfaced parking lot or roadways portions, the following treatment is recommended:

1. Clear and Grub the existing terrain
2. Prepare existing ground surfaces to ensure a minimum depth of 6 inches of existing ground scarifying and compaction (subgrade preparation)
3. Grade and compact the subgrade as needed to ensure for proper drainage prior to placing any surfacing material
4. Place 6.5 inches of compacted new aggregate surfacing material. If the heavy truck traffic is estimated to be from 5 to 10 trucks per day, the thickness of aggregate surfacing material shall be increased to 8.5 inches.

The aggregate surfacing materials gradation shall meet the following gradation:

<table>
<thead>
<tr>
<th>Sieve</th>
<th>Percent Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 inch</td>
<td>100</td>
</tr>
<tr>
<td>¾ inch</td>
<td>100</td>
</tr>
<tr>
<td>No. 4</td>
<td>50 - 78</td>
</tr>
<tr>
<td>No. 8</td>
<td>37 - 67</td>
</tr>
<tr>
<td>No. 40</td>
<td>13 - 35</td>
</tr>
<tr>
<td>No. 200</td>
<td>8 - 15</td>
</tr>
</tbody>
</table>

The aggregate surfacing material shall have a maximum Liquid Limit of 30 and a Plasticity Index ranging from 8 to 15.

Compaction of the aggregate surfacing material shall be to at least 95 percent of maximum dry density based on ASTM D1557.

Aggregate surfacing material can consist of virgin aggregate material or a blend of recycled asphalt pavement material and virgin aggregate material provided the material properties for gradation and Atterberg Limits (Liquid Limit and Plasticity Index) are met.

### 9.7 Grasspave 2 Section Recommendations

Grasspave2 is being considered for use a roadway surfacing material within the proposed Service and Fire Truck Loop. Grasspave2 is a proprietary product and is a cellular confinement system. Other similar systems are also available. Based on information provided by Grasspave and the
subsurface materials encountered at the project site, 12 inches of aggregate base material is recommended for use with the Grasspave2 system.

The aggregate surfacing materials gradation and Atterberg Limits shall meet the following gradation:

<table>
<thead>
<tr>
<th>Sieve</th>
<th>Percent Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 inch</td>
<td>100</td>
</tr>
<tr>
<td>¾ inch</td>
<td>90 - 100</td>
</tr>
<tr>
<td>⅜ inch</td>
<td>70 - 80</td>
</tr>
<tr>
<td>No. 4</td>
<td>55 - 70</td>
</tr>
<tr>
<td>No. 10</td>
<td>45 - 55</td>
</tr>
<tr>
<td>No. 40</td>
<td>25 - 35</td>
</tr>
<tr>
<td>No. 200</td>
<td>3 - 8</td>
</tr>
</tbody>
</table>

Compaction of the aggregate base shall be to at least 95 percent of maximum dry density based on ASTM D1557.

9.8 Pedestrian Pavement Recommendations

Park hard-surfacing will be included for pedestrian walkways which will include maintenance vehicles. The number of maintenance vehicles is anticipated to be very low when considered on a daily average basis.

All hard-surfacing subgrade shall be properly compacted prior to placement of pavement sections. See Section 10.0 for compaction requirements.

Concrete paving for pedestrian-only use sidewalk, with limited light-duty maintenance vehicles, should be a minimum of 6-inches thick over a minimum of 4-inches of aggregate base course.

Concrete paving for anticipated vehicle usage should be a minimum of 6.5 inches in thickness and bearing on a minimum of 6 inches of aggregate base course that meets CDOT requirements for gradation and Atterberg limits for Class 6 aggregate base course. Reinforcement with at least welded-wire mesh is recommended.

10.0 EMBANKMENT AND SITE GRADING

All embankment and site grading shall be performed in accordance with LUCASS Section 22.5.3.

10.1 Compaction Specifications

A representative of the geotechnical engineer should observe and test fill placement operations. The minimum compaction recommendations are presented in Table 10.1 and are based on AASHTO soil classifications. The majority of the existing site soils fall into the A-6 through A-7-6 grouping shown in Table 10.1.
Table 10.1 – Compaction Specifications

<table>
<thead>
<tr>
<th>AASHTO Classification (AASHTO M 145)</th>
<th>AASHTO T 99 (Standard Proctor) Relative Compaction (Minimum Percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-1</td>
<td>95</td>
</tr>
<tr>
<td>A-3</td>
<td>95</td>
</tr>
<tr>
<td>A-2-4</td>
<td>95</td>
</tr>
<tr>
<td>A-2-5</td>
<td>95</td>
</tr>
<tr>
<td>A-2-6, A-3, A-4, A-6, A-7-5, and A-7-6</td>
<td>95</td>
</tr>
</tbody>
</table>

10.2 Subgrade Preparation

Due to the swell potential of the subgrade soils within three feet of the existing ground surface, RockSol recommends moisture conditioning of the upper three feet of the existing soils in areas where sports courts, turf fields, sidewalks, and structures will be constructed. Where paved parking lot and drive lane pavement is to be constructed, double application lime treatment of the upper 12-inches is recommended in addition to the moisture conditioning. The double application method will be required due to the water-soluble sulfate concentrations noted in our testing.

As an alternative to moisture conditioning to a depth of three feet and lime stabilization, replacement of the upper three feet of soils with a low to non-expansive imported soil may be performed.

A maximum lift thickness of 6-inches should be observed for subexcavated and replaced soil. A maximum treatment of 12-inches should be observed for soil moisture treated and compacted in-place.

If the existing subgrade soils are moisture conditioned, subexcavation to an approximate depth of two feet, moisture conditioning and re-compacting the in-place soils to an additional depth of 12 inches, and replacement of the sub-excavated soils with moisture conditioning and compaction is recommended. Prior to stabilization with lime treatment the moisture conditioned, and compacted subgrade soils will likely exhibit instability under heavy construction equipment. Use of light-weight construction equipment is recommended.

10.3 Imported Fill

The following material specifications are recommended for imported materials on the project. The geotechnical engineer should approve all fill used on the site prior to placement in order to determine its suitability.

1. **Soil Embankment**: Material shall be soil predominately of materials smaller than No. 4 sieve in diameter. Soil embankment shall be constructed with moisture and density control. A maximum liquid limit of 40 and a maximum plasticity index of 20 is recommended for all imported fill material. When compacted to at least 95 percent of maximum dry density per AASHTO T99 the fill material shall exhibit a maximum swell potential under a 150 psf surcharge of 2.0 percent.

2. **Structural Backfill**: Materials shall consist of a free-draining granular material with 100% passing the 2-inch sieve and less than 20% passing the No. 200 sieve (CDOT Class 1 Structure Backfill, or equivalent).

3. **Unsuitable Material**: Vegetation, brush, sod, trash, and other deleterious substances shall not be placed in embankment, excavation backfill, or structural backfill. A geotechnical
engineer should approve all fill utilized on the site prior to placement to determine its suitability.

11.0 SPORTS COURT DISCUSSION

Basketball courts and tennis courts are proposed for the north-central portion of the Park. These sports courts are proposed to be constructed as post-tensioned sports courts

The existing soils encountered in the proposed sport court area were identified as a sandy clay (see Borehole Log P-2). Swell testing of a sample obtained at a depth of 2 feet at Borehole P-2 indicated a swell percentage of 4.7 percent with a 200-psf surcharge. Swell mitigation to a depth of three feet or replacement of the existing soil with a low to non-expansive soil is recommended (see Sections 10.1 and 10.2) to significantly reduce swell potential below the sports courts. The minimum relative compaction below the post-tensioned slab can be established at 92 percent is reconditioned on-site soils are used below the slab.

Control or minimization of slab/subgrade friction is important for design and construction of the sports court post-tensioned slabs. The existing site soils can be characterized as plastic soils which will provide elevated levels of friction. Use of a granular subbase and a sand layer below the slab is recommended and polyethylene sheeting should be considered.

Surface drainage water should not be allowed to accumulate at the edges of the slab.

12.0 IRRIGATION POND DISCUSSION

Two potential irrigation pond sites are proposed in the northeast and southeast portions of the project site to allow for on-site irrigation. One site will be chosen as site design progresses. collect storm water runoff. Boreholes P-3 and P-6 were drilled to characterize the subsurface soils at locations of the proposed ponds. Soils encountered at both locations indicate sandy clay soils are present at the proposed locations. These soils typically exhibit low permeability characteristics. Groundwater is at relatively shallow depths at both locations. Keeping the pond bottom elevation above the existing groundwater elevation should be considered.

13.0 OTHER DESIGN AND CONSTRUCTION CONSIDERATIONS

Proper construction practices and adherence to project plans and specifications should be followed during site preparation, earthwork, excavations, and construction of utilities, pavements, and structures for the suitable long-term performance of the proposed improvements. Excavation support should be provided to maintain onsite safety and the stability of excavations and slopes. Excavations shall be constructed in accordance with local, state and federal regulations including OSHA guidelines. The contractor must provide a competent person to determine compliance with OSHA excavation requirements. For preliminary planning, existing fill material and native soils may be considered as OSHA Type C soils.

The actual subsurface conditions between boring locations may vary from the information obtained at specific boring locations and described in this report.

Surface drainage patterns may be altered during construction and surface drainage must be controlled to prevent water ponding and excessive moisture infiltration into the subgrade soils during and after construction.
14.0 LIMITATIONS

This geotechnical investigation was conducted in general accordance with the scope of work. The geotechnical practices are similar to that used in the Colorado Front Range area with similar soil conditions and our understanding of the proposed work.

The subsurface investigation program was conducted to obtain information on the subsurface soil, groundwater, and bedrock conditions at Waggener Farm Park. Surface and groundwater hydrology, hydraulic engineering, and environmental studies including contaminant characterization were not included in RockSol’s geotechnical scope of work.

This report has been prepared by RockSol for BRS and the Town of Berthoud exclusively for the project described in this report. The report is based on our exploratory boreholes and does not take into account variations in the subsurface conditions that may exist between boreholes. Additional investigation is required to address such variation. If during construction activities, materials or water conditions appear to be different from those described herein, RockSol should be advised at once so that a re-evaluation of the recommendations presented in this report can be made. RockSol is not responsible for liability associated with interpretation of subsurface data by others.
APPENDIX A

LEGEND
AND
INDIVIDUAL BOREHOLE LOGS
LITHOLOGY

- **TOPSOIL**
- Native - SAND, silty
- Native - SAND, clayey
- Native - CLAY, sandy
- Native - GRAVEL, silty
- Bedrock - CLAYSTONE
- Bedrock - SANDSTONE

SAMPLE TYPE

- Auger Cuttings
- **MODIFIED CALIFORNIA SAMPLER**
  2.5" O.D. AND 2" I.D.
  WITH BRASS LINERS INCLUDED
- **SPLIT SPOON SAMPLER**
  2" O.D. AND 1 3/8" I.D.
  NO LINERS

Fines Content indicates amount of material, by weight, passing the US No 200 Sieve (%)

- 15/12 Indicates 15 blows of a 140 pound hammer falling 30 inches was required to drive the sampler 12 inches.
- 50/11 Indicates 50 blows of a 140 pound hammer falling 30 inches was required to drive the sampler 11 inches.
- 5,5,5 Indicates 5 blows, 5 blows, 5 blows of a 140 pound hammer falling 30 inches was required to drive the sampler 18 inches.

GROUND WATER LEVEL 1ST DEPTH
GROUND WATER LEVEL 2ND DEPTH
**Topsoil** - approximately 6 in in thickness, sandy clay
   - (Native) CLAY, sandy with gravel in parts, moist to wet, brown, medium stiff to very stiff

<table>
<thead>
<tr>
<th>ELEVATION (ft)</th>
<th>DEPTH (ft)</th>
<th>MATERIAL DESCRIPTION</th>
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<tbody>
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<tr>
<td>5055</td>
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<tr>
<td>5050</td>
<td>10</td>
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<tr>
<td>5045</td>
<td>15</td>
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<td>5035</td>
<td>25</td>
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**Bottom of hole at 29.0 feet.**
<table>
<thead>
<tr>
<th>ELEVATION (ft)</th>
<th>DEPTH (ft)</th>
<th>MATERIAL DESCRIPTION</th>
<th>SAMPLE TYPE</th>
<th>BLOW COUNTS</th>
<th>SWELL POTENTIAL (%)</th>
<th>SULFATE (%)</th>
<th>DRY UNIT WT. (pcf)</th>
<th>MOISTURE CONTENT (%)</th>
<th>LIQUID LIMIT</th>
<th>PLASTIC LIMIT</th>
<th>PLASTICITY INDEX</th>
<th>ATTERBERG LIMITS</th>
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<td>3.1</td>
<td>112.2</td>
<td>17.4</td>
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<tr>
<td>5055</td>
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<td>(Native) CLAY, sandy with gravel in parts, wet, brown, soft</td>
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<td>MC</td>
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<td>5035</td>
<td>25</td>
<td></td>
<td>MC</td>
<td>50/4</td>
<td></td>
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<td></td>
<td>114.1</td>
<td>15.6</td>
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Bottom of hole at 29.4 feet.
**Topsoil, approximately 6 in in thickness, sandy clay**

*(Native) CLAY, sandy with some gravel, moist to wet, brown, soft to stiff*

**Approximate Bulk Depth 0-5**

*(Bedrock) SANDSTONE, clayey, wet, brown, very hard*

**Bottom of hole at 29.3 feet.**
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<th>BLOW COUNTS</th>
<th>SWELL POTENTIAL (%)</th>
<th>SULFATE (%)</th>
<th>DRY UNIT WT. (pcf)</th>
<th>MOISTURE CONTENT (%)</th>
<th>LIQUID LIMIT</th>
<th>PLASTIC LIMIT</th>
<th>PLASTICITY INDEX</th>
<th>ATTERBERG LIMITS</th>
<th>FINE CONTENT (%)</th>
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</thead>
</table>
| 5060          | 0          | Topsoil - approximately 6 in in thickness, sandy clay  
(Native) CLAY, sandy to silty, moist to wet, brown to dark brown, stiff to very stiff, lightly calcareous | MC          | 26/12        | 8.2        | 0.01         | 114.7            | 15.1                  |
| 5055          | 5          | Topsoil - approximately 6 in in thickness, sandy clay  
(Native) CLAY, sandy to silty, moist to wet, brown to dark brown, stiff to very stiff, lightly calcareous | MC          | 10/12        | 0.3        | 106.7          | 21.4                  |
| 5050          | 10         | Topsoil - approximately 6 in in thickness, sandy clay  
(Native) CLAY, sandy to silty, moist to wet, brown to dark brown, stiff to very stiff, lightly calcareous | MC          | 11/12        | 0.1        | 111.3          | 19.0                  |
| 5045          | 15         | Topsoil - approximately 6 in in thickness, sandy clay  
(Native) CLAY, sandy to silty, moist to wet, brown to dark brown, stiff to very stiff, lightly calcareous | MC          | 13/12        | 0.1        | 111.3          | 19.0                  |
| 5040          | 20         | Topsoil - approximately 6 in in thickness, sandy clay  
(Native) CLAY, sandy to silty, moist to wet, brown to dark brown, stiff to very stiff, lightly calcareous | SS          | 50/8         | 0.04       | 17.3           | 14.2                  |
| 5035          | 25         | Topsoil - approximately 6 in in thickness, sandy clay  
(Native) CLAY, sandy to silty, moist to wet, brown to dark brown, stiff to very stiff, lightly calcareous | SS          | 50/8         | 0.04       | 17.3           | 14.2                  |

Bottom of hole at 29.6 feet.
### Boring: B-5

**Client:** Town of Berthoud  
**Project Name:** Community Park and Recreation Center  
**Project Number:** 542.01  
**Project Location:** Berthoud Colorado  
**Date Started:** 5/15/19  
**Completed:** 5/15/19  
**Ground Elevation:** 5058.9 ft  
**Hole Size:** 4.0"  
**Drilling Contractor:** Old Dirt Drilling  
**Drilling Method:** Solid Stem Auger  
**Logged By:** C. Shoen  
**Hammer Type:** Automatic

#### Ground Water Levels:
- **Water Depth:** 6.0 ft on 5/15/19

#### Boring Location:
Middle of the eastern side of rec center building

<table>
<thead>
<tr>
<th>Elevation (ft)</th>
<th>Depth (ft)</th>
<th>Material Description</th>
<th>Sample Type</th>
<th>Blown Counts</th>
<th>Swell Potential (%)</th>
<th>Sulfate (%)</th>
<th>Moisture Content (%)</th>
<th>Liquid Limit (%)</th>
<th>Plastic Limit (%)</th>
<th>Plasticity Index</th>
<th>Atterberg Limits</th>
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<tbody>
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<td>Topsoil - approximately 6 in in thickness, sandy clay (Native) Clay, sandy to silty, moist to very moist, brown, medium stiff to stiff</td>
<td>MC 11/12</td>
<td>1.0</td>
<td>105.8</td>
<td>20.6</td>
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<tr>
<td>5054</td>
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<td>(Native) Clay, sandy to silty, moist to very moist, brown, medium stiff to stiff</td>
<td>MC 5/12</td>
<td>-0.8</td>
<td>103.7</td>
<td>22.7</td>
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<tr>
<td>5049</td>
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<td>(Native) Sand, clayey, wet, light brown, loose</td>
<td>MC 4/12</td>
<td>-0.2</td>
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<td>19.0</td>
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<tr>
<td>5044</td>
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<td>(Native) Gravel, sandy, wet, dark brown, medium dense</td>
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<td>124.4</td>
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<td>MC</td>
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<td></td>
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<td></td>
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<tr>
<td>5034</td>
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<td>(Bedrock) Sandstone, clayey, wet, brown, very hard</td>
<td>SS 50/5</td>
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<td>12.4</td>
<td>49.2</td>
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Bottom of hole at 29.4 feet.

**Log - Standard Community Center and Rec. GPJ**  
6/3/19
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<tr>
<th>ELEVATION <em>(ft)</em></th>
<th>DEPTH <em>(ft)</em></th>
<th>MATERIAL DESCRIPTION</th>
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<tr>
<td>5059</td>
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<td>Topsoil - approximately 6 in in thickness, sandy clay</td>
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<tr>
<td></td>
<td></td>
<td>(Native) CLAY, sandy to silty, moist to very moist, light brown to brown, soft to stiff</td>
</tr>
<tr>
<td>5054</td>
<td>5</td>
<td>(Native) SAND, silty to clayey, wet, brown, loose</td>
</tr>
<tr>
<td>5049</td>
<td>10</td>
<td>(Native) SAND, clayey, wet, brown, loose</td>
</tr>
<tr>
<td>5044</td>
<td>15</td>
<td>(Bedrock) SANDSTONE, clayey, wet, brown, very hard</td>
</tr>
<tr>
<td>5039</td>
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<td>Bottom of hole at 30.0 feet.</td>
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<tr>
<td>5034</td>
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<tr>
<td>5029</td>
<td>30</td>
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</table>

**Ground Water Levels:**
- Date Started: 5/15/19
- Water Depth: 5.0 ft on 5/15/19

**Notes:**
- CME 45

**Logging by:** C. Shoen

**Hammer Type:** Automatic

**Boring Location:** Southwest corner of rec center building

**Drilling Method:** Solid Stem Auger

**Hole Size:** 4.0"
<table>
<thead>
<tr>
<th>ELEVATION (ft)</th>
<th>DEPTH (ft)</th>
<th>GRAPHIC LOG</th>
<th>MATERIAL DESCRIPTION</th>
<th>SAMPLE TYPE</th>
<th>BLOW COUNTS</th>
<th>SWELL POTENTIAL (%)</th>
<th>SULFATE (%)</th>
<th>DRY UNIT WT. (pcf)</th>
<th>MOISTURE CONTENT (%)</th>
<th>ATTERBERG LIMITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>5058</td>
<td>0</td>
<td></td>
<td>Topsoil - approximately 6 in in thickness, sandy clay (Native) SAND, clayey, moist to very moist, brown, stiff</td>
<td>MC</td>
<td>14/12</td>
<td>111.2</td>
<td>17.4</td>
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<td>50/10</td>
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<td>5033</td>
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<td>120.0</td>
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</table>

Bottom of hole at 29.5 feet.
Topsoil - approximately 8 in in thickness, sandy clay

(Native) CLAY, sandy, moist to wet, brown, medium stiff to very stiff

Approximate Bulk Depth 0-5

(Native) SAND, clayey, moist, tan to brown, light iron staining, dense

(Bedrock) CLAYSTONE, sandy, moist, tan to brown, hard, light iron staining

(Bedrock) CLAYSTONE, sandy, moist, tan to brown, very hard, light iron staining

Bottom of hole at 29.4 feet.
Topsoil - approximately 6 in in thickness, sandy clay

(Native) CLAY, sandy to silty, moist to wet, brown, soft to stiff

Approximate Bulk Depth 0-5

Bottom of hole at 10.0 feet.
## BORING: P-2

**CLIENT**: Town of Berthoud  
**PROJECT NAME**: Community Park and Recreation Center  
**PROJECT NUMBER**: 542.01  
**PROJECT LOCATION**: Berthoud Colorado

**DATE STARTED**: 5/15/19  
**COMPLETED**: 5/15/19  
**GROUND ELEVATION**: 5052.2 ft  
**STATION NO.:**

**DRILLING CONTRACTOR**: Old Dirt Drilling  
**DRILLING METHOD**: Solid Stem Auger  
**HOLE SIZE**: 4.0”  
**LOGGED BY**: C. Shoen  
**HAMMER TYPE**: Automatic

**GROUND WATER LEVELS:**

**DATE STARTED**: 5/15/19  
**COMPLETED**: 5/15/19  
**NOTES**: CME 45

### GROUND ELEVATION (ft)  
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### MATERIAL DESCRIPTION

- Topsoil - approximately 6 in in thickness, sandy clay
- (Native) CLAY, silty to sandy, brown, moist to wet, medium stiff to very stiff, calcareous in parts

### BLOW COUNTS

<table>
<thead>
<tr>
<th>SAMPLE TYPE</th>
<th>BLOW COUNTS</th>
<th>SWELL POTENTIAL (%)</th>
<th>SULFATE (%)</th>
<th>DRY UNIT WT. (pcf)</th>
<th>LIQUID LIMIT</th>
<th>PLASTIC LIMIT</th>
<th>PLASTICITY INDEX</th>
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**WATER DEPTH**: 8.0 ft on 5/15/19

**Bottom of hole at 10.0 feet.**
<table>
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<th>ELEVATION (ft)</th>
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<th>MATERIAL DESCRIPTION</th>
<th>SAMPLE TYPE</th>
<th>BLOW COUNTS</th>
<th>SWELL POTENTIAL (%)</th>
<th>SULFATE (%</th>
<th>DRY UNIT WT. (pcf)</th>
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<th>FINES CONTENT (%)</th>
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Bottom of hole at 15.0 feet.
<table>
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<th>ELEVATION (ft)</th>
<th>DEPTH (ft)</th>
<th>GRAPHIC LOG</th>
<th>MATERIAL DESCRIPTION</th>
<th>SAMPLE TYPE</th>
<th>BLOW COUNTS</th>
<th>SWELL POTENTIAL (%)</th>
<th>SULFATE (%</th>
<th>DRY UNIT WT. (pcf)</th>
<th>MOISTURE CONTENT (%)</th>
<th>ATTERBERG LIMITS</th>
<th>PLASTIC LIMIT</th>
<th>PLASTICITY INDEX</th>
<th>FINES CONTENT (%)</th>
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APPENDIX B

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**SUMMARY OF PHYSICAL & CHEMICAL TEST RESULTS**

**PROJECT NUMBER** 542.01

**CLIENT** Town of Berthoud

**PROJECT LOCATION** Berthoud Colorado

**PROJECT NAME** Community Park and Recreation Center

**PROJECT LOCATION** Berthoud Colorado

**SUMMARY-STANDARD LANDSCAPE CDOT SPACING  COMMUNITY CENTER AND REC.GPJ    6/3/19**
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**CLIENT** Town of Berthoud  
**PROJECT NAME** Community Park and Recreation Center  
**PROJECT NUMBER** 542.01  
**PROJECT LOCATION** Berthoud Colorado

---

**GRANULAR MATERIALS**

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**GRAIN SIZE DISTRIBUTION**

---

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<th>%Fine Sand</th>
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### Grain Size Distribution

**CLIENT**: Town of Berthoud  
**PROJECT NAME**: Community Park and Recreation Center  
**PROJECT NUMBER**: 542.01  
**PROJECT LOCATION**: Berthoud Colorado

#### Classification

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#### Grain Size Distribution

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**GRAIN SIZE DISTRIBUTION**

**CLIENT**  Town of Berthoud  
**PROJECT NUMBER**  542.01  
**PROJECT LOCATION**  Berthoud Colorado

**Classification**

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**Gradation - Standard Community Center and Rec.**

**CLIENT**  Town of Berthoud  
**PROJECT NAME**  Community Park and Recreation Center  
**PROJECT NUMBER**  542.01  
**PROJECT LOCATION**  Berthoud Colorado

**Gradation**

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**Percent finer by weight**

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### Atterberg Limits Results

AASHTO T89 Method B/T90

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UNCONFINED COMPRESSION TEST

CLIENT: Town of Berthoud
PROJECT NUMBER: 542.01
PROJECT NAME: Community Park and Recreation Center
PROJECT LOCATION: Berthoud Colorado

CLIENT

STRESS, psi

STRAIN, %

Specimen Identification | Classification | Compressive Strength (psi) | γ_d (pcf) | MC%
--- | --- | --- | --- | ---
B-2 | SANDSTONE, clayey | 11.1 | 114.1 | 15.6
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<th>Specimen Identification</th>
<th>Classification</th>
<th>Compressive Strength (psi)</th>
<th>$\gamma'_d$ (pcf)</th>
<th>MC%</th>
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<td>B-3</td>
<td>SANDSTONE, clayey</td>
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UNCONFINED COMPRESSION TEST

CLIENT: Town of Berthoud
PROJECT NUMBER: 542.01
PROJECT LOCATION: Berthoud Colorado

PROJECT NAME: Community Park and Recreation Center

STRAIN, %
STRESS, psi

Specimen Identification | Classification              | Compressive Strength (psi) | ρ₄ (pcf) | MC% |
------------------------|-----------------------------|---------------------------|-------|-----|
• B-6                   | SANDSTONE, clayey           | 41.1                      | 122.1 | 11.9|
UNCONFINED COMPRESSION TEST

CLIENT  Town of Berthoud  PROJECT NAME  Community Park and Recreation Center
PROJECT NUMBER  542.01  PROJECT LOCATION  Berthoud Colorado

Specimen Identification  Classification  Compressive Strength (psi)  $\gamma_f$ (pcf)  MC%
- B-7  29  SANDSTONE, silty to clayey  97.2  120.0  13.0
**UNCONFINED COMPRESSION TEST**

**CLIENT**  Town of Berthoud  
**PROJECT NUMBER**  542.01  
**PROJECT NAME**  Community Park and Recreation Center  
**PROJECT LOCATION**  Berthoud Colorado

---

**Specimen Identification**  
**Classification**  CLAYSTONE, sandy  
**Compressive Strength (psi)**  131.3  
**γ_d (pcf)**  122.7  
**MC%**  13.0
CLIENT: Town of Berthoud
PROJECT NAME: Community Park and Recreation Center
PROJECT NUMBER: 542.01
PROJECT LOCATION: Berthoud Colorado

SWELL - CONSOLIDATION TEST

STRAIN, %

STRESS, ksf

Specimen Identification  | Classification  | Swell/Consol. (%) | \( \gamma_d \) (pcf) | MC%
---|---|---|---|---
B-1 | CLAY, sandy | 6.4 | 115.8 | 15.5
SWELL - CONSOLIDATION TEST

CLIENT  Town of Berthoud
PROJECT NUMBER  542.01
PROJECT NAME  Community Park and Recreation Center
PROJECT LOCATION  Berthoud Colorado

Specimen Identification | Classification | Swell/Consol. (%) | γ₄ (pcf) | MC%
--- | --- | --- | --- | ---
B-1 | 4 | CLAY, sandy | -0.1 | 103.5 | 23.9
### Specimen Identification and Classification

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<th>( \gamma_d ) (pcf)</th>
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**CLIENT**  
Town of Berthoud

**PROJECT NUMBER**  
542.01

**PROJECT NAME**  
Community Park and Recreation Center

**PROJECT LOCATION**  
Berthoud Colorado
null
specimen identification | classification | swell/consol. (%) | \( \gamma_d \) (pcf) | mc %
--- | --- | --- | --- | ---
• B-2 | 4 | CLAY, sandy to silty | -0.2 | 100.4 | 23.4
### Specimen Identification

<table>
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**CLIENT**  
Town of Berthoud

**PROJECT NUMBER**  
542.01

**PROJECT NAME**  
Community Park and Recreation Center

**PROJECT LOCATION**  
Berthoud Colorado

---

### Diagram

- **Axes:**
  - X-axis: Stress, ksf
  - Y-axis: Strain, %

- **Data Points:**
  - B-2: (-0.1, 99.7, 25.8)
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<th>ρ (pcf)</th>
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<tbody>
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<td>● B-3</td>
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<td>Swell/Consol. (%)</td>
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<td>• B-4</td>
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Specimen Identification | Classification                  | Swell/Consol. (%) | \( \gamma \) (pcf) | MC%  
---|---|---|---|---
B-4  | CLAY, sandy to silty | 0.3 | 106.7 | 21.4
**Specimen Identification** | **Classification** | **Swell/Consol. (%)** | \( \gamma' \) (pcf) | MC%
--- | --- | --- | --- | ---
● B-4 | 9 | CLAY, sandy to silty | 0.1 | 111.3 | 19.0
CLIENT: Town of Berthoud
PROJECT NAME: Community Park and Recreation Center
PROJECT NUMBER: 542.01
PROJECT LOCATION: Berthoud Colorado

Specimen Identification | Classification          | Swell/Consol. (%) | ρ₄ (pcf) | MC%
---                     | ---                     | ---              | ---      | ---
• B-5                   | CLAY, sandy to silty   | 1.0              | 105.8    | 20.6
SWELL - CONSOLIDATION TEST

CLIENT: Town of Berthoud
PROJECT NAME: Community Park and Recreation Center
PROJECT NUMBER: 542.01
PROJECT LOCATION: Berthoud Colorado

Specimen Identification | Classification | Swell/Consol. (%) | γₜ (pcf) | MC%
--- | --- | --- | --- | ---
• B-5 | CLAY, sandy to silty | -0.8 | 103.7 | 22.7
### SWELL - CONSOLIDATION TEST

**CLIENT** Town of Berthoud  
**PROJECT NUMBER** 542.01  
**PROJECT LOCATION** Berthoud Colorado  

<table>
<thead>
<tr>
<th>Specimen Identification</th>
<th>Classification</th>
<th>Swell/Consol. (%)</th>
<th>γ₄ (pcf)</th>
<th>MC%</th>
</tr>
</thead>
<tbody>
<tr>
<td>● B-5</td>
<td>9</td>
<td>-0.2</td>
<td>111.1</td>
<td>19.0</td>
</tr>
</tbody>
</table>

**SWELL - STANDARD COMMUNITY CENTER AND REC.GPJ ROCKSOL TEMPLATE.GDT 6/3/19**
Specimen Identification | Classification       | Swell/Consol. (%) | ρₜ (pcf) | MC%  \\
--- | --- | --- | --- | ---  \\
• B-6 | CLAY, sandy to silty | 2.7 | 96.4 | 18.0
<table>
<thead>
<tr>
<th>Specimen Identification</th>
<th>Classification</th>
<th>Swell/Consol. (%)</th>
<th>$\gamma$ (pcf)</th>
<th>MC%</th>
</tr>
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<tbody>
<tr>
<td>B-6</td>
<td>4</td>
<td>-0.6</td>
<td>97.6</td>
<td>27.9</td>
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### Specimen Identification

<table>
<thead>
<tr>
<th>Specimen Identification</th>
<th>Classification</th>
<th>Swell/Consol. (%)</th>
<th>$\gamma_d$ (pcf)</th>
<th>MC%</th>
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</thead>
<tbody>
<tr>
<td>B-7</td>
<td>4</td>
<td>-0.9</td>
<td>94.1</td>
<td>30.1</td>
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</tbody>
</table>

**CLIENT**  
Town of Berthoud

**PROJECT NUMBER**  
542.01

**PROJECT NAME**  
Community Park and Recreation Center

**PROJECT LOCATION**  
Berthoud Colorado
CLIENT: Town of Berthoud
PROJECT NAME: Community Park and Recreation Center
PROJECT NUMBER: 542.01
PROJECT LOCATION: Berthoud Colorado

STRAIN, %

STRESS, ksf

<table>
<thead>
<tr>
<th>Specimen Identification</th>
<th>Classification</th>
<th>Swell/Consol. (%)</th>
<th>γ₄ (pcf)</th>
<th>MC%</th>
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<tbody>
<tr>
<td>● B-8</td>
<td>4</td>
<td>-0.1</td>
<td>101.8</td>
<td>23.2</td>
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</table>
### Specimen Identification

<table>
<thead>
<tr>
<th>Specimen Identification</th>
<th>Classification</th>
<th>Swell/Consol. (%)</th>
<th>$\gamma_s$ (pcf)</th>
<th>MC%</th>
</tr>
</thead>
<tbody>
<tr>
<td>B-8</td>
<td>SAND, clayey</td>
<td>0.2</td>
<td>123.6</td>
<td>13.0</td>
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<tr>
<td>Specimen Identification</td>
<td>Classification</td>
<td>Swell/Consol. (%)</td>
<td>( \gamma_f ) (pcf)</td>
<td>MC%</td>
</tr>
<tr>
<td>-------------------------</td>
<td>----------------------------</td>
<td>-------------------</td>
<td>----------------------</td>
<td>-----</td>
</tr>
<tr>
<td>P-1</td>
<td>CLAY, sandy to silty</td>
<td>0.8</td>
<td>101.6</td>
<td>21.4</td>
</tr>
<tr>
<td>Specimen Identification</td>
<td>Classification</td>
<td>Swell/Consol. (%)</td>
<td>ρd (pcf)</td>
<td>MC%</td>
</tr>
<tr>
<td>-------------------------</td>
<td>-------------------</td>
<td>-------------------</td>
<td>---------</td>
<td>-----</td>
</tr>
<tr>
<td>P-2</td>
<td>2, CLAY, silty to sandy</td>
<td>4.7</td>
<td>119.1</td>
<td>14.1</td>
</tr>
</tbody>
</table>
CLIENT: Town of Berthoud  
PROJECT NUMBER: 542.01

PROJECT NAME: Community Park and Recreation Center  
PROJECT LOCATION: Berthoud Colorado

---

**Specimen Identification**  
Classification: CLAY, silty to sandy

<table>
<thead>
<tr>
<th>Specimen Identification</th>
<th>Classification</th>
<th>Swell/Consol. (%)</th>
<th>ρ� (pcf)</th>
<th>MC%</th>
</tr>
</thead>
<tbody>
<tr>
<td>• P-2</td>
<td>4</td>
<td>0.4</td>
<td>111.7</td>
<td>18.6</td>
</tr>
<tr>
<td>Specimen Identification</td>
<td>Classification</td>
<td>Swell/Consol. (%)</td>
<td>( \gamma_v ) (pcf)</td>
<td>MC%</td>
</tr>
<tr>
<td>-------------------------</td>
<td>-----------------</td>
<td>-------------------</td>
<td>----------------------</td>
<td>-----</td>
</tr>
<tr>
<td>P-3</td>
<td>CLAY, sandy</td>
<td>10.4</td>
<td>120.7</td>
<td>12.6</td>
</tr>
</tbody>
</table>

**SWELL - CONSOLIDATION TEST**

**CLIENT** Town of Berthoud  
**PROJECT NUMBER** 542.01  
**PROJECT NAME** Community Park and Recreation Center  
**PROJECT LOCATION** Berthoud Colorado

**STRAIN, %**  
**STRESS, ksf**
Specimen Identification | Classification | Swell/Consol. (%) | γₜ (pcf) | MC%
--- | --- | --- | --- | ---
• P-3 | 4 | CLAY, sandy | 0.2 | 104.9 | 22.2
<table>
<thead>
<tr>
<th>Specimen Identification</th>
<th>Classification</th>
<th>Swell/Consol. (%)</th>
<th>γₙ (pcf)</th>
<th>MC%</th>
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</thead>
<tbody>
<tr>
<td>P-4</td>
<td>CLAY, sandy to silty</td>
<td>7.2</td>
<td>107.3</td>
<td>12.7</td>
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<tr>
<td>Specimen Identification</td>
<td>Classification</td>
<td>Swell/Consol. (%)</td>
<td>$\gamma_d$ (pcf)</td>
<td>MC%</td>
</tr>
<tr>
<td>-------------------------</td>
<td>----------------------</td>
<td>-------------------</td>
<td>------------------</td>
<td>-----</td>
</tr>
<tr>
<td>P-4</td>
<td>CLAY, sandy to silty</td>
<td>0.6</td>
<td>107.3</td>
<td>20.8</td>
</tr>
<tr>
<td>Specimen Identification</td>
<td>Classification</td>
<td>Swell/Consol. (%)</td>
<td>$\gamma$ (pcf)</td>
<td>MC%</td>
</tr>
<tr>
<td>------------------------</td>
<td>----------------------</td>
<td>------------------</td>
<td>----------------</td>
<td>-----</td>
</tr>
<tr>
<td>● P-5</td>
<td>2  CLAY, sandy to silty</td>
<td>0.4</td>
<td>99.2</td>
<td>23.4</td>
</tr>
</tbody>
</table>
**Specimen Identification**

<table>
<thead>
<tr>
<th>Specimen Identification</th>
<th>Classification</th>
<th>Swell/Consol. (%)</th>
<th>$\gamma$ (pcf)</th>
<th>MC%</th>
</tr>
</thead>
<tbody>
<tr>
<td>P-6</td>
<td>2 CLAY, sandy</td>
<td>5.7</td>
<td>116.7</td>
<td>14.8</td>
</tr>
</tbody>
</table>
R-VALUE TEST GRAPH (AASHTO T190)

<table>
<thead>
<tr>
<th>Project Number:</th>
<th>19.022, RockSol Consulting</th>
<th>Date:</th>
<th>31-May-19</th>
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<tbody>
<tr>
<td>Project Name:</td>
<td>Town of Berthoud Community Park and Recreation Center (Proj. No. 542.01)</td>
<td>Technician:</td>
<td>J. Holiman</td>
</tr>
<tr>
<td>Lab ID Number:</td>
<td>192868</td>
<td>Reviewer:</td>
<td>G. Hoyos</td>
</tr>
<tr>
<td>Sample Location:</td>
<td>P-5 at 0' to 5'</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Visual Description:</td>
<td>CLAY, sandy, brown</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**R-Value @ Exudation Pressure 300 psi:**

<table>
<thead>
<tr>
<th>Test Specimen:</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture Content, %:</td>
<td>16.8</td>
<td>19.3</td>
<td>21.0</td>
</tr>
<tr>
<td>Expansion Pressure, psi:</td>
<td>0.06</td>
<td>0.03</td>
<td>0.00</td>
</tr>
<tr>
<td>Dry Density,pcf:</td>
<td>113.6</td>
<td>107.8</td>
<td>106.3</td>
</tr>
<tr>
<td>R-Value:</td>
<td>11</td>
<td>9</td>
<td>7</td>
</tr>
<tr>
<td>Exudation Pressure, psi:</td>
<td>470</td>
<td>322</td>
<td>217</td>
</tr>
</tbody>
</table>

**Note:** The R-Value is measured; the $M_R$ is an approximation from correlation formulas.

Eq. 2.1 & 2.2, page 2-3.
APPENDIX C

PAVEMENT DESIGN CALCULATION SHEET
ESAL's = the number of Equivalent 18-kip axle loads for the appropriate design period
Mr = subgrade Resilient Modulus in pounds per square inch (psi)

If Mr is based on R-Value ===> Mr = 3,448 psi

Mr = 3,448 psi

S+18.72 = 22.074296

(3.53754741 ^ (73,000 / 3.53754741) ) = Design Life ESALs

Mr = 3,448 psi

S+18.72 = 22.074296

SN = 2.700 = Required SN when B equals (or slightly exceeds) A

Log₁₀ESAL = 4.86332

Design Mr = 3,448 psi

$ = 3.354296

S+18.72 = 22.074296

(3.53754741) = 3.53754741

Table 1.4 Reliability and Standard Normal Deviate

<table>
<thead>
<tr>
<th>Reliability, R (percent)</th>
<th>Standard Normal Deviate (Zₚ)</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>0.000</td>
</tr>
<tr>
<td>60</td>
<td>-0.253</td>
</tr>
<tr>
<td>70</td>
<td>-0.524</td>
</tr>
<tr>
<td>75</td>
<td>-0.674</td>
</tr>
<tr>
<td>80</td>
<td>-0.841</td>
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<tr>
<td>85</td>
<td>-1.037</td>
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<tr>
<td>90</td>
<td>-1.282</td>
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<td>91</td>
<td>-1.340</td>
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<td>92</td>
<td>-1.405</td>
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<td>93</td>
<td>-1.476</td>
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<tr>
<td>94</td>
<td>-1.555</td>
</tr>
<tr>
<td>95</td>
<td>-1.645</td>
</tr>
<tr>
<td>98</td>
<td>-2.054</td>
</tr>
</tbody>
</table>

Composite HMA over ABC (using specified layer of ABC)

Inches of ABC = 6.0

Calculated Thickness, inches = 5.14

Full Depth HMA

Structural Coefficient of HMA = 0.44

Structural Coefficient of ABC = 0.11

When A = B, ESAL’s and SN agree, then calculate thickness

Take Calculated Thickness and round appropriately for design thickness

Calculated thickness, inches = 5.14

Initial Serviceability Index = 4.5

Final Serviceability Index = 2.0

Design Serviceability Loss (ΔPSI) = 2.5

Overall Standard Deviation, So = 0.44

Reliability, R (percent) = 80

Standard Normal Deviate (Zₚ) = -0.841

(Use Table 1.4 from CDOT Pavement Design Manual)

Less than minimum allowed by LUCASS for Residential Roadway with 10 EDLA.
APPENDIX D

BRS GEOTEchnical SCOping LETTER
PROJECT DESCRIPTION
The Town of Berthoud is planning construction of a new Community Park & Recreation Center at the corner of Berthoud Parkway and Bunyan Ave., within the current Waggener Farm Park site. The project includes the new recreation facility building, outdoor pool and associated site development as well as the re-development of a portion of the adjacent farm park. The Recreation Center is planned at 34,275 Sq. Ft. with an additional 13,000 Sq. Ft for the outdoor pool.

The recreation center will include an outdoor aquatics component, gymnasium, cardio & weight training area, (1) group fitness rooms, child-watch, (1) birthday party room, administrative space, a climbing wall, a locker room, mechanical and storage areas.

The facility will be one story. Existing off-site utilities and off-site improvements are complete, and minimal work will be required to connect to these improvements outside the property line. Consultants should anticipate providing extensions from existing utilities within the street and completing all site improvements within the property line.

In addition to the Recreation Facility, the Park improvements will include an outdoor turf field, 4 sport courts, park restroom facility, picnic shelter(s), Parking for both the recreation facility as well as general park uses, a loop trail around the perimeter of the park, and an irrigation pond within the southern section of the Park.

The project will not pursue LEED certification.

GEOTECHNICAL SERVICES SCOPE
1. In addition to the number of copies of the report requested by the Owners Request for Proposal, provide a copy of the report in PDF format.
2. Provide 8 deep earth borings & 6 shallow earth borings based on attached boring location map (14 total). Deep earth boring shall be minimum 30’-0” length or to bedrock bearing strata. The attached Boring Map is being provided for basis of proposal. The final boring location shall be confirmed with the Architect prior to commencing work.
3. Common information required by all consultants:
   a. Provide information regarding site seismic considerations including Soil Classification in accordance with IBC 2015 and liquefaction potential.
   b. Identify and describe all soil conditions down to and including bedrock. Make recommendations as to most appropriate foundation systems and design parameters for those systems. Also, include any recommendations regarding existing foundations and underground structures or other geotechnical natural hazard as they might affect the new foundations and earthwork. Specific locations of borings can be adjusted based on field conditions and discretion of the geotechnical engineer.
   c. Address water tables as they may affect foundation construction and/or lower level construction. Describe dewatering requirements and pump sizes, if any, for both construction and permanent conditions with seasonal variations.
   d. The following design parameters are requested for perimeter drains and underdrains adjacent to/or below the proposed building:
      i. Anticipated ground water flow rate into the system and drainage patterns around and below the building.
      ii. Proposed underdrain sizes, materials, and minimum slopes required
iii. A detail of the perimeter drains and underdrains as it relates to the proposed foundation system including drainage, rock, piping, backfill, drainage boards, and geotextile fabric. Relationship to foundation with dimensions is also required.

iv. Recommendations for minimum and maximum depth dimension from finish floor to pipe invert.

v. Recommendations for spacing and number of cleanouts required for the system.

e. For existing fill which may exist on the site, address if that fill is acceptable for reuse, and the conditions under which it may be reused. Describe what material must be removed from that fill, if any. Provide import fill materials specifications and testing requirements.

f. Provide the actual existing grade elevation at the top of each boring or pit and identify the benchmark used to set these elevations. Coordinate with survey and USGS elevations.

g. Give recommendations relative to sub-grade (including any over-excavation, stabilization and procedures required) for pavements, slab-on-grade construction, foundations and retaining walls. Also, provide a recommendation whether a structural floor should be considered due to adverse soil conditions.

h. For slab-on-grade, provide modulus of subgrade reaction, slab reinforcing requirements and estimate differential settlement or heave. Will vapor barriers be required under slabs? Provide recommendation for control joint spacing and slab separation requirements. Will isolation be required at the top of partitions?

i. Define any voiding requirements under foundation walls, grade beams, and structural floors on grade.

j. Indicate any special cement requirements for concrete elements in contact with soils. Requirements shall conform to ACI 318-05 table 4.3.1.

k. Specify compaction requirements for fill and backfill areas throughout the building site and the associated settlements associated with these compaction requirements.

l. During the project design phase, review Earthwork, Asphalt Paving and Concrete Paving specification sections for inclusion in the Project Manual. Additionally, review Grading and Drainage Plans for conformance with geotechnical recommendations.

m. Provide unit rate fees for consultation with the design team to respond to questions and clarifications necessary during the design.

4. Within the written report provide the following information for Structural Design Purpose:

a. Give the lateral pressures to be used in design of vertical building walls, building frame foundations, site retaining walls and indoor swimming pool walls in terms of equivalent fluid pressures (active, at-rest and passive). Provide horizontal coefficient of friction to be used in the design of footings and slabs-on-grade resisting horizontal forces. Provide allowable footing bearing pressures for retaining wall design.

b. If a spread footing foundation system is recommended, define the allowable soil bearing pressure, the minimum dead load soil pressure to be maintained, total and differential footing settlement anticipated, coefficient of friction for footing sliding resistance, and balanced dead load design criteria (if any).

c. If a drilled pier foundation system is recommended, define the minimum spacing, minimum size, minimum length, minimum penetration into bedrock and minimum reinforcement requirements for the drilled piers. Also, provide design end bearing and side shear values including net tension (uplift). Will casing be required?

d. For lateral design of drilled piers, provide the following parameter for sand, clay and bedrock soil strata as indicated:

   i. Horizontal Subgrade Modulus (tcf)
   ii. Unit Weight (pcf)
   iii. Cohesion (clay only, psf)
   iv. Angle of Internal Friction (sand only, degrees)
   v. Strain corresponding to ½ max. Principal Stress (clay only)
   vi. Unconfined Compressive Strength (rock only, psi)
   vii. Young’s Modulus (psi)
   viii. Rock Quality Designation (rock only, %)

e. The project will include long-span structure(s) with concentrated loads. Engineer shall provide deep borings as required based on the local subgrade/bedrock formations and the overall loading of the building.

f. Provide recommendations regarding minimum earth cover to prevent frost heave consistent with local conditions and applicable building code regulations.
5. Within the written report provide the following information for Civil Design Purpose:
   a. If an underdrain is recommended, underdrain layout plans will be furnished to the Geotechnical Engineer for review and compliance with Geotechnical Study. Written approval by Geotechnical Engineer shall be required prior to construction.
   b. For site retaining walls, provide retention options. Give the lateral pressures to be used in design of site retaining walls in terms of equivalent fluid pressures for onsite materials and for imported structural fill. Give allowable soil footing pressures for retaining wall design. For tall retaining walls address overburden pressure effects on allowable soil pressures of the heel of the retaining wall. Provide horizontal equivalent fluid pressures for both level and sloping backfill against site retaining walls and footing friction values for resisting the horizontal forces. Also provide passive pressure values developed in the soil due to horizontal movement of the retaining walls of 1-inch maximum. Include compaction requirements for backfill to achieve these values. Provide ultimate values without factors of safety for friction, passive, active, and at rest soil values. The designer will apply code required factors of safety when sizing the foundation elements.
   c. Define settlement potential of existing and imported fill soils used under the building, for wall backfill, utility trench backfill, etc. Discuss the time required for settlement at anticipated fill thicknesses for on-site material and for imported granular backfill. Provide recommendations to mitigate settlement.
   d. Address excavation requirements and problems including temporary shoring design criteria for protection of adjacent buildings and property. Discuss whether use of un-conventional equipment is anticipated to excavate the site or if the use of blasting may be required.
   e. Provide recommendations for pavement thickness based upon the anticipated traffic, including recommendations for light and heavy loading for both asphaltic concrete and concrete. Address sub-base and base course, concrete reinforcement, joint spacing, and joint doweling.
   f. Provide resistivity and corrosivity test results (for borings as identified on the boring map) and mitigation recommendations with regard to utility piping and flatwork.
   g. Provide soil type, density, hydrologic soil group/texture, permeability, erosion potential, potential impacts of soil type on quality of storm water discharge from the site to satisfy City drainage and erosion criteria.
   h. Provide Post Tension design parameters & detail for Exterior Post Tension Tennis Courts.
   i. Provide ground water depths for each boring.

6. Within the written report provide the following information for Aquatics Design Purpose:
   a. Earthwork:
      i. Establish a range of "soil resistivity" and comment on whether underground tanks and piping should be provided with cathodic protection.
   b. Structural:
      i. Provide recommendations to achieve maximum ½” differential settlement as required for the pool structure(s).
   c. Pavement Design:
      i. Provide a modulus of subgrade reaction for concrete pavement and floor design.
      ii. Provide an "R" value for designing bituminous pavements.
      iii. Provide recommendations on granular cushions and subsurface drainage when the predominate soils are cohesive.

*   *   *
SITE BORING LOCATION MAP

Approximate Limits of Conservation Easement
Approximate Limits of Parking Area

Allowed In The Easement

Future Development by Developer

POST TENTIONED SPORT COURTS

POTENTIAL IRRIGATION POND LOCATION

PARKING

TURF FIELD

RESTROOM BUILDING

PARKING

DEEP EARTH BORINGS

SHALLOW EARTH BORINGS

SEE BUILDING BORING MAP ON NEXT PAGE
APPENDIX E

SCHEMATIC DESIGN – SITE DESIGN SHEET
(WAGGENER FARM PARK – PHASE 1)
Schematic Design - Site Design

- Berthoud Parkway / HWY 17
- Turner Middle School
- Bunyan Ave.
- Mountain Ave.
- Multi-Use Fields
- Multi-Use Fields
- Playground and Restroom
- Recreation Center
- Irrigation Pond
- Gravel Parking Lot
- Service and Fire Truck loop
- Loading Area
PART 1 GENERAL

1.01 AGREEMENT AND CONDITIONS OF THE CONTRACT
   A. The General Conditions are based on AIA A201.

1.02 FORMS
   A. Use the following forms for the specified purposes unless otherwise indicated elsewhere in Contract Documents.
   B. Post-Award Certificates and Other Forms:
      1. Schedule of Values Form: AIA G703.
      2. Application for Payment Forms: AIA G702 with AIA G703 (for Contractors).
   C. Clarification and Modification Forms:
      1. Architect's Supplemental Instructions Form: AIA G710.
   D. Closeout Forms:

1.03 REFERENCE STANDARDS
   A. AIA A201 - General Conditions of the Contract for Construction.
   B. AIA G701 - Change Order.
   C. AIA G702 - Application and Certificate for Payment.
   D. AIA G703 - Continuation Sheet.
   E. AIA G704 - Certificate of Substantial Completion.
   F. AIA G710 - Architect's Supplemental Instructions.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION
SECTION 00 6000

PROJECT FORMS

PART 1 GENERAL

1.01 SUMMARY
   A. Procedures for use of administrative forms.
   B. Administrative forms.

1.02 PROCEDURES
   A. Deliver or electronically transmit completed forms to Architect at the address listed on the cover of the Project Manual.
   B. Use of forms included at end of this Section is required. Architect will provide electronic copies of the forms upon request.
   C. Complete applicable information on form. Indicate date transmitted and date of required response, as applicable. Attach supporting documentation and additional descriptive information as necessary to fully describe the request.
   D. Use a single form for each separate request. Closely related items may be included in a single request only if acceptance of one item requires acceptance of all items in the request.

1.03 ARCHITECT’S ACTION
   A. Architect will review each request, and return the form to Contractor with written response within 10 days of receipt, except when it must be held for coordination with pending submittals, and Contractor is so advised.
   B. When requests are made within the time allowed for Architect's review, Architect will make reasonable effort to respond in a timely manner, but no claim for delay by Contractor will be allowed.

1.04 FORMS
   A. Request for Information: Number consecutively; include Architect's project number; clearly specify the document reference by specification Section number, article, paragraph, Drawing number, and detail numbers as applicable. Architect will complete the lower portion of the form as the written response.
   B. Proposal Request: Architect may submit a Proposal Request which may include detailed description(s) of proposed modification(s) with supplementary or revised drawings and specifications, the projected time for executing the modification with a stipulation of any overtime work required (if any), the period of time during which the requested price will be considered valid, and other pertinent information. Refer to Section 01 2000 for modification procedures.
   C. Supplemental Instructions: Architect may issue a Supplemental Instruction which includes detailed description of proposed minor modification, with supplementary or revised drawings and specifications.
   D. Forms are on pages immediately following the end of this Section.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION
No.

☐ Owner  ☐ Architect  ☐ Contractor  ☐ Consultant  ☐ Field  ☐ Other:

Project:  Date:

Project Number:  Contractor:

Subject:

This is in response to Contractor RFI form. See form for Contractor request.

Attachments:

Response by:

Signature:  Date:
CA SUBSTITUTION FORM

Project: 

Substitution Request Number: 

Date: 

Submitting Contractor: 

Reason for Substitution. Check all that apply.

☐ Equal Product – less cost
☐ Code Compliance
☐ Better Product – equal or less cost
☐ Unavailable from Manufacturer
☐ Project Schedule
☐ As-built Condition

Specification Title: 

Description: 

Section: 

Page: 

Article/Paragraph: 

Describe Advantage to Owner:

Proposed substitution affects other parts of work, including dimensions:  ☐ No  ☐ Yes; explain

Effect on drawing(s):  ☐ No  ☐ Yes; explain

Product Data Comparison

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<thead>
<tr>
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<th>Specified</th>
<th>Substitution</th>
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<td>Material</td>
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<tr>
<td>Requirements by Specification</td>
<td>(list all specified requirements)</td>
<td>(list all comparative data)</td>
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<td>Section Number</td>
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<td>Product History</td>
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<td>Similar Installation</td>
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<td>Cost Implications</td>
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<td>Supporting Data</td>
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See Specifications for Substitution Requirements & Responsibilities.

By filling out this form, the submitting contractor acknowledges the proposed substitution has been fully investigated and is equal or superior in all respects to the specified product.
Please submit an itemized quotation for changes in the Contract Sum and/or Time incidental to proposed modification to the Contract Documents described herein. THIS IS NOT A CHANGE ORDER NOR A DIRECTION TO PROCEED WITH THE WORK DESCRIBED HEREIN.

Description:

Attachments:

Issued:

Architect: Date:
The Work shall be carried out in accordance with the following supplemental instructions issued in accordance with the Contract Documents without change in Contract Sum or Contract Time. Prior to proceeding in accordance with these instructions, indicate your acceptance of these instructions for minor change to the Work as consistent with the Contract Documents and return a copy to the Architect.
CONSTRUCTION CHANGE DIRECTIVE (CCD)

Project:  
CCD Date:  
Contractor:  

Project #:  
CCD #:  
Contract For:  

In order to expedite the work and avoid or minimize delays in the work which may affect the contract sum or contract time, the contract documents are hereby amended as described below. Proceed with this work promptly. Submit final costs for work involved and change in contract time (if any), for inclusion in a subsequent Change order.

Description:

Proposed Adjustments:
1. The proposed basis of adjustment to the Contract Sum of Guaranteed Maximum Price is:
   - ☐ Lump sum ☐ increase ☐ decrease of $ .
   - ☐ Unit Price of $ per .
   - ☐ as follows:

2. The Contract Time is proposed to ☐ be adjusted ☐ remain unchanged. The proposed adjustment, if any, is ☐ an increase of days ☐ a decrease of days.

Architect:  
Date:  
Owner's Representative:  
Date:  
Contractor:  
Date:  

BRISARCH.COM
SECTION 01 1000
SUMMARY

PART 1 GENERAL

1.01 PROJECT
A. Project Name: Waggener Farm Park - Phase 1.
B. Owner's Name: Town of Berthoud, Colorado.
C. Architect's Name: BRS Architecture.
D. The Project consists of the construction of a new recreation and community center facility and associated site construction as more completely described in the Contract Documents.

1.02 CONTRACT DESCRIPTION
A. Contract Type: A single prime contract based on the Cost of the Work plus a fee with a Guaranteed Maximum Price as described in Document 00 5000 - Contracting Forms and Supplements.

1.03 DIVISION 01 SPECIFICATIONS
A. Division 01 General Requirements expand on the broad provisions of the Conditions of the Contract, and govern the execution of the work of all Sections of the specifications. Division 01 General Requirements specify administrative and procedural requirements relating to execution of the Work, and temporary facilities for use during the construction period.

1.04 PROJECT WARRANTY
A. Refer to General Conditions for warranty provisions applicable to this Contract.
   1. Project warranty period is governed by Colorado state statutes and other provisions of the Contract.

1.05 WORK BY OWNER
A. Items noted NIC (Not in Contract) will be supplied and installed by Owner after Substantial Completion. Some items include:
   1. Movable cabinets.
   2. Furnishings.
   3. Small equipment.
   4. Rugs.
   5. Artwork.
   7. Bouldering and climbing walls.
   8. Other items noted on Drawings.

1.06 OWNER OCCUPANCY
A. Owner intends to occupy the Project upon Substantial Completion.
B. Schedule the Work to accommodate Owner occupancy.

1.07 CONTRACTOR USE OF SITE
A. Construction Operations: Limited to areas noted on Drawings.
B. Arrange use of site to allow:
   1. Owner occupancy.
   2. Work by Others.
   3. Work by Owner.
C. Provide access to and from site as required by law and by Owner:
   1. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.
   2. Do not obstruct roadways, sidewalks, or other public ways without permit.
1.08 CONTRACTOR'S DESIGN-RELATED PROFESSIONAL DESIGN SERVICES (DELEGATED DESIGN WORK)

A. See Section 01 4000 - Quality Requirements, for Contractor's design-related professional design services.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION
SECTION 01 2000
PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Procedures for preparation and submittal of applications for progress payments.
   C. Modification procedures.
   D. Correlation of Contractor submittals based on Contract modifications.
   E. Procedures for preparation and submittal of application for final payment.

1.02 RELATED REQUIREMENTS
   A. Section 00 5000 - Contracting Forms and Supplements: Forms to be used.

1.03 SCHEDULE OF VALUES
   A. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit draft to Architect for approval.
   B. Forms filled out by hand will not be accepted.
   C. Submit Schedule of Values in duplicate within 15 days after date of Owner-Contractor Agreement.
   D. Format: Utilize the Table of Contents of this Project Manual. Identify each line item with number and title of the specification Section. Identify site mobilization.
   E. Revise schedule to list approved Change Orders, with each Application For Payment.

1.04 APPLICATIONS FOR PROGRESS PAYMENTS
   A. Payment Period: Submit at intervals stipulated in the Agreement.
   B. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit sample to Architect for approval.
      1. Forms filled out by hand will not be accepted.
   C. For each item, provide a column for listing each of the following:
      1. Item Number.
      2. Description of work.
      4. Previous Applications.
      5. Work in Place and Stored Materials under this Application.
      7. Total Completed and Stored to Date of Application.
      8. Percentage of Completion.
      10. Retainage.
   D. Execute certification by signature of authorized officer.
   E. Use data from approved Schedule of Values. Provide dollar value in each column for each line item for portion of work performed and for stored products.
   F. List each authorized Change Order as a separate line item, listing Change Order number and dollar amount as for an original item of work.
   G. Submit one electronic and three hard-copies of each Application for Payment.
H. Include the following with the application:
   1. Transmittal letter as specified for submittals in Section 01 3000.
   2. Construction progress schedule, revised and current as specified in Section 01 3000.
   3. Conditional release of liens from each Subcontractor and vendor for the current month’s payment application, and unconditional release of liens from each Subcontractor and vendor for the previous month’s payment application.
   4. Project record documents as specified in Section 01 7800, for review by Owner which will be returned to the Contractor.
   5. Affidavits attesting to off-site stored products.

I. When Architect requires substantiating information, submit data justifying dollar amounts in question. Provide one copy of data with cover letter for each copy of submittal. Show application number and date, and line item by number and description.

1.05 MODIFICATION PROCEDURES

A. Project Modification Forms: Forms for use primarily by Contractor are provided in Section 00 6000.

B. Establish and maintain a construction cost log, including the status of all pending and executed Change Orders (accepted, declined, pending, etc.), status of requests for information, supplemental instructions, other modification documents, and the status of allowances, including Owner's contingency allowance.

C. Supplemental Instructions: For minor modifications not involving an adjustment to the Contract Sum or Contract Time; Architect will issue instructions directly to Contractor.
   1. Architect's issuance of supplemental instructions may constitute a modification of the Contract Documents involving an adjustment to the Contract Sum or Contract Time. If Architect's supplemental instructions require such a modification of the Contract Documents, notify Owner immediately and prepare a request for change order or other modification according to applicable modification procedures specified in this Section. Owner's approval is required before any action is taken.

D. Construction Change Directive: For other required modifications, Architect will issue a document signed by Architect and Owner instructing Contractor to proceed with the modification, for subsequent inclusion in a Change Order.
   1. The document will describe the required changes and will designate method of determining any change in Contract Sum or Contract Time.
   2. Promptly execute the change.

E. Proposal Request: For modifications for which advance pricing is desired, Architect will issue a document which includes a detailed description of a proposed modification with supplementary or revised drawings and specifications, a modification in Contract Time for executing the modification with a stipulation of any overtime work required and the period of time during which the requested price will be considered valid. Contractor shall prepare and submit a fixed price quotation within 10 days.

F. Contractor may propose a change by submitting a request for change order or modification to Architect, describing the proposed change and its full effect on the Work, with a statement describing the reason for the change, and the effect on the Contract Sum and Contract Time with full documentation and a statement describing the effect on Work by separate or other contractors.
   1. Document any requested substitutions in accordance with Section 01 6000.

G. Computation of Change in Contract Amount: As specified in the Agreement and Conditions of the Contract.
   1. For change requested by Architect for work falling under a fixed price contract, the amount will be based on Contractor's price quotation.
   2. For change requested by Contractor, the amount will be based on the Contractor's request for a Change Order as approved by Owner and Architect.
   3. For pre-determined unit prices and quantities, the amount will be based on the fixed unit prices.
   4. For change ordered by Architect without a quotation from Contractor, the amount will be determined by Architect based on the Contractor's substantiation of costs as specified for Time and Material work.
H. Substantiation of Costs: Provide full information required for evaluation.
   1. Provide the following data:
      a. Quantities of products, labor, and equipment.
      b. Overhead and profit.
      c. Taxes, insurance, and bonds.
      d. Justification for any change in Contract Time in accordance with the Agreement.
      e. Credit for deletions from Contract, similarly documented.
   2. Support each claim for additional costs with additional information:
      a. Origin and date of claim.
      b. Dates and times work was performed, and by whom.
      c. Time records and wage rates paid.
      d. Invoices and receipts for products, equipment, and subcontracts, similarly documented.
   3. For Time and Material work, submit itemized account and supporting data after completion of change, within time limits indicated in the Conditions of the Contract.

I. Execution of Change Orders: Contractor will issue Change Orders for signatures of parties as provided in the Conditions of the Contract.

J. After execution of Change Order, promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Sum.

K. Promptly revise progress schedules to reflect any change in Contract Time, revise sub-schedules to adjust times for other items of work affected by the change, and resubmit.

L. Promptly enter changes in Project Record Documents.

1.06 APPLICATION FOR FINAL PAYMENT

A. Prepare Application for Final Payment as specified for progress payments, identifying total adjusted Contract Sum, previous payments, and sum remaining due.

B. Application for Final Payment will not be considered until the following have been accomplished:
   1. All closeout procedures specified in Section 01 7000.
   2. Receipt of final Certificate of Occupancy from jurisdictional authority.
   3. Acceptance of Work by Owner and Architect.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES
   A. List of unit prices.
   B. Measurement and payment criteria applicable to Work performed under a unit price payment method.
   C. Defect assessment and non-payment for rejected work.

1.02 COSTS INCLUDED
   A. Unit Prices shall include full compensation for all required labor, products, tools, equipment, plant, transportation, services and incidentals; erection, application or installation of an item of the Work; overhead and profit.

1.03 UNIT QUANTITIES SPECIFIED
   A. Quantities indicated in the individual specification Sections are for contract purposes only. Quantities and measurements of actual Work will determine the payment amount.

1.04 MEASUREMENT OF QUANTITIES
   A. Measurement methods delineated in the individual specification Sections complement the criteria of this Section. In the event of conflict, the requirements of the individual specification Section govern.
   B. Take all measurements and compute quantities. Measurements and quantities will be verified by Architect.
   C. Assist by providing necessary equipment, workers, and survey personnel as required.
   D. Linear Measurement: Measured by linear dimension, at the item centerline or mean chord.
   E. Perform surveys required to determine quantities, including control surveys to establish measurement reference lines. Notify Architect prior to starting work.
   F. Contractor's Engineer Responsibilities: Sign surveyor's field notes or keep duplicate field notes, calculate and certify quantities for payment purposes.

1.05 PAYMENT
   A. Payment for Work governed by unit prices will be made on the basis of the actual measurements and quantities of Work that is incorporated in or made necessary by the Work and accepted by the Architect, multiplied by the unit price.
   B. Payment will not be made for any of the following:
      1. Products wasted or disposed of in a manner that is not acceptable.
      2. Products determined as unacceptable before or after placement.
      3. Products not completely unloaded from the transporting vehicle.
      4. Products placed beyond the lines and levels of the required Work.
      5. Products remaining on hand after completion of the Work.

1.06 DEFECT ASSESSMENT
   A. Replace Work, or portions of the Work, not complying with specified requirements.
   B. If, in the opinion of Architect, it is not practical to remove and replace the Work, Architect will direct one of the following remedies:
      1. The defective Work may remain, but the unit price will be adjusted to a new unit price at the discretion of Architect.
      2. The defective Work will be partially repaired to the instructions of the Architect, and the unit price will be adjusted to a new unit price at the discretion of Architect.
C. The individual specification Sections may modify these options or may identify a specific formula or percentage price reduction.

D. The authority of Architect to assess the defect and identify payment adjustment is final.

1.07 SCHEDULE OF UNIT PRICES

A. Drilled concrete piers and shafts; Section 31 6329.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES
A. Documentation of changes to Contract Sum and Contract Time.

1.02 GENERAL ALTERNATE REQUIREMENTS
A. The description of each Alternate is recognized to be incomplete and abbreviated, but requires that each change must be complete for the scope or work affected. Refer to applicable specification Sections and applicable Drawings for the specific requirements of work.
   1. Where Drawings and specifications are inconsistent, and the inconsistency was not corrected by Addendum, calculate bid to include the greater quantity and superior quality of work.
B. Include work associated with described deductive alternates and exclude described additive alternates. Failure to submit proposals for all alternates may result in rejection of bid.

1.03 DESCRIPTION OF ALTERNATE REQUIREMENTS
A. Alternates are defined as alternative products, materials, equipment, systems, methods, units of work, or major elements of construction which may, at Owner's option, be selected for the work in place of corresponding requirements of the Contract Documents. Selection may occur prior to the Contract date, or may be deferred for possible selection at a subsequent date.
B. Include as part of each Alternate, miscellaneous devices, appurtenances, differences in utility or power requirements, and similar items incidental to or required for complete and functioning installation, whether or not specifically mentioned as part of the alternate description.
C. Immediately following award of the Contract, prepare and distribute to each entity involved, notification of the status of each Alternate. Indicate whether alternates have been accepted, rejected, or deferred for consideration at a later date. Indicate a complete description of negotiated modifications to described scope of Alternates, if any.

1.04 ACCEPTANCE OF ALTERNATES
A. Alternates will be reviewed and accepted or rejected at Owner's option. Accepted Alternates will be incorporated into the Owner-Contractor Agreement by Contract Modification.
B. Coordinate related work and modify surrounding work to integrate the Work of each Alternate.

1.05 SCHEDULE OF ALTERNATES
A. See Drawings for schedule of Alternates.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Procedural requirements for proposed substitutions.

1.02 RELATED REQUIREMENTS
   A. Section 01 6000 - Product Requirements: Fundamental product requirements, product options, delivery, storage, and handling, and substitution limitations.

1.03 DEFINITIONS
   A. Substitutions: Changes from Contract Documents requirements proposed by Contractor to materials, products, assemblies, and equipment.
      1. Substitutions for Cause: Proposed due to changed Project circumstances beyond Contractor’s control.
         a. Unavailability.
         b. Regulatory changes.
         c. Other limitations specified in Section 01 6000.
      2. Substitutions for Convenience: Proposed due to possibility of offering substantial advantage to the Project.
         a. Substitution requests offering advantages solely to the Contractor will not be considered.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS
   A. A Substitution Request for products, assemblies, materials, and equipment constitutes a representation that the submitter:
      1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product, equipment, assembly, or system.
      2. Agrees to provide the same warranty for the substitution as for the specified product.
      3. Agrees to provide same or equivalent maintenance service and source of replacement parts, as applicable.
      4. Agrees to coordinate installation and make changes to other work that may be required for the work to be complete, with no additional cost to Owner.
      5. Waives claims for additional costs or time extension that may subsequently become apparent.
   B. A Substitution Request for specified installer constitutes a representation that the submitter:
      1. Has acted in good faith to obtain services of specified installer, but was unable to come to commercial, or other terms.
   C. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents. Burden of proof is on proposer.
      1. Note explicitly any non-compliant characteristics.
      2. Submit shop drawings, product data, and certified test results attesting to the proposed product equivalence.
      3. Architect will notify Contractor in writing of decision to accept or reject request.
   D. Substitution Request Content: Include information necessary for tracking the status of each Substitution Request, and information necessary to provide an actionable response.
      1. Form included in the Project Manual are adequate for this purpose, and must be used; see Section 00 6000 - Project Forms.
   E. Limit each request to a single proposed substitution item.
      1. Submit an electronic document, combining the request form with supporting data into single document.
3.02 SUBSTITUTION PROCEDURES DURING CONSTRUCTION

A. Architect may consider requests for substitution only within 60 days after date established in Notice to Proceed, unless otherwise determined by Architect to be acceptable under extenuating circumstances.
   1. Substitutions will also be considered when a Product, through no fault of Contractor, becomes unavailable or unsuitable due to regulatory change.

B. Submit request for Substitution for Cause within 14 days of discovery of need for substitution, but not later than 14 days prior to time required for review and approval by Architect, in order to stay on approved project schedule.

C. Submit request for Substitution for Convenience immediately upon discovery of its potential advantage to the project, but not later than 14 days prior to time required for review and approval by Architect, in order to stay on approved project schedule.
   1. In addition to meeting general documentation requirements, document how the requested substitution benefits the Owner through cost savings, time savings, greater energy conservation, or in other specific ways.
   2. Document means of coordinating of substitution item with other portions of the work, including work by affected subcontractors.
   3. Bear the costs engendered by proposed substitution of:
      a. Other construction by Owner.
      b. Other unanticipated project considerations.

D. Substitutions will not be considered under one or more of the following circumstances:
   1. When they are indicated or implied on shop drawing or product data submittals, without having received prior approval.
   2. Without a separate written request.
   3. When acceptance will require revisions to Contract Documents.

3.03 RESOLUTION

A. Architect may request additional information and documentation prior to rendering a decision. Provide this data in an expeditious manner.

B. Architect will notify Contractor in writing of decision to accept or reject request.
   1. Architect's decision following review of proposed substitution will be noted on the submitted form.

3.04 ACCEPTANCE

A. Accepted substitutions modify the Contract, and thereby change the Work of the Project. They will be documented and incorporated into Work of the project by Change Order, or similar instrument provided for in the Conditions of the Contract.

3.05 CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

B. Include completed and approved Substitution Request Forms as part of the Project record.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES

A. General administrative requirements.
B. Electronic document submittal service.
C. Preconstruction meeting.
D. Progress meetings.
E. Project closeout meeting.
F. Construction progress schedule.
G. Use of Architect's digital Drawing files.
H. Submittals for review, information, and project closeout.
I. Number of copies of submittals.
J. Requests for Information (RFI) procedures.
K. Submittal procedures.

1.02 GENERAL ADMINISTRATIVE REQUIREMENTS

A. Comply with requirements of Section 01 7000 - Execution and Closeout Requirements for coordination of execution of administrative tasks with timing of construction activities.

B. Make the following types of submittals to Architect:
   1. Requests for Information (RFI).
   2. Requests for substitution.
   3. Shop drawings, product data, and samples.
   4. Test and inspection reports.
   5. Design data.
   6. Manufacturer's instructions and field reports.
   7. Applications for payment and change order requests.
   8. Progress schedules.
   9. Coordination drawings.
   10. Correction Punch List and Final Correction Punch List for Substantial Completion.
   11. Closeout submittals.
   12. Other specified submittals.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Construction Progress Schedule: Submit construction progress schedule according to the requirements specified in this Section.

C. Submittal Schedule: Submit submittal schedule according to the requirements specified in this Section.

D. Submittals: As specified in individual specification Sections.
PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 ELECTRONIC DOCUMENT SUBMITTAL SERVICE

A. All documents transmitted for purposes of administration of the contract are to be in electronic (PDF) format, as appropriate to the document, and transmitted via an Internet-based submittal service that receives, logs and stores documents, provides electronic stamping and signatures, and notifies addressees via email.
   1. Besides submittals for review, information, and closeout, this procedure applies to Requests for Information (RFIs), progress documentation, contract modification documents (e.g. supplementary instructions, change proposals, change orders), applications for payment, field reports and meeting minutes, Contractor's correction punchlist, and any other document any participant wishes to make part of the project record.
   2. Contractor and Architect are required to use this service.
   3. It is Contractor's responsibility to submit documents in allowable format.
   4. Subcontractors, suppliers, and Architect's consultants will be permitted to use the service at no extra charge.
   5. Users of the service need an email address, internet access, and PDF review software that includes ability to mark up and apply electronic stamps (such as Adobe Acrobat, www.adobe.com, or Bluebeam PDF Revu, www.bluebeam.com), unless such software capability is provided by the service provider.
   6. Paper document transmittals will not be reviewed; emailed electronic documents will not be reviewed.
   7. All other specified submittal and document transmission procedures apply, except that electronic document requirements do not apply to samples or color selection charts.

B. Submittal Service: The selected service is:
   1. Architect's existing Internet-based service.
   2. Substitutions: Permitted, subject to approval of Architect.

C. Training: One, one-hour, web-based training session will be arranged for all participants, with representatives of Architect and Contractor participating; further training is the responsibility of the user of the service.

D. Project Closeout: Architect will determine when to terminate the service for the project and is responsible for obtaining archive copies of files for Owner.

3.02 PRECONSTRUCTION MEETING

A. Architect will schedule a meeting after Notice to Proceed.

B. Attendance Required:
   1. Owner.
   3. Contractor.
   4. Other invited participants.

C. Minimum Agenda:
   1. Execution of Owner-Contractor Agreement.
   2. Submission of executed bonds and insurance certificates.
   4. Submission of list of subcontractors, list of products, schedule of values, and progress schedule.
   5. Submission of initial Submittal schedule.
   6. Submission of list of known or anticipated substitution requests.
   7. Designation of personnel representing the parties to Contract, including Contractor, Owner, and Architect.
   8. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
   9. Scheduling.
   10. Scheduling activities of the Owner's geotechnical engineer and construction and material testing engineer.
D. Record minutes and distribute copies within two days after meeting to participants, with copies to Architect, Owner, participants, and those affected by decisions made.

3.03 PROGRESS MEETINGS

A. Schedule and administer meetings throughout progress of the work at weekly intervals, unless otherwise agreed upon and approved by Owner.

B. Make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.

C. Attendance Required:
   1. Contractor
   2. Owner
   3. Architect
   4. Contractor’s superintendent
   5. Major subcontractors

D. Minimum Agenda:
   1. Review minutes of previous meetings
   2. Review of work progress
   3. Field observations, problems, and decisions
   4. Identification of problems that impede, or will impede, planned progress
   5. Review of submittals schedule and status of submittals
   6. Review of RFIs log and status of responses
   7. Review of known or anticipated substitution requests
   8. Modification (Change Order) status
   9. Review of off-site fabrication and delivery schedules
   10. Maintenance of progress schedule
   11. Corrective measures to regain projected schedules
   12. Planned progress during succeeding work period
   13. Coordination of projected progress
   14. Maintenance of quality and work standards
   15. Effect of proposed changes on progress schedule and coordination
   16. Owner-related items
   17. Other business relating to work

E. Record minutes and distribute electronically within two days after meeting to participants, with copies to Architect, Owner, participants, and those affected by decisions made.

3.04 PROJECT CLOSEOUT MEETING

A. Schedule and administer a Project closeout meeting minimum 3 months before scheduled Date of Substantial Completion, at location mutually agreed upon by Owner, Contractor, and Architect

B. Attendance Required: Owner, Contractor, job superintendent, and Architect

C. Minimum Agenda:
   1. Review specified closeout process, tasks required of respective participants, task scheduling, and deadline dates for each critical path task in the closeout process
   2. Review closeout submittals required and submittal procedures for each
   3. Review maintenance materials requirements and Owner’s requirements for delivery and storage
   4. Review final inspection requirements of AHJ and coordination of same
   5. Review status of record documentation, and discuss process for completing and distributing record documentation to Owner and Architect

D. Record minutes and distribute electronically within two days after meeting to participants and those affected by decisions made.

3.05 CONSTRUCTION PROGRESS SCHEDULE

A. Within 10 days after date of the Agreement, submit preliminary schedule defining planned operations for the first 60 days of work, with a general outline for remainder of work

B. If preliminary schedule requires revision after review, submit revised schedule within 10 days
C. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
   1. Include written certification that major Subcontractors have reviewed and accepted proposed schedule.

D. Within 10 days after joint review, submit complete schedule.

E. Submit updated schedule with each Application for Payment.

3.06 DIGITAL DRAWING FILES

A. Architect's Digital Files: Upon request by Contractor, a digital copy of Project Building Information Model (BIM) or CADD Drawing files will be provided as a courtesy for Contractor's limited use. Such information is not considered to be a part of the Contract Documents.
   1. Use of this information is at Contractor's sole risk.
   2. Report to Architect discrepancies, if any, between published Contract Documents and information provided according to General Conditions and other administrative requirements of the Contract.
   3. Prior to receiving digital files, execute data licensing agreement; Architect's standard form.
   4. The following files will be furnished free of charge, if requested:
      a. Building floor plans.
      b. Reflected ceiling plans.
      c. Exterior building elevations.
      d. Interior elevations.
   5. Architect is not responsible for updating or maintaining currency of digital drawing files after initially provided to Contractor.
   6. Additional digital files will be provided, upon request, at a cost of $100.00 for each file; cost will be deducted from the Contract Sum, and Architect will recover corresponding cost from Owner.
   7. Submittals prepared using any of these files as the primary submittal content without the inclusion of substantial additional content generated by Contractor according to specified requirements for applicable submittals will not be accepted or reviewed by Architect.

3.07 REQUESTS FOR INFORMATION (RFI)

A. Definition: A request seeking one of the following:
   1. An interpretation, amplification, or clarification of some requirement of Contract Documents arising from inability to determine from them the exact material, process, or system to be installed; or when the elements of construction are required to occupy the same space (interference); or when an item of work is described differently at more than one place in Contract Documents.
   2. A resolution to an issue which has arisen due to field conditions and affects design intent.

B. Whenever possible, request clarifications at the next appropriate project progress meeting, with response entered into meeting minutes, rendering unnecessary the issuance of a formal RFI.

C. Preparation: Prepare an RFI immediately upon discovery of a need for interpretation of Contract Documents. Failure to submit a RFI in a timely manner is not a legitimate cause for claiming additional costs or delays in execution of the work.
   1. Prepare a separate RFI for each specific item.
      a. Review, coordinate, and comment on requests originating with subcontractors and/or materials suppliers.
      b. Do not forward requests which solely require internal coordination between subcontractors.
   2. Prepare using an electronic version of the form included in Section 00 6000; copy Owner on all RFI activity.
   3. Prepare using software provided by the Electronic Document Submittal Service.

D. Reason for the RFI: Prior to initiation of an RFI, carefully study all Contract Documents to confirm that information sufficient for their interpretation is definitely not included.
   1. Include in each request Contractor's signature attesting to good faith effort to determine from Contract Documents information requiring interpretation.
2. Unacceptable Uses for RFIs: Do not use RFIs to request the following:
   a. Approval of submittals (use procedures specified elsewhere in this section).
   b. Approval of substitutions (see Section - 01 6000 - Product Requirements)
   d. Different methods of performing work than those indicated in the Contract Drawings and Specifications (comply with provisions of the Conditions of the Contract).

3. Improper RFIs: Requests not prepared in compliance with requirements of this section, and/or missing key information required to render an actionable response. They will be returned without a response, with an explanatory notation.

4. Frivolous RFIs: Requests regarding information that is clearly indicated on, or reasonably inferable from, Contract Documents, with no additional input required to clarify the question. They will be returned without a response, with an explanatory notation.
   a. The Owner reserves the right to assess the Contractor for the costs (on time-and-materials basis) incurred by the Architect, and any of its consultants, due to processing of such RFIs.

E. Content: Include identifiers necessary for tracking the status of each RFI, and information necessary to provide an actionable response.
   1. Official Project name and number, and any additional required identifiers established in Contract Documents.
   2. Owner's, Architect's, and Contractor's names.
   3. Discrete and consecutive RFI number, and descriptive subject/title.
   4. Issue date, and requested reply date; "ASAP", "As Soon as Possible", or "Immediately" not acceptable as reply date.
   5. Reference to particular Contract Document(s) requiring additional information/interpretation. Identify pertinent drawing and detail number and/or specification section number, title, and paragraph(s).
   6. Annotations: Field dimensions and/or description of conditions which have engendered the request.
   7. Contractor's Suggested Resolution: A written and/or a graphic solution, to scale, is required in cases where clarification of coordination issues is involved, for example; routing, clearances, and/or specific locations of work shown diagrammatically in Contract Documents. If applicable, state the likely impact of the suggested resolution on Contract Time or the Contract Sum.

F. Attachments: Include sketches, coordination drawings, descriptions, photos, submittals, and other information necessary to substantiate the reason for the request.

G. RFI Log: Prepare and maintain a tabular log of RFIs for the duration of the project.
   1. Indicate current status of every RFI. Update log promptly and on a regular basis.
   2. Note dates of when each request is made, and when a response is received.
   3. Highlight items requiring priority or expedited response.
   4. Highlight items for which a timely response has not been received to date.

H. Review Time: Architect will respond and return RFIs to Contractor within seven calendar days of receipt.
   For the purpose of establishing the start of the mandated response period, RFIs received after 12:00 noon will be considered as having been received on the following regular working day.
   1. Response period may be shortened or lengthened for specific items, subject to mutual agreement, and recorded in a timely manner in progress meeting minutes.

I. Responses: Content of answered RFIs will not constitute in any manner a directive or authorization to perform extra work or delay the project. If in Contractor's belief it is likely to lead to a change to Contract Sum or Contract Time, promptly issue a notice to this effect, and follow up with an appropriate Change Order request to Owner.
   1. Response may include a request for additional information, in which case the original RFI will be deemed as having been answered, and an amended one is to be issued forthwith. Identify the amended RFI with an R suffix to the original number.
   2. Do not extend applicability of a response to specific item to encompass other similar conditions, unless specifically so noted in the response.
   3. Upon receipt of a response, promptly review and distribute it to all affected parties, and update the RFI Log.
   4. Notify Architect within seven calendar days if an additional or corrected response is required by submitting an amended version of the original RFI, identified as specified above.
3.08 SUBMITTAL SCHEDULE

A. Submit to Architect for review a schedule for submittals in tabular format.
   1. Provide initial schedule at first progress meeting, and provide updated and current schedule at each progress meeting; copy Owner on all submittal activity.
   2. Coordinate with Contractor's construction schedule and schedule of values.
   3. Format schedule to allow tracking of status of submittals throughout duration of construction.
   4. Include in schedule anticipated dates for each submittal to Architect, required dates of return of reviewed submittal to Contractor, and any required lead times associated with applicable submittals.
      a. Schedule submittals to expedite the Project, and coordinate submission of related items.
      b. For each submittal for review, allow minimum 15 calendar days for review, excluding delivery time from and back to Contractor.
      c. Arrange information to include specification number and title, submittal category (for review or for information), description of item of work covered, and role and name of subcontractor.
   5. Account for time required for preparation, review, manufacturing, fabrication and delivery when establishing submittal delivery and review deadline dates.
      a. For assemblies, equipment, systems comprised of multiple components and/or requiring detailed coordination with other work, allow for additional time to make corrections or revisions to initial submittals, and time for their review.
      b. If Contractor fails to submit a submittal schedule, Contractor will not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals.

B. Coordinate submittals into logical groupings to facilitate interrelation of the several items:
   1. Submit complete package of specified submittals for each product or system, generally associated with an individual specification Section. Partial submittals will not be reviewed, and no delay claim will be considered as the result of a partial submittal being returned for proper resubmittal.
   2. Submit all structural steel framing shop drawings, product data, schedules, and other specified submittal information in a single package as specified in Division 05.
   3. Submit all door, frame, and hardware product data, schedules, and other specified submittal information in a single package as specified in Division 08.

3.09 SUBMITTALS FOR REVIEW

A. When the following are specified in individual Sections, submit them for review:
   1. Product data.
   2. Shop drawings.
   3. Samples for selection.
   4. Samples for verification.

B. Submit to Architect for review for the limited purpose of checking for compliance with information given and the design concept expressed in Contract Documents.

C. Samples will be reviewed for aesthetic, color, or finish selection as applicable.

D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 01 7800 - Closeout Submittals.

3.10 SUBMITTALS FOR INFORMATION

A. When the following are specified in individual Sections, submit them for information:
   1. Design data.
   2. Certificates.
   3. Test reports.
   4. Inspection reports.
   5. Manufacturer's instructions.
   6. Manufacturer's field reports.
   7. Other types specified.

B. Submit for Architect's knowledge as contract administrator or for Owner.

3.11 SUBMITTALS FOR PROJECT CLOSEOUT

A. Submit Correction Punch List for Substantial Completion.
B. Submit Final Correction Punch List for Substantial Completion.

C. When the following are specified in individual Sections, submit them at project closeout in conformance to requirements of Section 01 7800 - Closeout Submittals:
   1. Project record documents.
   2. Operation and maintenance data.
   3. Warranties.
   5. Maintenance materials.
   6. Other types specified.

D. Submit for Owner's benefit during and after project completion.

3.12 NUMBER OF COPIES OF SUBMITTALS

A. Electronic Documents - Submittals for Review and Information: Submit one electronic copy in PDF format; an electronically-marked up file will be returned. Create PDFs at native size and right-side up; illegible files will be rejected.

B. Submittals for Review: Submit electronically as specified.

C. Submittals for Information: Submit electronically as specified.

D. Samples: Submit the number specified in individual specification Sections; one of which will be retained by Architect.
   1. After review, produce duplicates.
   2. Retained samples will not be returned to Contractor unless specifically so stated.

3.13 SUBMITTAL PROCEDURES - GENERAL

A. General Requirements:
   1. Submit separate packages of submittals for review and submittals for information, when included in the same specification section.
   2. Transmit using approved form.
      a. Use form generated by Electronic Document Submittal Service software.
   3. Sequentially identify each item. For revised submittals use original number and a sequential combination numerical and alphabetical suffix.
   4. Identify: Project; Contractor; subcontractor or supplier; pertinent drawing and detail number; and specification section number and article/paragraph, as appropriate on each copy.
   5. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the work and Contract Documents.
      a. Submittals not bearing Contractor's review stamp, indicating both review and approval, will not be reviewed and be returned for required review.
      b. Submittals from sources other than Contractor will not be acknowledged, reviewed, or returned.
   6. Deliver each submittal on date noted in submittal schedule, unless an earlier date has been agreed to by all affected parties, and is of the benefit to the project.
   7. Schedule submittals to expedite the Project, and coordinate submission of related items.
      a. For each submittal for review, allow 15 days excluding delivery time to and from the Contractor.
      b. For sequential reviews involving Architect's consultants, Owner, or another affected party, allow an additional 7 days.
   8. Identify variations from Contract Documents and product or system limitations that may be detrimental to successful performance of the completed work.
   10. When revised for resubmission, identify all changes made since previous submission.
   11. Distribute reviewed submittals. Instruct parties to promptly report inability to comply with requirements.
   12. Incomplete submittals will not be reviewed, unless they are partial submittals for distinct portion(s) of the work, and have received prior approval for their use.
   13. Submittals not reviewed by Contractor will be rejected, and will not be reviewed by Architect. Claims for delay as the result of submittals not reviewed by Contractor will not be allowed.
   14. Submittals not requested will be recognized, and will be returned "Not Reviewed".
B. **Product Data Procedures:**
   1. Submit only information required by individual specification sections.
   2. Collect required information into a single submittal.
   3. Submit concurrently with related shop drawing submittal.
   4. Do not submit (Material) Safety Data Sheets for materials or products.
   5. **Manufacturer's Catalog Submittals:** If manufacturer's published catalog information is used as part of a submittal, include only those pages from catalog that are specifically applicable to the proposed products for this Project.
      a. Clearly identify in the submittal those specific products and components for which review and action is requested.
      b. Submittals received that do not clearly identify specific applicable products, or that include more pages than those specifically applicable to the subject submittal, will be returned as "not reviewed" and the time for submittal review will not commence until a properly scoped submittal is received by Architect.

C. **Shop Drawing Procedures:**
   1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting Contract Documents and coordinating related work.
   2. Do not reproduce the Contract Documents to create shop drawings, unless otherwise permitted.
   3. Generic, non-project-specific information submitted as shop drawings do not meet the requirements for shop drawings.

D. **Samples Procedures:**
   1. Transmit related items together as single package to Architect's office, unless otherwise specified.
   2. Identify each item to allow review for applicability in relation to shop drawings showing installation locations.
   3. Include with transmittal high-resolution image files of samples to facilitate electronic review and approval. Provide separate submittal page for each item image.

3.14 **SUBMITTAL REVIEW**

A. **Submittals for Review:** Architect will review each submittal, and approve, or take other appropriate action. See below for actions to be taken.

B. **Submittals for Information:** Architect will acknowledge receipt and review. See below for actions to be taken.

C. **Architect's actions will be reflected by marking each returned submittal using virtual stamp on electronic submittals.**
   1. Notations may be made directly on submitted items and/or listed on appended Submittal Review cover sheet.

D. **Architect's Actions:**
   1. Architect will review each submittal, mark it with appropriate "action," and return it to Contractor within specified time allowance; except when it must be held for coordination, and Contractor is so advised.
   2. Where submittals include materials, products, systems, or manufacturers not specified, approved by Addendum prior to execution of the Contract, or approved in writing in conjunction with the proposed products list submittal specified in Section 01 6000, Architect reserves the right to exceed the specified time allowance to allow sufficient time to determine the acceptability of such items, and no claim for delay by Contractor will be allowed.
   3. Where submittals include a material, product, system, or manufacturer substitution which has not been previously accepted or approved in writing, Architect reserves the right to reject such submittal and require a compliant submittal, or may direct that other action be taken by Contractor to achieve compliance with Contract Documents, and no claim for delay by Contractor will be allowed.
   4. Architect's review is for general conformance only and does not relieve Contractor from full compliance with the Contract Documents.

**END OF SECTION**
SECTION 01 3114
FACILITY SERVICES COORDINATION

PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Coordination of facility services construction.
   B. Services of a coordinator for facility services construction.
   C. Coordination documents.

1.02 MECHANICAL AND ELECTRICAL COORDINATOR
   A. Provide staff dedicated to this Project who are technically qualified and administratively experienced in field coordination of the type of work required to be coordinated, for the duration of the Work.

1.03 SUBMITTALS
   A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
   B. Coordination Drawings:
      1. Submit coordination drawings and schedules prior to submitting shop drawings, product data, and samples.
      2. Submit coordination drawings in a timely manner to facilitate proper coordination with the construction schedule, and to avoid adverse impacts on progress of construction.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 COORDINATION REQUIRED
   A. See Drawings, Division 23 specifications, and Division 26 specifications for mechanical/electrical coordination schedules which define responsibilities for providing, setting, and final connecting of applicable devices and equipment items.
   B. Coordinate the work listed below:
      1. Fire Suppression: Division 21.
      2. Plumbing: Division 22.
      3. Heating, Ventilating, and Air Conditioning: Division 23.
      5. Communications: Division 27.
      7. Site Utilities: Division 33.
      8. All facility construction work affected by work listed above.
      9. All Owner-furnished work affected by work listed above.
   C. Coordinate progress schedules, including dates for submittals and for delivery of products.
   D. Conduct meetings among subcontractors and others concerned, to establish and maintain coordination and schedules, and to resolve coordination matters in dispute.
   E. Participate in progress meetings. Report on progress of work to be adjusted under coordination requirements, and any required changes in schedules. Transmit minutes of meetings and reports to concerned parties.

3.02 COORDINATION OF INSTALLATIONS
   A. Comply with manufacturer’s installation instruction and recommendations to the extent that those instructions and recommendations are more explicit or stringent than requirements contained in the Contract Documents.
B. Coordinate installation of materials and equipment above and below ceilings with suspension systems, light fixtures, and other building components. Where mounting heights are not detailed or dimensioned, install services and overhead equipment to provide the maximum headroom possible.

C. Coordinate ceiling and joist cavity space carefully with all affected trades. In the event of conflict, install mechanical and electrical systems within the cavity space allocation in the following order of priority:
1. Plumbing waste and vent piping, roof drain mains and leaders.
2. Supply, return and exhaust ductwork.
3. Steam and condensate piping and traps.
4. Fire sprinkler mains and leaders.
5. Electrical conduit.
6. Domestic hot and cold water, and lab gas piping.
7. Heating and cooling water supply and return piping.
8. Fire sprinkler branch piping and sprinkler run outs.
9. Pneumatic control piping and tubing.

D. Coordinate installation of equipment and piping support, sleeves, and other structural components that penetrate walls, floors, ceilings, or roofs.

3.03 COORDINATION DOCUMENTS

A. Prepare coordination drawings to organize installation of products for efficient use of available space, for proper sequence of installation, and to identify potential conflicts.

B. Prepare a master schedule identifying responsibilities for activities that directly relate to this work, including submittals and temporary utilities; organize by specification Section.

C. Identify electrical power characteristics and control wiring required for each item of equipment.

D. Maintain documents for the duration of the work, recording changes due to site instructions, modifications or adjustments.

E. Coordination Drawings for Acoustical and Gypsum Board Ceilings, Plumbing, Fire Protection, HVAC and Electrical:
   1. Submit to Architect as information submittal as specified in Section 01 3000.
   2. HVAC: Prepare reproducible coordination layout and installation drawings at minimum 1/4 inch per foot scale for resolution of interferences and conflicts with other trades.
   3. Plumbing, Fire Protection, Electrical, and Ceilings: Superimpose these shop drawings on the HVAC coordination drawings and verify layout and elevations to eliminate conflicts; highlight apparent conflicts. Fabrication of ductwork, fire protection piping, or other prefabricated systems is at risk until coordination drawings have been completed and reviewed by Contractor and Architect.
      a. Gravity systems have routing priority above the ceilings.
   4. Access Panels: Clearly show locations of access panels for maintenance in "hard" ceilings for access to HVAC boxes, fire damper motors, plumbing valves, fire protection drains, valves, light fixture remote ballasts, ceiling hung equipment, and similar items requiring access; coordinate with reflected ceiling plans. Indicate locations of access panels in walls and location of plumbing cleanouts.
   5. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of above-ceiling coordinated items; require attendance by all affected installers.
      a. Convene under general provisions of Section 01 7000.
      b. Discuss installation of coordinated items above ceilings.
      c. Ceilings may not be lowered to resolve apparent conflicts without written approval of Owner and Architect.

3.04 COORDINATION OF SUBMITTALS

A. Review shop drawings, product data, and samples for compliance with Contract Documents and for coordination with related work. Transmit copies of reviewed documents to Architect.

B. Check field dimensions and clearances and relationship to available space and anchors.

C. Check compatibility with equipment and work of other Sections, electrical characteristics, and operational control requirements.

D. Check motor voltages and control characteristics.
E. Coordinate controls, interlocks, wiring of switches, and relays.
F. Coordinate wiring and control diagrams.
G. When changes in the work are made, review their effect on other work.
H. Verify information and coordinate maintenance of record documents.

3.05 COORDINATION OF SUBSTITUTIONS AND MODIFICATIONS
A. Review proposals and requests for substitution prior to submission to Architect.
B. Verify compliance with Contract Documents and for compatibility with work of other Sections.

3.06 INSPECTION OF WORK
A. Inspect work for compliance with Contract Documents.
B. Maintain a list of observed deficiencies and defects; promptly submit to Architect.

3.07 DOCUMENTATION
A. Observe and maintain a record of tests. Record:
   1. Specification Section number and product name.
   2. Name of Contractor, subcontractor, and installer if applicable.
   3. Name of testing agency and name of inspector.
   4. Name of manufacturer’s representative present.
   5. Date, time, and duration of tests.
   6. Type of test, and results.
   7. Retesting required.
B. Assemble background documentation and retain in the event that dispute resolution becomes necessary.

3.08 EQUIPMENT START-UP
A. Verify utilities, connections, and controls are complete and equipment is in operable condition as required by Section 01 7000.
B. Observe start-up and adjustments, test run, record time and date of start-up, and results.
C. Observe equipment demonstrations made to Owner; record times and additional information required for operation and maintenance manuals.

3.09 INSPECTION AND ACCEPTANCE OF EQUIPMENT
A. Prior to inspection, verify that equipment is tested, operational, clean, and ready for operation.

END OF SECTION
SECTION 01 4000
QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Submittals.
B. Quality assurance.
C. References and standards.
D. Testing and inspection agencies and services.
E. Contractor’s construction-related professional design services.
F. Contractor’s design-related professional design services (delegated design work).
G. Control of installation.
H. Mock-ups.
I. Tolerances.
J. Manufacturers’ field services.
K. Defect Assessment.
L. Basis of design specifications.

1.02 DEFINITIONS

A. Contractor’s Professional Design Services: Design of some aspect or portion of the project by party other than the design professional of record. Provide these services as part of the Contract for Construction.
   1. Design Services Types Required:
      a. Construction-Related: Services Contractor needs to provide in order to carry out the Contractor’s sole responsibilities for construction means, methods, techniques, sequences, and procedures.
      b. Design-Related: Design services explicitly required to be performed by another design professional due to highly-technical and/or specialized nature of a portion of the project. Services primarily involve engineering analysis, calculations, and design, and are not intended to alter the aesthetic aspects of the design.

B. Design Data: Design-related, signed and sealed drawings, calculations, specifications, certifications, shop drawings and other submittals provided by Contractor, and prepared directly by, or under direct supervision of, appropriately licensed design professional.

1.03 CONTRACTOR’S CONSTRUCTION-RELATED PROFESSIONAL DESIGN SERVICES

A. Coordination: Contractor’s professional design services are subject to requirements of project’s Conditions for Construction Contract.

B. Provide such engineering design services as may be necessary to plan and safely conduct certain construction operations, pertaining to, but not limited to the following:
   1. Temporary sheeting, shoring, or supports.
   2. Temporary scaffolding.
   3. Temporary bracing.
   4. Temporary falsework for support of spanning or arched structures.
   5. Temporary stairs or steps required for construction access only.
   6. Temporary hoist(s) and rigging.
   7. Investigation of soil conditions to support construction equipment.
1.04 CONTRACTOR'S DESIGN-RELATED PROFESSIONAL DESIGN SERVICES (DELEGATED DESIGN WORK)

A. Coordination: Contractor's professional design services are subject to requirements of project's Conditions of the Contract for Construction.

B. Performance and Design Requirements: Where professional design services or certifications by a licensed design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with requirements specified in individual specification Sections.
   1. Base design of products and systems on performance and design criteria indicated or specified in individual specification Sections.
   2. Submit a Request for Information to Architect if the criteria indicated or specified are not sufficient to perform required design services.

C. Scope of Contractor's Professional Design Services is specified in the following Sections, which include but may not be limited to:
   1. [List populates as specification is developed].
   2. Section 03 3000 - Cast-in-Place Concrete.
   3. Section 05 2100 - Steel Joist Framing.
   4. Section 05 5213 - Pipe and Tube Railings.
   5. Section 05 7300 - Decorative Metal Railings.
   6. Section 07 4113 - Metal Roof Panels.
   7. Section 07 4213 - Metal Wall Panels.
   8. Section 07 6200 - Sheet Metal Flashing and Trim.
   9. Section 07 8400 - Firestopping.
  10. Section 08 4313 - Aluminum Storefront and Curtainwall.
  11. Section 08 4500 - Translucent Wall and Roof Assemblies.
  12. Section 08 8000 - Glazing.
  13. Section 13 3419 - Pre-Engineered Metal Building Systems.

D. Design of building systems, or components of systems, specified to be provided by Contractor; refer to applicable Division 13, 21, 27, and 28 Sections:
   1. Aquatics (pools) systems, structures, and finishes.
   2. Fire sprinkler systems.
   3. Fire alarm systems.

E. Contractor's Responsibilities:
   1. Coordinate design and space requirements with other affected work and Architect.
   2. Review applicable submittals and coordinate selections with Architect.
   3. Receive and unload products and systems at the site; inspect for completeness and for damage.
   4. Handle, store, install, and finish products and systems.
   5. Repair or replace damaged, defective, or missing items.
   6. Arrange for manufacturer's warranties, inspections, and service.
   7. Comply with applicable provisions of Division 01 - General Requirements, specifically including administrative requirements, coordination, quality, regulatory, and product requirements.
   8. Coordinate delegated design work with Sections 07 8400 - Firestopping, 08 3100 - Access Doors and Panels, applicable Division 09 painting Sections, and applicable Division 23 HVAC instrumentation and control Sections. Provide work scope specified in these Sections that is applicable to delegated design work.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Designer's Qualification Statement: Submit for Architect's knowledge as contract administrator, or for Owner's information.
   1. Include information for each individual professional responsible for producing, or supervising production of, design-related professional services provided by Contractor.
      a. Full name.
      b. Professional licensure information.
      c. Statement addressing extent and depth of experience specifically relevant to design of items assigned to Contractor.
C. Design Data: Submit for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.
   1. Include calculations that have been used to demonstrate compliance to performance and regulatory criteria provided, and to determine design solutions.
   2. Include required product data and shop drawings.
   3. Include a statement or certification attesting that design data complies with criteria indicated, such as building codes, loads, functional, and similar engineering requirements.
   4. Include signature and seal of design professional responsible for allocated design services on calculations and drawings.
   5. Provide additional copies of design data for Architect's design consultants, including but not limited to structural engineer, mechanical engineer, plumbing engineer, and electrical engineer; transmit to each design consultant's address concurrently, if requested by Architect.

D. Certificates: When specified in individual specification Sections, submit certification by the manufacturer and Architect or installation/application subcontractor to Architect, in quantities specified for Product Data.
   1. Indicate material or product complies with or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
   2. Certificates may be recent or previous test results on material or product, but must be acceptable to Architect.

E. Subcontractor, Trade Contractor and Installer Qualifications: When specified in individual specification Sections, submit qualifications data substantiating specified qualifications; three copies, one of which will be reviewed and returned to Contractor indicating action taken.

F. Manufacturer’s Instructions: When specified in individual specification Sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the Owner's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

G. Manufacturer’s Field Reports: Submit reports for Architect's benefit as contract administrator or for Owner.
   1. Submit report in duplicate within 30 days of observation to Architect for information.
   2. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents.

1.06 QUALITY ASSURANCE

A. Designer Qualifications: Where professional engineering design services and design data submittals are specifically required of Contractor by Contract Documents, provide services of a Professional Engineer experienced in design of this type of work and licensed in Colorado.

1.07 REFERENCES AND STANDARDS

A. For products and workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Comply with reference standard of date of issue current on date of Contract Documents, except where a specific date is established or required by applicable code.

C. Obtain copies of standards where required by product specification Sections.
   1. Maintain copy at project site during submittals, planning, and progress of the specific work, until Substantial Completion.

D. Should specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.

E. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of Architect shall be altered from Contract Documents by mention or inference otherwise in any reference document.
1.08 TESTING AND INSPECTION AGENCIES AND SERVICES

A. Special Testing and Inspection: It is recognized that specified special testing and inspection program is intended to assist Contractor, Owner, Architect, and jurisdictional authorities in nominal determination of probable compliance with specified requirements for certain elements of the Work. This program is not intended to limit Contractor’s standard quality control program.
   1. See Section 01 4533 - Code-Required Special Inspections, for special inspection and testing requirements.

1.09 BASIS OF DESIGN SPECIFICATIONS

A. Individual specification Sections may include a Basis of Design Manufacturer or Product, which forms the basis of the specifications, Drawing details, and other requirements of the Contract Documents. The specified Basis of Design Manufacturer or Product is not intended to exclude other manufacturers, products, or systems which comply with the requirements of the Contract Documents, subject to the provisions and requirements specified in individual specification Sections.

B. Comply with the administrative requirements for substitutions specified in Section 6000 for proposed products or systems other than the specified Basis of Design Manufacturer or Product.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.

B. Comply with manufacturers’ instructions, including each step in sequence.

C. Comply with specified standards as minimum quality for the work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

D. Have work performed by persons qualified to produce required and specified quality.

E. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.

F. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

3.02 MOCK-UPS

A. Before installing portions of the Work where mock-ups are required, construct mock-ups in location and size indicated for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work. The purpose of mock-up is to demonstrate the proposed range of aesthetic effects and workmanship and, if applicable, compliance with moisture management materials, claddings, and fenestrations.

B. Accepted mock-ups establish the standard of quality the Architect will use to judge the Work.

C. Integrated Exterior Mock-ups: Construct integrated exterior mock-up as indicated on Drawings. Coordinate installation of exterior envelope materials and products as required in individual Specification Sections. Provide adequate supporting structure for mock-up materials as necessary.
   1. Include typical and unique material and fenestration transition conditions, and typical roof applications.
   2. Construct mock-up in phased sequence matching sequencing of building construction, so that building envelope and drainage plane details can be observed on mock-up prior to installation on building, and also prior to installation of finish materials on mock-up.
   3. When finish materials are installed on mock-up, provide partial cut-away features which leave concealed drainage plane components including weather barriers, flashings, and sealants remain visible for ongoing reference throughout construction process.
D. Notify Architect fifteen (15) working days in advance of dates and times when mock-ups will be completed and ready for review and evaluation.

E. Provide supervisory personnel who will oversee mock-up construction. Provide workers that will be employed during the construction at Project.

F. Tests will be performed under provisions identified in this Section and identified in the respective product specification Sections.

G. Assemble and erect specified items with specified backing materials, attachment and anchorage devices, weather barriers, flashings, sealants, applied coatings, surface treatments, and finishes.

H. Obtain Architect's approval of mock-ups before starting work, fabrication, or construction.
   1. Architect will issue written comments within seven (7) working days of initial review and each subsequent follow up review of each mock-up.
   2. Make corrections as necessary until Architect's approval is issued.

I. Accepted mock-ups shall be a comparison standard for the remaining Work.

J. Where mock-up has been accepted by Architect and is specified in product specification Sections to be removed, protect mock-up throughout construction, remove mock-up and clear area when directed to do so by Architect.

3.03 TOLERANCES

A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.

B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding.

C. Adjust products to appropriate dimensions; position before securing products in place.

3.04 MANUFACTURERS' FIELD SERVICES

A. When specified in individual specification Sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust and balance of equipment, and inspection of surfaces to receive waterproofing systems as applicable, and to initiate instructions when necessary.
   1. Manufacturer's field representative will be required to submit daily reports as specified in this Section, when daily observations and inspections are specified in individual Sections.

B. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

3.05 DEFECT ASSESSMENT

A. Replace Work or portions of the Work not complying with specified requirements.

B. If, in the opinion of Architect, it is not practical to remove and replace the Work, Architect will direct an appropriate remedy or adjust payment, with Owner's consent.

END OF SECTION
PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. Obtain and pay for required permits, fees, licenses, and inspections as stipulated in the Agreement.
B. Arrange for required regulatory inspections and approvals.
C. Verify applicable codes and regulations.
D. Comply with applicable codes and regulations as stipulated in the Agreement.
   1. Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities.
   2. Contractor is required to promptly report to Architect any nonconformity discovered by or made known to Contractor as a request for information as specified, or in such form as Architect may otherwise require.
E. Listing of applicable Codes and regulations in this Section is not to be considered complete and all-inclusive; listing refers to primary applicable Codes and regulations only. See Drawings for additional information.

1.02 SUMMARY OF APPLICABLE CODES AND REFERENCE STANDARDS

A. Federal Regulations (Including but not limited to); currently adopted editions of the following, unless noted otherwise:
   2. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design.
   3. 29 CFR 1910 - Occupational Safety and Health Standards.
B. Township of Berthoud, State of Colorado Regulations, and other regulations (including but not limited to); currently adopted editions of the following, unless noted otherwise:
   3. State of Colorado Health Department standards and regulations, as applicable.
   5. ICC (IFC) - International Fire Code.
   7. ICC (IPC) - International Plumbing Code.
   8. ICC (IMC) - International Mechanical Code.
   12. Erosion and Sedimentation Control Regulations: Local jurisdiction, unless otherwise specified.

1.03 QUALITY ASSURANCE

A. Become familiar with applicable requirements of codes and regulations.
B. Verify that substituted materials and equipment used in the Work meet or exceed requirements of applicable codes and regulations.
C. Contractor’s Designer Qualifications: Refer to Section - 01 4000 - Quality Requirements.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION
SECTION 01 4216
DEFINITIONS AND EXPLANATIONS

PART 1 GENERAL

1.01 SUMMARY
A. This Section supplements the definitions contained in the General Conditions and other Contract Documents.
B. Other definitions are included in individual specification Sections.
C. Limitations: Definitions and explanations are not necessarily complete or exclusive, but are generally applicable to the Work to the extent such definitions or explanations are not stated more explicitly in other provisions of the Contract Documents.

1.02 SPECIFICATION EXPLANATIONS
A. General: Explanations are provided to assist in understanding format, language, implied requirements and conventions of specification content. None of these explanations will be interpreted to modify the substance of content requirements.
B. Division 01 General Requirements: Expand on the broad provisions of the Conditions of the Contract, and govern the execution of the work of all Sections of the specifications. Division 01 General Requirements specify administrative and procedural requirements relating to execution of the Work, and temporary facilities for use during the construction period.
C. Sections and Divisions: The basic unit of specification text is the "Section," each of which is named and numbered. These are organized into related families called "Divisions," which generally conform to the most current edition of "MasterFormat" as published by CSI. Any Section title is not intended to limit meaning or content of Section, nor to be fully descriptive of requirements specified therein, nor to be an integral part of the text.
D. Imperative Language: Used generally in the Specifications. Except as otherwise specified, requirements expressed imperatively are to be performed by Contractor. For clarity of reading at certain locations, contrasting subjective language is used to describe the responsibilities which must be fulfilled either indirectly by Contractor, or when so noted by others.

1.03 SPECIFICATION CONTENT CONVENTIONS
A. Overlapping Requirements: Where compliance with two or more industry standards or sets of requirements is specified, and overlapping of those requirements also establishes different or conflicting minimums or levels of quality, the more stringent requirement will be enforced (which is generally the more costly level).
B. Refer apparently equal but different requirements and uncertainties as to which level of quality is required to Architect for interpretation or decision before proceeding.
C. Specification Minimum: In every instance, the specified requirement is the minimum to be performed or fulfilled. In complying with minimum requirements, the indicated numeric values are either minimums or maximums as noted or as appropriate for the context of the requirement. Refer instances of uncertainty to Architect for decision.
D. Abbreviations: The language of the Specifications and elsewhere in the Contract Documents is of the abbreviated type in certain instances, and implies words and meanings which will be appropriately interpreted. Actual work abbreviations of a self-explanatory nature have been included in the text.
E. Trade associations and general standards are frequently abbreviated. Singular words will be interpreted as plural and plural words will be interpreted as singular wherever applicable and wherever the full context of the requirements so indicate.
F. Specialists: In certain instances the Specification text may require that specific work be assigned to certain specialists or expert entities for the performance of those units of the Work. These are specified as requirements on which the Contractor has no choice or option.
1.04 DEFINITIONS

A. Approve/Approved: Where used in conjunction with Architect's or Architect's consultant response to submittals, requests, applications, inquiries, reports, and claims by Contractor, the meaning of the term "approve" or "approved" will be held to the limitations of Architect's responsibilities and duties as specified in Section 01 3000 and stipulated in the General Conditions of the Contract. In no case will approval by Architect be interpreted as an assurance to Contractor that the requirements of the Contract Documents have been fulfilled.

B. By Others: Work performed by entities outside the Contract; interchangeable with "NIC" or "Not in Contract."

C. Contract Documents: Those documents defined in the Owner-Contractor Agreement (Contract) as applicable to the construction of the Project by Contractor.
   1. Refer to General Conditions of the Contract for Construction for broader definition of this term.

D. Contractor's Option: Where materials, products, systems or methods are specified to be at Contractor's option, the choice of which material, method, product, or system will be used is solely Contractor's. There will be no change in Contract Sum or Time because of such choice.

E. Directed, Requested, etc.: Where not otherwise explained, terms such as "directed," "requested," "authorized," "selected," "approved," "required," "accepted," and "permitted" mean "directed by Architect", "requested by Architect", etc. However, no such implied meaning will be interpreted to extend Architect's responsibility into Contractor's area of construction supervision.

F. Drawings: Capitalized term referring to the drawings prepared by Architect and its design consultants, and by any Owner consultants as applicable; bound and published as a sub-set of the Contract Documents as defined in Owner-Contractor Agreement (Contract). Non-capitalized term "drawings" used in the Contract Documents generally refers to other drawings not part of the Contract Documents, unless the context explicitly indicates otherwise.
   1. Refer to General Conditions of the Contract for Construction for broader definition of this term.

G. Equipment: Defined as products with operational parts, regardless of whether motorized or manually operated, and particularly including connections (wiring, piping, etc.).

H. Final Acceptance: The administrative action taken by Owner authorizing final payment and settlement of the Contract.
   1. Refer to General Conditions of the Contract for Construction for broader definition of this term.

I. Furnish: To supply, deliver, unload, and inspect for damage (by Contractor).

J. General Requirements: Provisions or requirements of Division 01 specification Sections. General Requirements apply to the entire Work of the Contract and, where so indicated, to other elements of work which are included in the Project. See specification explanations in this Section.

K. Indicated: Cross reference to details, notes or schedules on the Drawings, other paragraphs or schedules in the Specifications, and similar means of recording requirements in the Contract Documents. Where terms such as "shown," "noted," "scheduled," and "specified" are used in lieu of "indicated," it is for the purpose of helping the reader accomplish the cross reference, and no limitation is intended except as specifically noted.

L. Install: To unpack, assemble, erect, apply, place, finish, cure, protect, clean, start up, and make ready for use (by Contractor).

M. Installer: The entity (person or firm) engaged by Contractor or his Subcontractor or Sub-subcontractor for the performance of a particular unit of work at the project site, including installations, erection, application and similar required operations.

N. Material(s): Defined as products which must be substantially cut, shaped, worked, mixed, finished, refined or otherwise fabricated, processed, installed or applied to form units of work.

O. Not in Contract (NIC): Work performed by entities outside the Contract; interchangeable with "By Others."
P. Product(s): Material, machinery, components, equipment, fixtures, and systems forming the work result. Not materials or equipment used for preparation, fabrication, conveying, or erection and not incorporated into the work result. Products may be new, never before used, or re-used materials or equipment.

Q. Project Manual: The book-sized volume that includes the procurement requirements (if any), the contracting requirements, and the Specifications.

R. Provide: To furnish and install.

S. Supply: Same as Furnish.

T. Testing Agency/Laboratory: An independent entity engaged to perform specific inspections or tests of the Work, either at the project site or elsewhere; and to report and (if required) interpret the results of those inspections or tests.

U. Work (the Work): Capitalized term referring to the entire scope of work of the Project as defined in the Contract Documents. Non-capitalized term "work" used in the Contract Documents generally refers to work by specific trades or other entities as components or phases of the Work, unless the context explicitly indicates otherwise.

   1. Refer to General Conditions of the Contract for Construction for broader definition of this term.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION
SECTION 01 4533
CODE-REQUIRED SPECIAL INSPECTIONS AND PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Code-required special inspections and testing.
B. Testing services incidental to special inspections.
C. Submittals.

1.02 DEFINITIONS
A. Code or Building Code: ICC (IBC), International Building Code, Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements and specifically, Chapter 17 - Special Inspections and Tests.
B. Authority Having Jurisdiction (AHJ): Agency or individual officially empowered to enforce the building, fire and life safety code requirements of the permitting jurisdiction in which the Project is located.
C. Special Inspection and Testing:
   1. Special inspections are inspections and testing of materials, installation, fabrication, erection or placement of components and connections mandated by the AHJ that also require special expertise to ensure compliance with the approved Contract Documents and the referenced standards.
   2. Special inspections are separate from and independent of tests and inspections conducted by Owner or Contractor for the purposes of quality assurance and contract administration.

1.03 REFERENCE STANDARDS
D. ICC (IBC) - International Building Code.

1.04 SUBMITTALS
A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Special Inspection Agency Qualifications: Prior to the start of work, the Special Inspection Agency is required to:
   1. Submit agency name, address, and telephone number, names of full time registered Engineer and responsible officer.
   2. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.
   3. Submit certification that Special Inspection Agency is acceptable to AHJ.
C. Special Inspection Reports: After each special inspection, Special Inspector shall promptly submit two copies of report; one to Architect and one to the AHJ.
   1. Include:
      a. Date issued.
      b. Project title and number.
      c. Name of Special Inspector.
      d. Date and time of special inspection.
      e. Identification of product and specifications Section.
      f. Location in the Project.
      g. Type of special inspection.
CODE-REQUIRED SPECIAL INSPECTIONS AND PROCEDURES

Design Development

2. Final Special Inspection Report: Document special inspections and correction of discrepancies prior to the start of the work.

D. Fabricator Special Inspection Reports: After each special inspection of fabricated items at the Fabricator's facility, Special Inspector is required to promptly submit at least two copies of report; one to Architect and one to AHJ.

1. Include:
   a. Date issued.
   b. Project title and number.
   c. Name of Special Inspector.
   d. Date and time of special inspection.
   e. Identification of fabricated item and specification Section.
   f. Location in the Project.
   g. Results of special inspection.
   h. Verification of fabrication and quality control procedures.
   i. Compliance with Contract Documents.
   j. Compliance with referenced standard(s).

E. Certificates: When special inspection requirements are specified in individual specification Sections, Special Inspector is required to submit certification by the manufacturer, fabricator, and installation subcontractor to Architect and AHJ, in quantities specified for Product Data.

1. Indicate material or product complies with or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.

2. Certificates may be recent or previous test results on material or product, but must be acceptable to Architect and AHJ.

1.05 SPECIAL INSPECTION AND TESTING AGENCY

A. Owner will employ services of a Special Inspection and Testing Agency to perform inspections and associated testing and sampling required by the building code.

B. The Special Inspection and Testing Agency may employ and pay for services of an independent testing agency to perform testing and sampling associated with special inspections and required by the building code.

C. Owner's employment of agency in no way relieves Contractor of obligation to perform work in accordance with requirements of Contract Documents.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 SPECIAL INSPECTIONS AND TESTING - GENERAL

A. Frequency of Special Inspections and Testing: Special Inspections are indicated as continuous or periodic.

1. Continuous Special Inspection: Special Inspection Agency is required to be present in the area where the work is being performed and observe the work at all times the work is in progress.

2. Periodic Special Inspection: Special Inspection Agency is required to be present in the area where work is being performed and observe the work part-time or intermittently and at the completion of the work.

3.02 SCHEDULE OF SPECIAL INSPECTIONS AND TESTING

A. A schedule of required special inspections and testing for structural work is included in the structural Drawings.

1. Additional special inspection and testing requirements are specified in this Section.
3.03 SPECIAL INSPECTIONS FOR SOILS

A. Materials and Placement: Verify each item below complies with approved construction documents and approved geotechnical report.
   1. Design bearing capacity of material below shallow foundations; periodic.
   2. Design depth of excavations and suitability of material at bottom of excavations; periodic.
   4. Subgrade, prior to placement of compacted fill verify proper preparation; periodic.

B. Testing: Classify and test excavated material; periodic.

3.04 SPECIAL INSPECTION AND TESTING AGENCY DUTIES AND RESPONSIBILITIES

A. Special Inspection and Testing Agency is required to:
   1. Verify samples submitted by Contractor comply with the referenced standards and the approved Contract Documents.
   3. Perform specified sampling and testing of products in accordance with specified reference standards.
   5. Promptly notify Architect and Contractor of observed irregularities or non-compliance of work or products.
   6. Perform additional tests and inspections required by Architect.
   7. Submit reports of all tests or inspections specified.

B. Limits on Special Inspection and Testing Agency Authority:
   1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
   2. Agency may not approve or accept any portion of the work.
   3. Agency may not assume any duties of Contractor.
   4. Agency has no authority to stop the work.

3.05 CONTRACTOR DUTIES AND RESPONSIBILITIES

A. Contractor Responsibilities - General:
   1. Deliver to agency at designated location, adequate samples of materials for special inspections that require material verification.
   2. Cooperate with agency and laboratory personnel; provide access to approved documents at project site, to the work, to manufacturers' facilities, and to fabricators' facilities.
   3. Provide incidental labor and facilities:
      a. To provide access to work to be tested or inspected.
      b. To obtain and handle samples at the site or at source of Products to be tested or inspected.
      c. To facilitate tests or inspections.
      d. To provide storage and curing of test samples.
   4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing or inspection services.
   5. Re-testing: Performed by same agency if required because of non-conformance to specified requirements, on instructions from Architect.
      a. Paid by Contractor if required because of non-conformance to specified requirements.

END OF SECTION
PART 1 GENERAL
1.01 SECTION INCLUDES
   A. Dewatering.
   B. Temporary utilities.
   C. Temporary telecommunications services.
   D. Temporary sanitary facilities.
   E. Temporary Controls: Barriers, enclosures, and fencing.
   F. Vehicular access and parking.
   G. Waste removal facilities and services.
   H. Project identification sign.
   I. Field offices.
1.02 DEWATERING
   A. Provide temporary means and methods for dewatering all temporary facilities and controls.
   B. Maintain temporary facilities in operable condition throughout duration of construction period.
1.03 TEMPORARY UTILITIES
   A. Provide and pay for all electrical power, lighting, water, heating and cooling, and ventilation required for construction purposes.
   B. New permanent facilities may not be used.
   C. Use trigger-operated nozzles for water hoses, to avoid waste of water.
1.04 TELECOMMUNICATIONS SERVICES
   A. Provide, maintain, and pay for telecommunications services to field office at time of project mobilization.
   B. Telecommunications services shall include:
      1. Windows-based personal computer or lap-top computer dedicated to project telecommunications, with necessary software and laser printer.
      2. Telephone Land Lines: One line, minimum; one handset per line.
      3. Internet Connections: Minimum of one; DSL modem or faster.
      4. Email: Account/address reserved for project use.
1.05 TEMPORARY SANITARY FACILITIES
   A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.
   B. Maintain daily in clean and sanitary condition.
1.06 BARRIERS
   A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public and to protect existing facilities and adjacent properties from damage from construction operations.
   B. Provide barricades and covered walkways required by governing authorities for public rights-of-way.
   C. Provide protection for plants designated to remain. Replace damaged plants.
   D. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.
1.07  FENCING
   A. Construction: Commercial grade chain link fence.
   B. Provide minimum 6 foot high fence around construction site; equip with vehicular and pedestrian gates with locks.

1.08  EXTERIOR ENCLOSURES
   A. Provide temporary insulated weather tight closure of exterior openings to accommodate acceptable working conditions and protection for Products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.

1.09  VEHICULAR ACCESS AND PARKING
   A. Comply with regulations relating to use of streets and sidewalks, access to emergency facilities, and access for emergency vehicles.
   B. Coordinate access and haul routes with governing authorities and Owner.
   C. Provide and maintain access to fire hydrants, free of obstructions.
   D. Provide means of removing mud from vehicle wheels before entering streets.
   E. Provide temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking.
   F. Do not allow vehicle parking on existing pavement, unless authorized by Owner in writing.

1.10  WASTE REMOVAL
   A. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.
   B. Provide containers with lids. Remove trash from site periodically.
   C. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.
   D. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

1.11  PROJECT IDENTIFICATION
   A. Provide project identification sign of design, construction, and location approved by Owner.
   B. No other signs are allowed without Owner permission except those required by law.

1.12  FIELD OFFICES
   A. Office: Weather tight, with lighting, electrical outlets, heating, cooling equipment, and equipped with sturdy furniture, drawing rack, and drawing display table.
   B. Provide space for Project meetings, with table and chairs to accommodate 10 persons.
   C. Locate offices a minimum distance of 30 feet from existing and new structures.

1.13  REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS
   A. Remove temporary utilities, equipment, facilities, materials, prior to Date of Substantial Completion inspection.
   B. Remove underground installations to a minimum depth of 2 feet. Grade site as indicated.
   C. Clean and repair damage caused by installation or use of temporary work.
   D. Restore new permanent facilities used during construction to specified condition.
SECTION 01 6000
PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES
A. General product requirements.
B. Transportation, handling, storage and protection.
C. Product option requirements.
D. Substitution limitations.
E. Procedures for Owner-supplied products.
F. Maintenance materials, including extra materials, spare parts, tools, and software.

1.02 RELATED REQUIREMENTS
A. Section 01 2500 - Substitution Procedures: Substitutions made after Contract award.
B. Section 01 4000 - Quality Requirements: Product quality monitoring.

1.03 SUBMITTALS
A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Proposed Products List: Submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.
   1. Submit within 15 days after date of Notice to Proceed.
   2. For products specified only by reference standards, list applicable reference standards.
C. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
D. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
E. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
   1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

PART 2 PRODUCTS

2.01 NEW PRODUCTS
A. Provide new products unless specifically required or permitted by Contract Documents.
B. See Section 01 4000 - Quality Requirements, for additional source quality control requirements.
C. Use of products having any of the following characteristics is not permitted:
   1. Made using or containing CFC's or HCFC's.
   2. Containing lead, cadmium, or asbestos.
D. Where all other criteria are met, give preference to products that:
   1. Are extracted, harvested, and/or manufactured closer to the location of the project.
   2. Have longer documented life span under normal use.
   3. Result in less construction waste. See Section 01 7419
2.02 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.

B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.

C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

D. Products Specified by Naming a Basis of Design Manufacturer or Product with a Provision for Substitutions: Submit a request for substitution for any other manufacturer listed under Other Acceptable Manufacturers, or for a manufacturer not named.
   1. Refer to Section 4000 for basis of design specifications requirements.

2.03 MAINTENANCE MATERIALS

A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification Sections.

B. Deliver and place in location as directed; obtain receipt prior to final payment.

PART 3 EXECUTION

3.01 SUBSTITUTION LIMITATIONS

A. See Section 01 2500 - Substitution Procedures, for procedural requirements for proposed substitutions.

B. Architect may consider requests for substitutions when one or more of the following conditions exist, as determined by Architect. If one or more of the following conditions are determined not to exist, Architect may not consider request further, and may take no action except to record the request and its non-compliance. Consideration may be given if substitution request:
   1. Offers Owner substantial advantage in cost, time, energy conservation, or other consideration, after deducting additional responsibilities Owner must assume as the result.
   2. Does not require extensive modification of Contract Documents.
   3. Is consistent with intent of Contract Documents, and will produce intended work results.
   4. Is fully documented and properly submitted.
   5. Resolves specified Product being unable to receive required approval by Authority Having Jurisdiction (AHJ), and substitution has received such approval prior to submission.
   6. Resolves incompatibility of specified Product with other related Products, and substitution is compatible with related Products.
   7. Resolves non-coordination of specified Product with other related Products, and substitution is coordinated with related Products.
   8. Provides specified warranty when specified Product cannot be provided with specified warranty.
   9. Is proposed for a Product that, through no fault of Contractor, becomes unavailable or unsuitable due to regulatory change.
  10. Will be considered if a Product cannot be provided within the Contract Time; Architect will not consider substitution if Product cannot be provided as the result of Contractor's failure to schedule and coordinate the Work as required by Contract Documents.
  11. Has been coordinated with and among all affected Subcontractors and other portions of the Work, and is acceptable to all affected Subcontractors.

3.02 OWNER-SUPPLIED PRODUCTS

A. Owner's Responsibilities:
   1. Arrange for and deliver Owner reviewed shop drawings, product data, and samples, to Contractor.
   2. Arrange and pay for product delivery to site.
   3. On delivery, inspect products jointly with Contractor.
   4. Submit claims for transportation damage and replace damaged, defective, or deficient items.
   5. Arrange for manufacturers' warranties, inspections, and service.
B. Contractor’s Responsibilities:
   1. Designate submittals and delivery date for each product in progress schedule.
   2. Review Owner reviewed shop drawings, product data, and samples.
   3. Receive and unload products at site; inspect for completeness or damage jointly with Owner.
   4. Handle, store, install and finish products.
   5. Provide installation inspections required by jurisdictional authorities.
   6. Repair or replace items damaged after receipt.

3.03 TRANSPORTATION AND HANDLING

A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.

B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.

C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.

D. Transport and handle products in accordance with manufacturer’s instructions.

E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.

F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.

G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.

H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.04 STORAGE AND PROTECTION

A. Provide protection of stored materials and products against theft, casualty, or deterioration.

B. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication. See Section 01 7419.
   1. Structural Loading Limitations: Handle and store products and materials so as not to exceed static and dynamic load-bearing capacities of project roof areas.

C. Store and protect products in accordance with manufacturers’ instructions.

D. Store with seals and labels intact and legible.

E. Arrange storage of materials and products to allow for visual inspection for the purpose of determination of quantities, amounts, and unit counts.

F. Store sensitive products in weathertight, climate-controlled enclosures in an environment favorable to product.

G. For exterior storage of fabricated products, place on sloped supports above ground.

H. Provide bonded off-site storage and protection when site does not permit on-site storage or protection.

I. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.

J. Comply with manufacturer’s warranty conditions, if any.

K. Do not store products directly on the ground.

L. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

M. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.

N. Prevent contact with material that may cause corrosion, discoloration, or staining.
O. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

P. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Examination, preparation, and general installation procedures.
   B. Pre-installation meetings.
   C. Cutting and patching.
   D. Surveying for laying out the work.
   E. Cleaning and protection.
   F. Starting of systems and equipment.
   G. Demonstration and instruction of Owner personnel.
   H. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.
   I. General requirements for maintenance service.

1.02 DEFINITIONS
   A. Verify, Field Verify, or Drawing Abbreviation: Use on Drawings or in specifications is intended to alert Contractor that indicated measurement or description of work may not be fully determined without comparing verified dimension in larger context or other dependent measurements due to specific product, actual versus nominal dimensions, or measurements of existing conditions.
      1. Notify Architect of discrepancies between dimensions shown and field layout or measurements.

1.03 REFERENCE STANDARDS

1.04 SUBMITTALS
   A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
   B. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
      1. Structural integrity of any element of Project.
      2. Integrity of weather exposed or moisture resistant element.
      3. Efficiency, maintenance, or safety of any operational element.
      5. Work of Owner or separate Contractor.
      6. Include in Request:
         a. Identification of Project.
         b. Location and description of affected work.
         c. Necessity for cutting or alteration.
         d. Description of proposed work and products to be used.
         e. Alternatives to cutting and patching.
         f. Effect on work of Owner or separate Contractor, if applicable.
         g. Written permission of affected separate Contractor, if applicable.
         h. Date and time work will be executed.
   C. Project Record Documents: Accurately record actual locations of capped and active utilities.

1.05 QUALIFICATIONS
   A. For surveying work, employ a land surveyor licensed in Colorado.
   B. For design of temporary shoring and bracing, employ a Professional Engineer experienced in design of this type of work and licensed in Colorado.
1.06 PROJECT CONDITIONS

A. Use of explosives is not permitted without written permission from Owner.

B. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.

C. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.

D. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

E. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.
   1. Provide dust-proof enclosures to prevent entry of dust generated outdoors.

F. Erosion and Sediment Control: Plan and execute work by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.
   1. Minimize amount of bare soil exposed at one time.
   2. Provide temporary measures such as berms, dikes, and drains, to prevent water flow.
   3. Construct fill and waste areas by selective placement to avoid erosive surface silts or clays.
   4. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.

G. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.

H. Rodent Control: Provide methods, means, and facilities to prevent rodents from accessing or invading premises.

I. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. Comply with federal, state, and local regulations.

1.07 ADMINISTRATIVE COORDINATION - GENERAL

A. See Section 01 3114 - Facility Services Coordination, for detailed coordination requirements.

B. Coordinate scheduling, submittals, and work of the various Sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.

C. Notify affected utility companies and comply with their requirements.

D. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various Sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

E. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on Drawings. Follow routing indicated for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

F. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.

G. Coordinate completion and clean-up of work of separate Sections.

H. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.
PART 2 PRODUCTS

2.01 PATCHING MATERIALS

A. New Materials: As specified in product Sections; match existing products and work for patching and extending work.

B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.

C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.

B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.

C. Examine and verify specific conditions described in individual specification Sections.

D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.

E. Verify that utility services are available, of the correct characteristics, and in the correct locations.

F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

3.02 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance.

B. Seal cracks or openings of substrate prior to applying next material or substance.

C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.03 PRE-INSTALLATION MEETINGS

A. When required in individual specification Sections, convene a pre-installation meeting at the site prior to commencing work of the Section.

B. Require attendance of parties directly affecting, or affected by, work of the specific Section.

C. Notify Architect minimum 7 calendar days in advance of proposed meeting date.

D. Prepare agenda and preside at meeting:
   1. Review conditions of examination, preparation and installation procedures.
   2. Review coordination with related work.

E. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.04 LAYING OUT THE WORK

A. Verify locations of survey control points prior to starting work.

B. Promptly notify Architect of any discrepancies discovered.

C. Locate and protect survey control and reference points.
D. Control datum for survey is that indicated on Drawings.

E. Protect survey control points prior to starting site work; preserve permanent reference points during construction.

F. Promptly report to Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.

G. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect.

H. Utilize recognized engineering survey practices.

I. Establish a minimum of two permanent bench marks on site, referenced to established control points. Record locations, with horizontal and vertical data, on project record documents.

J. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
   1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.
   2. Grid or axis for structures.
   3. Building foundation, column locations, ground floor elevations.

K. Periodically verify layouts by same means.

L. Maintain a complete and accurate log of control and survey work as it progresses.

3.05 GENERAL INSTALLATION REQUIREMENTS

A. In addition to compliance with regulatory requirements, conduct construction operations in compliance with NFPA 241, including applicable recommendations in Appendix A.

B. Install products as specified in individual Sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.

C. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.

D. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.

E. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.

F. Make neat transitions between different surfaces, maintaining texture and appearance.

3.06 CUTTING AND PATCHING

A. Whenever possible, execute the work by methods that avoid cutting or patching.

B. Perform whatever cutting and patching is necessary to:
   1. Complete the work.
   2. Fit products together to integrate with other work.
   3. Provide openings for penetration of mechanical, electrical, and other services.
   4. Match work that has been cut to adjacent work.
   5. Repair areas adjacent to cuts to required condition.
   6. Repair new work damaged by subsequent work.
   7. Remove samples of installed work for testing when requested.
   8. Remove and replace defective and non-complying work.

C. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.

D. Employ original installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.

E. Cut rigid materials, resulting in clean and neat edges, using masonry saw or core drill. Cutting rigid materials using chisels, impact or pneumatic tools is not allowed without prior approval.

F. Restore work with new products in accordance with requirements of Contract Documents.
G. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

H. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07 8400, to full thickness of the penetrated element.

I. Patching:
   1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
   2. Match color, texture, and appearance.
   3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

3.07 PROGRESS CLEANING

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.

B. Remove debris and rubbish from wall cavities, pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.

C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.

D. Collect and remove waste materials, debris, and trash/rubbish from site weekly and dispose off-site; do not burn or bury.

3.08 PROTECTION OF INSTALLED WORK

A. Protect installed work from damage by construction operations.

B. Provide special protection where specified in individual specification Sections.

C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

F. Protect work from spilled liquids. If work is exposed to spilled liquids, immediately remove protective coverings, dry out work, and replace protective coverings.

G. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
   1. Keep waterproofed and roofed surfaces clean and free of debris that could cause damage to surfaces and membranes, particularly sharp objects including fasteners, wire cut-offs, and similar items.

H. Prohibit traffic from landscaped areas.

I. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

J. Failure to protect installed work may result in withholding of payments to Contractor as determined by Architect. Damage resulting from failure to protect installed work must be fully repaired or replaced as applicable to the satisfaction of Architect at no additional cost to Owner.

3.09 SYSTEM STARTUP

A. Coordinate schedule for start-up of various equipment and systems.

B. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.

C. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.

D. Verify that wiring and support components for equipment are complete and tested.
E. Execute start-up under supervision of applicable Contractor personnel and manufacturer’s representative in accordance with manufacturers’ instructions.

F. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.

G. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.10 DEMONSTRATION AND INSTRUCTION

A. See Section 01 7900 - Demonstration and Training.

B. The amount of time required for instruction on each item of equipment and system is that specified in individual Sections.

3.11 ADJUSTING

A. Adjust operating products and equipment to ensure smooth and unhindered operation.

B. Testing, Adjusting, and Balancing HVAC Systems: See Division 23 and Section 01 4000.

3.12 FINAL CLEANING

A. Execute final cleaning after Substantial Completion but before making final application for payment.

B. Use cleaning materials that are nonhazardous.

C. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, and vacuum carpeted and soft surfaces.

D. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.

E. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.

F. Clean filters of operating equipment.

G. Clean debris from roofs, gutters, downspouts, scuppers, overflow drains, area drains, and drainage systems.

H. Clean site; sweep paved areas, rake clean landscaped surfaces.

I. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

3.13 CLOSEOUT PROCEDURES

A. Make submittals that are required by governing or other authorities.

1. Provide copies to Architect and Owner.

B. Notify Architect in writing when work is considered ready for Architect’s Substantial Completion inspection.

1. Prerequisite for Substantial Completion: In addition to definition of Substantial Completion in the General Conditions or Agreement, Substantial Completion is not considered achieved until Certificate of Occupancy is issued by primary jurisdictional authority, allowing Owner to fully occupy or utilize building and associated facilities for intended use in all respects.

C. Submit written certification containing Contractor’s Correction Punch List, that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Architect’s Substantial Completion inspection.

D. Conduct Substantial Completion inspection and create Final Correction Punch List containing Architect’s and Contractor’s comprehensive list of items identified to be completed or corrected and submit to Architect.

E. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Owner-occupied areas.
F. Accompany Owner and Architect on Contractor's preliminary final inspection.

G. Notify Architect when work is considered finally complete and ready for Architect's Substantial Completion final inspection.

H. Complete items of work determined by Architect listed in executed Certificate of Substantial Completion.

3.14 MAINTENANCE

A. Provide service and maintenance of components indicated in specification Sections.

B. Maintenance Period: As indicated in specification Sections or, if not indicated, not less than one year from the Date of Substantial Completion or the length of the specified warranty, whichever is longer.

C. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.

D. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.

E. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of Owner.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Project record documents.
   B. Operation and maintenance data.
   C. Warranties and bonds.

1.02 SUBMITTALS
   A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
   B. Project Record Documents: Submit documents to Architect with claim for final Application for Payment.
   C. Operation and Maintenance Data:
      1. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Architect will review draft and return one copy with comments.
      2. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
      3. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Architect comments. Revise content of all document sets as required prior to final submission.
      4. Submit two sets of revised final documents in final form within 10 days after final inspection.
   D. Warranties and Bonds:
      1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
      2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
      3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PROJECT RECORD DOCUMENTS
   A. Maintain on site one set of the following record documents; record actual revisions to the Work:
      1. Drawings.
      2. Specifications.
      3. Addenda.
      4. Change Orders and other modifications to the Contract.
      5. Reviewed shop drawings, product data, and samples.
      6. Manufacturer's instruction for assembly, installation, and adjusting.
   B. Ensure entries are complete and accurate, enabling future reference by Owner.
   C. Store record documents separate from documents used for construction.
   D. Record information concurrent with construction progress.
   E. Specifications: Legibly mark and record at each product Section description of actual products installed, including the following:
      1. Manufacturer's name and product model and number.
      2. Product substitutions or alternates utilized.
      3. Changes made by Addenda and modifications.
F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
1. Measured depths of foundations in relation to finish main floor datum.
2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
4. Field changes of dimension and detail.
5. Details not on original Contract Drawings.

3.02 OPERATION AND MAINTENANCE DATA

A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.

B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.

C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.

D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.03 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

A. For Each Product, Applied Material, and Finish:
1. Product data, with catalog number, size, composition, and color and texture designations.
2. Information for re-ordering custom manufactured products, if any.

B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.


D. Additional information as specified in individual product specification Sections.

E. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

A. For Each Item of Equipment and Each System:
1. Description of unit or system, and component parts.
2. Identify function, normal operating characteristics, and limiting conditions.
3. Include performance curves, with engineering data and tests.
4. Complete nomenclature and model number of replaceable parts.

B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

C. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.

D. Include manufacturer- or installer-produced wiring diagrams representing installed conditions.

E. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

F. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
G. Provide servicing and lubrication schedule, and list of lubricants required.
H. Include manufacturer's printed operation and maintenance instructions.
I. Include sequence of operation by controls manufacturer.
J. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
K. Provide control diagrams by controls manufacturer representing installed conditions.
L. Provide Contractor's coordination drawings, with color coded piping diagrams documenting installed conditions.
M. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
N. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
O. Include test and balancing reports.
P. Additional Requirements: As specified in individual product specification Sections.

3.05 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS
A. Assemble operation and maintenance data into electronic files for Owner's personnel use, with data arranged in the same sequence as, and identified by, the specification Sections.
   1. Where systems involve more than one specification Section, provide separate electronic bookmarked tab for each system.
B. Electronic Cover Page: Identify each file with first page titled OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.
C. Table of Contents: Arrange content by systems under Section numbers and sequence of Table of Contents of this Project Manual.
D. Project Directory: Provide title of Project; names, addresses, and telephone numbers of Architect, Consultants, and Contractor with name of responsible parties; schedule of products and systems, indexed to content of the volume.
E. Electronic Bookmarking: Provide electronically bookmarked divider pages in each file for each separate product and system; identify the contents on the divider page; immediately following the divider page include a description of product and major component parts of equipment.
F. Arrangement of Contents: Organize each volume in parts as follows:
   1. Project Directory.
   2. Table of Contents, of all volumes, and of this volume.
   3. Operation and Maintenance Data: Arranged by system, then by product category.
      a. Source data.
      b. Product data, shop drawings, and other submittals.
      c. Operation and maintenance data.
      d. Field quality control data.
      e. Electronic scans warranties and bonds.
   4. Design Data: To allow for addition of design data furnished by Architect or others, provide a bookmarked divider page labeled "Design Data" and allow for insertion of additional electronic data, if applicable.
3.06 WARRANTIES AND BONDS

A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner’s permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.
   1. Warranties must clearly state that warranty commences on Date of Substantial Completion, and the actual Date of Substantial Completion according to the Contract must be clearly stated on the warranty form.

B. Verify that documents are in proper form, contain full information, and are notarized.

C. Co-execute submittals when required.

D. Retain warranties and bonds until time specified for submittal.

E. Include photocopies of each in operation and maintenance manuals, indexed separately on Table of Contents.

F. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification Section in which specified, and the name of product or work item.

END OF SECTION
SECTION 01 7900
DEMONSTRATION AND TRAINING

PART 1 GENERAL

1.01 SUMMARY

A. Demonstration of products and systems where indicated in specific specification Sections.

B. Training of Owner personnel in operation and maintenance is required for:
   1. All software-operated systems.
   2. HVAC systems and equipment.
   3. Plumbing equipment.
   4. Electrical systems and equipment.
   5. Landscape irrigation.
   6. Items specified in individual product Sections.

C. Training of Owner personnel in care, cleaning, maintenance, and repair is required for:
   1. Roofing, waterproofing, and other weather-exposed or moisture protection products.
   2. Finishes, including flooring, wall finishes, ceiling finishes.
   3. Fixtures and fittings.
   4. Items specified in individual product Sections.

1.02 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures; except:

B. Training Plan: Owner will designate personnel to be trained; tailor training to needs and skill-level of attendees.
   1. Submit to Architect for transmittal to Owner.
   2. Submit not less than four weeks prior to start of training.
   3. Revise and resubmit until acceptable.
   4. Provide an overall schedule showing all training sessions.
   5. Include at least the following for each training session:
      a. Identification, date, time, and duration.
      b. Description of products and/or systems to be covered.
      c. Name of firm and person conducting training; include qualifications.
      d. Intended audience, such as job description.
      e. Objectives of training and suggested methods of ensuring adequate training.
      f. Methods to be used, such as classroom lecture, live demonstrations, hands-on, etc.
      g. Media to be used, such as slides, hand-outs, etc.
      h. Training equipment required, such as projector, projection screen, etc., to be provided by Contractor.

C. Training Manuals: Provide training manual for each attendee; allow for minimum of two attendees per training session.
   1. Include applicable portion of O&M manuals.
   2. Include copies of all hand-outs, slides, overheads, video presentations, etc., that are not included in O&M manuals.
   3. Provide one extra copy of each training manual to be included with operation and maintenance data.

D. Training Reports:
   1. Identification of each training session, date, time, and duration.
   2. Sign-in sheet showing names and job titles of attendees.
   3. List of attendee questions and written answers given, including copies of and references to supporting documentation required for clarification; include answers to questions that could not be answered in original training session.

E. Video Recordings: Submit digital video recording of each demonstration and training session for Owner's subsequent use.
   1. Format: DVD Disc or accepted alternative media.
   2. Label each disc and container with session identification and date.
1.03 QUALITY ASSURANCE

A. Instructor Qualifications: Familiar with design, operation, maintenance and troubleshooting of the relevant products and systems.
   1. Provide as instructors the most qualified trainer of those contractors and/or installers who actually supplied and installed the systems and equipment.
   2. Where a single person is not familiar with all aspects, provide specialists with necessary qualifications.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 DEMONSTRATION - GENERAL

A. Demonstrations conducted during system start-up do not qualify as demonstrations for the purposes of this Section, unless approved in advance by Owner.

B. Demonstration may be combined with Owner personnel training if applicable.

C. Operating Equipment and Systems: Demonstrate operation in all modes, including start-up, shut-down, seasonal changeover, emergency conditions, and troubleshooting, and maintenance procedures, including scheduled and preventive maintenance.
   1. Perform demonstrations not less than two weeks prior to Substantial Completion.
   2. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

D. Non-Operating Products: Demonstrate cleaning, scheduled and preventive maintenance, and repair procedures.
   1. Perform demonstrations not less than two weeks prior to Substantial Completion.

3.02 TRAINING - GENERAL

A. Conduct training on-site unless otherwise indicated.

B. Owner will provide classroom and seating at no cost to Contractor.

C. Provide training in minimum two hour segments.

D. Training schedule will be subject to availability of Owner's personnel to be trained; re-schedule training sessions as required by Owner; once schedule has been approved by Owner failure to conduct sessions according to schedule will be cause for Owner to charge Contractor for personnel "show-up" time.

E. Review of Facility Policy on Operation and Maintenance Data: During training discuss:
   1. The location of the O&M manuals and procedures for use and preservation; backup copies.
   2. Typical contents and organization of all manuals, including explanatory information, system narratives, and product specific information.
   3. Typical uses of the O&M manuals.

F. Product- and System-Specific Training:
   1. Review the applicable O&M manuals.
   2. For systems, provide an overview of system operation, design parameters and constraints, and operational strategies.
   3. Review instructions for proper operation in all modes, including start-up, shut-down, seasonal changeover and emergency procedures, and for maintenance, including preventative maintenance.
   4. Provide hands-on training on all operational modes possible and preventive maintenance.
   5. Emphasize safe and proper operating requirements; discuss relevant health and safety issues and emergency procedures.
   6. Discuss common troubleshooting problems and solutions.
   7. Discuss any peculiarities of equipment installation or operation.
   8. Discuss warranties and guarantees, including procedures necessary to avoid voiding coverage.
   9. Review recommended tools and spare parts inventory suggestions of manufacturers.
  10. Review spare parts and tools required to be furnished by Contractor.
  11. Review spare parts suppliers and sources and procurement procedures.
G. Be prepared to answer questions raised by training attendees; if unable to answer during training session, provide written response within three days.

END OF SECTION
SECTION 03 3000
CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete forming and accessories.
B. Concrete for composite floor construction.
C. Elevated concrete slabs.
D. Floors and non-paving slabs on grade.
E. Concrete for drilled concrete piers.
F. Concrete reinforcing.
G. Joint devices associated with concrete work.
H. Miscellaneous concrete elements, including equipment pads, light pole bases, thrust blocks, and similar items.
I. Underslab vapor retarder.
J. Concrete curing.

A. ASTM C31/C31M - Standard Practice for Making and Curing Concrete Test Specimens in the Field.

1.02 REFERENCE STANDARDS

B. ACI 117 - Specifications for Tolerances for Concrete Construction and Materials.
D. ACI 301 - Specifications for Structural Concrete.
E. ACI 302.1R - Guide to Concrete Floor and Slab Construction.
F. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete.
H. ACI 308R - Guide to External Curing of Concrete.
I. ACI 309R - Guide for Consolidation of Concrete.
J. ACI 318 - Building Code Requirements for Structural Concrete and Commentary.
K. ACI 347R - Guide to Formwork for Concrete.
M. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement.
N. ASTM A706/A706M - Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
AC. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
AE. ASTM C1293 - Standard Test Method for Determination of Length Change of Concrete Due to Alkali-Silica Reaction; 2008b.
AI. ASTM E1155 - Standard Test Method for Determining F(F) Floor Flatness and F(L) Floor Levelness Numbers.
AJ. ASTM E1155M - Standard Test Method for Determining F(F) Floor Flatness and F(L) Floor Levelness Numbers (Metric).
AK. ASTM E1643 - Standard Practice for Selection, Design, Installation and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
AL. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.
AN. COE CRD-C 48 - Method of Test for Water Permeability of Concrete.
AO. COE CRD-C 513 - COE Specifications for Rubber Waterstops.
AP. CRSI (DA4) - Manual of Standard Practice.
AQ. CRSI (P1) - Placing Reinforcing Bars.
AR. NSF 61 - Drinking Water System Components - Health Effects.
AS. NSF 372 - Drinking Water System Components - Lead Content.
AT. PCA (GS) - Portland Cement Association; Guide Specification for Concrete Subject to Alkali-Silica Reactions.
1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   2. Coordinate the use and application of specified curing methods for slabs and floor surfaces with accepted flooring system manufacturers.

B. Contractor’s Option - Slab Moisture Control: The following requirements for controlling moisture in concrete slabs are Contractor’s option. Requirements are listed in the order of Architect’s preference from first preference to last preference. Submit Contractor’s elected option prior to making specified submittals which include information on associated products.
   1. Option 1: Moisture Vapor Reducing Admixture (MVRA) or Engineered Moisture Vapor Reduction (EMVR) Slab Concrete mix.
   2. Option 2: Moisture emission reducing curing and sealing compound.
   3. Option 3: Moisture curing as specified; no curing compounds permitted on slabs to receive adhesively applied flooring.
   4. All Options: Comply with requirements specified in Section 09 0561.

C. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this Section.
   1. Convene under general provisions of Section 01 7000.
   2. Required Attendance: Contractor’s quality control supervisor or superintendent, Architect, structural engineer, Owner’s independent testing agency, and all affected trades including reinforcing subcontractor and concrete supplier.
   3. Discuss construction document requirements, required clarifications to construction documents, construction schedule, and coordination of affected trades, including:
      a. Special inspection and testing, and inspection agency procedures for field quality control.
      b. Construction joints, control joints, isolation joints, and joint filler strips.
      c. Semi-rigid joint fillers.
      d. Vapor retarder installation.
      e. Anchor rod anchorage device installation tolerances.
      f. Cold and hot weather concreting procedures.
      g. Concrete finishes and finishing.
      h. Curing procedures.
         i. Forms and form removal limitations.
         j. Shoring and reshoring procedures.
         k. Methods for achieving specified floor and slab flatness and levelness.
      l. Floor and slab flatness and levelness measurements.
      m. Concrete repair procedures.
      n. Concrete protection.
         o. Initial curing and field curing of field test cylinders (ASTM C31/C31M).
         p. Protection of field-cured field test cylinders.
   4. Moisture Vapor Reducing Admixture (MVRA): Include admixture manufacturer or authorized representative, concrete supplier, and concrete finisher to verify project requirements, substrate conditions, manufacturer’s installation instructions, and manufacturer’s warranty requirements. Concrete suppliers and finishers must be certified.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit manufacturers’ data on all specified manufactured products showing compliance with specified requirements and installation instructions.
   1. Curing Compounds: Provide data on method of removal in the event of incompatibility with floor covering adhesives.
   2. For chemical-resistant waterstops, provide data on ASTM D471 test results.
   3. Moisture Emission Reducing Curing and Sealing Compound: Provide manufacturers specifications and product data showing application requirements and limitations, requirements for establishing and maintaining specified warranty, and quality assurance requirements of manufacturer.
4. Under-Slab Vapor Retarder: Provide data on specified products, including all accessory components of vapor retarder system.

C. Mix Designs: Submit proposed mix design for each class of concrete specified. Include mix identification number (unique for each submitted mix), intended use of mix, air content, proportions of ingredients, aggregate analysis, cement brand and type, slump, water/cement ratio, and strength test reports for 7 and 28 day strengths.
   1. Indicate proposed mix design complies with applicable requirements of ACI 301, Section 4 - Concrete Mixtures and Chapter 5 - Concrete Quality, Mixing and Placing.
   2. Moisture Vapor Reducing Admixture (MVRA): Include specific information showing quantities of MVRA included in applicable mix designs.
      a. Register project with MVRA manufacturer according to MVRA manufacturer's requirements and submit product batch numbers to MVRA manufacturer prior to initiation of the use or incorporation of any MVRA materials.
      b. Submit applicable mix design directly to admixture manufacturer and provide evidence of submission and MVRA manufacturer's approval to Architect.
   3. Provide specific aggregate analysis for recycled aggregates proposed for use in concrete mixes.
   4. For mixes specifying a maximum allowed drying shrinkage, submit data according to ASTM C157/C157M substantiating conformance with specified requirements.
   5. Fly-Ash Content Submittal: If any fly ash or ground granulated blast furnace slag is used in mix designs to replace Portland cement, submit the total volume of concrete cast in place, mix design(s) used showing the quantity of portland cement replaced, reports showing successful cylinder testing, and temperature on day of pour if cold weather mix is used.

D. Shop Drawings: Comply with requirements of ACI SP-66. Include bar schedules, shapes of bent bars, spacing of bars, and location of splices.
   1. Provide 1/4 inch scale elevations of all walls and grade beams with reinforcing shown.
   2. Show splice locations, if any.
   3. Provide proposed schedule and sequence of stripping of forms, shoring removal, and reshoring installation and removal.

E. Samples for Pigment Color Selection: Submit manufacturer's complete sample chip set, including pigment number and required dosage rate for each color.

F. Samples: Submit samples of underslab vapor retarder to be used.

G. Test Reports: Submit report for each test or series of tests specified.

H. Material Test Reports: Include service record data for aggregates indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.

I. Manufacturer's Installation Instructions: For concrete accessories, curing compounds, and admixtures, indicate installation procedures and interface required with adjacent construction.

J. Manufacturer's Certificate: Provide written certification for each admixture actually used that admixtures contain no thiocyanates, and admixtures do not exceed 0.05 percent chloride ions.
   1. Moisture Vapor Reducing Admixture (MVRA): Include specific information signed by admixture manufacturer certifying that materials meet or exceed specified requirements.

K. Project Record Documents: Accurately record actual locations of embedded utilities and components that will be concealed from view upon completion of concrete work.

L. Warranty: Submit specified manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Perform work of this Section in accordance with ACI 117, ACI 301, and ACI 318.

B. Follow recommendations of ACI 301 when concreting during hot and cold weather.

C. Slabs Required to Include Moisture Vapor Reduction Admixture (MVRA):
   1. Do not proceed with placement unless manufacturer's representative is present for every day of placement.
2. Manufacturer Qualifications: A firm with not less than 10 years experience in manufacturing concrete water vapor reducing admixture of the type specified, capable of providing test reports indicating compliance with specified performance requirements, and able to provide on-site technical representation. Selected product must have ASTM C494/C494M, Type S Concrete Admixture approval from an independent approved laboratory.

3. Concrete Supplier Qualifications: Certified by the MVRA manufacturer; submit certificates issued by the manufacturer as specified.

4. Concrete Finishers Qualifications: Certified by the MVRA manufacturer; submit certificates issued by the manufacturer as specified.

5. Moisture Testing: MVRA supplier will perform moisture testing. MVRA manufacturer will issue warranty prior to start of installation of flooring and moisture sensitive adhesives and coatings of any type. See Section 09 0561 for moisture testing requirements.

6. Adhesive Bond Testing: Warranted moisture sensitive coatings and adhesives must be installed by each subcontractor in coordination with MVRA manufacturer. Bond test results will be evaluated by MVRA manufacturer as part of warranty issuance process. See Section 09 0561 for moisture testing requirements.

7. Source Limitations: Obtain each type of concrete MVRA from same manufacturer.

1.06 MOCK-UP

A. Comply with general mock-up requirements specified in Section 01 4000.

B. Mock-up: Construct and erect mock-up panel for architectural concrete surfaces indicated to receive special treatment or finish as result of formwork.
   1. Panel Size: Sufficient to illustrate full range of treatment.
   2. Mock-up may remain as part of the Work.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Engineered Moisture Vapor Reduction (EMVR) Concrete Slabs: Provide warranty to cover the cost of flooring failures due to moisture migration from slabs for ten years.
   1. Include cost of repair or removal of failed flooring, placement of topical moisture remediation system, and replacement of flooring with comparable flooring system.
   2. Provide warranty by manufacturer of engineered moisture vapor reduction slab systems matching terms of flooring adhesive or primer manufacturer's material defect warranty.

C. Slabs with Moisture Vapor Reducing Admixture (MVRA): Provide warranty to cover the cost of flooring failures due to moisture migration from slabs for life of the concrete.
   1. Include cost of repair or removal of failed flooring, placement of topical moisture remediation system, and replacement of flooring with comparable flooring system.
   2. Provide warranty by manufacturer of MVRA matching terms of flooring adhesive or primer manufacturer's material defect warranty.

D. Moisture Emission Reducing Curing and Sealing Compound: Provide warranty to cost of flooring delamination failures for 10 years.
   1. Include cost of repair or removal of failed flooring, remediation with a moisture vapor impermeable surface coating, and replacement of flooring with comparable flooring system.

PART 2 PRODUCTS

2.01 FORMWORK

A. Formwork Design and Construction: Comply with guidelines of ACI 347R to provide formwork that will produce concrete complying with tolerances of ACI 117.

B. Forming Materials: Contractor's choice of standard products with sufficient strength to withstand hydrostatic head without distortion in excess of permitted tolerances.
   1. Form Facing for Exposed Finish Concrete: Contractor's choice of materials that will provide smooth, stain-free final appearance.
   2. Earth Cuts: Do not use earth cuts as forms for vertical surfaces.
3. Form Coating: Release agent that will not adversely affect concrete or interfere with application of coatings.
4. Form Ties: Cone snap type that will leave no metal within 1-1/2 inches of concrete surface.

C. Void Forms: Factory fabricated, corrugated paper with moisture resistant treated paper faces; biodegradable; internal uniform cellular construction, structurally sufficient to support weight of wet concrete until initial set; 12 inches thick.
   1. Backfill Retainer Boards: High-density, cellular polypropylene sheet, 3/8 inch minimum thick, 12 inch minimum width or as required to adequately cover exposed edges of void forms; white color; accessory product manufactured by specified void form manufacturer.
   2. Acceptable Products:
      b. Substitutions: See Section 01 6000 - Product Requirements.

2.02 REINFORCEMENT MATERIALS
A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi).
   1. Type: Deformed billet-steel bars.
   2. Finish: Unfinished, unless otherwise indicated.
B. Reinforcing Steel for Welded Connections and Splices: ASTM A706/A706M, deformed low-alloy steel bars.
   1. Finish: Unfinished.
C. Reinforcement Accessories:
   1. Tie Wire: Annealed, minimum 16 gage, 0.0508 inch.
   2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement.
   3. Provide stainless steel, galvanized, plastic, or plastic coated steel components for placement within 1-1/2 inches of weathering surfaces.

2.03 CONCRETE MATERIALS
A. Cement: ASTM C150/C150M, Type I/II Portland type.
   1. Acquire cement for entire project from same source.
B. Fine and Coarse Aggregates: ASTM C33/C33M.
   1. Acquire aggregates for entire project from same source.
   2. Tested according to ASTM C295/C295M or ASTM C1293 and according to PCA (GS) Section 5.1.
   3. Recycled coarse aggregates may be used in foundation and elevated slab mixes; limit use to 50 percent of total coarse aggregate in each mix by weight.
C. Fly Ash: ASTM C618, Class C or F.
   1. Acquire all fly ash for entire project from same source.
   2. Limit use to following maximum percentages of cement content, by weight, unless otherwise specified:
      b. Slab on Grade, Shear Wall Foundations, Concrete on Metal Deck, and Site Concrete: 25 percent.
      c. All Other Concrete: Zero (0) percent.
      d. Do not use fly-ash or slag materials that come from sources co-fired with hazardous waste, medical waste, or tire-derived fuel.
D. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to concrete.

2.04 ADMIXTURES
A. Do not use chemicals that will result in soluble chloride ions in excess of 0.05 percent by weight of cement.
   1. Use of calcium chloride is not permitted.
B. Use of admixtures will not relax cold weather placement requirements.
C. Admixtures:
   1. Air Entrainment Admixture: ASTM C260/C260M.
   2. High Range Water Reducing Admixture: ASTM C494/C494M Type F.
   3. Water Reducing and Accelerating Admixture: ASTM C494/C494M Type E.
   4. Accelerating Admixture: ASTM C494/C494M Type C.
5. Water Reducing Admixture: ASTM C494/C494M Type A.
6. Microbiologically-Induced Corrosion Inhibiting Admixture: Resists growth of bacteria and fungi on or inside concrete.
   a. Acceptable Products:
      1) ConShield Technologies, Inc.; ConShield HD: www.conshield.com/#sle.
      2) Substitutions: See Section 01 6000 - Product Requirements.
7. Moisture Vapor Reduction Admixture (MVRA): ASTM C494/C494M, Type S; liquid, inorganic admixture free of volatile organic compounds (VOCs) and formulated to close capillary systems formed during curing to reduce moisture vapor emission and transmission, with no adverse effect on concrete properties.
   a. Option 1: Provide admixture in all slabs to receive adhesively applied flooring.
   b. Acceptable Products:
      1) Barrier One, Inc.; Barrier One Moisture Vapor Reduction Admixture: www.barrierone.com/#sle.
      4) Specialty Products Group; Vapor Lock 20/20: www.spggogreen.com/#sle.
      5) Substitutions: See Section 01 6000 - Product Requirements.
8. Waterproofing Admixture: Admixture formulated to reduce permeability to liquid water, with no adverse effect on concrete properties.
   a. Applications: Concrete mixes for surge tank.
   b. Admixture Composition: Crystalline, functioning by growth of crystals in capillary pores.
   c. Permeability of Cured Concrete: No measurable leakage when tested in accordance with COE CRD-C 48 at 200 psi; provide test reports.
   d. Potable Water Contact Approval: National Science Foundation (NSF) certification for use on structures holding potable water, based on testing in accordance with NSF 61 and NSF 372
   e. Acceptable Products:
      1) Euclid Chemical Company; Eucon Vandex AM-10: www.euclidchemical.com/#sle.
      3) Xypex Chemical Corporation; XYPEX Admix C-500: www.xypex.com/#sle.
      4) Substitutions: See Section 01 6000 - Product Requirements.

2.05 ACCESSORY MATERIALS

A. Underslab Vapor Retarder: Multi-layer, fabric-, cord-, grid-, or aluminum-reinforced polyethylene or equivalent, complying with ASTM E1745, Class A; maximum permeance of 0.01 as measured according to ASTM E96/E96M; nominal thickness 15 mils; stated by manufacturer as suitable for installation in contact with soil or granular fill under concrete slabs. The use of single ply polyethylene is prohibited.
   1. Accessory Products: Vapor retarder manufacturer’s recommended tape, adhesive, mastic, prefabricated boots, etc., for sealing seams and penetrations.
   2. Acceptable Product:
      b. Substitutions: See Section 01 6000 - Product Requirements.

2.06 BONDING AND JOINTING PRODUCTS

A. Latex Bonding Agent: Non-redispersable acrylic latex, complying with ASTM C1059/C1059M, Type II.
   1. Acceptable Products:
      b. Kaufman Products Inc; SureBond: www.kaufmanproducts.net/#sle.
      e. Substitutions: See Section 01 6000 - Product Requirements.
B. Epoxy Filler: Two-part liquid, 100 percent solids epoxy resin; gray color.
C. Epoxy Resin: Two-part, pourable or injection-applied epoxy resin; gray color.
D. Waterstops: Rubber, complying with COE CRD-C 513.
   1. Applications: Where indicated on Drawings.
   2. Configuration: As indicated on the Drawings.
4. Acceptable Products:
   c. Substitutions: See Section 01 6000 - Product Requirements.

E. Slab Isolation Joint Filler: 1/2 inch thick, height equal to slab thickness, with removable top section that will form 1/2 inch deep sealant pocket after removal.
   2. Acceptable Products:
      b. Substitutions: See Section 01 6000 - Product Requirements.

F. Slab Contraction Joint Device: Preformed linear strip intended for pressing into wet concrete to provide straight route for shrinkage cracking.

G. Slab Construction Joint Devices: Combination keyed joint form and screed, galvanized steel, with rectangular or round knockout holes for conduit or rebar to pass through joint form at 6 inches on center; ribbed steel stakes for setting.
   1. Provide removable plastic cap strip that forms wedge-shaped joint for sealant installation.
   2. Height: To suit slab thickness.

2.07 CURING MATERIALS

   1. Product dissipates within 4 to 6 weeks.
   2. Provide product containing fugitive red dye.
   3. Acceptable Products:
      e. Substitutions: See Section 01 6000 - Product Requirements.

B. Curing and Sealing Compound, Moisture Emission Reducing, Membrane-Forming: Liquid, membrane-forming, clear sealer, for application to newly-placed concrete; capable of providing adequate bond for flooring adhesives, initially and over the long term; with sufficient moisture vapor impermeability to prevent deterioration of flooring adhesives due to moisture emission.
   1. Applications - Option 2: Use this product to cure and seal all slabs to receive adhesively applied flooring.
   2. Comply with ASTM C1315 and ASTM C309, Type I, Class A or C.
   3. VOC Content: Less than 100 g/L.
   5. Acceptable Products:
      d. Substitutions: See Section 01 6000 - Product Requirements.

C. Cover Curing Sheets: ASTM C171; lay-flat sheets comprised of two layers of wet strength kraft paper with tri-dimensional reinforcing fibers completely embedded in high-grade asphalt; 72 inch wide rolls.
   1. Water Resistance: ASTM D779; more than 24 hours.
   2. Vapor Permeance: Maximum 0.20 according to ASTM E96/E96M, Procedure A.
   3. Acceptable Product:
      b. Substitutions: See Section 01 6000 - Product Requirements.

D. Water: Potable, not detrimental to concrete.
2.08 CONCRETE MIX DESIGN - GENERAL

A. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.

B. Concrete Strength: Establish required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI 301.
   1. For trial mixtures method, employ independent testing agency acceptable to Architect for preparing and reporting proposed mix designs.

C. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended or required by manufacturer.
   1. Moisture Vapor Reduction Admixture (MVRA): Strictly comply with admixture manufacturer’s requirements in all respects to achieve specified warranty.

D. Adjustment to Concrete Mixes: Mix design adjustments may be requested when characteristics of materials, project conditions, weather, test results, or other circumstances indicate necessary adjustments, at no additional cost to the Owner, and as accepted by the Architect. Laboratory test data for revised mix design and strength results must be submitted to Architect and accepted before use of revised mix designs in the Work.

2.09 CONCRETE MIXES

A. See Drawings for concrete mix design schedule.

B. Engineered Moisture Vapor Reduction (EMVR) Slab Concrete: Engineered concrete mix design containing proportions of admixtures complying with ASTM C494 for applicable Types; free of volatile organic compounds (VOCs) and formulated to close capillary systems formed during curing to reduce moisture vapor emission and transmission, with no adverse effect on concrete properties.
   1. Option 1: Applications: Provide admixture in all slabs to receive adhesively applied flooring.
   2. System Requirements: Comply strictly with manufacturer’s requirements for finishing and curing to establish and maintain specified warranty, including application of evaporation reducer and cover curing methods, and the incorporation of a Class A vapor retarder under slabs-on-grade.
   3. Compressive Strength, when tested in accordance with ASTM C39/C39M at 28 days: 4,000 psi, minimum.
   4. Acceptable Manufacturers:
      b. Substitutions: See Section 01 6000 - Product Requirements.

2.10 MIXING

A. Transit Mixers: Comply with ASTM C94/C94M.
   1. Deliver concrete and discharge entire load within 1-1/2 hours, or before drum has turned 300 revolutions, whichever occurs first, after introduction of mixing water.
      a. When air temperature is between 85 and 90 degrees F, reduce mixing and delivery time from 1-1/2 hours to maximum 75 minutes.
      b. When air temperature is 90 degrees and above, reduce mixing and delivery time from 1-1/2 hours to maximum 60 minutes.
   2. During cold weather (below 45 degrees F), use heated water and aggregates if necessary to maintain concrete temperature between 60 degrees F and 90 degrees F.

B. Adding Water: If concrete arrives on-site with slump less than suitable for placement, do not add water that exceeds the maximum water-cement ratio or exceeds the maximum permissible slump.

C. Add water in accordance with ACI 304R, add at one time only, not more than 2 gal/cu yd of concrete, and provided the increase in slump does not exceed one inch.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify lines, levels, and dimensions before proceeding with work of this Section.
3.02 PREPARATION

A. Formwork: Comply with requirements of ACI 301. Design and fabricate forms to support all applied loads until concrete is cured, and for easy removal without damage to concrete.

B. Verify that forms are clean and free of rust before applying release agent.

C. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning and applying bonding agent in accordance to bonding agent manufacturer's instructions.
   1. Use latex bonding agent only for non-load-bearing applications.

D. Where new concrete with integral waterproofing is to be bonded to previously placed concrete, prepare surfaces to be treated in accordance with waterproofing manufacturer's instructions. Saturate cold joint surface with clean water, and remove excess water before application of coat of waterproofing admixture slurry. Apply slurry coat uniformly with semi-stiff bristle brush at rate recommended by waterproofing manufacturer.

3.03 INSTALLATION - VAPOR RETARDER

A. Install vapor retarder under interior slabs on grade according to manufacturer's instructions and ASTM E1643. Lap joints minimum 6 inches and seal watertight by taping edges and ends.
   1. Fine grade under slab soils to smooth and level surface prior to installation of slab on grade edge and construction joint forms.
   2. Tamp and level subbase soil materials to within plus zero (0) inches to minus 3/4 inches from required subgrade elevation.
   3. Lap vapor retarder up and over foundation elements and terminate edges of vapor retarder at top level of concrete slab; seal to foundation elements and other perimeter elements using materials and methods that will result in continuous seals that have same or better perm rating as specified for vapor retarder.
   4. Seal all penetrations, including pipes, with specified pipe boots; no penetrations of vapor retarder membrane are permitted except for reinforcing steel and permanent utilities.
   5. Do not disturb or damage vapor retarder while placing concrete. Repair damaged vapor retarder by cutting patches of vapor retarder, overlapping damaged area 6 inches minimum and taping all four sides with vapor retarder manufacturer's approved seal tape.

3.04 INSTALLATION - VOID FORMS

A. Install void forms in accordance with manufacturer's recommendations. Protect forms from moisture or crushing.
   1. Tape seams or use manufacturer's standard seam pads at joints between units.
   2. At intersection of concrete piers and grade beams, use factory fabricated void form with radiused vertical end to conform to pier diameter, fitted tight to pier.
   3. At concrete piers in floor slab areas, use two-piece factory fabricated void form with radiused vertical edge adjacent to pier to conform to pier diameter, fitted tight to pier.
   4. Install backfill retainer boards continuously along exposed edges of void forms at both sides of grade beams, and at other locations where void forms could be displaced by earthwork backfill operations.

3.05 INSTALLATION - REINFORCEMENT AND OTHER EMBEDDED ITEMS

A. Fabricate concrete reinforcing in accordance with CRSI (DA4) - Manual of Standard Practice.
   1. Place reinforcement in accordance with CRSI (P1).

B. Comply with requirements of ACI 301. Clean reinforcement of loose rust and mill scale, and accurately position, support, and secure in place to achieve not less than minimum concrete coverage required for protection.

C. Verify that anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not interfere with concrete placement.

3.06 INSTALLATION - WATERSTOPS

A. Install and splice waterstops in accordance with manufacturer's instructions.

B. Provide smooth, even surface to ensure proper bond between waterstops and substrates.
C. Locate waterstops in center of construction joints as indicated on Drawings.
D. Remove dust, oil, and other contaminants from concrete substrates prior to application and adhering waterstops.
E. Secure waterstops sufficiently to substrate to prohibit movement of waterstops during placement of concrete.

3.07 PLACING CONCRETE
A. Place concrete in accordance with ACI 304R.
B. Place concrete for floor slabs in accordance with ACI 302.1R.
C. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.
D. Ensure reinforcement, inserts, embedded parts, and formed construction joint devices will not be disturbed during concrete placement.
E. Place concrete continuously without construction (cold) joints wherever possible; where construction joints are necessary, before next placement prepare joint surface by removing laitance and exposing the sand and sound surface mortar, by sandblasting or high-pressure water jetting.
F. Consolidate concrete placed in forms by mechanical vibrating equipment supplemented by hand spading, rodding, and tamping according to ACI 309R. Vibration of forms and reinforcing is not permitted.
G. Finish floors level and flat, unless otherwise indicated, within the tolerances specified in this Section.

3.08 SLAB JOINTING
A. Locate joints as indicated on Drawings.
B. Anchor joint fillers and devices to prevent movement during concrete placement.
C. Isolation Joints: Use preformed joint filler with removable top section for joint sealant, total height equal to thickness of slab, set flush with top of slab.
   1. Install wherever necessary to separate slab from other building members, including columns, walls, equipment foundations, footings, stairs, manholes, sumps, and drains.
   2. Separate piping, conduit, and similar penetrations through slabs on grade to allow free vertical movement of slab or penetrating element.
D. Saw Cut Contraction Joints: Saw cut joints before concrete begins to cool, within 4 to 12 hours after placing; use 3/16 inch thick blade and cut at least 1 inch deep but not less than one quarter (1/4) the depth of the slab.
E. Construction Joints: Where not otherwise indicated, use metal combination screed and key form, with removable top section for joint sealant.

3.09 SEPARATE FLOOR TOPPINGS
A. Prior to placing floor topping, roughen substrate concrete surface and remove deleterious material. Broom and vacuum clean.
B. Place required dividers, edge strips, reinforcing, and other items to be cast in.
C. Apply bonding agent to substrate in accordance with manufacturer's instructions.
D. Place concrete floor toppings to required lines and levels.
E. Screed toppings level, maintaining surface flatness as specified for other elevated slabs.

3.10 FLOOR FLATNESS AND LEVELNESS TOLERANCES
A. An independent testing agency, as specified in Section 01 4000, will inspect finished slabs for compliance with specified tolerances.
B. See Section 09 0561 - Flooring Preparation for additional requirements for preparation of concrete slabs.
C. Continuous intermediate screed strips set prior to concrete placement are required. Set screeds and adjust as necessary to achieve proper slab elevation and thickness.

D. For slabs poured over metal decking, place screeds along beam lines. Set screeds and adjust as necessary to achieve uniform slab thickness over beams, allowing for beam camber and deflection. Additional slab thickness between beams due to metal deck deflection is acceptable.

E. Screed floors level, maintaining the following minimum F(F) Floor Flatness and F(L) Floor Levelness values:
   1. Gymnasium Slab:
      a. Specified Overall Value: F(F) of 40, F(L) of 30.
      b. Minimum Local Value: F(F) of 26, F(L) of 20.
   2. Floor Slabs Except Gymnasium Slab:
      a. Specified Overall Value: F(F) of 30, F(L) of 25.
      b. Minimum Local Value: F(F) of 20, F(L) of 16.

F. Measure F(F) Floor Flatness and F(L) Floor Levelness in accordance with ASTM E1155 (ASTM E1155M), within 48 hours after slab installation; report both composite overall values and local values for each measured section.

G. Corrective Measures:
   1. Correct the slab surface if tolerances are less than specified.
   2. Correct the slab surface if composite overall value is less than specified and if local value is less than two-thirds of specified value or less than F(F) 13/F(L) 10.
   3. Correct defects by grinding or by removal and replacement of the defective work. Areas requiring corrective work will be identified. Re-measure corrected areas by the same process.

3.11 CONCRETE FINISHING

A. Repair surface defects, including tie holes, immediately after removing formwork.

B. Exposed Form Finish: Rub down or chip off and smooth fins or other raised areas 1/4 inch or more in height unless otherwise specified. Provide finish as follows:
   1. Remove all fins, projections, and other detrimental irregularities on surfaces to receive waterproofing systems; comply with waterproofing system manufacturer's requirements for surface preparation.

C. Concrete Slabs: Finish to requirements of ACI 302.1R, and as follows:
   1. Surfaces to Receive Thick Floor Coverings: "Wood float" as described in ACI 302.1R; thick floor coverings include quarry tile, ceramic tile, and Portland cement terrazzo with full bed setting system.
   2. Surfaces to Receive Adhesive-Applied Floor Coverings: "Steel trowel," non-burnished and free of ridges, as described in ACI 302.1R; adhesive-applied floor coverings include carpeting, resilient flooring, seamless flooring, thin set ceramic tile, and other specified flooring systems.
   3. Surfaces to Receive Swirl Broom Finish: Immediately after float finishing, slightly roughen surface by brooming in swirl pattern with fiber-bristle broom in half-circle motion, or as directed by Architect. Coordinate required final finish with Architect before application. Maintain consistency with direction of swirl and swirl size over entire finished surface.
      a. Applications: Pool deck surfaces and where otherwise indicated on Drawings.
   4. Surfaces to Receive Standard Broom Finish: Immediately after float finishing, slightly roughen surface by brooming with fiber-bristle broom perpendicular to main traffic route, or as directed by Architect.
      Coordinate required final finish with Architect before application.
   5. Other Surfaces to Be Left Exposed: Trowel as described in ACI 302.1R, minimizing burnish marks and other appearance defects.

D. In areas with floor drains, maintain floor elevation at walls; pitch surfaces uniformly to drains as indicated on Drawings.

3.12 CURING AND PROTECTION

A. Comply with requirements of ACI 308R. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
   1. Curing and Sealing Compound - Moisture Vapor Reducing: Strictly comply with curing compound manufacturer's requirements in all respects to achieve specified warranty.
B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
   1. Normal Concrete: Not less than 7 days.

C. Formed Surfaces: Cure by moist curing with forms in place for full curing period.

D. Surfaces Not in Contact with Forms:
   1. Curing - Slabs and Floors To Receive Adhesive-Applied Flooring: Curing compounds and other surface coatings are usually considered unacceptable by flooring and adhesive manufacturers. Unless approved otherwise in writing by Architect and accepted flooring manufacturers, cure slabs and floors to receive adhesive-applied flooring according to Contractor's Option - Slab Moisture Control specified under ADMINISTRATIVE REQUIREMENTS in this Section.
      a. Option 1: Cure slabs using only cover sheets or other methods as specifically required by MVRA manufacturer to maintain specified warranty.
      b. Option 2: Cure slabs using specified moisture emission reducing curing compound; application method and rate in strict conformance with curing compound manufacturer's requirements to maintain specified warranty.
      c. Option 3: Cure applicable slabs by cover curing method.
         1) Start as soon as possible after slab surface is sufficiently set that it will not be marred by foot traffic. Keep continuously moist for not less than 7 days by application of specified cover curing sheets. Lay sheets flat, and in full contact with slab surface; lap edges minimum 6 inches. Protect from damage during curing period.
   2. Curing - Slabs and Floors Not Receiving Adhesive-Applied Flooring: Begin after initial curing but before surface is dry.
      a. Curing Compound: Apply specified naturally ydissipating curing compound in two coats at right angles, using application rate recommended by manufacturer.

3.13 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 4000 - Quality Requirements.

B. Provide free access to concrete operations at project site and cooperate with appointed firm.

C. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of concrete operations.

D. Tests of concrete and concrete materials may be performed at any time to ensure compliance with specified requirements.

E. Concrete Tests: Obtain composite samples of fresh concrete according to ASTM C172/C172M, and perform tests according to the following requirements:
   1. Frequency: Minimum one composite sample for each 100 cu. yd. or fraction, of all concrete, but not less than one set for each concrete mixture placed each day.
      a. When frequency of testing provides fewer than five compressive strength tests for each concrete mixture, conduct testing from at least five randomly selected batches or from each batch if fewer than five are used.
   2. Compression Test Specimens: ASTM C31/C31M.
      a. Cast and field-cure one set of specimens for each composite sample. A single set of specimens consists of four standard 6 by 12 inch cylinders or five 4 by 8 inch cylinders.
      a. Test one field-cured specimen at 7 days.
      b. Test a set of two 6 by 12 or 4 by 8 inch cylinder specimens at 28 days; the average of the two test results will represent the 28 day compressive strength test result.
      c. Test one specimen at 56 days for information only if 28 day test results are below minimum required strength.

F. Anchor Bolt Concrete: Cast and field-cure one set of specimens for each type of concrete each day in which anchor bolts are cast-in, as required by 29 CFR 1926. A single set of specimens consists of four standard 6 by 12 inch cylinders or five 4 by 8 inch cylinders.

G. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.
H. Perform one slump test for each set of test cylinders taken, following procedures of ASTM C143/C143M.

I. Slab Testing: Cooperate with manufacturer of specified moisture vapor reduction admixture (MVRA) to allow access for sampling and testing concrete for compliance with warranty requirements.

J. Sample concrete used for each set of test cylinders for air content, temperature, and unit weight.

K. Reinforcing: Inspected by testing agency prior to closing formwork or placing concrete.

L. Special inspection is required for post-installed anchors.

M. Leakage Testing - Surge Tank:
1. Perform leak testing after concrete has obtained specified design strength, and before backfilling or other work begins which will cover faces of tank structure walls.
2. Testing may occur prior to placement of tank top slab; tank structure walls must be in place prior to testing.
3. Fill tank structure with water to high operating level. After tank has been full for 24 hours it will be assumed, for purposes of leakage testing, that absorption of moisture by concrete is complete. Measure change in water level after 24 hours have elapsed.
4. Fill container with water and place next to or in tank structure being tested. Locate container so that it experiences environmental conditions as close as possible to those experienced by tank structure. Use container as an indicator to measure loss of water due to evaporation. Measure level of water in container and record over same period as tank structure leakage testing.
5. If drop in water level, adjusted for evaporation in 24 hour period, exceeds 1/10 of one percent of volume of water in tank structure, leakage will be considered excessive.
6. During test period, examine tank structure and mark visible leaks and damp spots.
7. Drain tank structure to 2 feet minimum below lowest leaks and damp spots and repair. Repair by method at Contractor's option, subject to specified requirements and review/approval of Architect.
8. If leakage is determined to be excessive, refill tank structure to specified level and retest.
9. Continue this process until drop in water level in 24 hour period is less than 1/10 of 1 percent of volume of water in tank structure.
10. Beyond initial leakage test, repairs and additional leakage tests required until successful testing process is achieved will be borne by Contractor at no additional cost to Owner.

3.14 DEFECTIVE CONCRETE

A. Defective Concrete: Concrete not complying with required lines, details, dimensions, tolerances or specified requirements.

B. Repair or replacement of defective concrete will be determined by the Architect. The cost of additional testing shall be borne by Contractor when defective concrete is identified.

C. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Architect for each individual area.

D. Repair interior and exterior slab and wall cracks, holes, and voids exceeding 1/16 inch wide by grinding crack to 1/8 inch wide and fill with epoxy bonding system. Grind smooth and flush with adjacent surface.
   2. Cracks: Epoxy filler.

3.15 PROTECTION

A. Do not permit traffic over unprotected concrete floor surface until fully cured.

END OF SECTION
PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section of the Work includes furnishing, placing, shoring, bracing, and anchorage of formwork, concrete reinforcement, accessories, and placing concrete in connection with cast-in-place concrete installation including installation of control and expansion joints, concrete curing and concrete finishing.

B. Related Sections:
1. Division 01 Section “Layout of Work and Surveys”
2. Division 01 Section “Submittals”.
3. Division 01 Section “Contractor Quality Control”.
4. Division 01 Section “Erosion and Sedimentation Control”.
5. Division 31 Section “Earth Moving”.
6. Division 32 Section “Aggregate Base Course”.
7. Division 32 Section “Concrete Walks, Curbs, and Miscellaneous Flatwork”.

1.3 DEFINITIONS

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

1.4 REFERENCES

A. Note: All references below shall be from the most current edition.

B. American Concrete Institute (ACI):
1. ACI 117 - Standard Tolerances for Concrete Construction and Materials.
2. ACI 301 - Specifications of Structural Concrete for Buildings.
3. ACI 304 - Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.
4. ACI 305 and 306 - Hot and Cold Weather Protection for Concrete.
5. ACI 315 - Details and Detailing of Concrete Reinforcement.
6. ACI 318 - Building Code Requirements for Reinforced Concrete.
7. ACI 347 - Recommended Practice for Concrete Formwork.

C. American National Standards Institute (ANSI):
1. ANSI/ASTM A82 - Cold Drawn Steel Wire for Concrete Reinforcement.
2. ANSI/ASTM A185 - Welded Steel Wire Fabric for Concrete Reinforcement.

D. American Society for Testing and Materials (ASTM):
1. ASTM A615 - Deformed and Plain Billet-Steel for Concrete Reinforcement.
2. ASTM C33 - Concrete Aggregates.
3. ASTM C94 - Ready-Mixed Concrete.
5. ASTM C260 - Air Entraining Admixtures for Concrete.
6. ASTM C309 - Liquid Membrane-Forming Compounds for Curing Concrete.
8. ASTM C618 - Fly Ash Mineral Admixture for Concrete.
9. ASTM C672 - Scaling Resistance of Concrete Surfaces Exposed to Deicing Chemicals.
10. ASTM-C800 - Curing Compound, Concrete, for New and Existing Surfaces.
11. ASTM-C1315 - Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete

E. Concrete Reinforcing Steel Institute (CRSI) - Manual of Standard Practice.

F. Colorado Department of Transportation (CDOT) - Standard Specifications for Road and Bridge Construction.

G. National Ready Mixed Concrete Association (NRMCA)

1.5 QUALITY CONTROL

A. Reference Standards: Comply with following standards except where more stringent requirements are shown or specified:
1. American Concrete Institute (ACI) Publications: Comply with the following unless modified by requirements in the Contract Drawings. Note: All references below shall be from the most current edition.
   b. ACI 301 - Specifications of Structural Concrete for Buildings.
   c. ACI 304 - Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.
   d. ACI 305 and 306 - Hot and Cold Weather Protection for Concrete.
   e. ACI 315 - Details and Detailing of Concrete Reinforcement.
   f. ACI 318 - Building Code Requirements for Reinforced Concrete.
   g. ACI 347 - Recommended Practice for Concrete Formwork.
   h. ANSI/ASTM A82 - Cold Drawn Steel Wire for Concrete Reinforcement.
   i. ANSI/ASTM A185 - Welded Steel Wire Fabric for Concrete Reinforcement.
   j. ACI 301, "Specifications for Structural Concrete," Sections 1 through 5.
   k. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
   l. ASTM A615 - Deformed and Plain Billet-Steel for Concrete Reinforcement.
   m. ASTM C33 - Concrete Aggregates.
   n. ASTM C94 - Ready-Mixed Concrete.
   o. ASTM C150 - Portland Cement.
   p. ASTM C260 - Air Entraining Admixtures for Concrete.
   q. ASTM C309 - Liquid Membrane-Forming Compounds for Curing Concrete.
   r. ASTM C494 - Water Reducing Admixtures for Concrete.
   s. ASTM C618 - Fly Ash Mineral Admixture for Concrete.
   t. ASTM C672 - Scaling Resistance of Concrete Surfaces Exposed to Deicing Chemicals.

2. ASTM-C800 - Curing Compound, Concrete, for New and Existing Surfaces.

B. Pre-Construction Conference: Conduct conference at location approved by Project Manager.

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. Contractor's superintendent.
   b. Independent testing agency responsible for concrete design mixtures.
   c. Ready-mix concrete manufacturer.
   d. Concrete subcontractor.
   e. Special concrete finish subcontractor.
2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, semi-rigid joint fillers, forms and form removal limitations, shoring and reshoring procedures, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, concrete repair procedures, and concrete protection.

C. Refer to Part 3 QUALITY CONTROL for Contractor’s testing requirements.

1.6 SUBMITTALS

A. Product Data: For each type of product specified.

B. Mix Designs:
   1. Submit substantiating data for each concrete mix design specified for use to the Project Manager not less than four (4) weeks prior to first concrete placement. Data for each mix shall, as a minimum, include the following:
      a. Mix identification designation (unique for each mix submitted).
      b. Statement of intended use for mix.
      c. Mix proportions.
      d. Admixtures (must be approved by the Project Manager).
      e. Wet and dry unit weight.
      f. Entrained air content.
      g. Design slump.
      h. Strength qualification data.

C. Submit shop drawings for fabrication, bending and placement of concrete reinforcement. Comply with ACI Detailing Manual SP 66. Include all accessories specified and required to support reinforcement.

D. Qualification Data: Installer to document for Owner’s Representative experience on projects of similar scope and scale successfully completed within the past five (5) years.

E. Material Certificates: For each of the following, signed by manufacturers:
   1. Cementitious materials and aggregates.
   2. Admixtures.
   3. Form materials and form-release agents.
   4. Steel reinforcement and accessories.
   5. Fiber reinforcement.
   6. Waterstops.
   7. Curing compounds.
   8. Floor and slab treatments.
   10. Adhesives.
   11. Vapor retarders.
   12. Semirigid joint filler.
   15. Epoxy joint filler.

F. 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.

G. Field quality-control reports.

H. Minutes of Pre-Construction conference.
1.7 DELIVERY, STORAGE AND HANDLING

A. General: Materials handling and batching shall conform to applicable provisions of ASTM C94.

B. Reinforcing: Unload and store reinforcing bars so they are kept free of mud and damage.

C. Hauling Time for Concrete: Deliver and discharge all concrete transmitted in a truck mixer, agitator, or other transportation device not later than one and one-half (1-1/2) hours, or three-hundred (300) revolutions of the drum after the initial mixing water has been added, whichever is earliest.

D. Extra Water:
   1. Deliver concrete to site in exact quantities required by design mix.
   2. Should extra water be required for workability before depositing concrete, and the water/cement ratio of accepted mix design will not be exceeded, the General Contractor’s superintendent shall have the sole authority to authorize addition of water. Additional water shall not exceed one (1) gal/cu. yd. Any additional water added to mix after leaving batch plant shall be indicated on truck ticket and signed by person responsible.
   3. Where extra water is added to concrete it shall be mixed thoroughly for thirty (30) revolutions of drum before depositing.
   4. Water may be added at the site only once for each batch.
   5. A full set of tests shall be performed after addition of water. Excessive slump or other out of range tests will be cause for rejection.

1.8 PROJECT CONDITIONS

A. Environmental Requirements:
   1. Cold Weather Placement:
      a. When for three successive days prior to concrete placement the average daily outdoor temperature drops below forty degree (40°) F or when the average outdoor temperature is expected to drop below forty degrees forty degree (40°) F on the day of concrete placement, preparation, protection and curing of concrete shall comply with ACI 306R.
      b. Minimum temperature of concrete upon delivery shall conform to ACI 301 Table 7.6.1.1. Concrete at time of placement shall conform to minimum values of ACI 306R Table 1.4.1, and shall not exceed minimum values by more than twenty degrees (20°) F.
      c. Subject to acceptance of the Project Manager an accelerating admixture may be used. Admixtures shall meet requirements of Part 2. Calcium Chloride and other chloride-type accelerating admixtures are not allowed.
      d. Comply with concrete protection temperature requirements of ACI 306R. Record concrete temperatures during specified protection period at intervals not to exceed sixteen (16) hours and no less than twice during any twenty four (24) hour period.
   2. Hot Weather Placement:
      a. When depositing concrete in hot weather, follow recommendations of ACI 305R.
      b. Temperature of concrete at time of placement shall not exceed eighty-five degrees (85°) F.
      c. When air temperatures on day of placement are expected to exceed ninety degrees (90°) F, mix ingredients shall be cooled before mixing. Flake ice or well-crushed ice of a size that will melt completely during mixing may be substituted for all or part of mix water.
      d. Retarding admixture may be used subject to acceptance of the Project Manager. Admixtures shall meet requirements of Part 2.
      e. Protect to prevent rapid drying. Start finishing and curing as soon as possible.

B. Protection: Protect newly finished slabs from vandalism and all weather related damage. Protect finished slabs from mortar leakage from pouring of concrete above. Cover masonry walls, glazing, and other finish materials with polyethylene or otherwise protect from damage due to pouring of concrete.
PART 2 PRODUCTS

1.9 FORM MATERIALS

A. Hand Placed Steel Forms: Hand placed steel forms are only to be used for sections that are straight and have no bend, radii, or curvature in the sections to be used.

B. Plywood Forms: Are to be used on any section of concrete that have bends, radii or curvature. Forms shall be made of Douglas Fir or Spruce species; solid one side grade; sound, undamaged sheets with straight edges.
   1. Curved elements shown on plans are to be constructed with smooth-curved forms. Faceted forms composed of straight sections will not be accepted.

C. Lumber: Douglas Fir or Spruce species; construction grade; with grade stamp clearly visible.

D. Form Coatings: Provide commercial formulation form coating compounds that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

1.10 REINFORCING STEEL

A. Reinforcing Steel: ASTM A615, grade forty (40) for, ties and stirrups; grade sixty (60) for all other bar; billet-steel deformed bars, uncoated finish.

B. Tie Wire: ASTM A82, minimum sixteen (16) gauge annealed type.

C. Chairs, Bolsters, Bar Supports, and Spacers: Sized and shaped for strength and support of reinforcement during installation and placement of concrete. Wood, brick or other unacceptable material is not permitted.

1.11 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A 615/A 615M, Grade sixty (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, plastic, 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 one (1) plastic-protected steel wire or CRSI Class two (2) stainless-steel bar supports.
   2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.
   3. For zinc-coated reinforcement, use galvanized wire or dielectric-polymer-coated wire bar supports.

1.12 CONCRETE MATERIALS

A. Provide materials in accordance with ACI 301, unless amended or superseded by requirements of this section or general notes on structural drawings.
   2. Cement: ASTM C150. Type II
   3. Fly ash: ASTM C618 Class C or F.
      a. Obtain from same source throughout project.
      b. All sand and aggregates to meet C-33 Table 3 for Class 4S “Severe Weathering Region”.

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1.13 ADMIXTURES

A. General: Unless specified, no admixtures may be used without specific approval of the Project Manager.

B. Prohibited Products: Calcium chloride or admixtures containing more than one half of one percent (0.05%) chloride ions or thiocyanates are not permitted.

C. Color Admixture: Color Pigment: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, nonfading, and resistant to lime and other alkalis.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. ChemMasters.
   b. Davis Colors.
   c. Dayton Superior Corporation.
   d. Hoover Color Corporation.
   e. Lambert Corporation.
   f. QC Construction Products.
   g. Rockwood Pigments NA, Inc.
   h. Scofield, L. M. Company.
   i. Solomon Colors, Inc.
   j. Acceptable substitution.


D. Air-Entraining Admixture: ASTM C260. Subject to compliance with requirements, provide one of the following:
   1. “Air Mix” by Euclid Chemical Co.

E. Water Reducing Admixture: ASTM C494, Type A. Subject to compliance with requirements, provide one of the following:
   1. “Eucon WR-75” by Euclid Chemical Co.
   2. “Rheobuild 1000” by Master Builders.
   3. “Plastocrete 106” by Sika Chemical Co.

F. High Range Water Reducing Admixture (Superplasticizer): ASTM C494, Type F or G. Subject to compliance with requirements, provide one of the following:
   1. “Eucon 37” by Euclid Chemical Co.
   2. “Pozzolith 400N” by Master Builders.
   3. “Sikament” by Sika Chemical Co.

G. Warm Weather Admixtures: ASTM C494. Use of admixtures will not relax warm weather placement requirements.

H. Cold Weather Admixtures: ASTM C494. Use of admixtures will not relax cold weather placement requirements.
1.14 ACCESSORIES

A. Form Release Agent: Colorless material which will not stain concrete, absorb moisture, contain oils or waxes, or impair natural bonding or color characteristics of coating intended for use on concrete. Subject to compliance with requirements, use one of the following:
   1. “Pro-Cote” by Protex.
   2. “Cast Off” by Sonneborn.

B. Epoxy Adhesive: ASTM C881; two (2)-component material suitable for use on dry or damp surfaces. Subject to compliance with requirements, use one of the following:
   1. “Sikadur Hi-Mod LV” by Sika Chemical Corp.
   2. “Patch and Bond Epoxy” by Burke.
   3. “Epoxite” by A.C. Horn.
   4. “Sure-Poxy” by Kaufman Products, Inc.
   5. “Euco Epoxy 463 or 615” by Euclid Chemical Co.

C. Expansion Joints:
   1. Interior Use or Exterior Use Where Sealants are Specified: Bituminous saturated fiber conforming to ASTM D1751, one half inch (1/2”) thick. Provide manufacturer’s certification of compatibility with specified sealants where required.
   2. Exterior Use Where Sealants are not Specified: Premolded asphalt and fiber conforming to ASTM D994, one half inch (1/2”) thick.

D. Slip Joints:
   1. Speed Dowel Model PSD09/#4TX, nine inch (9”) long sleeve to accommodate eighteen inch (18”) smooth steel round bar. Manufactured by Sika/Greenstreak, (800)325-9504.
   2. Dowel, eighteen inch (18”) long smooth round steel bar, five eighth inch (5/8”) diameter. De-bur cut ends.

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, shaped as sized on the drawings.

G. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.

H. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
   1. Formulate form-release agent with rust inhibitor for steel form-facing materials. Form-release agent is not to stain or discolor final concrete surface.

I. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete surface.
   1. Furnish units that will leave no corrodible metal closer than 1 inch (1”) to the plane of exposed concrete surface, or as shown on the drawings.
   2. Furnish ties that, when removed, will leave holes no larger than 1 inch (1”) in diameter in concrete surface.
   3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

J. Spray Curing Compound: All spray curing compound shall meet ASTM C-1315, and be prepared by manufacturer’s instructions. Use per where required in Section 3.9.
1.15 CONCRETE MIX

A. Refer to the City and County of Denver Right of Way Services approved materials list of pre-approved concrete mixes at the following website:


B. All Concrete mixes from the approved list or submitted for approval shall meet the following criteria:

1. Mix concrete in accordance with ASTM C94 and ACI 301 Chapter 3.
2. Cement Content: Type II cement, minimum of five hundred sixty four (564) pounds per cubic yard.
3. Fly ash: ASTM C618 Class C or F. Fly ash shall not exceed fifteen (15%) of total cementitious material by weight unless approved by Project Manager.
4. Maximum water-cement ratio: 0.45.
5. Slump: Four inches (4") maximum.
6. Air Entrainment: Five percent (5%) to eight percent (8%).
7. Aggregate Size: three quarter inch (3/4"), maximum.
8. Deliver concrete and discharge all concrete transmitted in a truck mixer, agitator, or other transportation device not later than one and one-half (1-1/2) hours from batch time, or three hundred (300) revolutions of the drum after the initial mixing water has been added, whichever is earliest.
9. During cold weather (below forty-five degree (45°) F), use heated water and aggregates if necessary to maintain concrete temperature between sixty degree (60°) F. and ninety degree (90°) F.
10. Concrete for Footings, Walls, and Interior Slabs-on-Grade shall be Class B or Class D, as approved by the Project Manager.
11. Fly Ash: Per CDOT Standard Specifications for Road and Bridge Construction Section 701.02.

1.16 FABRICATING REINFORCEMENT

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

1.17 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and ASTM C 1116/C 1116M, and furnish batch ticket information.

1. When air temperature is between eighty-five (85°) and ninety degrees (90°) F, reduce mixing and delivery time from one and one-half (1-1/2) hours to seventy-five (75) minutes; when air temperature is above ninety degrees (90°) F, reduce mixing and delivery time to sixty (60) minutes.
2. Project-Site Mixing: Not allowed without prior approval from Project Manager. If allowed, submit process description to Project Manager for approval prior to construction.

PART 3 EXECUTION

1.18 QUALITY CONTROL

A. Requirements of Regulatory Agencies: Comply with all applicable provisions of the state and local building and safety codes.
B. 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, unless otherwise approved by Project Manager.

C. Ready-Mix-Concrete 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" (Quality Control Manual - Section 3, "Plant Certification Checklist").

D. Testing: All testing shall be completed by the Contractor at their expense unless otherwise specified by the contract.

E. Testing Agency Qualifications: Engage a qualified testing agency to perform material evaluation tests and to design concrete mixtures. 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.

F. Testing Frequency: Obtain at least one composite sample for each one hundred (100) cubic yards, or fraction thereof of each concrete mixture placed each day.
   a. When frequency of testing will provide fewer than five (5) compressive-strength tests for each concrete mixture, testing shall be conducted from at least five (5) randomly selected batches or from each batch if fewer than five (5) are used.
   2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one (1) 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, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
   4. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one (1) set of four (4) standard cylinder specimens for each composite sample.
   5. Compressive-Strength Tests: ASTM C 39/C 39M; test one specimen at seven days and two specimens at twenty-eight (28) days. and keep one for backup in the event a sample should break.
      a. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at twenty-eight (28) days.

G. Strength of each concrete mixture will be satisfactory if 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 two-hundred (200) psi.

H. Test results shall be reported in writing to Project Manager, concrete manufacturer, and Contractor within forty-eight (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 twenty-eight (28) days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both seven (7) and twenty-eight (28) day tests.

I. 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 Project Manager.

J. Concrete work will be considered defective if it does not pass tests and inspections.

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

L. Prepare test and inspection reports.
M. Record of Work: A record shall be kept by the Contractor listing the time and date of placement of all concrete for the structure. Such record shall be kept until the completion of the project and shall be available to the Project Manager for examination at any time.

N. Mockups: If requested by the Project Manager, prior to starting any concrete work, provide a sample panel using materials indicated for project work. For each type, color and finish of concrete specified, build panel at the site of full thickness and approximately ten feet (10') by 10 feet (10'), including reinforcement, expansion joints, control joint, scales, fillers, and one radial edge. Provide the workmanship proposed for the work. Correct and replace sample panel until Project Manager's acceptance of the work. Retain panel(s) during construction as a standard for completed paving work.
   1. Build panel approximately one-hundred (100) sq. ft. in the location indicated or, if not indicated, as directed by Project Manager.
   2. Approved mockups may become part of the completed Work if approved prior to the construction of the mock up and is undisturbed at time of Substantial Completion.
   3. Notify the Project Manager a minimum of seven (7) days in advance of dates and times when mockups will be constructed.
   4. Obtain the Project Manager's written approval of the mockups before starting construction.
   5. If the Project Manager determines that the mockup does not meet the requirements, demolish and remove from the site and cast another until the mockup is approved.
   6. Maintain the mockups during construction in an undisturbed condition as a standard for judging the completed Work.
   7. Demolish and remove mockups when directed by Project Manager.

O. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold and hot-weather concreting procedures, curing procedures, contraction and isolation joints, and joint-filler strips, semi-rigid joint fillers, forms and form removal limitations, shoring and reshoring procedures, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, concrete repair procedures, and concrete protection.

1.19 FORMWORK ERECTION

A. Construct formwork to maintain tolerances in accordance with ACI 301.

B. Verify lines, levels, and measurement before proceeding with formwork.

C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
   1. Class A, one eighth inch (1/8") for smooth-formed finished surfaces.
   2. Class B, one-quarter inch (1/4") for rough-formed finished surfaces.

D. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

E. Form Tie Holes: Form tie holes are to be filled with grout and finished to match adjacent concrete surface.

F. Elements shown as curved on plans are to be formed with flexible form material to form smooth curve transitions. Disjointed, poorly transitioned form alignments will not be accepted. Curved sections formed with straight facets will not be accepted.

G. Contractor shall notify the Project Manager a minimum of forty eight (48) hours in advance of placing concrete for review of formwork. Contractor shall make correction within twenty four (24) hours of review. If formwork is not in place at time of the scheduled inspection, then the Contractor will be responsible for compensation of the Project Manager's time and expenses per the General Contract Conditions.

H. Minimize form joints. Symmetrically align form joints and make watertight to prevent leakage of mortar.
I. Provide chamfer strips on all exposed corners or as indicated on construction documents.

J. Do not apply form release agent other than specified materials where concrete surfaces receive special finishes or applied coatings which may be affected by agent. Soak contact surfaces of untreated forms with clean water. Keep surfaces wet prior to placing concrete.

K. Coordinate work of other Sections in forming and setting openings, slots, recesses, chases, sleeves, bolts, dowels, anchors, and other inserts and embedded materials.

L. Do not remove forms, shoring and bracing until concrete has sufficient strength to support its own weight, and construction and design loads which may be imposed upon it.

M. During cold weather, remove ice and snow from forms. Do not use deicing salts. Do not use water to clean out completed forms unless formwork and construction proceed within heated enclosure. Use compressed air to remove foreign matter.

1.20 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 fifty degrees (50°) F for twenty four (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 structural elements that supports weight of concrete in place until concrete has achieved at least seventy percent (70%) of its twenty-eight (28) day design compressive strength.

2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

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

C. 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 Project Manager.

1.21 SHORES AND RESHORES

A. Comply with ACI 318 (ACI 318M) 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. 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.

1.22 EMBEDDED ITEMS

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's "Code of Standard Practice for Steel Buildings and Bridges."
1.23 REINFORCEMENT

A. Place, support, and secure reinforcement against displacement.

B. Locate reinforcing splices per ACI 318 unless indicated otherwise on the Contract Drawings.

1.24 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 Project Manager.

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. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

D. Joint Sealants: See Division 3 Section “Concrete Paving Joint Sealants”.

1.25 CONCRETE PLACEMENT

A. Contractor’s Review: Contractor shall inspect forms and reinforcing prior to concrete placement to assure accurate placement of embedded items and overall acceptability.

B. Project Manager’s Review: Contractor shall provide minimum of forty-eight (48) hours notice to the Project Manager to allow review of forms and reinforcement before concrete is placed and to observe placing of concrete.

C. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

D. Do not add water to concrete during delivery, at Project site, or during placement. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be 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 to not 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.

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 six inches (6”) 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.

E. Deposit and consolidate concrete for concrete pavements in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.


3. Screed slab surfaces with a straightedge and strike off to correct elevations.
4. Slope surfaces as indicated on drawings.
5. 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.
6. Allow time for bleed water to appear, then scrape or push off all bleed water. Do not work water into surface.
7. Final level, light bull float, but do not trowel surface.
8. Broom or drag surface or other specified finish, per Subsection 3.8 this Section.
9. Do not use evaporative retarders as finishing aid.

F. Cold-Weather Placement: Comply with ACI 301, ACI 304, ACI 306R 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 forty degrees (40°) 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.

G. Hot-Weather Placement: Comply with ACI 301, ACI 304, ACI 305R, and as follows:

1. Maintain concrete temperature below ninety degrees (90°) 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 prohibited.
2. Spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

H. Ensure reinforcement, inserts, embedded parts and formed joints are not disturbed during concrete placement.

1.26 FINISHING

A. Rough Form Finish: All texture imparted by form facing material, including tie holes and defective areas, shall be repaired and patched, and all fins and other projections exceeding one-quarter inch (1/4") shall be removed.

B. 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.

1.27 CONCRETE CURING, PROTECTION, AND SURFACE TREATMENTS

A. General:
1. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Maintain concrete with minimal moisture loss at a relatively constant temperature for the period necessary for hydration of the cement and hardening of concrete.
2. Curing shall commence as soon as free water has disappeared from the concrete surface after placing and finishing. The curing period shall be seven days for all concrete unless test cylinders, made and kept adjacent to the structure and cured by the same methods, are tested with the average compressive strength equal to seventy percent (70%) of the specified twenty-eight (28) day strength.
3. Curing shall be in accordance with ACI 301 procedures. Avoid rapid drying at the end of the curing period. During hot and cold weather, cure concrete in accordance with ACI 305R and ACI 306R.
B. Curing Methods: Perform curing of concrete by moisture curing, by moisture-retaining cover curing, by curing compound, and by combinations thereof, as herein specified and in accordance with ACI 308.1. Coordinate with and choose a curing method that is compatible with the requirements for subsequent material usage on the concrete surface.

1. Provide moisture retaining cover curing as follows: Cover concrete surfaces with a moisture-retaining cover for curing concrete, placed in widest practical width with sides and ends lapped at least three inches (3") and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

2. Provide curing and sealing compound to interior slabs left exposed, and to exterior slabs, walks and curbs as follows:
   a. Apply specified curing and sealing compound to concrete slabs as soon as final finishing operations are complete (within thirty (30) minutes). Apply uniformly in continuous operation by power-spray or roller in accordance with manufacturer's directions. Recoat areas subjected to rainfall within three hours after initial application.
   b. Maintain continuity of coating and repair damage during period.
   c. Do not use membrane curing compounds on surfaces which are to be covered with materials applied directly to concrete: liquid floor hardener, waterproofing, dampproofing, painting, and other coating and finish materials.

C. Curing Formed Surfaces: Where wooden forms are used, cure formed concrete surfaces by moist curing with forms in place for full curing period or until forms are removed. When forms are removed, continue curing by methods specified above for specified curing time.

D. Curing Unformed Surfaces:  
   1. Cure unformed surfaces, such as slabs, floor topping, and other flat surfaces by application of appropriate curing method.

1.28 FORM REMOVAL

A. Removal of Forms: Supplement and Modify ACI 301 as follows:

   1. ACI 301 4.5.4: Formwork not supporting weight of concrete such as sides of grade beams, walls, and similar parts of the work, may be removed after cumulatively curing at not less than fifty degrees (50°) F for twenty-four (24) hours after placing the concrete provided:
      a. The concrete is sufficiently cured to be undamaged by form removal.
      b. Required shores and supports are so arranged that they will not be loosened or disturbed during form removal.
      c. Supplemental curing and protection is provided for exposed concrete surfaces.

1.29 TOLERANCES

A. Formed Surfaces and Building Lines: Conform to ACI 301 4.3.

B. Slab Finishing Tolerances: See Division 32 Section "Concrete Walks, Curbs, and Miscellaneous Flatwork".

C. Embedded Items: Unless noted otherwise on drawings, tolerances shall be as follows:

   1. Anchor Bolts:
      a. Adjacent anchor bolts in a group receiving a single fabricated setting piece: Plus or minus one-eighth inch (1/8”).
      b. Location and alignment of anchor bolt groups from designated location and alignment: Plus or minus one-eighth inch (1/8”).

1.30 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Project Manager. Remove and replace concrete that cannot be repaired and patched to Project Manager’s approval.
B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a Number sixteen (#16) sieve, using only enough water for handling and placing. Achieve approval of Project Manager prior to any patching as to location of patches and patch material.

C. Patch Testing: On a portion of the work which will, in the finished condition, be concealed, test patch materials and methods and obtain Project Manager’s approval prior to patching concrete surfaces needing repair that will be visible in the final construction.

D. 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 one half inch (1/2") in any dimension to solid concrete. Limit cut depth to three quarter inch (3/4"). 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 will match surrounding color and texture. 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 Project Manager.

E. Repairing Unformed Surfaces: Test unformed surfaces, such tops of walls, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped for trueness of slope and smoothness; use a sloped template.

1. After obtaining approval of Project Manager, repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of one-hundredths inch (0.01") wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
   a. If, after repairs are complete, the Project Manager deems the repairs did not successfully correct the original deficiencies, the pavement or concrete element in question is to be removed and replaced per Subsection 3.13.E.1. above.

2. After concrete has cured at least fourteen (14) days, test for low and high spots in finished surface. Areas that do not conform to the tolerances set forth in Division 32 and in other reference standards identified in this specification are to be sawcut to the nearest joint as approved by the Project Manager, defective concrete removed, and new conforming paving reinstalled. Color and finish is to match adjacent concrete.

3. If approved by Project Manager, repair random cracks and single holes one inch (1") 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 seventy-two (72) hours.

F. Perform structural repairs of concrete, subject to Project Manager's approval, using epoxy adhesive and patching mortar.

G. Repair materials and installation not specified above may be used, subject to Project Manager approval.

END OF SECTION
SECTION 03 3511
CONCRETE FLOOR FINISHES

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Surface treatments for concrete floors and slabs.

1.02 REFERENCE STANDARDS

1.03 ADMINISTRATIVE REQUIREMENTS
A. Coordination: Coordinate the work with concrete floor placement and concrete floor curing.

1.04 SUBMITTALS
A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Manufacturer’s published data on each finishing product, including information on compatibility of different products and limitations.
C. Maintenance Data: Provide data on maintenance and renewal of applied finishes.

1.05 DELIVERY, STORAGE, AND HANDLING
A. Deliver materials in manufacturer’s sealed packaging, including application instructions.

1.06 FIELD CONDITIONS
A. Special Protection of Floor Finish Substrates:
   1. Provide special protection of concrete surfaces to receive specified floor finishes to prevent detrimental damage that prevents proper application of floor finishes and production of intended results; also comply with other protection requirements where specified in related specification Sections.
   2. Provide temporary and removable protective coverings to completely protect floor surfaces.
   3. Protect floors, stairs, and other surfaces prepared under other Sections from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
   4. Control activity in work area to prevent detrimental damage.
B. Maintain light level equivalent to a minimum 200 W light source at 8 feet above the floor surface over each 20 foot square area of floor being finished.
C. Do not finish floors until interior heating system is operational.
D. Maintain ambient temperature of 50 degrees F minimum.

PART 2 PRODUCTS

2.01 CONCRETE FLOOR FINISH APPLICATIONS
A. Unless otherwise indicated, all exposed concrete floors are to be finished using low gloss concrete sealer.
   1. Include specified aggregate additive to produce slip-resistance on sealed floor surfaces where specifically scheduled on Drawings.

2.02 FLOOR COATINGS
A. Low Gloss Clear Sealer: Liquid, membrane-forming, clear, non-yellowing acrylic; complying with ASTM C1315, Type 1, Class A.
   3. VOC Content: OTC compliant.
4. Acceptable Products:
   a. Concrete Sealers USA; TS202: www.concretesealersusa.com/#sle.
   e. Substitutions: See Section 01 6000 - Product Requirements.

2.03 COATING ADDITIVES

A. Plastic Aggregate: Finely ground polymer for addition to coatings for slip resistance.
   1. Acceptable Products:
      a. Dayton Superior Corporation; Grip Aid: www.daytonsuperior.com/#sle.
      b. Euclid Chemical Company; EUCO GRIP: www.euclidchemical.com/#sle.
      d. Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that floor surfaces are acceptable to receive the work of this Section.
B. Verify that flaws in concrete have been patched and joints filled with methods and materials suitable for further finishes.

3.02 INSTALLATION - GENERAL

A. Apply materials in strict accordance with manufacturer's instructions.

3.03 COATING APPLICATION

A. Verify that surface is free of previous coatings, sealers, curing compounds, water repellents, laitance, efflorescence, fats, oils, grease, wax, soluble salts, residues from cleaning agents, and other impediments to adhesion.
B. Protect adjacent non-coated areas from drips, overflow, and overspray; immediately remove excess material.

3.04 PROTECTION

A. Provide special protection of concrete surfaces which have received specified floor finishes to prevent detrimental damage to finished flooring surfaces; also comply with other protection requirements where specified in related specification Sections.
B. Control activity in work area to prevent detrimental damage.

END OF SECTION
PART 1  GENERAL

1.01  SECTION INCLUDES
   A. Concrete block.
   B. Mortar and grout.
   C. Reinforcement and anchorage.
   D. Accessories.

1.02  REFERENCE STANDARDS
   A. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement.
   E. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units.
   H. ASTM C140/C140M - Standard Test Methods of Sampling and Testing Concrete Masonry Units and Related Units.

1.03  SUBMITTALS
   A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
   B. Product Data:  Provide data for masonry units, fabricated wire reinforcement, and mortar and grout.
   C. Shop Drawings:
      1. Indicate bar sizes, spacing, locations, and quantities of reinforcing steel, bending and cutting schedules, and supporting and spacing devices.
      2. Include elevation drawings of all concrete masonry walls, at minimum 1/4 inch = 1 foot scale, showing all reinforcing and required openings.
      3. Show and dimension all vertical and horizontal bar splices.
      4. Indicate locations of all openings, framing and special conditions affecting masonry work. Provide shop drawings to affected facility services trades through Contractor showing size and location of wall openings and penetrations required for facility services trades, and secure their approval prior to submitting to Architect and fabricating reinforcing.
      5. Prior to installing reinforcing, provide copy of approved shop drawings to Owner's testing agency.
1.04 QUALITY ASSURANCE
   A. Comply with applicable provisions of TMS 402/602 and ACI 530/530.1/ERTA, except where exceeded by requirements of Contract Documents.
   B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING
   A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

1.06 FIELD CONDITIONS
   A. Cold and Hot Weather Requirements: Comply with requirements of TMS 402/602, ACI 530/530.1/ERTA, or applicable building code, whichever is more stringent.

PART 2 PRODUCTS

2.01 CONCRETE MASONRY UNITS
   A. Concrete Block: Comply with referenced standards and as follows:
      1. Size: Standard units with nominal face dimensions of 16 by 8 inches and nominal depths as indicated on the Drawings for specific locations.
      2. Special Shapes: Provide non-standard blocks configured for corners, lintels, headers, control joint edges, and other detailed conditions.
      3. Load-Bearing Units: ASTM C90, light weight.
         a. Hollow block.
         b. Minimum Compressive Strength: 2,000 psi.
         c. Exposed Faces: Manufacturer's standard gray color and texture.

2.02 MORTAR AND GROUT MATERIALS
   A. Masonry Cement: ASTM C91/C91M Type S.
   B. Hydrated Lime: ASTM C207, Type S.
   C. Mortar Aggregate: ASTM C144.
   E. Water: Clean and potable.

2.03 REINFORCEMENT AND ANCHORAGE
   A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi) yield strength.
      1. Deformed billet-steel bars.
      2. Unfinished.
   B. Single Wythe Joint Reinforcement: ASTM A951/A951M.
      1. Type: Truss or ladder.
      3. Size: 0.1483 inch side rods with 0.1483 inch cross rods; width as required to provide not less than 5/8 inch of mortar coverage on each exposure.

2.04 MORTAR MIXES
   A. Mortar for Unit Masonry: ASTM C270, using the Property Specification.
      1. Engineered Masonry; Type S.
      2. Masonry below grade and in contact with earth; Type S.

2.05 MORTAR MIXING
   A. Thoroughly mix mortar ingredients using mechanical batch mixer, in accordance with ASTM C270 and in quantities needed for immediate use.
B. Maintain sand uniformly damp immediately before the mixing process.
C. Do not use anti-freeze compounds to lower the freezing point of mortar.
D. If water is lost by evaporation, re-temper only within two hours of mixing.

2.06 GROUT MIXES
A. Bond Beams and Lintels: 3,000 psi strength at 28 days; 8-10 inches slump; provide premixed type in accordance with ASTM C94/C94M.
   1. Fine grout for spaces with smallest horizontal dimension of 2 inches or less.
   2. Coarse grout for spaces with smallest horizontal dimension greater than 2 inches.
B. Engineered Masonry: 3,000 psi strength at 28 days; 8-10 inches slump; provide premixed type in accordance with ASTM C94/C94M.
   1. Fine grout for spaces with smallest horizontal dimension of 2 inches or less.
   2. Coarse grout for spaces with smallest horizontal dimension greater than 2 inches.

2.07 GROUT MIXING
A. Mix grout in accordance with ASTM C94/C94M.
B. Thoroughly mix grout ingredients in quantities needed for immediate use in accordance with ASTM C476 for fine and coarse grout.
C. Do not use anti-freeze compounds to lower the freezing point of grout.

PART 3 EXECUTION
3.01 EXAMINATION
A. Verify that field conditions are acceptable and are ready to receive masonry.
B. Verify that related items provided under other sections are properly sized and located.
C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.02 PREPARATION
A. Direct and coordinate placement of metal anchors supplied for installation under other sections.
B. Clean reinforcement of loose rust.
C. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.
D. For areas where high-lift grouting will be employed, provide cleanout openings as follows:
   1. Hollow Masonry: Not less than 8 inches high at the bottom of each cell to be grouted, formed by cutting out face shell of masonry unit.

3.03 COURSING
A. Establish lines, levels, and coursing indicated. Protect from displacement.
B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
C. Concrete Masonry Units:
   1. Bond: Running.
   2. Coursing: One unit and one mortar joint to equal 8 inches.

3.04 PLACING AND BONDING
A. Lay hollow masonry units with face shell bedding on head and bed joints.
B. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.
C. Remove excess mortar as work progresses.
D. Interlock intersections and external corners.

E. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.

F. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

3.05 REINFORCEMENT AND ANCHORAGE

A. Reinforcement Bars: Secure at locations indicated and to avoid displacement during grouting. Minimum spacing between bars or to masonry surfaces shall be one bar diameter.

B. Joint Reinforcement: Install horizontal joint reinforcement at locations and spacing as indicated on Drawings.
   1. Lap joint reinforcement ends minimum 12 inches.

C. Reinforced Hollow Unit Masonry: Keep vertical cores to be grouted clear of mortar, including bed area of first course.
   1. Bond Beams: At bond beams or other locations for horizontally reinforced masonry, provide special masonry units or saw to accommodate reinforcement.

3.06 GROUTING

A. Use either high-lift or low-lift grouting techniques, at Contractor's option, subject to other limitations of Contract Documents.

B. Low-Lift Grouting:
   1. Limit height of pours to 12 inches.
   2. Limit height of masonry to 16 inches above each pour.
   3. Pour grout only after vertical reinforcing is in place; place horizontal reinforcing as grout is poured. Prevent displacement of bars as grout is poured.
   4. Place grout for each pour continuously and consolidate immediately; do not interrupt pours for more than 1-1/2 hours.

C. High-Lift Grouting:
   1. Verify that horizontal and vertical reinforcement is in proper position and adequately secured before beginning pours.
   2. Clean out masonry cells and other cavities to be grouted by high pressure water spray or compressed air. Remove debris, allow to dry, and inspect before sealing cleanout openings.
   3. Hollow Masonry: Limit lifts to maximum 4 feet and pours to maximum height of 24 feet.
   4. Place grout for spanning elements in single, continuous pour.

3.07 CONTROL AND EXPANSION JOINTS

A. Continue horizontal joint reinforcement through control joints.

B. Do not continue horizontal joint reinforcement through expansion joints.

C. Size control joints as indicated on Drawings; if not indicated, 3/8 inch wide and deep.

D. Form expansion joint as detailed on Drawings.

3.08 BUILT-IN WORK

A. As work progresses, install built-in metal door frames, fabricated metal frames, anchor bolts, and plates and other items to be built into the work and furnished under other sections.

B. Install built-in items plumb, level, and true to line.

C. Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill frame voids solid with grout.
   1. Fill adjacent masonry cores with grout minimum 12 inches from framed openings.

D. Do not build into masonry construction organic materials that are subject to deterioration.
3.09  TOLERANCES
   A. Maximum Variation from Alignment of Columns:  1/4 inch.
   B. Maximum Variation From Unit to Adjacent Unit:  1/16 inch.
   C. Maximum Variation from Plane of Wall:  1/4 inch in 10 ft and 1/2 inch in 20 ft or more.
   D. Maximum Variation from Plumb:  1/4 inch per story non-cumulative; 1/2 inch in two stories or more.
   E. Maximum Variation from Level Coursing:  1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.
   F. Maximum Variation of Joint Thickness:  1/8 inch in 3 ft.
   G. Maximum Variation from Cross Sectional Thickness of Walls:  1/4 inch.

3.10  CUTTING AND FITTING
   A. Cut and fit for chases, pipes, conduit, and sleeves.  Coordinate with other sections of work to provide correct size, shape, and location.
   B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.11  FIELD QUALITY CONTROL
   A. An independent testing agency will perform field quality control tests, as specified in Section 01 4000 - Quality Requirements.
   B. Concrete Masonry Unit Tests:  Test each variety of concrete unit masonry in accordance with ASTM C140/C140M for compliance with requirements of this specification.
   C. Mortar Tests:  Test each type of mortar in accordance with recommended procedures in ASTM C780, testing with same frequency as masonry samples.

3.12  CLEANING
   A. Remove excess mortar and mortar smears as work progresses.
   B. Replace defective mortar.  Match adjacent work.
   C. Use non-metallic tools in cleaning operations.

3.13  PROTECTION
   A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES
  A. Anchored cut stone veneer at exterior walls.
  B. Mortar.
  C. Reinforcement and anchorage.
  D. Flashings.
  E. Lintels.
  F. Accessories.

1.02 REFERENCE STANDARDS

1.03 ADMINISTRATIVE REQUIREMENTS
  A. Coordination: Direct and coordinate placement of metal anchors supplied for installation under other Sections.
  B. Preinstallation Meeting: Convene meeting one week before starting work of this Section.
     1. Convene under general provisions of Section 01 7000.
     2. Require attendance by all relevant installers.
     3. Require attendance of parties directly affecting work of this Section.
     4. Review conditions of installation, installation procedures, and coordination with related work.

1.04 SUBMITTALS
  A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
  B. Product Data: Provide data for stone masonry units, fabricated wire reinforcement, mortar, masonry accessories, and anchor ties.
  C. Samples: Submit four samples of facing brick units to illustrate color, texture, and extremes of color range.
  D. Selection Samples: Submit pre-finished metal flashing manufacturer's chart or deck of available colors, for selection.
  E. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.
1.05 QUALITY ASSURANCE
   A. Comply with provisions of ACI 530/530.1/ERTA, except where exceeded by requirements of Contract Documents.
   B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.06 MOCK-UP
   A. Comply with general mock-up requirements specified in Section 01 4000.
   B. Mock-up: Construct a stone masonry veneer wall as a mock-up panel sized 8 feet long by 6 feet high; include mortar, accessories, structural backup, wall openings, flashings (with lap joint, corner, and end dam), wall insulation, and full weather barrier system in mock-up.
      1. Locate as indicated on Drawings.
      2. Mock-up may remain as part of the Work.

1.07 DELIVERY, STORAGE, AND HANDLING
   A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

PART 2 PRODUCTS

2.01 STONE
   A. Stone Material: Colorado Buff Quartzite Sandstone.
      1. Quarry: Lyons Sandstone Quarry & Fabrication; 303-823-0173.
      2. Surface Texture: 75 percent Ledgestone and 25 percent Natural Cleft.
   B. Stone Fabrication:
      1. Nominal Thickness: 4 inch.
      2. Face Size: 2 inch to 8 inch high (vary sizes) by length equal to 3 times height.
      3. Pattern and Coursing: Random pattern; reviewed and approved by Architect in specified mock-up.
      4. Form stone corners to irregular joint profile. Clean jagged corners from stone in preparation for setting.
      5. Slope exposed top surfaces of stone and horizontal sill surfaces for shedding water.

2.02 MORTAR MATERIALS
   A. Portland Cement: ASTM C150/C150M, Type I.
      1. Not more than 0.60 percent alkali.
      2. Hydrated Lime: ASTM C207, Type S.
   B. Water: Clean and potable.
   C. Admixtures: Not permitted unless specified, or requested by Contractor in writing and approved in writing by Architect.

2.03 REINFORCEMENT AND ANCHORAGE
   A. Single Wythe Joint Reinforcement: ASTM A951/A951M.
      1. Type: Ladder.
      3. Size: 0.1483 inch side rods with 0.1483 inch cross rods; width as required to provide not less than 5/8 inch of mortar coverage on each exposure.
   B. Two-Piece Wall Ties: Formed steel wire, 0.1875 inch thick, adjustable, eye and pintle type, stainless steel, sized to provide not less than 5/8 inch of mortar coverage from masonry face and to allow vertical adjustment of up to 1-1/4 inch; self-sealing head flange.
1. Acceptable Product:
   b. Substitutions: See Section 01 6000 - Product Requirements.

2.04 FLASHINGS
A. Stainless Steel/Polymer Fabric Drainage Plane Flashing: ASTM A240/A240M; 2 mil type 304 stainless steel sheet bonded between one sheet of polymer fabric and one sheet of non-woven drainage material.
   1. Accessories: Provide all accessory components required by manufacturer for complete system, including termination bars, seaming tapes, and similar components.
   2. Acceptable Manufacturer:
      b. Substitutions: See Section 01 6000 - Product Requirements.

B. Lap Sealants and Tapes: As recommended by flashing manufacturer; compatible with membrane and adhesives.

2.05 ACCESSORIES
A. Weeps and Cavity Vents: Molded PVC grilles, insect resistant.
   1. Width: Match specified mortar joint thickness; 3/8 inch, unless otherwise indicated.
   2. Height: Match height of applicable masonry unit, plus 3/8 inch.
   3. Depth: Match depth of applicable masonry unit, plus 1/4 inch.
   4. Color(s): As selected by Architect from manufacturer's full range.

B. Drainage Fabric: Polyester or polypropylene mesh bonded to a water and vapor-permeable fabric.
   1. Acceptable Manufacturers:
      b. Substitutions: See Section 01 6000 - Product Requirements.

C. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.
   1. Acceptable Product:
      b. Substitutions: See Section 01 6000 - Product Requirements.

2.06 MORTAR MIXES
A. Mortar for Unit Masonry: ASTM C270, using the Property Specification.
   1. Exterior Non-loadbearing Masonry: Type N.

B. Mixing: Use mechanical batch mixer and comply with referenced standards.

PART 3 EXECUTION
3.01 EXAMINATION
A. Verify that field conditions are acceptable and are ready to receive masonry.
B. Verify that related items provided under other Sections are properly sized and located.
C. Verify that built-in items are in proper location, and ready for roughing into masonry work.
D. Verify that weather barrier is installed according to Section 07 2500.

3.02 PREPARATION
A. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

3.03 COLD AND HOT WEATHER REQUIREMENTS
A. Comply with requirements of ACI 530/530.1/ERTA or applicable building code, whichever is more stringent.

3.04 PLACING AND BONDING
A. Lay hollow masonry units with face shell bedding on head and bed joints.
B. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.

C. Remove excess mortar and mortar smears as work progresses.

D. Interlock intersections and external corners.

E. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.

F. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

3.05 WEEPS/CAVITY VENTS

A. Install weeps in veneer and cavity walls at maximum 24 inches on center horizontally above through-wall flashing, above shelf angles and lintels, at bottom of walls, and rowlock/belt courses where indicated, unless otherwise specified.
   1. Space weeps maximum 16 inches on center where through-wall flashings are installed directly below rowlock courses, belt courses, precast concrete courses, and similar locations.

B. Install cavity vents in veneer and cavity walls at maximum 32 inches on center horizontally below shelf angles and lintels and near top of walls.

C. Position weep/cavity vent tabs to extend maximum 1/8 inch beyond outside face of veneer masonry, but not less than 1/16 inch.

3.06 CAVITY MORTAR CONTROL

A. Do not permit mortar to drop or accumulate into cavity air space or to plug weep/cavity vents.

B. Install drainage fabric or cavity mortar diverter at base of cavity and at other flashing locations as recommended by manufacturer to prevent mortar droppings from blocking weep/cavity vents.

3.07 REINFORCEMENT AND ANCHORAGE - MASONRY VENEER

A. Masonry Back-Up: Embed anchors to bond veneer at maximum 16 inches on center vertically and 36 inches on center horizontally. Place additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 8 inches on center.

B. Stud Back-Up: Secure veneer anchors to stud framed back-up and embed into masonry veneer at maximum 16 inches on center vertically and 24 inches on center horizontally. Place additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 8 inches on center.

3.08 MASONRY FLASHINGS

A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.
   1. Extend flashings full width at such interruptions and at least 6 inches, minimum, into adjacent masonry or turn up at least 12 inches, minimum, to form watertight pan at non-masonry construction. Use continuous lengths of flashing material in each individual opening wherever possible; minimize seams.
   2. Form end dams at sides of flashing openings as recommended by flashing manufacturer for indicated conditions of installation and service.
   3. Seal top edge of flashings with manufacturer's required termination bar and continuous sealant bead at top edge of termination bar.
   4. Install 1 inch fillet bead of liquid membrane or mastic at changes in plane to fully support membrane at those locations.
   5. Remove or cover protrusions or sharp edges that could puncture flashings.
   6. Tape seal butted seams and penetrations of flashing before covering with mortar.

B. Install manufactured through-wall flashings in conjunction with manufacturer's required accessories, including web spacer/bridge units, termination bars, drainage fabrics, and similar items to produce a complete, properly functioning installation.

C. Extend metal flashings with straight edge to within 1/8 inch of exterior face of masonry veneer; do not extend flashing edge beyond outside face of masonry veneer.
3.09 CONTROL AND EXPANSION JOINTS
A. Size control joints as indicated on Drawings; if not shown, 3/8 inch wide.
   1. Provide sealed expansion joint at all internal corners of only non-structural masonry veneer, whether or
      not specifically noted or detailed.
B. Do not continue horizontal joint reinforcement through control or expansion joints.
C. Locate expansion joints as indicated on Drawings.

3.10 BUILT-IN WORK
A. As work progresses, install built-in metal door frames and other items to be built into the work and furnished
   under other Sections.
B. Install built-in items plumb, level, and true to line.
C. Do not build into masonry construction organic materials that are subject to deterioration.

3.11 TOLERANCES
A. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.
B. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.

3.12 CUTTING AND FITTING
A. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of
   masonry work may be impaired.

3.13 CLEANING
A. Remove excess mortar and mortar droppings.
B. Replace defective mortar. Match adjacent work.
C. Clean soiled surfaces with specified cleaning solution, at low pressure or by hand methods only; do not
   introduce excessive moisture into masonry wall surfaces during cleaning operations.
D. Use non-metallic tools and stiff brushes in cleaning operations.

3.14 PROTECTION
A. Without damaging completed work, provide protective boards at exposed external corners that are subject
   to damage by construction activities.
   1. Install required protection of installed work at the end of each work day.
SECTION 05 1200
STRUCTURAL STEEL FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Structural steel framing.
B. Base plates, shear stud connectors and expansion joint plates.
C. Grouting under base plates and other bearing members.

1.02 REFERENCE STANDARDS
A. AISC (MAN) - Steel Construction Manual.
C. AISC S348 - Specification for Structural Joints Using ASTM A325 or A490 Bolts.
K. ASTM E164 - Standard Practice for Contact Ultrasonic Testing of Weldments.
N. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination.
O. AWS D1.1/D1.1M - Structural Welding Code - Steel.
P. RCSC (HSBOLT) - Specification for Structural Joints Using High-Strength Bolts; Research Council on Structural Connections.
Q. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer.
R. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic").
S. SSPC-SP 2 - Hand Tool Cleaning.
T. SSPC-SP 6 - Commercial Blast Cleaning.

1.03 SUBMITTALS
A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Shop Drawings:
   1. Indicate profiles, sizes, spacing, locations of structural members, openings, attachments, and fasteners.
   2. Connections.
   3. Indicate cambers and loads.
4. Indicate welded connections with AWS A2.4 welding symbols. Indicate net weld lengths.
5. Indicate type, size, and length of bolts, distinguishing between shop and field bolts; identify pretensioned and slip-critical high-strength bolted connections.
6. Alternate Connections: Submit Request for Substitution under provisions of Section 01 6000. Shop drawings indicating alternate connection details without prior approval of a Substitution Request will not be accepted.

C. Manufacturer’s Mill Certificate: Certify that products meet or exceed specified requirements.
D. Mill Test Reports: Indicate structural strength, destructive test analysis and non-destructive test analysis.
E. Fabricator Test Reports: Comply with ASTM A1011/A1011M.
F. Product Test Reports:
   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. Shear stud connectors.
   5. Shop primers.
G. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within the previous 12 months.

1.04 QUALITY ASSURANCE
A. Fabricate structural steel members in accordance with AISC (MAN) "Steel Construction Manual."
B. Fabricator: Company specializing in performing the work of this Section with minimum five years of documented experience.
   1. Qualifications: A qualified steel fabricator that participates in AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD.
C. Erector: Company specializing in performing the work of this Section with minimum five years of documented experience.
   1. Qualifications: A qualified steel erector that participates in AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CSE.

1.05 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 F1852 fasteners and for retesting fasteners after lubrication.

PART 2 PRODUCTS
2.01 MATERIALS
A. Steel Materials, Shapes, Connectors: As specified on structural Drawings.
B. Structural Bolts and Nuts: Carbon steel, ASTM A307, Grade A and galvanized in compliance with ASTM A153/A153M, Class C.
C. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
D. Grout: ASTM C1107/C1107M; Non-shrink; premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.
   1. Minimum Compressive Strength at 48 Hours: 2,000 pounds per square inch.
   2. Minimum Compressive Strength at 28 Days: 7,500 pounds per square inch.
   3. Height Change, Plastic State; when tested according to ASTM C827/C827M:
      b. Minimum: Plus 1 percent.

E. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

F. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.02 FABRICATION

A. Fabricate structural steel members in accordance with AISC S303 specifications.

B. Shop fabricate to greatest extent possible.

C. Account for distortion and shrinkage due to welding processes as part of detailing and fabrication procedures, both in the shop and in the field.

D. Provide connections as shown or noted on Drawings; if not shown or noted, provide Standard Framed Beam Connections as shown in AISC (MAN).
   1. Combination of bolts and welds to transmit stress in the same faying surface of any connection is not permitted.
   2. Provide welded or bolted shop connectors using high-strength bolts.
   3. Field Connections: Bolt field connections, except where welded connections are specifically indicated.
      a. Provide high-strength bolts for principal connections including all beam-to-beam and all beam-to-column connections.
      b. Provide high-strength or unfinished bolts for connections of secondary framing members including girts and other framing members taking only nominal stresses.

E. Mark all members in protected, plainly visible locations in accordance with reference numbers on setting diagrams. Determine and mark the member work point at each end of columns in the shop with a center punch or other acceptable means. Place marking on the flanges and web at each end of columns. Define work point in accordance with AISC (MAN).

F. Finish work as specified and indicated on Drawings, true and free from twists, kinks, buckles, open joints, and other defects.

G. Perform necessary cutting, fitting, and drilling to accommodate other trades, and secure correct information from other trades before and after steel is delivered. Cutting or drilling will not be permitted on the site without approval of Architect.

H. Completely assemble and weld sub-assemblies with milled surfaces before welding.

I. Welding: Comply with AISC specifications and AWS standards. Provide 3/16 inch continuous fillet welds, but not less than AISC minimum based on thickness of parts joined for welds not specified.

J. Splices: Splicing of members to obtain the required lengths is not permitted without prior approval of Architect, unless specifically detailed on Drawings.

K. Substitutions: Where exact sizes and weights specified are not readily available, secure Architect's acceptance of suitable sizes in sufficient time to prevent delay due to substitutions.

2.03 FINISH

A. Steel Receiving Standard Paint Coatings: Prepare structural component surfaces in accordance with SSPC-SP 2.
B. Steel Receiving High-Performance Coatings: Clean and prepare structural steel surfaces before priming in accordance with SSPC-SP 6 for non-galvanized members and SSPC-SP 16 for galvanized members.
   1. Coordinate requirements specified in Section 09 9600 for preparation of surfaces to receive field-applied high performance coating systems; primers are specified and applied under provisions of Section 09 9600.

C. Shop prime structural steel members to receive field-applied paint or high performance coatings. Do not prime surfaces that are slip-critical, or those that are fireproofed, field welded, or in contact with concrete.
   1. Acceptable Primer Product - Galvanized Steel:
      b. Substitutions: Not permitted.
   2. Acceptable Primer Product - Non-Galvanized Steel:
      b. Substitutions: Not permitted.

2.04 SOURCE QUALITY CONTROL
A. Shop Inspection: For all columns and 50 percent of beams and girders, examination of steel for straightness and alignment, conformance to length tolerances, fissures, mill scale, and other defects and deformities as described in ASTM A6/A6M, and examination of fabricated pieces for conformity with approved shop drawings.

B. High-Strength Bolts: Provide testing and verification of shop-bolted connections in accordance with RCSC (HSBOLT), testing at least 10 percent of bolts at each connection.

C. Welded Connections: Visually inspect all shop-welded connections and test at least 10 percent of welds using one of the following:
   1. Radiographic testing performed in accordance with ASTM E94/E94M.
   2. Ultrasonic testing performed in accordance with ASTM E164.
   3. Liquid penetrant inspection performed in accordance with ASTM E165/E165M.
   4. Magnetic particle inspection performed in accordance with ASTM E709.

PART 3 EXECUTION
3.01 EXAMINATION
A. Verify that conditions are appropriate for erection of structural steel and that the work may properly proceed.

3.02 ERECTION
A. Erect structural steel in compliance with applicable AISC S303 requirements.
B. Align the various members forming a complete frame or structure after assembly and adjust accurately before fastening.
C. Measure and adjust for distortion and shrinkage of field welded assemblies as erection proceeds.
D. Allow for erection loads, and provide sufficient temporary bracing to maintain structure in safe condition, plumb, and in true alignment until completion of erection and installation of permanent bracing.
E. Clean bearing surfaces for base plates and roughen to improve bond. Clean bottom surface of base plates.
F. Set base, bearing plates, and leveling plates level and at correct elevations. Temporarily support on steel wedges or shims until supported members are plumbed and grouting is completed. Tighten anchor bolts after supported members have been positioned and plumbed. Cut protruding bearing pads or shims back flush with edge of base plates prior to grouting.
G. Field weld components and shear studs indicated on Drawings.
H. Use carbon steel bolts only for temporary bracing during construction, unless otherwise specifically permitted on Drawings. Install high-strength bolts in accordance with AISC S348.
I. Provide bolts of sufficient length to allow at least two full threads beyond nut after tightening.
J. Provide bearing-type connections, with threads excluded from shear planes, unless otherwise shown or indicated.

K. Provide slip critical type connections where shown on Drawings, complying with AISC S348.

L. Install lock nuts on slip connections and nick threads or tack weld nuts.

M. Where bolts will be exposed-to-view, space at regular intervals, in uniform patterns.

N. High-Strength Bolts: Install high-strength bolts using types and grades as specified for type of bolt and type of joint indicated on Drawings.

O. Do not field cut or alter structural members without approval of Architect.

P. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.

Q. After erection, touch-up primer on welds, abrasions, and surfaces shop primed or galvanized, except surfaces to be in contact with concrete.

R. Grout solidly between column plates and bearing surfaces, complying with manufacturer's instructions for non-shrink grout. Trowel grouted surfaces smooth, splaying neatly to 45 degrees.

3.03 TOLERANCES
A. Comply with requirements of Chapter 10 of AISC S303. Measure conformance at mean operating temperature of 70 degrees F. Compensate for difference in temperature at time of erection.

3.04 FIELD QUALITY CONTROL
A. An independent testing agency will perform field quality control tests, as specified in Section 01 4000 - Quality Requirements.

B. Inspect in accordance with AISC (MAN).

C. High-Strength Bolts: Provide testing and verification of field-bolted connections in accordance with RCSC (HSBOLT), testing at least 10 percent of bolts at each connection.

D. Field Inspection: Assure that the work conforms to specified requirements, and include:
   1. Inspection of field welding.
   2. Verification of proper fit and alignment.
   3. Verification that Contractor's erection procedures adequately correct for distortion and shrinkage in field welded assemblies and connections. Measure weld shrinkage at all groove welded column splices. Submit reports of measurements to the Architect within two days of completion of welding.

E. Welding Inspection: Assure that the work conforms to specified requirements, and include:
   1. Verification that electrodes used for manual shielded metal-arc welding and the electrodes and flux used for submerged arc welding conform to specified requirements.
   2. Verification that the approved welding procedure and the approved welding sequence are followed without deviation, unless specific approval for change is obtained from the Architect.
   3. Visual inspection on 100 percent of fillet welds.

F. Shear Stud Connectors:
   1. Weld a minimum of 2 shear connectors at the start of each production period in order to determine proper generator, control unit, and shear connector welder setting. Shear connectors must be capable of being bent 45 degrees from vertical without weld failure.
   2. If, after welding, visual inspection reveals that a sound weld or a full 360 degree fillet has not been obtained for a particular shear connector, bend connector to 15 degrees. If no fracture occurs, stud is considered acceptable and left bent. Replace shear connectors failing this test.
   3. Test studs acoustically by striking each one with hammer. Bend each stud to 15 degrees that does not ring when struck. If no fracture occurs, stud is considered acceptable and left bent. Replace shear connectors failing this test.
   4. Additional Testing: Test not less than one of each 100 studs by bending 15 degrees. If no fracture occurs, stud is considered acceptable and left bent. Replace shear connectors failing this test.
5. If the number of rejected studs exceeds 3 percent of the total number of studs tested, perform additional testing on one of each 25 studs by bending to 15 degrees. Continue increased frequency of testing until the number of rejected studs is less than 3 percent of the total number of studs tested.

6. Do not weld shear connectors when precipitation is occurring and the moisture cannot be prevented from accumulating on connection surfaces.

G. Welded Connections: Visually inspect all field-welded connections and test at least 20 percent of welds using one of the following:
   1. Radiographic testing performed in accordance with ASTM E94/E94M; minimum quality level 2-2T.
   2. Ultrasonic testing performed in accordance with ASTM E164.
   3. Liquid penetrant inspection performed in accordance with ASTM E165/E165M.
   4. Magnetic particle inspection performed in accordance with ASTM E709; performed on root pass and finished weld. Cracks or zones of incomplete fusion or penetration not acceptable.
   5. Correct deficiencies in structural steel work which inspection and test reports indicate non-compliance with specified requirements. Perform additional tests, at Contractor's expense, as necessary until compliance is achieved.

3.05 CLEANING

A. Clean erected structural steel members of field-applied markings, soil, and mud in accordance with Section 01 7000.

END OF SECTION
SECTION 05 1213
ARCHITECTURALLY-EXPOSED STRUCTURAL STEEL

PART 1 - GENERAL

1.01 SECTION INCLUDES
   A. Additional requirements for structural steel members designated as architecturally-exposed structural steel (AESS).

1.02 RELATED REQUIREMENTS
   A. Section 05 1200 - Structural Steel Framing: General requirements for structural steel members, including AESS framing specified in this Section.

1.03 DEFINITIONS
   A. Architecturally-Exposed Structural Steel: Structural steel complying with designated AESS category as defined in AISC 303.

1.04 REFERENCE STANDARDS
   B. AISC 360 - Specification for Structural Steel Buildings.
   D. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
   E. ASTM A1085/A1085M - Standard Specification for Cold-Formed Welded Carbon Steel Hollow Structural Sections (HSS).
   F. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination.
   G. AWS D1.1/D1.1M - Structural Welding Code - Steel.

1.05 ADMINISTRATIVE REQUIREMENTS
   A. Preinstallation Meeting: Schedule and conduct a preinstallation meeting at project site one week prior to start of work of this Section
      1. Convene under general provisions of Section 01 7000.
      2. Require attendance by all affected installers.
      3. Discuss requirements for shipping, special handling, storage, attachment of safety cables and temporary erection bracing, final coating, touch-up painting, mock-up coordination, Architect's observations, and other requirements for AESS.

1.06 SUBMITTALS
   A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
   B. Shop Drawings: Detailing for fabrication of AESS components.
      1. Provide erection documents clearly indicating which members are AESS members and the AESS category of each part.
      2. Include details that clearly identify AESS requirements found in this specification. Provide connections for AESS consistent with concepts shown on drawings.
      3. Indicate welds by AWS A2.4 symbols, distinguishing between shop and field welds, and show size, length and type of each weld. Identify grinding, finish and profile of welds as defined by the designated AESS category.
      4. Indicate orientation of hollow structural section (HSS) seams and mill marks (where applicable).
      5. Indicate type, size, finish and length of bolts, distinguishing between shop and field bolts. Identify high-strength bolted slip-critical, direct-tensioned shear/bearing connections. Indicate orientation of bolt heads.
6. Indicate which surfaces or edges are exposed and what class of surface preparation is being used.

7. Indicate special tolerances and erection requirements as noted on Drawings or defined by the designated AESS category.

8. Indicate vent or drainage holes for HSS members.

C. AESS 1 and AESS 2 Samples: Provide samples of specific AESS characteristics. Samples may be small size samples or components of conventional structural steel demonstrating specific AESS characteristics, including surface preparation, sharp edges ground smooth, continuous weld appearance, weld show through, and fabrication mark removal.

D. Qualification data for fabricator and erector to demonstrate their capabilities and experience. Include lists of completed projects names and address, names and addresses of architects and owners, photographs showing detail of installed AESS, and other information specified.

1.07 QUALITY ASSURANCE

A. Fabricator Qualifications: In addition to those qualifications listed in Section 05 1200, engage an AISC Certified Fabricator, experienced in fabricating AESS similar to that indicated for this project with a record of successful in-service performance, as well as sufficient production capacity to fabricate AESS without delaying the work.

B. Erector Qualifications: In addition to those qualifications listed in Section 05 1200, engage an AISC Certified Erector, experienced in erecting AESS work similar in material, design, and extent to that indicated for this project and with a record of successful in-service performance.

C. Comply with applicable provisions of AISC 303, Section 10 for the designated AESS category.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Handle finished pieces in accordance with Section 10 of AISC 303, using nylon-type slings, or chains with softeners, or wire ropes with softeners such that they are not damaged.

B. Store materials to permit easy access for inspection and identification. Keep steel members off ground by using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration. Use special care in handling to prevent twisting or warping of AESS members.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Comply with Section 05 1200, except as amended in this Section for aesthetic purposes.

B. Comply with AISC 303, Section 10 for specific AESS category designated on Drawings.

2.02 FABRICATION

A. Fabricate and assemble AESS in shop to greatest extent possible. Locate field joints in AESS assemblies at concealed locations or as approved by Architect. Detail AESS assemblies to minimize field handling and expedite erection.

B. Permissible tolerances for member depth, width, out of square, and camber and sweep to be as specified in ASTM A6/A6M, ASTM A500/A500M, and ASTM A1085/A1085M.

C. Use special care in handling and shipping of AESS both before and after shop painting to minimize damage to any shop finish. Use nylon-type slings or softeners when using chains or wire rope slings.

D. Bolted Connections:
   1. Make in accordance with Section 05 1200. Provide bolt type and finish as specified in this Section.

E. Welded Connections:
   1. Comply with AWS D1.1/D1.1M and Section 05 1200.
   2. Assemble and weld built-up sections by methods that will maintain alignment of members without warp exceeding tolerances of this section.
2.03 PAINT SYSTEM

A. Compatibility: All components/procedures of AESS paint system to comply with coating system specified, submitted, and approved per Sections 09 9123 and 09 9600. As a minimum, identify required surface preparation, primer, intermediate coat (if applicable), and finish coat. Primer, intermediate coating, and finish coating to be from a single manufacturer combined in a system documented by manufacturer with adequate guidance for fabricator to procure and execute.

B. Finish Coating: Field apply intermediate and top coats per Sections 09 9123 and 09 9600.

2.04 SHOP PRIMING

A. General: Comply with requirements specified in Section 05 1200.

2.05 MATERIALS

A. General: Meet requirements of 05 1200 as amended below.

2.06 SOURCE QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Structural Requirements:
   1. Comply with quality control requirements per AISC 360, Chapter N and AISC 303, Section 10. Refer to Section 05 1200 for additional requirements.
   2. Quality assurance agency to review work for compliance with requirements of AISC 360, Chapter N and AISC 303, Section 10.

C. AESS 1 and 2 Acceptance: Architect to observe AESS in the shop at a viewing distance consistent with final installation and determine acceptability based on qualification data and submittals. Quality assurance agency has no responsibility for enforcing requirements related to aesthetic effect.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Erector to check all AESS members upon delivery for twist, kinks, gouges or other imperfections which may result in rejection of appearance of member. Coordinate remedial action with fabricator prior to erecting steel.

3.02 PREPARATION

A. Provide connections for temporary shoring, bracing and supports only where noted on approved fabrication documents. Temporary connections not shown are to be made at locations not exposed to view in final structure or as approved by Architect.

B. Handle, lift and align pieces using nylon straps or chains with softeners required to maintain appearance of AESS through process of erection.

3.03 ERECTION

A. AESS 1 and 2: Basic elements; feature elements not in close view:
   1. Employ special care to handle and erect AESS. Erect finished pieces using nylon straps or chains with softeners such that they are not damaged.
   2. Place weld tabs for temporary bracing and safety cabling at points concealed from view in completed structure or where approved by Architect during pre-installation meeting. Obtain Architect approval of methods for removing temporary devices and finishing AESS members prior to erection.
3. **AESS Erection Tolerances:** Erect to standard frame tolerances for structural steel per Chapter 7 of AISC 303.

4. Set AESS accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.

5. Remove blemishes or unsightly surfaces resulting from temporary braces or fixtures.

6. Remove all backing and run out tabs.

7. When temporary braces or fixtures are required to facilitate erection, take care to avoid any blemishes, holes or unsightly surfaces resulting from use or removal of such temporary elements.

8. **Bolted Connections:** Align bolt heads on same side of connection as indicated on approved fabrication or erection documents.

9. **Welded Connections:** Comply with AWS D1.1/D1.1M and Section 05 1200. Appearance and quality of welds to be consistent. Employ methods that will maintain alignment of members without warp exceeding tolerance of this section.

10. Remove weld spatter exposed to view.

11. Grind off projections larger than 1/16 inch at field butt and plug welds.

12. **Continuous Welds:** Where continuous welding is noted on drawings, provide continuous welds of a uniform size and profile.

13. Do not enlarge holes in members by burning or by using drift pins. Ream holes that must be enlarged to admit bolts. Replace connection plates that are misaligned where holes cannot be aligned with acceptable final appearance.

14. Obtain permission for any torch cutting or field fabrication from Architect. Finish sections thermally cut during erection to a surface appearance consistent with mock-up.

3.04 **FIELD QUALITY CONTROL**

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. **Structural Requirements:**
   1. Comply with quality control requirements per AISC 360, Chapter N and AISC 303, Section 10. Refer to Section 05 1200 for additional requirements.
   2. Quality assurance agency to review work for compliance with requirements of AISC 360, Chapter N and AISC 303, Section 10.

C. **AESS 1 and 2 Acceptance:** Architect to observe AESS in place and determine acceptability based on qualification data and submittals. Quality assurance agency has no responsibility for enforcing requirements related to aesthetic effect.

3.05 **CLEANING**

A. **Touch-up Painting:** Complete cleaning and touch-up painting of field welds, bolted connections, and abraded areas of shop paint to blend with adjacent surfaces of AESS. Perform touch-up work in accordance with manufacturer's instructions and as specified in Section 09 9123 and 09 9600.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES

A. Open web steel joists, with bridging, attached seats and anchors.
B. Loose bearing members, such as plates or angles, and anchor bolts for site placement.
C. Supplementary framing for roof openings greater than 18 inches.
D. Design engineering for steel joists.

1.02 REFERENCE STANDARDS

E. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions.
H. AWS D1.1/D1.1M - Structural Welding Code - Steel.
I. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel.
J. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer.
K. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic").
L. SSPC-SP 2 - Hand Tool Cleaning.
M. SSPC-SP 6 - Commercial Blast Cleaning.
N. SSPC-SP 16 - Commercial Blast Cleaning of Coated and Uncoated Galvanized Steels, Stainless Steels, and Non-Ferrous Metals; 2010.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Shop Drawings: Indicate standard designations, joist coding, configurations, sizes, spacings, cambers, locations of joists, joist leg extensions, bridging, connections, and attachments as applicable.
C. In addition to shop drawings, submit the following for information only, prior to the erection of joists:
   1. One set of design calculations for joists and joist girders, which demonstrate compliance with SJI (SPEC), and with specified requirements.
   2. Special joists requiring modification by manufacturer to support non-uniform, unequal, or special loading conditions that invalidate load tables in SJI (SPEC).
   3. Submit supplemental calculations for the following:
      a. Connections not completely detailed or not indicated on the structural Drawings.
b. Request for substitution of member sizes, material grades, or any modification of the strength or configuration of the structural framing requested for the Contractor's convenience, erection sequence, construction equipment, and materials.

c. Calculations: Conform to specified reference standards and clearly demonstrate applicability for intended use.

D. Product Data: Manufacturer's specifications and installation instructions for each type of joist and accessory. Include manufacturer's certification that joists comply with AISC-SJI Specifications. Submit manufacturer's data for primer paint indicating compliance with specified formulation and performance.

E. Welders' Certificates: Submit manufacturer's certificates, certifying welders employed on the Work, verifying AWS qualification within the previous 12 months.

F. Manufacturer's Qualification Statement.

1.04 QUALITY ASSURANCE

A. Design joists, and connections not detailed on the Drawings, under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in Colorado.

B. Manufacturer Qualifications: Company specializing in performing the work of this Section with minimum five years documented experience.

C. Fabricator Qualifications: A qualified steel fabricator that is accredited by the International Accreditation Service (IAS) Fabricator Inspection Program for Structural Steel in accordance with IAS AC172.

D. Erector Qualifications: Company specializing in performing the work of this Section with minimum five years documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Transport, handle, store, and protect products to SJI requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers:
   4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 DESIGN REQUIREMENTS

A. Design Roof Loads: Specified on Drawings.

2.03 MATERIALS

A. Open Web Joists: Types as indicated on Drawings.
   1. Minimum End Bearing on Steel Supports: Comply with referenced SJI standard.
   2. Finish: Shop primed.

B. High-Strength Structural Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, with matching compatible ASTM A563 or ASTM A563M nuts and ASTM F436/F436M washers.

C. Structural Steel For Supplementary Framing and Joist Leg Extensions: ASTM A36/A36M.

D. Bridging: As required by SJI (SPEC).

E. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

F. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

G. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.
2.04  FABRICATION
A. Drill holes in chords for attachment of wood nailers where indicated.
B. Frame special sized openings in joist web framing as detailed.
C. Provide joist chord extensions indicated. Design for minimum load carrying capacity of joists, or as indicated on Drawings.
D. Provide horizontal and diagonal bridging as required by SJI (SPEC).

2.05  FINISH
A. Steel Receiving Standard Paint Coatings: Prepare structural component surfaces in accordance with SSPC-SP 2.
B. Steel Receiving High-Performance Coatings: Clean and prepare structural steel surfaces before priming in accordance with SSPC-SP 6 for non-galvanized members and SSPC-SP 16 for galvanized members.
   1. Coordinate requirements specified in Section 09 9600 for preparation of surfaces to receive field-applied high performance coating systems; primers are specified and applied under provisions of Section 09 9600.
C. Shop prime structural steel members to receive field-applied paint or high performance coatings. Do not prime surfaces that are slip-critical, or those that are fireproofed, field welded, or in contact with concrete.
   1. Acceptable Primer Product - Galvanized Steel:
      b. Substitutions: Not permitted.
   2. Acceptable Primer Product - Non-Galvanized Steel:
      b. Substitutions: Not permitted.

2.06  SOURCE QUALITY CONTROL
A. Shop Inspection: For all joists, examination for straightness and alignment, conformance to length tolerances, fissures, mill scale, and other defects and deformities as described in ASTM A6/A6M, and examination of fabricated pieces for conformity with approved shop drawings.

PART 3  EXECUTION
3.01  EXAMINATION
A. Verify existing conditions prior to beginning work.

3.02  ERECTION
A. Erect joists with correct bearing on supports.
B. Allow for erection loads. Provide sufficient temporary bracing to maintain framing safe, plumb, and in true alignment.
C. Coordinate the placement of anchors for securing loose bearing members furnished as part of the work of this section.
D. After joist alignment and installation of framing, field weld joist seats to steel bearing surfaces.
E. Position and field weld joist chord extensions and wall attachments as detailed.
F. Do not permit erection of decking until joists are braced, bridged, and secured or until completion of erection and installation of permanent bridging and bracing.
G. Do not field cut or alter structural members without approval of joist manufacturer.
H. After erection, prime welds, damaged shop primer, damaged galvanizing, and surfaces not shop primed, except surfaces specified not to be primed.
3.03 TOLERANCES
   A. Maximum Variation From Plumb: 1/4 inch.
   B. Maximum Offset From True Alignment: 1/4 inch.

3.04 FIELD QUALITY CONTROL
   A. Perform field testing under provisions of Section 05 1200.

3.05 CLEANING
   A. Clean erected steel joist members of field-applied markings, soil, and mud in accordance with Section 01 7000.

END OF SECTION
SECTION 05 3100
STEEL DECKING

PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Acoustical roof deck.
   B. Roof deck.
   C. Floor deck.
   D. Supplementary framing for openings up to and including 18 inches.
   E. Stud shear connectors.
   F. Acoustical insulation in roof deck flutes.

1.02 REFERENCE STANDARDS
   C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   G. AWS D1.1/D1.1M - Structural Welding Code - Steel.
   I. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel.
   J. ICC-ES AC70 - Acceptance Criteria for Fasteners Power Driven into Concrete, Steel and Masonry Elements.
   K. SDI (DM) - Publication No.30, Design Manual for Composite Decks, Form Decks, and Roof Decks.
   L. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer.
   M. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic").
   N. UL (FRD) - Fire Resistance Directory.

1.03 SUBMITTALS
   A. See Section 01 3000 - Administrative Requirements, for submittals procedures.
   B. Product Data: Provide deck profile characteristics, dimensions, structural properties, and finishes.
   C. Shop Drawings: Indicate deck plan, support locations, projections, openings, reinforcement, pertinent details, and accessories.
   D. Certificates: Certify that products furnished meet or exceed specified requirements.
      1. Provide adhesion testing reports indicating successful adhesion of field-applied coatings specified in other Sections according to adhesion criteria established by field-applied coating manufacturer.
   E. Submit manufacturer's installation instructions.

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F. Welders Certificates: Certify welders employed on the work, verifying AWS qualification within the previous 12 months.

G. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is accredited under IAS AC172.

1.04 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified steel fabricator that is accredited by the International Accreditation Service (IAS) Fabricator Inspection Program for Structural Steel in accordance with IAS AC172.

B. Installer Qualifications: Company specializing in performing the work of this Section with minimum five years of experience.

C. Fire-Test-Response Characteristics: Where indicated, provide steel deck units identical to those tested for fire resistance per ASTM E119 by a testing and inspecting agency acceptable to authorities having jurisdiction.
   1. Fire-Resistance Ratings: Indicated by design designations of applicable testing and inspecting agency.
   2. Steel deck units shall be identified with appropriate markings of applicable testing and inspecting agency.

D. Basis of Design: Specifications are based on certain deck types by specified basis of design manufacturer and product(s). Deck types manufactured by other acceptable manufacturers are permitted, subject to compliance with specified requirements; and provided that deviations in design, weight, and profile are minor, and do not detract substantially from the indicated design intent.
   1. Comply with requirements specified in Section 01 4000 and Section 01 6000.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Cut plastic wrap to encourage ventilation.

B. Separate sheets and store deck on dry wood sleepers; slope for positive drainage.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers - Steel Decking:
   8. Substitutions: See Section 01 6000 - Product Requirements.

B. Basis of Design Manufacturer - Acoustical Steel Decking:
      a. Roof Deck: As specified on Drawings.
   2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 STEEL DECK

A. Acoustical Roof Deck: Non-composite type, steel sheet with plain vertical flute faces perforated with 1/8 inch diameter holes staggered 3/8 inch on center:
   1. Ungalvanized Steel Sheet: ASTM A1008/A1008M, Designation SS, Grade 33, Type 1.
   2. Primer: Shop coat of manufacturer's standard primer paint over cleaned and phosphatized substrate.
   3. Structural Properties and Profiles: As indicated on Drawings.
B. Roof Deck: Non-composite type, fluted steel sheet:
      a. Locations: As noted on Drawings.
      b. Restrictions: Do not use passivation materials or rinses that will leave detrimental residue for field-applied coatings specified in other Sections.
         1) Option 1: Refer to Section 09 9600 for surface preparation requirements prior to painting.
         2) Option 2: Factory primed decking; if this option is used, full testing of adhesion between decking manufacturer's factory primer and high performance coating system specified in Section 09 9600 is required, including an approval letter from high performance coating manufacturer. This process may take 6 to 8 weeks or longer to confirm; delay claims associated with this testing and approval process will not be accepted.
   2. Ungalvanized Steel Sheet: ASTM A1008/A1008M, Designation SS, Grade 33, Type 1.
      a. Locations: As noted on Drawings.
      b. Primer: Shop coat of manufacturer's standard primer paint over cleaned and phosphatized substrate.
   3. Structural Properties and Profiles: As indicated on Drawings.

2.03 ACCESSORY MATERIALS

A. Shear Stud Connectors: Made from ASTM A108 Grade 1015 bars.

B. Welding Materials: AWS D1.1/D1.1M.

C. Powder Actuated Mechanical Fasteners: Steel; with knurled shank and forged ballistic point. Comply with applicable requirements of ICC-ES AC70.
   1. Material: Steel; ASTM A510/A510M.
      a. Corrosion Resistance - Natatorium Locations:
         1) Steel Bar Joist Framing Applications: ASTM B633, SC1, Type III zinc electroplate.
         2) Exposed Roof Deck Applications: Provide manufacturer's standard stainless steel sealing caps with bonded neoprene washer over each fastener.
   2. Acceptable Manufacturer:
      b. Substitutions: See Section 01 6000 - Product Requirements.

D. Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

E. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, complying with VOC limitations of authorities having jurisdiction.

F. Acoustical Insulation: Glass fiber type, minimum 1.1 lb/cu ft density; profiled to suit deck.

2.04 FABRICATED DECK ACCESSORIES

A. Sheet Metal Deck Accessories: Metal closure strips, wet concrete stops, and cover plates, 22 gage, 0.0299 inch thick sheet steel; of profile and size as indicated; finished same as deck.

B. Roof Sump Pans: Formed sheet steel, 14 gage, 0.0747 inch minimum thickness, flat bottom, sloped sides, recessed 1-1/2 inches below roof deck surface, bearing flange 3 inches wide, sealed watertight.

C. Floor Drain Pans: Formed sheet steel, 14 gage, 0.0747 inch minimum thickness, flat bottom, sloped sides, recessed 1-1/2 inches below floor deck surface, bearing flange 3 inches wide, sealed watertight.

2.05 FABRICATED EQUIPMENT SUPPORT DEVICES - BASIS OF DESIGN ACOUSTICAL DECKING

A. Specified basis of design manufacturer's proprietary support devices specifically designed to support ductwork, lighting fixtures, equipment, and similar items from the acoustical deck system without the need to physically penetrate the deck material.
   1. Supply these devices to related trades or subcontractors for installation, in quantities required by each related trade or subcontractor; coordinate requirements for supports through Contractor.
   2. All-thread rods, available in diameters from 1/4 inch to 3/4 inch, provided in diameters required by each related trade or subcontractor to support indicated elements.
   3. Wedge Nut with Wedge Lock devices for use with specified roof and floor deck system.
   4. ER3.5 Ankore with Ankore Lock devices for use with specified roof deck system.
5. ER6.5 Wedge Ankore devices for use with specified roof deck system.
6. Wideck EpiGrip devices for use with specified roof deck system.

**PART 3 EXECUTION**

3.01 EXAMINATION

A. Verify existing conditions prior to beginning work.

3.02 INSTALLATION

A. Erect metal deck in accordance with SDI Design Manual and manufacturer's instructions. Align and level.
B. On concrete and masonry surfaces provide minimum 4 inch bearing, unless otherwise specified on Drawings.
C. On steel supports provide minimum 1-1/2 inch bearing, unless otherwise specified on Drawings.
D. Fasten deck to steel support members at ends and intermediate supports at center-to-center spacing as indicated on Drawings, parallel with the deck flute and at each transverse flute using methods specified.
E. At mechanically fastened male/female side laps fasten at center-to-center spacing as indicated on Drawings.
F. Drive mechanical sidelap connectors completely through adjacent lapped sheets; positively engage adjacent sheets with minimum three-thread penetration.
G. At welded male/female side laps weld at center-to-center spacing as indicated on Drawings.
H. Weld deck in accordance with AWS D1.3/D1.3M.
I. At floor edges, install concrete stops upturned to top surface of slab, to contain wet concrete. Provide stops of sufficient strength to remain stationary without distortion.
J. At openings between deck and walls, columns, and openings, provide sheet steel closures and angle flashings to close openings.
K. Position roof drain pans with flange bearing on top surface of deck. Fusion weld at each deck flute.
L. Position floor drain pans with flange bearing on top surface of deck. Fusion weld at each deck flute.
M. Weld stud shear connectors through steel deck to structural members below.
   1. Coordinate installation of stud shear connectors with Section 05 1200 and Section 05 2100.
N. Immediately after welding deck and other metal components in position, coat welds, burned areas, and damaged surface coating, with touch-up primer.

3.03 FIELD QUALITY CONTROL

A. Perform field testing under provisions of Section 05 1200.

**END OF SECTION**
SECTION 05 4000
COLD-FORMED METAL FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Formed steel stud exterior wall framing.

1.02 REFERENCE STANDARDS
A. AISI S100-12 - North American Specification for the Design of Cold-Formed Steel Structural Members; American Iron and Steel Institute.
C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
E. ASTM C955 - Standard Specification for Cold-Formed Steel Structural Framing Members.
G. AWS D1.1/D1.1M - Structural Welding Code - Steel.
H. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer.
I. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic").

1.03 ADMINISTRATIVE REQUIREMENTS
A. Coordination: Coordinate with work of other Sections that is to be installed in or adjacent to the metal framing system, including but not limited to structural anchors, cladding anchors, utilities, insulation, and firestopping.

1.04 SUBMITTALS
A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide data on standard framing members; describe materials and finish, product criteria, limitations and other pertinent data.
   1. Provide manufacturer's data on factory-made framing connectors, showing compliance with requirements.
C. 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.
D. Manufacturer's Installation Instructions: Indicate special procedures, and conditions requiring special attention.

1.05 QUALITY ASSURANCE
A. Installer Qualifications: Company specializing in performing the work of this Section with minimum three years documented experience and approved by manufacturer.
PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers:
   7. SCAFCO Corporation: www.scafco.com/#sle.
   10. Substitutions: See Section 01 6000 - Product Requirements.

B. Acceptable Manufacturers - Framing Connectors and Accessories:
   1. Same manufacturer as metal framing.
   3. Substitutions: See Section 01 6000 - Product Requirements.

2.02 FRAMING SYSTEM

A. Provide primary and secondary framing members, bridging, bracing, plates, gussets, clips, fittings, reinforcement, and fastenings as required to provide a complete framing system.

2.03 FRAMING MATERIALS

A. studs and Track: ASTM C955; studs formed to channel, “C”, or “Sigma” shape with punched web; U-shaped track in matching nominal width and compatible height.
   1. Gage and Depth: As indicated on the Drawings.
   2. Galvanized in accordance with ASTM A653/A653M, G90/Z275 coating.
   3. Provide components fabricated from ASTM A1008/A1008M, Designation SS (structural steel).


C. Sub-girts and Flat Straps for Metal Panel Cladding Systems: Minimum 14 gage; shapes and accessories as detailed on Drawing and recommended by panel system manufacturer.

D. Framing Connectors: Factory-made, formed steel sheet.
   1. Material: ASTM A653/A653M SS Grade 33 and 40 (minimum), with G90/Z275 hot dipped galvanized coating for base metal thickness less than 10 gage, 0.1345 inch, and factory punched holes and slots.
   2. Structural Performance: Maintain load and movement capacity required by applicable code, when evaluated in accordance with AISI S100-12.
   3. Movement Connections: Provide mechanical anchorage devices that accommodate movement using slotted holes, shouldered screws or screws and anti-friction or stepped bushings, while maintaining structural performance of framing. Provide movement connections where indicated on Drawings.
      a. Where continuous studs bypass elevated floor slab, connect stud to slab in manner allowing vertical and horizontal movement of slab without affecting studs; allow for minimum movement of 1/2 inch.
      b. Where top of stud wall terminates below structural floor or roof, connect studs to structure in manner allowing vertical and horizontal movement of slab without affecting studs; allow for minimum movement of 1/2 inch.
   5. Wall Stud Bridging Connections: Provide mechanical load-transferring devices that accommodate wind load torsion and weak axis buckling induced by axial compression loads. Provide bridging connections where indicated on Drawings.
2.04 FASTENERS
A. Self-Drilling, Self-Tapping Screws, Bolts, Nuts and Washers: Hot dip galvanized per ASTM A153/A153M.
B. Anchorage Devices: Powder actuated.
C. Welding: Comply with AWS D1.1/D1.1M.

2.05 ACCESSORIES
A. Bracing, Furring, Bridging: Formed sheet steel, thickness determined for conditions encountered; finish to match framing components.
B. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.
C. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

PART 3 EXECUTION
3.01 EXAMINATION
A. Verify that substrate surfaces are ready to receive work.
B. Verify field measurements and adjust installation as required.

3.02 INSTALLATION OF STUDS
A. Install components in accordance with manufacturers’ instructions and ASTM C1007 requirements.
B. Place studs at 16 inches on center unless otherwise indicated on Drawings; not more than 2 inches from abutting walls and at each side of openings. Connect studs to tracks using fastener or welding method as indicated.
C. Construct corners using minimum of three studs.
D. Wall Openings:
   1. Install additional studs at wall openings as required by structural design, but not less than 1/2 the number of studs interrupted by the opening.
   2. Install headers over wall openings that are wider than stud spacing. Locate headers above openings as indicated. Fabricate headers of compound shapes indicated or required to transfer loads to supporting jamb studs, complete with clip-angle connectors, web stiffeners, or gusset plates.
   3. Fasten jamb members together to uniformly distribute loads.
   4. Install runner tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with clip angles or by welding, and space jack studs same as full-height wall studs.
E. Blocking and Supplemental Fixture and Equipment Support:
   1. Install supplemental framing, including additional studs, blocking, and bracing within framing system where indicated or required for support of fixtures, equipment, services, casework, heavy trim, furnishings, and similar items requiring attachment to wall framing system.
   2. Where type of supplementary support is not otherwise indicated, comply with stud manufacturer’s recommendations and industry standards in each case, considering weight or loading resulting from supported item.
F. Install framing between studs for attachment of mechanical and electrical items, and to prevent stud rotation.
G. Touch-up field welds and damaged primed surfaces with primer.

3.03 SOFFIT FRAMING
A. Install level and plumb, complete with bracing and reinforcing as indicated on Drawings. Provide not less than 1-1/2 inch end attachment. Install members at indicated spacing; not more than 2 inches from abutting walls. Connect joists to supports using welding method.
B. Reinforce ends with clips, steel angle clips, steel stud or track section, or as recommended by manufacturer.

3.04 TOLERANCES

A. Maximum Variation from True Position: 1/4 inch.
B. Maximum Variation of any Member from Plane: 1/8 inch.
C. Maximum Variation from Plumb and Level: 1/4 inch in 10 feet, non-cumulative.

END OF SECTION
SECTION 05 4300
SLOTTED CHANNEL FRAMING

PART 1  GENERAL

1.01  SECTION INCLUDES
A. Slotted channel framing system.
B. Accessories.
C. Engineering design of framing system and connections to building structure.

1.02  REFERENCE STANDARDS
D. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions.
F. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

1.03  SUBMITTALS
A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.

1.04  QUALITY ASSURANCE
A. Designer Qualifications: Design slotted channel framing system under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in Colorado.

PART 2  PRODUCTS

2.01  MANUFACTURERS
A. Acceptable Manufacturers:
   3. Substitutions: See Section 01 6000 - Product Requirements.

2.02  SLOTTED CHANNEL FRAMING
A. Design framing system to and connections to building structure to carry static and dynamic loads imposed on framing system; limit framing member deflection to recommendations of framing system manufacturer.

2.03  MATERIALS
A. Slotted Channel Framing: ASTM A653/A653M Grade 33 or ASTM A1011/A1011M Grade 33.
   1. Primary Framing Member Profile: 1-1/4 inch; square, with holes on channel legs.
   2. Finish: Powder coat.
B. Slotted Channel Fittings: ASTM A1011/A1011M.
   1. Finish: Match channel framing.
C. Fasteners: As detailed or required for indicated applications; manufacturer's standard fasteners designed specifically for specified system.

D. Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, galvanized to ASTM A153/A153M where connecting galvanized components.

E. Threaded Rod: ASTM A307; threaded full length of rod; minimum 1/2 inch diameter, or as required to suit design requirements.
   1. Finish: Galvanized.

F. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic.

2.04 FABRICATION

A. Fit and field assemble items in largest practical sections.

B. Fabricate items with joints tightly fitted and secured.

C. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

D. Supply components required for anchorage of framing components. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.05 FINISHES

A. Galvanizing of Non-structural Items: Galvanize after fabrication to ASTM A123/A123M requirements.

B. Powder-Coat Finish: Manufacturer's standard thermosetting polyester or acrylic urethane powder coating; minimum cured-film thickness of 1.5 mils.
   1. Color: As selected from manufacturer's full or custom range.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

A. Supply setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

3.03 INSTALLATION

A. Install items plumb and level, accurately fitted, free from distortion or defects.

B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

C. Obtain approval prior to site cutting or making adjustments not scheduled.

D. After erection, repair and refinish abrasions to match specified finish for each component.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch in 10 feet, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.


END OF SECTION
SECTION 05 5000
METAL FABRICATIONS

PART 1  GENERAL

1.01  SECTION INCLUDES

A. Shop fabricated steel items, including:
   1. Bollards.
   2. Loose lintels.
   3. Other items as specified in this Section and as indicated on Drawings.

1.02  REFERENCE STANDARDS

G. AWS D1.1/D1.1M - Structural Welding Code - Steel.
I. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer.
J. SSPC-SP 2 - Hand Tool Cleaning.

1.03  SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
   1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

PART 2  PRODUCTS

2.01  MATERIALS - STEEL

A. Steel Sections: ASTM A36/A36M.
B. Steel Tubing: ASTM A501/A501M hot-formed structural tubing.
C. Plates: ASTM A283/A283M.
E. Mechanical Fasteners: Same material as or compatible with materials being fastened; type consistent with design and specified quality level.
F. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
G. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

2.02  FABRICATION

A. Fit and shop assemble items in largest practical sections, for delivery to site.
B. Fabricate items with joints tightly fitted and secured.

C. Continuously seal joined members by continuous welds.

D. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
   1. Comply with NOMMA voluntary guidelines for joint finishes; Finish #2 - completely sanded joint, some undercutting and pinholes acceptable.

E. Provide for thermal expansion/contraction of exterior metal railings and similar linear fabrications exceeding 30 feet in running length; and not closer than 24 inches from corners and intersections.

F. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

G. Tubular and Hollow Fabrications: Fabricate with open ends or 1/8 inch diameter drilled holes for moisture weepage, unobtrusively located and concealed from view wherever possible.

H. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.03 FABRICATED ITEMS

A. Provide and install items shown on Drawings with anchorage and attachments necessary for installation.

B. The following is a list of principal items only. Refer to Drawing details for items not specifically scheduled.

C. Bollards: Steel pipe, concrete filled, crowned cap, as detailed; prime paint finish.
   1. Color: Paint Safety Yellow (RAL 1023) or as specified by Owner requirements.

D. Lintels: As detailed; prime paint finish.

E. Firestopping Sleeves: Comply with requirements of Section 8400, and supply to that Section for installation; unfinished.

2.04 ACCESSORIES

A. Non-Shrink Grout: ASTM C1107/C1107M, Grade B; pre-mixed compound consisting of non-metallic aggregate, cement, and manufacturer's specified water reducing and plasticizing agents; non-staining, non-gas-forming, containing no chlorides; plastic consistency as measured according to ASTM C230/C230M; capable of developing minimum compressive strength of 10,000 psi in 28 days.

2.05 FINISHES - STEEL

A. General:
   1. Prepare surfaces to be primed in accordance with SSPC-SP 2, or as recommended by finish coating manufacturer.
   2. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

B. Prime paint all steel items, unless otherwise specified.
   1. Exceptions: Do not prime surfaces in direct contact with concrete, where field welding is required, and items to be covered with sprayed fireproofing.
   2. Prime Painting: One coat.

2.06 FABRICATION TOLERANCES

A. Squareness: 1/8 inch maximum difference in diagonal measurements.

B. Maximum Offset Between Faces: 1/16 inch.

C. Maximum Misalignment of Adjacent Members: 1/16 inch.

D. Maximum Bow: 1/8 inch in 48 inches.

E. Maximum Deviation From Plane: 1/16 inch in 48 inches.
PART 3  EXECUTION

3.01  EXAMINATION
   A. Verify that field conditions are acceptable and are ready to receive work.

3.02  PREPARATION
   A. Clean and strip primed steel items to bare metal where site welding is required.
   B. Supply setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

3.03  INSTALLATION
   A. Install items plumb and level, accurately fitted, free from distortion or defects.
   B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
   C. Field weld components indicated on Drawings.
   D. Perform field welding in accordance with AWS D1.1/D1.1M.
   E. Obtain approval prior to site cutting or making adjustments not scheduled.
   F. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.

3.04  TOLERANCES
   A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.
   B. Maximum Offset From True Alignment: 1/4 inch.

END OF SECTION
SECTION 05 5113
PREFabricated metal stairs

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Prefabricated stairs.

1.02 REFERENCE STANDARDS
C. AWS D1.1/D1.1M - Structural Welding Code - Steel.

1.03 SUBMITTALS
A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide manufacturer's product data for prefabricated metal stair assemblies, indicating all specified features.
C. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories.
   1. Include the design engineer's seal and signature on each sheet of shop drawings.

PART 2 PRODUCTS

2.01 METAL STAIRS - GENERAL
A. Metal Stairs: Provide stairs of the design specified, complete with landing platforms, vertical and horizontal supports, railings, and guards, fabricated accurately for anchorage to each other and to building structure.
   1. Regulatory Requirements: Provide stairs and railings complying with the most stringent requirements of local, state, and federal regulations; where requirements of Contract Documents exceed those of regulations, comply with Contract Documents.
   2. Handrails: Comply with applicable accessibility requirements of ADA Standards.
   3. Dimensions: As indicated on Drawings.
   4. Shop assemble components; disassemble into largest practical sections suitable for transport and access to site.
   5. No sharp or rough areas on exposed travel surfaces and surfaces accessible to touch.
   6. Separate dissimilar metals using paint or permanent tape.

B. Metal Jointing and Finish Quality Levels:

C. Fasteners: Same material or compatible with materials being fastened; type consistent with design and specified quality level.

D. Anchors and Related Components: Same material and finish as item to be anchored, except where specifically indicated otherwise; provide all anchors and fasteners required.

2.02 PREFABRICATED STAIRS
A. Alternating Tread Stairs: Welded metal unit; factory fabricated to the greatest degree possible.
   1. Design Requirements:
      a. Stair Load Capacity: Support the following without exceeding the allowable working stress of the material.
         1) Single Point Load: 1000 pounds.
         2) Distributed Load: 100 pounds per square foot.
b. Guardrail and Handrail Capacity: Support the following without exceeding the allowable working stress of the material.
   1) Single Point Load: 200 pounds.
   2) Distributed Load: 50 pounds per linear foot.

   c. Support the following without exceeding the allowable working stress of the material.
   1) Single Point Load: 1000 pounds.
   2) Distributed Load: 100 pounds per square foot.

   a. Stair Angle: 68 degrees.
   b. Components: Manufacturer's standard handrails, guardrails, non-skid treads and stringers.
   c. Finish: Natural aluminum.
   d. Accessories: Manufacturer's standard foot divider with rubber bumper strip.

3. Acceptable Manufacturer:
   b. Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 PREPARATION
   A. When field welding is required, clean and strip primed steel items to bare metal.
   B. Supply items required to be cast into concrete and embedded in masonry with setting templates.

3.02 INSTALLATION
   A. Install components plumb and level, accurately fitted, free from distortion or defects.
   B. Provide anchors, plates, angles, hangers, and struts required for connecting stairs to structure.
   C. Allow for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
   D. Provide welded field joints where specifically indicated on Drawings. Perform field welding in accordance with AWS D1.1/D1.1M.
   E. Other field joints may be either welded or bolted provided the result complies with the limitations specified for jointing quality levels.
   F. Obtain approval prior to site cutting or creating adjustments not scheduled.
   G. After erection, prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.

3.03 TOLERANCES
   A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.
   B. Maximum Offset From True Alignment: 1/4 inch.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES
A. Prefabricated ladders.

1.02 REFERENCE STANDARDS
C. ASTM B211/B211M - Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold Finished Bar, Rod, and Wire.
D. AWS D1.1/D1.1M - Structural Welding Code - Steel.
E. AWS D1.2/D1.2M - Structural Welding Code - Aluminum.

1.03 SUBMITTALS
A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide manufacturer's product data for prefabricated metal ladder assemblies, indicating all specified features.
C. Shop Drawings:
   1. Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
   2. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

PART 2 PRODUCTS

2.01 MATERIALS - ALUMINUM
A. Extruded Aluminum: ASTM B211/B211M, 6063 alloy, T6 temper.
B. Aluminum-Alloy Drawn Seamless Tubes: ASTM B210/B210M, 6063 alloy, T6 temper.
C. Aluminum-Alloy Bars: ASTM B211/B211M, 6061 alloy, T6 temper.
D. Bolts, Nuts, and Washers: Stainless steel.
E. Welding Materials: AWS D1.2/D1.2M; type required for materials being welded.

2.02 FABRICATION
A. Fit and shop assemble items in largest practical sections, for delivery to site.
B. Fabricate items with joints tightly fitted and secured.
C. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
D. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.
E. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.03 PREFABRICATED LADDERS
A. Prefabricated Ladders: Welded metal unit complying with ANSI A14.3; factory fabricated to greatest degree practical and in the largest components possible.
1. Components: Manufacturer's standard rails, rungs, treads, handrails, returns, platforms and safety devices complying with the requirements of the MATERIALS article of this section.
2. Mounting Brackets: Provide intermediate and extended brackets as required for each indicated wall condition.
5. Basis of Design Manufacturers:
   c. Substitutions: See Section 01 6000 - Product Requirements.

2.04 FABRICATION TOLERANCES
A. Squareness: 1/8 inch maximum difference in diagonal measurements.
B. Maximum Offset Between Faces: 1/16 inch.
C. Maximum Misalignment of Adjacent Members: 1/16 inch.
D. Maximum Bow: 1/8 inch in 48 inches.
E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

PART 3 EXECUTION

3.01 EXAMINATION
A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION
A. Clean and strip primed steel items to bare metal where site welding is required.
B. Supply setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

3.03 INSTALLATION
A. Install items plumb and level, accurately fitted, free from distortion or defects.
B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
C. Field weld components as indicated on Drawings.
D. Perform field welding in accordance with AWS D1.1/D1.1M.
E. Obtain approval prior to site cutting or making adjustments not scheduled.
F. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.

3.04 TOLERANCES
A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.
B. Maximum Offset From True Alignment: 1/4 inch.

END OF SECTION
SECTION 05 5213
PIPE AND TUBE RAILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Wall mounted handrails.
   B. Free-standing railings at steps and ramps.
   C. Structural design of railing systems.

1.02 REFERENCE STANDARDS
   C. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design.
   E. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.

1.03 SUBMITTALS
   A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
   B. Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.

1.04 QUALITY ASSURANCE
   A. Structural Designer Qualifications: Professional Structural Engineer experienced in design of this work and licensed in Colorado, or personnel under direct supervision of such an engineer.

PART 2 PRODUCTS

2.01 RAILINGS - GENERAL REQUIREMENTS
   A. Design, fabricate, and test railing assemblies in accordance with the most stringent requirements of applicable local code.
      1. Distributed Loads: Design railing assembly, wall rails, and attachments to resist distributed force of 75 pounds per linear foot applied to the top of the assembly and in any direction, without damage or permanent set.
      2. Concentrated Loads: Design railing assembly, wall rails, and attachments to resist a concentrated force of 200 pounds applied at any point on the top of the assembly and in any direction, without damage or permanent set.
   B. Allow for expansion and contraction of members and building movement without damage to connections or members.
   C. Dimensions: See Drawings for configurations and heights.
D. Provide anchors and other components as required to attach to structure, made of same materials as railing components unless otherwise indicated; where exposed fasteners are unavoidable provide flush countersunk fasteners.

E. Provide welding fittings to join lengths, seal open ends, and conceal exposed mounting bolts and nuts, including but not limited to elbows, T-shapes, splice connectors, flanges, escutcheons, and wall brackets.

2.02 STEEL RAILING SYSTEM

A. Steel Tube: ASTM A500/A500M, Grade B cold-formed structural tubing.

B. Steel Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.

C. Welding Fittings: Factory- or shop-welded from matching pipe or tube; seams continuously welded; joints and seams ground smooth.

2.03 FABRICATION

A. Accurately form components to suit specific project conditions and for proper connection to building structure.

B. Fabricate components with joints tightly fitted and secured. Provide spigots and sleeves to accommodate site assembly and installation.

C. Welded Joints:
   1. Exterior Components: Continuously seal joined pieces by intermittent welds and plastic filler. Drill condensate drainage holes at bottom of members at locations that will not encourage water intrusion.
   2. Interior Components: Continuously seal joined pieces by intermittent welds and plastic filler.
   3. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

A. Comply with NOMMA voluntary guidelines for joint finishes; Finish #2 - completely sanded joint, some undercutting and pinholes acceptable.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

B. Supply items required to be cast into concrete or embedded in masonry with setting templates, for installation as work of other sections.

C. Apply one coat of bituminous paint to concealed aluminum surfaces that will be in contact with cementitious or dissimilar materials.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install components plumb and level, accurately fitted, free from distortion or defects, with tight joints.

C. Install railings in compliance with ADA Standards for accessible design at applicable locations.

D. Anchor railings securely to structure.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per floor level, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.


END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Formed metal floor gratings.

1.02 REFERENCE STANDARDS
   A. ASTM B211 - Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold Finished Bar, Rod, and Wire.
   B. ASTM B211M - Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold-Finished Bar, Rod, and Wire (Metric).

1.03 SUBMITTALS
   A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
   B. Product Data: Provide span and deflection tables.
   C. Shop Drawings: Indicate details of component supports, openings, perimeter construction details, and tolerances.

PART 2 PRODUCTS

2.01 MANUFACTURERS
   A. Acceptable Manufacturers:
      3. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS
   A. Design Loads:
      1. Load Design: NAAMM MBG 532.
   B. Maximum Allowable Deflection Under Live Load: 1/240 of span; size components by single support design.
   C. Maximum Spacing Between Bars: 4 inches, or as otherwise restricted by applicable code.

2.03 MATERIALS
   A. Aluminum For Lock Forming: ASTM B221 (ASTM B221M), extruded, shapes as indicated.
   B. Cross Bars: ASTM B211 (ASTM B211M) solid bars.

2.04 FABRICATION
   A. Grating Type: NAAMM MBG 532, Pressure Locked Type.
   B. Mechanically clinch joints of intersecting metal sections.
   C. Top Surface: Non-slip.
2.05 FINISHES
   A. Aluminum: Mill finish.

PART 3 EXECUTION

3.01 EXAMINATION
   A. Verify that opening sizes and dimensional tolerances are acceptable.
   B. Verify that supports are correctly positioned.

3.02 INSTALLATION
   A. Install components in accordance with manufacturer's instructions.
   B. Place frames in correct position, plumb and level.
   C. Set perimeter closure flush with top of grating and surrounding construction.
   D. Secure to prevent movement.

3.03 TOLERANCES
   A. Comply with NAAMM MBG 532.

END OF SECTION
SECTION 05 7300
DECORATIVE METAL RAILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Railing and guardrail assemblies.
B. Design engineering for stair and railing assemblies and anchorage to supporting structure.

1.02 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design.
H. AWS D1.1/D1.1M - Structural Welding Code - Steel.
I. AWS D1.6/D1.6M - Structural Welding Code - Stainless Steel.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Shop Drawings: Indicate railing system elevations and sections, details of profile, dimensions, sizes, connection attachments, anchorage, size and type of fasteners, and accessories. Indicate anchor and joint locations, brazed connections, transitions, and terminations.
C. Delegated Design Data: As required by authorities having jurisdiction.
   1. Design Calculations: Submit design calculations sealed by a registered Professional Engineer licensed in Colorado.
D. Test Reports: Submit test reports from an independent testing agency showing compliance with specified design and performance requirements.

1.04 QUALITY ASSURANCE

A. Structural Designer Qualifications: Professional Structural Engineer experienced in design of this work and licensed in Colorado, or personnel under direct supervision of such an engineer.
B. Installer Qualifications: Company specializing in installing decorative stairs and railing systems and acceptable to manufacturer.
C. Templates: Supply installation templates, reinforcing and required anchorage devices.

1.05 MOCK-UPS

A. Comply with general mock-up requirements specified in Section 01 4000.
B. Mock-ups: Construct an example of each railing design specified.
   1. Locate where directed.
   2. Mock-up may remain as part of the Work.
1.06 DELIVERY, STORAGE, AND HANDLING
   A. Deliver materials in factory provided protective coverings and packaging.
   B. Protect materials against damage during transit, delivery, storage, and installation at site.
   C. Inspect materials upon delivery for damage. Repair damage to be indistinguishable from undamaged areas; if damage cannot be repaired to be indistinguishable from undamaged parts and finishes, replace damaged items.
   D. Prior to installation, store materials and components under cover, in a dry location.

PART 2 PRODUCTS

2.01 RAILING SYSTEMS
   A. Railing Systems - General: Factory- or shop-fabricated in design indicated, to suit specific project conditions, and for proper connection to building structure, and in largest practical sizes for delivery to site.
      1. Performance Requirements: Design and fabricate railings and anchorages to resist the following loads without failure, damage, or permanent set; loads do not need to be applied simultaneously.
         a. Lateral Force: 75 lb minimum, at any point, when tested in accordance with ASTM E935.
         b. Distributed Load: 50 lb/ft minimum, applied in any direction at the top of the handrail, when tested in accordance with ASTM E935.
         d. Concentrated Load: 200 lbs minimum, applied in any direction at any point along the handrail system, when tested in accordance with ASTM E935.
   2. Assembly: Join lengths, seal open ends, and conceal exposed mounting bolts and nuts using slip-on non-weld mechanical fittings, flanges, escutcheons, and wall brackets.
   4. Field Connections: Provide sleeves to accommodate site assembly and installation.
   5. Welded Joints: Make exposed joints butt tight, flush, and hairline; use methods that avoid discoloration and damage of finish; grind smooth, polish, and restore to required finish.
      a. Ease exposed edges to small uniform radius.
   6. Welded Joints:
      a. Carbon Steel: Perform welding in accordance with AWS D1.1/D1.1M.
      b. Stainless Steel: Perform welding in accordance with AWS D1.6/D1.6M.
   B. Metal Railing: Engineered, post-supported railing system with metal mesh infill.
      1. Configuration: Guardrail only as detailed on Drawings.
      2. Wall Mounted Components: Components necessary to support railing with 1-1/2 inch clearance from wall, and as follows:
         3. Fasteners: Concealed.

2.02 MATERIALS
   A. Steel Components:
      1. Sections, Shapes, Plate and Bar: ASTM A36/A36M.

2.03 ACCESSORIES
   A. Welding Fittings: Factory- or shop-welded from matching pipe or tube; joints and seams ground smooth.
   B. Anchors and Fasteners: Provide anchors and other materials as required to attach to structure, made of same materials as railing components unless otherwise indicated; where exposed fasteners are unavoidable provide flush countersunk fasteners.
      1. For anchorage to concrete, provide inserts to be cast into concrete for bolting anchors.
      2. For anchorage to masonry, provide brackets to be embedded in masonry for bolting anchors.
      3. For anchorage to stud walls, provide backing plates for bolting anchors.
      4. Exposed Fasteners: No exposed bolts or screws.
D. Finish Touch-Up Materials: As recommended by manufacturer for field application.

PART 3 EXECUTION

3.01 EXAMINATION
A. Verify that substrate and site conditions are acceptable and ready to receive work.
B. Verify field dimensions of locations and areas to receive work.
C. Notify Architect immediately of conditions that would prevent satisfactory installation.
D. Do not proceed with work until detrimental conditions have been corrected.
E. Furnish components to be installed in other work to installer of that other work, including but not limited to blocking, sleeves, inserts, anchor bolts, embedded plates and supports for attachment of anchors.

3.02 PREPARATION
A. Review installation drawings before beginning installation. Coordinate diagrams, templates, instructions and directions for installation of anchorages and fasteners.
B. Clean surfaces to receive units. Remove materials and substances detrimental to the installation.

3.03 INSTALLATION
A. Comply with manufacturer's drawings and written instructions.
B. Install components plumb and level, accurately fitted, free from distortion or defects and with tight joints, except where necessary for expansion.
C. Anchor securely to structure.
D. Conceal anchor bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.
E. Weld connections that cannot be shop welded due to size limitations.
   1. Weld in accordance with AWS D1.1/D1.1M.
   2. Match shop welding and bolting.
   3. Clean welds, bolted connections and abraded areas.
   4. Touch up shop primer and factory applied finishes.
   5. Repair galvanizing with galvanizing repair paint per ASTM A780/A780M.
F. Isolate dissimilar materials with bituminous coating, bushings, grommets or washers to prevent electrolytic corrosion.

3.04 TOLERANCES
A. Maximum Variation From Plumb: 1/4 inch per floor level, non-cumulative.
B. Maximum Offset From True Alignment: 1/4 inch.

3.05 CLEANING
A. Remove protective film from exposed metal surfaces.
B. Metal: Clean exposed metal finishes with potable water and mild detergent, in accordance with manufacturer recommendations; do not use abrasive materials or chemicals, detergents or other substances that may damage the material or finish.

3.06 PROTECTION
A. Protect installed components and finishes from damage after installation.
B. Repair damage to exposed finishes to be indistinguishable from undamaged areas.
   1. If damage to finishes and components cannot be repaired to be indistinguishable from undamaged finishes and components, replace damaged items.

END OF SECTION
SECTION 06 1053
MISCELLANEOUS ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Preservative treated wood materials.
   B. Fire retardant treated wood materials.
   C. Concealed wood blocking, nailers, and supports.
   D. Miscellaneous wood nailers, furring, and grounds.

1.02 REFERENCE STANDARDS
   C. PS 1 - Structural Plywood.
   E. WWPA G-5 - Western Lumber Grading Rules.

1.03 ADMINISTRATIVE REQUIREMENTS
   A. Coordination:
      1. Coordinate installation of rough carpentry members specified in other Sections.
      2. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.

1.04 DELIVERY, STORAGE, AND HANDLING
   A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.
   B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, or installation.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS
   A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
      1. Species: Douglas Fir-Larch or Hem-Fir, unless otherwise indicated.
      2. Grading Agency: Any grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alsc.org) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.
   B. Lumber fabricated from recovered timber (abandoned in transit) is permitted in lieu of sustainably harvested lumber, unless otherwise noted, provided it meets the specified requirements for new lumber and is free of contamination; identify source.

2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS
   A. Grading Agency: Western Wood Products Association; WWPA G-5.
   B. Sizes: Nominal sizes as indicated on Drawings, S4S.
   C. Moisture Content: S-dry or MC19.
   D. Wood Blocking, Nailers, Grounds, and Furring:
      1. Lumber: S4S, No. 2 or Standard Grade.
      2. Boards: Standard or No. 3.
2.03 CONSTRUCTION PANELS
A. Communications and Electrical Room Mounting Boards: PS 1 A-D plywood, or medium density fiberboard; 3/4 inch thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.
B. Blocking Applications:
   1. Plywood Blocking/Nailers - Concealed From View But Located Within Exterior Enclosure: PS 1, C-C Plugged or better, Exterior grade.
   2. Plywood Blocking/Nailers - Other Locations: PS 1, C-D Plugged or better.

2.04 ACCESSORIES
A. Fasteners and Anchors:
   2. Anchors: Toggle bolt type for anchorage to hollow masonry.

2.05 FACTORY WOOD TREATMENT - GENERAL
A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
   1. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements, and also stamped "Kiln Dried After Treatment" ("KDAT").
   2. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards, and also stamped "Kiln Dried After Treatment" ("KDAT").

2.06 FIRE RETARDANT TREATMENT (FRT)
A. Interior Type: AWPA U1, Use Category UCFA, Commodity Specification H, low temperature (low hygroscopic) type, chemically treated and pressure impregnated; capable of providing a maximum flame spread index of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes.
   1. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
   2. Applications:
      a. Treat all interior rough carpentry items.
      b. Treat rough carpentry items as scheduled.
      c. Do not use treated wood in applications exposed to weather or where the wood may become wet.

2.07 PRESERVATIVE TREATMENT (PT)
A. Preservative Pressure Treatment of Lumber Above Grade: AWPA U1, Use Category UC3B, Commodity Specification A using waterborne preservative.
   1. Kiln dry lumber after treatment to maximum moisture content of 19 percent.
   2. Applications:
      a. Treat lumber in contact with roofing, flashing, or waterproofing.
      b. Treat lumber in contact with masonry or concrete.
      c. Treat lumber less than 18 inches above grade.
      d. Treat lumber in other locations as indicated.

PART 3 EXECUTION
3.01 INSTALLATION - GENERAL
A. Select material sizes to minimize waste.
B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including shims, bracing, and blocking.
C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.
3.02 BLOCKING, NAILERS, AND SUPPORTS

A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.

B. In framed assemblies that have concealed spaces, provide solid wood fireblocking as required by applicable local code, to close concealed draft openings between floors and between top story and roof/attic space; other material acceptable to code authorities may be used in lieu of solid wood blocking.

C. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.

D. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.

E. Provide the following specific non-structural framing and blocking:
   1. Cabinets and shelf supports.
   2. Wall brackets.
   3. Handrails.
   4. Grab bars.
   5. Towel and bath accessories.
   6. Wall-mounted door stops.
   7. Chalkboards and marker boards.
   8. Wall paneling and trim.
   9. Joints of rigid wall coverings that occur between studs.
   10. Other locations as detailed on Drawings.

3.03 INSTALLATION OF CONSTRUCTION PANELS

A. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches on center on all edges and into studs in field of board.
   1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
   2. Install adjacent boards without gaps.
   3. Size and Location: As indicated on Drawings.

3.04 SITE APPLIED WOOD TREATMENT

A. Apply preservative treatment compatible with factory applied treatment at site-sawn cuts, complying with manufacturer's instructions.

B. Allow preservative to dry prior to erecting members.

3.05 CLEANING

A. Waste Disposal:
   1. Comply with applicable regulations.
   2. Do not burn scrap on project site.
   3. Do not burn scraps that have been pressure treated.
   4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or "waste-to-energy" facilities.

B. Do not leave any wood, shavings, sawdust, or similar waste on the ground or buried in fill.

C. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION
SECTION 06 2000
FINISH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Finish carpentry items, including:
   1. Wood casings and moldings.
   2. Balle barres.
   3. Other items as detailed on Drawings.

1.02 REFERENCE STANDARDS

A. ANSI A208.2 - American National Standard for Medium Density Fiberboard for Interior Use.
D. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.
B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
   1. Scale of Drawings: 1-1/2 inch to 1 foot, minimum.
   2. Provide the information required by AWI/AWMAC/WI (AWS).
C. Samples: Submit two samples of each type of wood trim 12 inch long, illustrating profiles and completed finishes.

1.04 QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in fabricating the products specified in this Section with minimum five years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store finish carpentry items under cover, elevated above grade, and in a dry, well-ventilated area not exposed to heat or sunlight.
   1. Store finish carpentry items in installation areas. If finish carpentry items must be stored in other than installation areas, store only where environmental conditions meet requirements specified for installation areas.
   2. Stack lumber and provide for adequate air circulation within and around stacks and under temporary coverings.
   3. Protect from moisture damage.

B. Handle materials and products to prevent damage to edges, ends, or surfaces.

1.06 ENVIRONMENTAL CONDITIONS

A. Comply with specified standard and as additionally specified.
B. Do not deliver finish carpentry items until environmental conditions meet specified requirements for installation areas.
C. Do not deliver or install finish carpentry items until building is enclosed and weatherproof, wet work in installation areas is complete and nominally dry, and building's environmental control systems are operating and will maintain temperature and relative humidity at designed occupancy levels throughout the remainder of the construction period.
PART 2 PRODUCTS

2.01 FINISH CARPENTRY ITEMS
A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS), unless otherwise specified for each carpentry item.
B. Interior Woodwork Items:
   1. Moldings, Bases, Casings, and Miscellaneous Trim: Medium density fiberboard; prepare for paint finish.
   2. Ballet Barres: As specified in this Section.
   3. Other Items: As detailed on Drawings.

2.02 LUMBER MATERIALS
A. Hardwood Lumber: White maple species, plain or quarter sawn, maximum moisture content of 6 percent according to ASTM D4442; with flat grain, of quality suitable for transparent finish.

2.03 SHEET MATERIALS
A. Medium Density Fiberboard (MDF): ANSI A208.2; Grade 130; pressed hardwood or softwood fibers, made with fire-retardant and waterproof resin binders, tempered grade; sanded faces.
   1. Fire-retardant additive blended with wood fibers during manufacturing process; product inherently capable of providing Class 1 flame spread index and smoke developed index when tested in accordance with ASTM E84.
   2. Core: Dyed red to identify product.
   3. Acceptable Product:
      b. Substitutions: See Section 01 6000 - Product Requirements.

2.04 FASTENINGS
A. Fasteners: Of size and type to suit application; galvanized finish.
B. Concealed Joint Fasteners: Threaded steel.

2.05 ACCESSORIES
A. Lumber for Shimming and Blocking: Softwood lumber of fir or pine species.
B. Primer: Alkyd primer sealer.
C. Wood Filler: Latex base, tinted to match surface finish color.
D. Ballet Barre (Bar Mount) Bracket: Cast stainless steel bar.
   1. Size: 7 inches from wall.
   2. Bars: White maple, 1-5/8 inch diameter; clear finish.
   3. Acceptable Product:
      b. Substitutions: See Section 01 6000 - Product Requirements.

2.06 FABRICATION
A. Shop assemble work for delivery to site, permitting passage through building openings.
B. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

PART 3 EXECUTION

3.01 EXAMINATION
A. Verify adequacy of backing and support framing.
3.02 INSTALLATION
A. Install custom fabrications in accordance with AWI/AWMAC/WI (AWS) requirements for grade indicated.
B. Set and secure materials and components in place, plumb and level.
C. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim to conceal larger gaps.
D. Install components with finish nails at maximum 8 inch on center.
E. Install finish carpentry items with minimum number of joints practical, using full length pieces from maximum lengths of lumber available. Do not use individual pieces less than 24 inches long, except where necessary.
   1. Stagger joints in adjacent and related standing and running trim.
   2. Cope at returns and miter at corners to produce tight-fitting joints with full surface contact throughout the length of joints.
   3. Use scarf joints at end-to-end joints.
   4. Plane back surfaces of casings as required to provide uniform thickness and flush finished surfaces across joints.
   5. Match color and grain across joints.
F. Install trim after finishing of substrate surfaces is complete.
G. Pre-drill pilot holes in hardwood carpentry items before fastening to prevent splitting. Securely fasten to prevent warping or movement.

3.03 PREPARATION FOR SITE FINISHING
A. Set exposed fasteners. Apply wood filler in exposed fastener indentations. Sand work smooth.
B. Site Finishing: See Section 09 9123 and 09 9300.
C. Before installation, prime paint surfaces of items or assemblies to be in contact with cementitious materials.

3.04 TOLERANCES
A. Maximum Variation from True Position: 1/16 inch.
B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch.

3.05 PROTECTION
A. Protect installed finish carpentry items from damage due to subsequent construction operations.

END OF SECTION
SECTION 06 4100
ARCHITECTURAL WOOD CASEWORK

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Specially fabricated cabinet units.
B. Hardware.
C. Factory finishing.
D. Preparation for installing utilities.

1.02 RELATED REQUIREMENTS
A. Section 12 3600 - Countertops and Bench Tops.

1.03 REFERENCE STANDARDS
A. ANSI A208.2 - American National Standard for Medium Density Fiberboard for Interior Use.
C. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards.
D. BHMA A156.9 - American National Standard for Cabinet Hardware.
E. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood.
F. NEMA LD 3 - High-Pressure Decorative Laminates.

1.04 ADMINISTRATIVE REQUIREMENTS
A. Coordination: Coordinate fabrication schedule with construction progress to avoid delaying the Work.
   1. Field verify critical dimensions and clearances prior to fabrication of casework items; assure that field conditions are as required to comply with indicated design requirements.
   2. By accurate field measurements before being enclosed, verify locations of concealed framing, blocking, reinforcements, and furring that support woodwork; record measurements on shop drawings.
   3. Where field measurements cannot be made without delaying work, establish required dimensions and maintain those dimensions for fabrication of woodwork.
   4. Coordinate construction to ensure that actual dimensions correspond to established required dimensions.
   5. Coordinate cabinet spacing and clearances to ensure that doors and drawers do not conflict with each other.
   6. Coordinate cabinet opening and spacing requirements with approved appliances and plumbing fixtures.

1.05 SUBMITTALS
A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
   1. Scale of Drawings: 1-1/2 inch to 1 foot, minimum.
   2. Provide the information required by AWI/AWMAC/WI (AWS).
   3. Shop drawings are required to be generated as separate digital drawings specific to this Project, not utilizing Architect's digital drawing files in any manner; comply with other restrictions on use of Architect's digital drawing files specified in Section 01 3000.
   4. Show all adjacent construction including abutting walls, columns and similar elements affecting casework installation.
C. Product Data: Provide data for hardware accessories.
D. Samples: Submit actual samples of architectural cabinet face construction, minimum 12 inches square, illustrating proposed cabinet substrate and finish.

E. Samples: Submit actual sample items of proposed pulls, hinges, shelf standards, and locksets, demonstrating hardware design, quality, and finish.

1.06 QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in fabricating the products specified in this Section with minimum five years of documented experience.
   1. Company with at least one project in the past 5 years with value of woodwork within 20 percent of cost of woodwork for this Project.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver casework items to installation areas only after clean, well ventilated, and temperature-controlled installation areas are available. Do not deliver casework items to installation areas until painting and similar operations are complete in those areas.

B. Protect units from moisture and impact damage during transit, delivery, and storage; use protective covers during delivery, storage, and handling operations.

1.08 FIELD CONDITIONS

A. Do not deliver or install casework items until building is enclosed and weatherproof, and building's environmental control systems are operating and will maintain temperature and relative humidity at designed occupancy levels throughout the remainder of the construction period.

B. During and after installation of custom cabinets, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.

PART 2 PRODUCTS

2.01 CABINETS

A. Quality Standard - General: Grades as indicated or specified, in accordance with AWI/AWMAC/WI (AWS).

B. Wood Veneer Faced Cabinets:
   1. Quality Standard: Premium Grade, unless noted otherwise.
   2. Exposed Surfaces: HPVA HP-1 Grade A, Maple, plain sliced, random-matched.
   4. Concealed Surfaces: Manufacturer's option.

C. Plastic Laminate Faced Cabinets:
   1. Quality Standard: Custom Grade, unless noted otherwise.

2.02 SHEET MATERIALS

A. Hardwood Plywood: Face species as indicated, plain sawn, balance matched, medium density fiberboard core; HPVA HP-1, Front Face Grade AA, Back Face Grade 1, glue type as recommended for application.

B. Thermally Fused Melamine (TFM): NEMA LD 3, Type VGL laminate panels; resin-impregnated decor paper thermally fused to medium density fiberboard (MDF).

C. Medium Density Fiberboard (MDF): ANSI A208.2; Grade 130; pressed hardwood or softwood fibers, made with fire-retardant and waterproof resin binders, tempered grade; sanded faces.
   1. Fire-retardant additive blended with wood fibers during manufacturing process; product inherently capable of providing Class 1 flame spread index and smoke developed index when tested in accordance with ASTM E84.
   2. Core: Dyed red to identify product.
   3. Acceptable Product:
      b. Substitutions: See Section 01 6000 - Product Requirements.
2.03 LAMINATE MATERIALS
   A. High Pressure Decorative Laminate (HPDL): NEMA LD 3, types as recommended for specific applications.

2.04 COUNTERTOPS
   A. Countertops are specified in Section 12 3600.

2.05 ACCESSORIES
   A. Adhesive: Type recommended by fabricator to suit application; non-water-based.
   B. Counter Support Brackets: Tempered, fabricated steel brackets designed for surface or flush mounting as indicated; sizes and configurations as indicated.
      1. Acceptable Product:
         b. Substitutions: See Section 01 6000 - Product Requirements.
   C. Fasteners: Size and type to suit application.
   D. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; galvanized or chrome-plated finish in concealed locations and stainless steel or chrome-plated finish in exposed locations.
   E. Concealed Joint Fasteners: Threaded steel.

2.06 HARDWARE
   A. Hardware: BHMA A156.9, types as recommended by fabricator for quality grade specified, unless otherwise specified.
   B. Drawer and Door Pulls: "U" shaped wire pull, steel with satin finish, 4 inch centers.
   C. Cabinet Locks: Keyed cabinet-grade lock, two keys per lock, steel with satin finish.
   D. Drawer Slides:
      1. Type: Full extension with overtravel.
      2. Static Load Capacity: Commercial grade.
      4. Stops: Integral type.
   E. Hinges: European style concealed, self-closing type, steel with satin finish.

2.07 FABRICATION
   A. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.
   B. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.
   C. Fitting: When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide matching trim for scribing and site cutting.
   D. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Locate counter butt joints minimum 2 feet from sink cut-outs.
      1. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.
      2. Apply thermally fused laminate to inside of cabinets on exposed and semi-exposed surfaces, and to shelving surfaces.
      3. Cap exposed plastic laminate finish edges with material of same finish and pattern.
   E. Matching Wood Grain: Comply with requirements of quality standard for specified Grade and as follows:
      1. Provide balance matched panels at each elevation.
      2. Provide sequence matching across each elevation.
F. Mechanically fasten back splash to countertops as recommended by laminate manufacturer at 16 inches on center.

G. Provide cutouts for plumbing fixtures. Verify locations of cutouts from on-site dimensions. Prime paint cut edges.

2.08 SHOP FINISHING

A. Sand work smooth and set exposed nails and screws.

B. On items to receive transparent finishes, use wood filler matching or blending with surrounding surfaces and of types recommended for applied finishes.

C. Finish work in accordance with AWI/AWMAC/WI (AWS), Section 5 - Finishing for grade specified and as follows:
   1. Transparent:
      a. System - 12, Polyurethane, Water-based.
      b. Stain: As selected by Architect.
      c. Sheen: Satin.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify adequacy of backing and support framing.

B. Verify location and sizes of utility rough-in associated with work of this Section.

C. Verify critical clearances and dimensions prior to installation of casework items.

3.02 INSTALLATION

A. Install work in accordance with AWI/AWMAC/WI (AWS) requirements for grade indicated.

B. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.

C. Use fixture attachments in concealed locations for wall mounted components.

D. Use concealed joint fasteners to align and secure adjoining cabinet units.

E. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose.

F. Secure cabinets to floor using appropriate angles and anchorages.

G. Secure full height cabinets, shelving units, and similar casework items exceeding 60 inches in height to floor using appropriate angles and anchorages.

3.03 ADJUSTING

A. Adjust moving or operating parts to function smoothly and correctly.

3.04 CLEANING

A. Clean casework, counters, shelves, hardware, fittings, and fixtures.

3.05 PROTECTION

A. Protect installed casework items from damage due to subsequent construction operations.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES
A. Plastic-fabricated locker room bench seating.
B. Attachment components and accessories.

1.02 REFERENCE STANDARDS

1.03 SUBMITTALS
A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Shop Drawings: Submit shop drawings indicating materials, component profiles, fastening methods, jointing details, finishes, and accessories to a minimum scale of 1-1/2 inch to one foot.
C. Product Data: Submit data for use of attachment hardware.
D. Samples: Submit two samples 12 inches long of plastic carpentry profiles.
   1. Submit samples of available colors and textures for selection.
E. Maintenance Materials:
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Supply two seating planks and mounting brackets for Owner's use in maintenance of project.

1.04 QUALITY ASSURANCE
A. Installer Qualifications: Company specializing in performing the work of this Section and approved by manufacturer.

1.05 DELIVERY, STORAGE, AND PROTECTION
A. Store materials in ventilated, interior locations under constant minimum temperature of 60 degrees F.

PART 2 PRODUCTS

2.01 MANUFACTURERS
A. Acceptable Manufacturer:
   2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS
A. Plastic Lumber: Manufacturer's proprietary HDPE formulation, containing UV-inhibitive pigments, anti-oxidant processing aids, and foaming agents as required for indicated end-uses; wood-grain textured surfaces; continuous lengths with finished ends and edges; profiles as indicated on Drawings.
   1. Conform to ASTM E84 and applicable code for fire retardant requirements.
   2. Color: As selected by Architect from manufacturer's full line.

2.03 ACCESSORIES
A. Mounting Brackets: Stainless steel; specified in Section 05 5000.
B. Bolts, Nuts, Washers, Lags, and Screws: Size and type to suit application; non-corrosive base metal.

2.04 FABRICATION
A. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.
PART 3 EXECUTION

3.01 EXAMINATION
   A. Verify that field measurements are as indicated on Drawings.
   B. Verify that surfaces and openings are ready to receive work and field measurements are as required for proper installation.
   C. Verify mechanical, electrical, and building items affecting work of this Section are placed and ready to receive this work.
   D. Beginning of installation means acceptance of conditions.

3.02 INSTALLATION
   A. Install work in accordance with manufacturer’s printed specifications and recommendations.
   B. Set and secure materials and components in place, plumb, and level.
   C. Install components with concealed or countersunk fasteners as appropriate to each item.

3.03 TOLERANCES
   A. Maximum Variation From True Position: 1/8 inch.
   B. Maximum Offset From True Alignment: 1/8 inch.

3.04 PROTECTION
   A. Protect finished installation from damage, including edges, corners, and finished surfaces.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES
A. Fiberglass reinforced plastic panels.
B. Accessories and trim.

1.02 REFERENCE STANDARDS
G. ISO 2812-1 - Paints and varnishes -- Determination of resistance to liquids -- Part 1: Immersion in liquids other than water.

1.03 SUBMITTALS
A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.

1.04 DELIVERY, STORAGE, AND HANDLING
A. Store panels flat, indoors, on a clean, dry surface. Remove packaging and allow panels to acclimate to room temperature for 48 hours prior to installation.

1.05 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 absolute limits.

PART 2 PRODUCTS

2.01 MANUFACTURERS
A. Acceptable Manufacturers - Panels:
   6. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PANEL SYSTEMS
A. Wall Panels:
   1. Panel Size: As indicated on Drawings.
   2. Panel Thickness: 0.10 inch (2.5 mm).
4. Color: As selected by Architect from manufacturer's full line.
5. Attachment Method: Adhesive only, with trim and sealant in joints.

2.03 MATERIALS

A. Panels: Fiberglass reinforced plastic (FRP), complying with ASTM D5319.
   1. Surface Burning Characteristics: Maximum flame spread index of 25 and smoke developed index of 450; when system tested in accordance with ASTM E84.
   2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
   3. Scratch Resistance: Barcol hardness score greater than 35, when tested in accordance with ASTM D2583.
   4. Impact Strength: Greater than 6 ft lb force per inch, when tested in accordance with ASTM D256.
   5. Chemical Cleanability: Excellent chemical resistance to common cleaners and detergents when tested in accordance with ISO 2812-1.
   6. Biological Resistance: Rating of 0, when tested in accordance with ISO 846.

B. Trim: Vinyl; color coordinating with panel.

C. Sealant: Silicone; color matching panel.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions and substrate flatness before starting work.
   B. Verify that substrate conditions are ready to receive the work of this section.

3.02 INSTALLATION - WALLS

A. Install panels in accordance with manufacturer's instructions.
   B. Cut and drill panels with carbide tipped saw blades, drill bits, or snips.
   C. Apply adhesive to the back side of the panel using trowel as recommended by adhesive manufacturer.
   D. Apply panels to wall with seams plumb and pattern aligned with adjoining panels.
   E. Install panels with manufacturer's recommended gap for panel field and corner joints.
   F. Place trim on panel before fastening edges, as required.
   G. Fill channels in trim with sealant before attaching to panel.
   H. Install trim with adhesive and screws or nails, as required.
   I. Seal gaps at floor, ceiling, and between panels with applicable sealant to prevent moisture intrusion.
   J. Remove excess sealant after paneling is installed and prior to curing.

END OF SECTION
SECTION 07 0553
FIRE AND SMOKE ASSEMBLY IDENTIFICATION

PART 1 GENERAL
1.01 SECTION INCLUDES
   A. Identification markings for fire and smoke rated partitions, and fire rated walls.

1.02 REFERENCE STANDARDS
   A. ICC (IBC) - International Building Code.

1.03 SUBMITTALS
   A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
   B. Product Data: Manufacturer's printed product literature for each type of marking, indicating font, foreground and background colors, wording, and overall dimensions.
   C. Schedule: Completely define scope of proposed marking, and indicate location of affected walls and partitions, and number of markings.

1.04 FIELD CONDITIONS
   A. Do not install adhered markings when ambient temperature is lower than recommended by label or sign manufacturer.
   B. Do not install painted markings when ambient temperature is lower than recommended by coating manufacturer.

PART 2 PRODUCTS
2.01 MANUFACTURERS
   A. Acceptable Manufacturers:
      3. Substitutions: See Section 01 6000 - Product Requirements.

2.02 ASSEMBLY IDENTIFICATION - GENERAL
   A. Provide all signs required by Authority Having Jurisdiction (AHJ) for marking and identification of fire walls, fire barriers, fire partitions, smoke barriers, smoke partitions, and other walls required to have protected openings; determine requirements and report to Owner and Architect prior to making specified submittals.
      1. Include cost of these signs in Contract Sum.

2.03 FIRE AND SMOKE ASSEMBLY IDENTIFICATION
   B. Adhered Fire and Smoke Assembly Identification Signs: Printed vinyl sign with factory applied adhesive backing.
   C. Applied Fire and Smoke Assembly Identification: Identification markings applied to partition with paint and a code compliant stencil.
   D. Languages: Provide sign markings in English and Spanish.

2.04 WALL, BARRIER, AND PARTITION SIGNS
   A. Sign Type: Flat signs with applied character media; permanent materials and installation.
      1. Sign Copy: Lettering not less than 0.5 inch high; copy content as specified in this Section or required otherwise by applicable Code.
PART 3 EXECUTION

3.01 EXAMINATION
   A. Verify that substrate surfaces are ready to receive work.

3.02 PREPARATION
   A. See Section 09 9123 for substrate preparation for painted markings.

3.03 INSTALLATION - GENERAL
   A. Locate markings as required by ICC (IBC), and as follows:
       1. Sign Copy: "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS."
       2. Locations:
          a. Accessible concealed ceilings above ceiling plane.
          b. Accessible floor-ceiling spaces.
          c. Accessible attic spaces.
       3. Spacing: Maximum 30 feet on center, measured along wall or partition; minimum one sign on each wall plane or surface.
   B. Install adhered markings in accordance with manufacturer's instructions.
   C. Install applied markings in general accordance with Section 09 9123.
   D. Install neatly, with horizontal edges level.
   E. Protect from damage until Date of Substantial Completion; repair or replace damaged markings.

3.04 THROUGH-PENETRATION FIRESTOPPING IDENTIFICATION
   A. Identify firestopping systems with pre-printed metal or plastic labels. Attach label permanently to surfaces immediately adjacent to and within 6 inches of edge of firestop installation so that label will be visible to anyone seeking to remove penetrating items or firestop system.
       1. Metal Labels: Use mechanical fasteners.
       2. Plastic Labels: Use self-adhering type with adhesive capable of permanently bonding label to substrate and, in combination with label material, will result in partial destruction of label if removal is attempted.
   B. Include following information on each label:
       1. The words "WARNING - THROUGH-PENETRATION FIRESTOP SYSTEM - DO NOT DISTURB. NOTIFY BUILDING MANAGEMENT OF ANY DAMAGE."
       2. Installing contractor's name, address, and phone number.
       3. Firestop system designation, including applicable testing and inspection agency.
       4. Date of installation.
       5. Firestop system manufacturer's name.
       6. Installer's name.

END OF SECTION
SECTION 07 1113
BITUMINOUS DAMPPROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Bituminous dampproofing.
   B. Protection boards.

1.02 REFERENCE STANDARDS

1.03 SUBMITTALS
   A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
   B. Product Data: Provide properties of primer, bitumen, and mastics.
   C. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

1.04 QUALITY ASSURANCE
   A. Installer Qualifications: Company specializing in performing the work of this Section with at least three years of documented experience and approved by manufacturer.

1.05 FIELD CONDITIONS
   A. Maintain ambient temperatures above 40 degrees F for 24 hours before and during application until dampproofing has cured.

PART 2 PRODUCTS

2.01 BITUMINOUS DAMPPROOFING
   A. Bituminous Dampproofing: Cold-applied, spray-grade; asphalt base, volatile petroleum solvents, and other content, suitable for application by spray, brush, roller, or squeegee; asbestos-free; suitable for application on vertical and horizontal surfaces.
      1. Composition: ASTM D4479/D4479M Type I, minimum, asbestos free.
      2. VOC Content: Not more than permitted by local, State, and federal regulations.
      3. Applied Thickness: 1/16 inch, minimum, wet film.
      4. Acceptable Products:
         b. Substitutions: See Section 01 6000 - Product Requirements.

   B. Primers, Mastics, and Related Materials: Type as recommended by dampproofing manufacturer.

2.02 ACCESSORIES
   A. Protection Board: Rigid insulation specified in Section 07 2100.

PART 3 EXECUTION

3.01 EXAMINATION
   A. Verify existing conditions are acceptable prior to starting this work.
   B. Verify substrate surfaces are durable, free of matter detrimental to adhesion or application of dampproofing system.
   C. Verify that items penetrating surfaces to receive dampproofing are securely installed.
3.02 PREPARATION
   A. Protect adjacent surfaces not designated to receive dampproofing.
   B. Clean and prepare surfaces to receive dampproofing in accordance with manufacturer's instructions.
   C. Do not apply dampproofing to surfaces unacceptable to manufacturer.
   D. Apply mastic to seal penetrations, small cracks, or minor honeycombs in substrate.

3.03 APPLICATION
   A. Foundation Walls: Apply two coats of asphalt dampproofing.
   B. Prime surfaces in accordance with manufacturer's instructions.
   C. Apply bitumen by spray application.
   D. Apply from 2 inches below finish grade elevation down to bottom of foundation walls.
   E. Seal items watertight with mastic, that project through dampproofing surface.
   F. Place protection board directly over dampproofing, butt joints, and adhere to tacky dampproofing.
   G. Scribe and cut boards around projections, penetrations, and interruptions.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Self-adhered modified bituminous sheet membrane.

1.02 REFERENCE STANDARDS
   D. ASTM D903 - Standard Test Method for Peel or Stripping Strength of Adhesive Bonds.
   E. ASTM D1876 - Standard Test Method for Peel Resistance of Adhesives (T-Peel Test).
   H. ASTM E154/E154M - Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.

1.03 ADMINISTRATIVE REQUIREMENTS
   A. Coordination:
      1. Coordinate with concrete installer for surface preparation required prior to installation of waterproofing system at indicated locations.

1.04 SUBMITTALS
   A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
   B. Product Data: Provide data for membrane, surface conditioner, flexible flashings, and joint and crack sealants.
   C. Shop Drawings: Indicate special joint or termination conditions and conditions of interface with other materials.
   D. Manufacturer’s Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention, and acceptable installation temperatures.
   E. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner’s name and registered with manufacturer.

1.05 QUALITY ASSURANCE
   A. Installer Qualifications: Company specializing in performing the work of this Section with minimum five years experience and approved, licensed or acceptable to waterproofing manufacturer for installation of waterproofing required for this Project.

1.06 FIELD CONDITIONS
   A. Maintain ambient temperatures above 40 degrees F for 24 hours before and during application, unless otherwise allowed by manufacturer’s requirements, and until liquid or mastic accessories have cured.

1.07 WARRANTY
   A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
B. Special Manufacturer’s Warranty: Manufacturer’s standard form in which manufacturer agrees to replace waterproofing material that does not comply with requirements or that fails to remain watertight within specified warranty period.
   1. Failure includes, but is not limited to, failure of waterproofing due to failure of substrate prepared and treated according to requirements or formation of new joints and cracks in substrate exceeding 1/16 inch in width.
   2. Warranty Period: Five years from date of Substantial Completion
C. Special Installer’s Warranty: Specified Contractor’s form, signed by Subcontractor, covering Work of this Section, for warranty period of two years.
   1. Warranty includes removing and reinstalling protection board, drainage panels, insulation, pedestals, and pavers on plaza decks.

PART 2  PRODUCTS

2.01 WATERPROOFING APPLICATIONS
A. Self-Adhered Modified Bituminous Sheet Membrane:
   1. Location: Where indicated on Drawings.
   2. Cover with drainage panel.

2.02 MEMBRANE MATERIALS
A. Self-Adhered Modified Bituminous Sheet Membrane:
   1. Thickness: 60 mil, 0.060 inch, minimum.
   2. Sheet Width: 36 inch, minimum.
   3. Tensile Strength:
      a. Film: 5000 pounds per square inch, minimum, measured according to ASTM D882 and at grip-separation rate of 2 inches per minute.
      b. Membrane: 325 pounds per square inch, minimum, measured according to ASTM D412 Method A, using die C and at spindle-separation rate of 2 inches per minute.
   4. Elongation at Break: 300 percent, minimum, measured according to ASTM D412.
   5. Peel Strength: 7 pounds per inch, minimum, when tested according to ASTM D903.
   6. Lap Adhesion Strength: 4 pounds per inch, minimum, when tested according to ASTM D1876.
   7. Puncture Resistance: 50 pounds, minimum, measured in accordance with ASTM E154/E154M.
   8. Water Absorption: 0.1 percent increase in weight, maximum, measured in accordance with ASTM D570, 24 hour immersion.
   9. Hydrostatic Resistance: Resists the weight of 200 feet when tested according to ASTM D570, 24 hour immersion.
   10. Adhesives, Sealants, Tapes, and Accessories: As recommended by membrane manufacturer.
   11. Acceptable Products:
      b. GCP Applied Technologies; Bituthene 3000: www.gcpat.com/sle.
      d. Substitutions: See Section 01 6000 - Product Requirements.

2.03 ACCESSORIES
A. Accessory Materials: All accessory materials required by primary membrane manufacturer for use with specified waterproofing system to produce complete installation in all respects.
   1. Seaming Materials: As recommended and supplied by membrane manufacturer.
   2. Membrane Sealant: As recommended and supplied by membrane manufacturer.
   3. Flexible Flashings: Type recommended and supplied by membrane manufacturer.
   4. Adhesives: As recommended and supplied by membrane manufacturer.
   5. Thinner and Cleaner: As recommended by adhesive manufacturer, compatible with sheet membrane.
   6. Sealant for Cracks and Joints In Substrates: Resilient elastomeric joint sealant compatible with substrates and waterproofing materials.

B. Protection Board: Rigid insulation as specified in Section 07 2100.
C. Drainage Panel: Drainage layer with geotextile filter fabric on earth side; minimum 1/4 inch thick.
   1. Composition: Dimpled polystyrene, polyethylene, or polypropylene core; polypropylene filter fabric.
   2. Acceptable Products:
      a. Product provided or recommended by waterproofing system manufacturer; compatible with all system components.
      b. Substitutions: See Section 01 6000 - Product Requirements.

PART 3  EXECUTION

3.01  EXAMINATION
A. Verify substrate surfaces are durable; free of matter detrimental to adhesion or application of waterproofing system.
B. Verify items that penetrate surfaces to receive waterproofing are securely installed.

3.02  PREPARATION
A. Protect adjacent surfaces from damage not designated to receive waterproofing.
B. Clean and prepare surfaces to receive waterproofing in accordance with manufacturer's instructions; vacuum substrate clean.
C. Do not apply waterproofing to surfaces unacceptable to membrane manufacturer.
D. Concrete Surfaces for Adhesive Bonding: Prepare concrete substrate according to ASTM D5295/D5295M.
   1. Remove substances that inhibit adhesion including form release agents, curing compounds admixtures, laitance, moisture, dust, dirt, grease and oil.
   2. Repair surface defects including honeycombs, fins, tie holes, bug holes, sharp offsets, rutted cracks, ragged corners, deviations in surface plane, spalling and delaminations, as described in the reference standard.
   3. Remove and replace areas of defective concrete as specified in Section 03 3000.
   4. Prepare concrete for adhesive bonded waterproofing using mechanical or chemical methods described in the referenced standard.
   5. Test concrete surfaces as described in the referenced standards. Verify surfaces are ready to receive adhesive bonded waterproofing membrane system.

3.03  INSTALLATION - MEMBRANE
A. Install membrane waterproofing in accordance with manufacturer's instructions.
B. Roll out membrane, and minimize wrinkles and bubbles.
C. Self-Adhering Membrane: Remove release paper layer, and roll out onto substrate with a mechanical roller to provide full contact bond.
D. Overlap edges and ends, minimum 3 inches, seal permanently waterproof by method recommended by manufacturer, and apply uniform bead of sealant to joint edge.
E. Reinforce membrane with multiple thickness of membrane material over joints, whether joints are static or dynamic.
F. Weather lap joints on sloped substrate in direction of drainage, and seal joints and seams.
G. Flexible Flashings: Seal items watertight that penetrate through waterproofing membrane with flexible flashings.
H. Seal membrane and flashings to adjoining surfaces.

3.04  INSTALLATION - DRAINAGE PANEL AND PROTECTION BOARD
A. Place drainage panel directly against membrane, butt joints, place to encourage drainage downward. Scribe and cut boards around projections, penetrations, and interruptions.
B. Place protection board directly against drainage panel; butt joints. Scribe and cut boards around projections, penetrations, and interruptions.
C. Install drainage panels so that geotextile fabric laps subsequent panels to prevent soil from entering drainage panel core. Wrap top of top panel with additional fabric layer to prevent soil from entering drainage core.

3.05 FIELD QUALITY CONTROL

A. Owner will provide testing services in accordance with Section 01 4000 - Quality Requirements.
   1. Provide temporary construction and materials for testing.
   2. Require manufacturer's field representative to observe waterproofing system installations on a daily basis throughout the installation process when such work is being performed.
   3. Comply with instructions provided by manufacturer's field representative for installation of waterproofing systems, whether or not specifically included in manufacturer's printed installation instructions and specifications, to ensure that installations will comply with all system manufacturer's requirements to provide specified warranty, and to ensure that waterproofing systems will perform according to manufacturer's published performance characteristics and specifications.

3.06 PROTECTION

A. Do not permit traffic over unprotected or uncovered membrane.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Graffiti-resistant coating to exterior masonry surfaces.

1.02 ADMINISTRATIVE REQUIREMENTS
   A. Preinstallation Meeting: Convene a meeting at least one week prior to starting work; require attendance of affected installers; invite Architect and Owner.
      1. Convene under general provisions of Section 01 7000.

1.03 SUBMITTALS
   A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
   B. Product Data: Provide product description, details of tests performed, limitations, and chemical composition.
   C. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention; cautionary procedures required during application.
   D. Manufacturer's Field Reports: Report whether manufacturer's "best practices" are being followed; if not, state corrective recommendations. Email report to Architect the same day as inspection occurs; mail report on manufacturer's letterhead to Architect within 2 days after inspection.

1.04 QUALITY ASSURANCE
   A. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience

1.05 MOCK-UP
   A. Comply with general mock-up requirements specified in Section 01 4000.
   B. Mock-up: Prepare a representative surface 60 by 60 inch in size using specified materials and preparation and application methods on surfaces identical to those to be coated; approved mock-up constitutes standard for workmanship.
      1. For proposed substitutions, prepare side-by-side mock-ups of specified and substitute products.
      2. Locate where directed.
      3. Mock-up may remain as part of the Work.

1.06 FIELD CONDITIONS
   A. Protect liquid materials from freezing.
   B. Do not apply coating when ambient temperature is lower than 50 degrees F or higher than 100 degrees F.
   C. Do not apply coatings, except with the written recommendation of the manufacturer, when the substrate surfaces have cured for less than a period of 60 days; when rain or temperatures below 50 degrees F are predicted for a period of 24 hours; earlier than 3 days after the surfaces became wet from rainfall or other moisture sources; when the substrate is frozen; or on substrate temperature of less than 40 degrees F.
   D. Do not apply coatings when wind velocity is higher than 20 mph.

1.07 WARRANTY
   A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
   B. Provide five year manufacturer warranty for graffiti coating.
      1. Include coverage for reduction in graffiti resistance on designated substrate.
PART 2 PRODUCTS

2.01 MATERIALS

A. Coatings: Non-glossy, colorless, penetrating, water-vapor-permeable, non-yellowing sealer, that dries invisibly leaving appearance of substrate unchanged.
   1. Applications: Vertical surfaces of stone and masonry veneer.
   2. Maintains dry appearance when wetted.

B. Exterior Graffiti Coating: Two-component, solvent-based aliphatic urethane coating system; non-glossy, colorless, water-vapor-permeable, non-yellowing sealer, that dries invisibly leaving appearance of substrate unchanged.
   1. Number of Coats: Three; primer, base coat and top coat.
   2. Basis of Design Product:
      b. Substitutions: See Section 01 6000 - Product Requirements.
   3. Other Acceptable Products:
      c. Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify joint sealants are installed and cured.

C. Verify surfaces to be coated are dry, clean, and free of efflorescence, oil, or other matter detrimental to application.

3.02 PREPARATION

A. Protection of Adjacent Work:
   1. Protect adjacent landscaping, property, and vehicles from drips and overspray.
   2. Protect adjacent surfaces not intended to receive coatings.

B. Prepare surfaces to be coated as recommended by coating manufacturer for best results.

C. Do not start work until masonry mortar substrate is cured a minimum of 60 days.

D. Remove loose particles and foreign matter.

E. Remove oil and foreign substances with a chemical solvent that will not affect coatings.

F. Scrub and rinse surfaces with water and let dry.

G. Allow surfaces to dry completely to degree recommended by coating manufacturer before starting coating work.

3.03 APPLICATION

A. Apply in accordance with coating manufacturer's instructions, using procedures and application methods recommended as producing the best results.

B. Apply at rate recommended by coating manufacturer, continuously over entire surface.

C. Comply with coating manufacturer's instructions for limitations on drying time between coats, and for drying times after rainstorm wetting of surfaces between coats. Consult manufacturer's technical representative if recommendations are not applicable to project conditions.

D. Delay application of coating until installation of sealants has been completed in joints adjoining surfaces to be coated.
E. Remove coating from unintended surfaces immediately by a method instructed by coating manufacturer.

F. Provide manufacturer's field service representative to inspect preparation and application work continuously during entire application period to ensure that manufacturer's "best practices" for preparation and application are being followed.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES

A. Board insulation at perimeter foundation wall, exterior wall behind exterior wall clading systems, and at steep slope roofing under metal roof panels.

B. Batt insulation and vapor retarder in exterior wall construction.

C. Batt insulation with integral vapor retarder in exposed exterior wall and roof construction in pre-engineered metal building system assemblies.

1.02 REFERENCE STANDARDS


E. ASTM E136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace At 750 Degrees C.


1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.

C. Manufacturer's Installation Instructions: Include information on special environmental conditions required for installation and installation techniques.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Do not allow insulation materials to become wet, soiled, or covered with ice or snow. Comply with manufacturer's recommendations for handling, storage, and protection during installation.

B. Protect plastic insulation from exposure to direct sunlight.

C. Do not deliver plastic insulation materials to the project site ahead of time of installation. Protect at all times against ignition. Complete the installation and concealment of plastic materials as soon as possible in each area of work.

1.05 FIELD CONDITIONS

A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers:
   1. As specified in this Section for each insulation type and application.
   2. Substitutions: See Section 01 6000 - Product Requirements.
2.02 APPLICATIONS

A. Insulation at Perimeter of Foundation: Extruded polystyrene (XPS) board.
B. Insulation Over Metal Stud Framed Walls - Continuous: Polyisocyanurate board (Type A).
C. Insulation in Pre-Engineered Metal Building Framed Assemblies: Batt insulation with integral vapor retarder.
D. Insulation in Metal Framed Walls: Batt insulation with integral vapor retarder.
E. Insulation Over Roof Deck Under Metal Roof Panels: Polyisocyanurate board (Type B) and composite (nail base) polyisocyanurate board.

2.03 INSULATION MATERIALS

A. Where units are included in fire rated wall, ceiling, or floor construction, provide insulation units which have been tested and rated as required for the indicated assembly.

2.04 FOAM BOARD INSULATION MATERIALS

A. Extruded Polystyrene (XPS) Board Insulation: Complies with ASTM C578 with either natural skin or cut cell surfaces.
   1. Type and Compressive Resistance: Type IV, 25 psi (173 kPa), minimum.
   2. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
   3. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
   4. Type and Thermal Resistance, R-value: Type IV, 5.0 (0.88) per 1 inch thickness at 75 degrees F mean temperature.
   5. Board Thickness: As indicated on Drawings.
   7. Type and Water Absorption: Type IV, 0.3 percent by volume, maximum, by total immersion.
   8. Acceptable Manufacturers:
      b. Kingspan Insulation LLC; GreenGuard XPS: www.kingspan.com/#sle.
      c. Owens Corning Corporation; FOAMULAR Extruded Polystyrene (XPS) Insulation: www.ocbuildingspec.com/#sle.
      d. Substitutions: See Section 01 6000 - Product Requirements.

B. Polyisocyanurate (ISO) Board Insulation - Type A: Rigid cellular foam, complying with ASTM C1289.
   1. Classification: Type I; faced with acrylic coated aluminum foil on both major surfaces of the core foam.
      a. Class 1 - Non-reinforced core foam.
      b. Compressive Strength: 25 psi, minimum.
      c. Thermal Resistance, R-value: At 1-1/2 inch thick; 9.0 at 75 degrees F.
   2. Board Size: 48 inch by 96 inch.
   3. Board Thickness: As indicated on Drawings.
   5. Acceptable Manufacturer:
      b. Substitutions: See Section 01 6000 - Product Requirements.

C. Polyisocyanurate (ISO) Board Insulation with Facers Both Sides: Rigid cellular foam, complying with ASTM C1289.
   1. Applications: Suplemental insulation in conjunction with nail base insulation under metal roof panels.
   2. Classification: Type II.
      a. Class 1 - Faced with glass fiber reinforced cellulotic felt facers on both major surfaces of core foam.
      b. Compressive Strength: Classes 1-2-3, Grade 1 - 16 psi (110 kPa), minimum.
      c. Thermal Resistance, R-value: At 1-1/2 inch thick; Class 1, Grades 1-2-3 - 8.4 (1.48) at 75 degrees F.
   3. Board Thickness: As indicated on Drawings.
   5. Acceptable Manufacturer:
D. Composite Polyisocyanurate (ISO) Board Insulation Faced with Oriented Strand Board: Rigid cellular foam, complying with ASTM C1289.

1. Classification: Type V; faced with FRT oriented strand board (OSB) on one major surface of core foam and glass fiber reinforced cellulosic felt or uncoated or coated polymer-bonded glass fiber mat facer on other major surface of core foam.
   a. Compressive Strength: 16 psi, minimum.
   b. Thermal Resistance, R-value: At 1-1/2 inch thick; 6.2 at 75 degrees F.

2. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.

3. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.

4. OSB Thickness: 7/16 inch.

5. Insulation Board Thickness: 4.5 inch.


7. Acceptable Manufacturer:

8. Substitutions: See Section 01 6000 - Product Requirements.

2.05 BATT INSULATION MATERIALS

A. Glass Fiber Batt Insulation: Flexible preformed batt or blanket, complying with ASTM C665; friction fit.

1. Combustibility: Non-combustible, when tested in accordance with ASTM E136, except for facing, if any.

2. Formaldehyde Content: Zero.

3. Thermal Resistance: As noted on Drawings, minimum value.

4. Thickness: Full thickness of framing or cavity space indicated, unless otherwise specifically noted on Drawings.

5. Facing: Provide following types, as noted on Drawings:
   a. Aluminum foil, flame spread 25 rated; one side.
   b. Foil-scrim-kraft faced one side; rated maximum flame spread 25 and smoke developed 50; approved for exposed applications where required by applicable building code.

6. Acceptable Manufacturers:
   c. Knauf Insulation: www.knaufinsulation.us.
   e. Substitutions: See Section 01 6000 - Product Requirements.

B. Glass Fiber Batt Insulation With Integral Vapor Retarder: Flexible preformed batt or blanket, complying with ASTM C665; integral, self-extinguishing vapor retarder fabric lining.

1. Applications: Pre-engineered metal building assemblies.

2. Complies with fire-resistance requirements specified; tested for compliance in accordance with NFPA 701, large scale.

3. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.

4. Smoke Developed Index: 50 or less, when tested in accordance with ASTM E84.

5. Combustibility: Non-combustible, when tested in accordance with ASTM E136.


7. Thermal Resistance: As noted on Drawings, minimum value.

8. Thickness: Full thickness of framing or cavity space indicated, unless otherwise specifically noted on Drawings.

9. Vapor Barrier Liner Fabric: Woven, reinforced, high-density polyethylene yarns coated on both sides with a continuous white or colored polyethylene film, as specified.
   a. Permeance of Fabric and Seams: 0.025 perms.
   b. Size and Seaming: Manufactured in large custom pieces by extrusion welding from roll goods, and fabricated to substantially fit defined building area with minimum practicable job site sealing.
   c. Stapled seams not acceptable.
   d. Factory-folded to allow for rapid pull-out on strap support system.
   e. Color: White.

10. Acceptable Manufacturer:
2.06 ACCESSORIES

A. Tape: Type and composition matching each type of membrane or insulation to be taped; self-adhering, mesh reinforced, 2 inch wide.

B. Accessories for Pre-Engineered Metal Building Insulation System:
   1. Vapor Barrier Lap Adhesive: Manufacturer's standard fast tack, synthetic rubber adhesive.
   2. Vapor Barrier Patch Tape: Double stick sealant tape made from same material as liner fabric.
   3. Thermal Breaks: 1/8 inch thick x 3 inch wide white, closed-cell polyethylene foam with pre-applied adhesive film and peel-off backing and polystyrene snap-on thermal blocks.
   4. Straps: 100 KSI tempered, high-tensile-strength steel; galvanized, primed, and painted specified finish color on the exposed side.
      a. Size: Not less than 0.015 inch by 3/4 inch by continuous length.

C. Adhesive: Type recommended by insulation manufacturer for indicated applications.

D. Liquid Flashing: One part, fast curing, non-sag, gun grade, trowelable liquid flashing for gaps less than 1/4 inch.
   1. Applications: For use in conjunction with specified polyisocyanurate continuous wall insulation.
   2. Acceptable Product:
      b. Substitutions: See Section 01 6000 - Product Requirements.

E. Flexible Flashing: One part silicone, liquid flashing for gaps less than 1/4 inch.
   1. Applications: For use in conjunction with specified polyisocyanurate continuous wall insulation.
   2. Acceptable Product:
      b. Substitutions: See Section 01 6000 - Product Requirements.

F. Penetration and Gap Filler: Foamed-in-place insulation; type as specified in Section 07 2119.
   1. Applications: Use for gaps in polyisocyanurate contiguous insulation 1/4 inch and greater.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.

B. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.

3.02 BOARD INSTALLATION AT FOUNDATION PERIMETER

A. Install boards horizontally on foundation perimeter.
   1. Place boards to maximize adhesive contact.
   2. Install in running bond pattern.
   3. Butt edges and ends tightly to adjacent boards and to protrusions.

B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

C. Immediately following application of board insulation, place protective boards over exposed insulation surfaces.
   1. Apply specified adhesive in five continuous beads per board length.
2. Install boards horizontally from base of foundation to top of insulation.
3. Butt boards tightly, with joints staggered from insulation joints.

3.03 BOARD INSTALLATION AT EXTERIOR WALLS

A. Continuous Foam Board Insulation: Install insulation over sheathing and weather barrier at maximum 16 inches on center with manufacturer's recommended mechanical fasteners.
   1. Lap joints oriented for positive moisture drainage to outside surface of insulation boards on all edges.
   2. Tape joints in insulation using manufacturer's required flashing tape product, in accordance with insulation manufacturer's instructions for joint types indicated or required.
   3. Seal joints in insulation with specified penetration and gap filler in accordance with manufacturer's instructions for joint types indicated or required.
   4. Apply manufacturer's required liquid flashing and flexible flashing to seal insulation to openings to provide continuous air barrier and foam board sheathing assembly.

B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.04 BOARD INSTALLATION OVER STEEP SLOPE ROOF SHEATHING OR ROOF STRUCTURE

A. Installation of board insulation over steep slope roof structure or roof sheathing is specified in Section 06 1053.

B. Board Installation Over Roof Deck - General:
   1. Ensure deck surfaces are clean and dry, continuous, and ready for application of insulation system.
   2. Do not apply more insulation than can be covered with roofing in same day.

C. Attachment of Insulation: Mechanically fasten insulation to deck in accordance with insulation manufacturer's instructions.
   1. Use minimum 2 fasteners per board, regardless of board size.
   2. Use minimum one fastener per 4 sq ft.

3.05 BATT INSULATION INSTALLATION

A. Installation - General:
   1. Install insulation and vapor retarder at locations indicated and in accordance with manufacturer's instructions.
   2. Install in exterior wall and roof spaces without gaps or voids. Do not compress insulation.
   3. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.
   4. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.
   5. Integral Vapor Retarder Membranes: Install with factory applied vapor retarder membrane facing warm side of building spaces. Lap ends and side flanges of membrane over framing members. Tape and seal to full perimeter of adjacent window, door, and other opening frames, and other items interrupting plane of vapor membrane.

B. Metal Stud Framing: Tape insulation batts in place.

C. Tape seal butt ends, lapped flanges, and tears or cuts in vapor retarder membranes.

3.06 PRE-ENGINEERED METAL BUILDING ROOF INSULATION INSTALLATION

A. Steel Straps:
   1. Cut straps to length and install in the pattern and spacings indicated on Drawings.
   2. Tension straps to required value.

B. Vapor Barrier Fabric:
   1. Position pre-folded fabric on the strap platform along one eave purlin.
   2. Clamp the two bottom corners at the eave and also centered on the bay.
   3. Pull the other end of the pleat-folded fabric across the building width on the strap platform, pausing only at the ridge to fasten the straps and fabric in position where plane of roof changes and to release temporary fasteners on the opposite ridge purlin.
   4. Once positioned, install fasteners from the bottom side at each strap/purlin intersection.
   5. Trim edges and seal along the rafters.

C. Insulation:
1. Unpack and shake to a thickness exceeding the specified thickness.
2. Ensure that cavities are filled completely with insulation.
3. Place on the vapor barrier liner fabric without voids or gaps.
4. Place top layer of insulation over and perpendicular to the purlins without voids or gaps, as roof sheathing is applied.

3.07 PRE-ENGINEERED METAL BUILDING WALL INSULATION INSTALLATION

A. Insulation:
   1. Install thermal break to exterior surface of girts as wall sheathing is applied.
   2. Ensure that cavities are filled completely with insulation.
   3. Cut insulation to required lengths to fit vertically between girts.
   4. Neatly position in place and secure to hangers.
   5. Fluff the insulation to exceed the specified thickness.

B. Vapor Barrier Fabric:
   1. Apply the vapor barrier fabric by clamping it in position over eave strap.
   2. Once in position, install fasteners through the eave strap into each roof strap, permanently clamping the wall fabric between them.

C. Straps: Install vertical straps along each column and 5 feet on center, maximum, fastening to each girt to retain system permanently in place.

3.08 PROTECTION

A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION
SECTION 07 2119
FOAMED-IN-PLACE INSULATION

PART 1 GENERAL
1.01 SECTION INCLUDES
   A. Foamed-in-place insulation:
      1. In exterior wall crevices.
      2. In shim spaces at windows, storefront frames, and similar locations.
      3. At junction of wall and roof materials in Natatorium.
      4. At junctions of dissimilar wall and roof materials.

1.02 REFERENCE STANDARDS

1.03 SUBMITTALS
   A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
   B. Product Data: Provide product description, insulation properties, overcoat properties, and preparation requirements.

1.04 QUALITY ASSURANCE
   A. Applicator Qualifications: Company specializing in performing work of the type specified, with minimum three years documented experience.

1.05 FIELD CONDITIONS
   A. Do not apply foam when temperature is below that specified by the manufacturer for ambient air and substrate.
   B. Do not apply foam when temperature is within 5 degrees F of dew point.

PART 2 PRODUCTS
2.01 MATERIALS
   A. Foamed-In-Place Insulation - Type A: Medium-density, rigid or semi-rigid, closed cell polyurethane foam; foamed on-site, using blowing agent of water or non-ozone-depleting gas.
      1. Density In Place: Minimum 2.0 lb/cu ft.; ASTM D1622/D1622M.
      2. Thermal Resistance: R-value of 5.0, minimum, per 1 inch thickness at 75 degrees F mean temperature when tested in accordance with ASTM C518.
      3. Water Vapor Permeance: Vapor retarder; 2 perms, maximum, when tested at intended thickness in accordance with ASTM E96/E96M, desiccant method.
      4. Water Absorption: Less than 2 percent by volume, maximum, when tested in accordance with ASTM D2842.
5. Air Permeance: 0.04 cfm/sq ft, maximum, when tested at intended thickness in accordance with ASTM E2178 or ASTM E283 at 1.57 psf.
6. Closed Cell Content: At least 90 percent.
7. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/450, maximum, when tested in accordance with ASTM E84.
8. Acceptable Products:
   d. Substitutions: See Section 01 6000 - Product Requirements.

B. Foamed-in-Place Insulation - Type B1: High density, multi-component, quick cure closed cell polyurethane foam, low-pressure spray foam.
   1. Density In Place: 3.0 lb/cu ft.; ASTM D1622/D1622M.
   2. Flame Spread/Smoke Developed (2 inch Thickness): 25/300, Class 1; ASTM E84.
   3. Closed Cell Content: Greater than 95 percent.
   4. Water Permeance (1 inch Thickness): 7.14 perm; ASTM E96/E96M.
   5. Acceptable Product:
      b. Substitutions: See Section 01 6000 - Product Requirements.

C. Foamed-in-Place Insulation - Type B2: High density, multi-component, quick cure polyurethane foam, chemically cured, low-pressure spray foam.
   1. Density In Place: 2.9 lb/cu ft.; ASTM D1622/D1622M.
   2. Water Permeance (1 inch Thickness): 3.9 perm; ASTM E96/E96M.
   3. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/450, maximum, when tested in accordance with ASTM E84.
   4. Acceptable Product:
      b. Substitutions: See Section 01 6000 - Product Requirements.

2.02 ACCESSORIES
   A. Primer: As required by insulation manufacturer.
   B. Protective Coating: Intumescent type, spray applied; flame spread index (FSI) of 25 and smoke developed index (SDI) of 450, when tested in accordance with ASTM E84.
      1. Acceptable Product:
         a. Product required by accepted insulation manufacturer to comply with applicable code requirements for fire-resistant coating at exposed locations.

PART 3 EXECUTION

3.01 EXAMINATION
   A. Verify work within construction spaces or crevices is complete prior to insulation application.
   B. Verify that surfaces are clean, dry, and free of matter that may inhibit insulation or overcoat adhesion.

3.02 PREPARATION
   A. Mask and protect adjacent surfaces from over spray or dusting.
   B. Apply primer in accordance with manufacturer's instructions.

3.03 APPLICATION
   A. Apply insulation in accordance with manufacturer's instructions.
   B. Apply insulation by spray method, to a uniform monolithic density without voids. Screed away excess foam to produce smooth and uniformly textured exposed surfaces.
   C. Patch damaged areas.
D. Where applied to voids and gaps assure space for expansion to avoid pressure on adjacent materials that may bind operable parts or void applicable warranties of windows and other opening components.

3.04 PROTECTION

A. Do not permit subsequent construction work to disturb applied insulation.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES
A. Air Barriers: Materials that form a system to stop passage of air through exterior walls, joints between exterior walls and roof, and joints around frames of openings in exterior walls.

1.02 DEFINITIONS
A. Weather Barrier: Assemblies that form either water-resistant barriers, air barriers, or vapor retarders.
B. Air Barrier: Air tight barrier made of material that is relatively air impermeable but water vapor permeable, both to the degree specified, with sealed seams and with sealed joints to adjacent surfaces.

1.03 REFERENCE STANDARDS

1.04 ADMINISTRATIVE REQUIREMENTS
A. Coordination:
   1. Coordinate the installation of weather barriers with adjacent flashings and weather barriers for compatibility and continuity of those systems.
   2. Coordinate installation of flexible flashing at openings with Sections that specify window, door, and other opening installations.

1.05 SUBMITTALS
A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide data on system materials and accessory components, material characteristics, performance criteria, limitations, and manufacturer's standard flashing and termination details.
C. Shop Drawings: Provide drawings of project-specific flashing, termination, and special joint conditions based on manufacturer's standard details; minimum scale 1-1/2 inch equals 1 foot.
D. Manufacturer's Installation Instructions: Indicate substrate and surface preparation, installation methods, and storage and handling criteria.

1.06 QUALITY ASSURANCE
A. Installer Qualifications: Company specializing in performing the work of this Section with minimum three years of documented experience; approved by primary weather barrier system manufacturer.
B. System Compatibility: Assume responsibility for confirming that weather barrier system components are compatible with each other as an system, and also compatible with substrate surfaces with which they will be in contact, including but not limited to wall and sheathing surfaces, opening materials, other flashings and weather barrier materials, and joint sealants.
   1. Assure that system components are compatible as specified prior to preparing and making specified submittals.
   2. Assume responsibility for removal of incompatible system components and installation of properly compatible components at no additional cost to Owner regardless of when incompatibility is discovered.
1.07 FIELD CONDITIONS
   A. Maintain temperature and humidity recommended by the materials manufacturers before, during and after installation.

1.08 DELIVERY, STORAGE, AND HANDLING
   A. Store products in manufacturer's unopened packaging until ready for installation.

PART 2 PRODUCTS

2.01 WEATHER BARRIER ASSEMBLIES
   A. Air Barriers:
      1. On outside surface of sheathing of exterior walls use air barrier sheet, self-adhesive type.

2.02 AIR BARRIER MATERIALS
   A. Air Barrier Sheet - Self-Adhered:
      1. Air Permeance: 0.004 cfm/sq ft, maximum, when tested in accordance with ASTM E2178.
      2. Water Vapor Permeance: 10 perms, minimum, when tested in accordance with ASTM E96/E96M Procedure A (Desiccant Method) at 73.4 degrees F.
      4. Ultraviolet (UV) and Weathering Resistance: Approved in writing by manufacturer for up to 90 days of weather exposure.
      5. Surface Burning Characteristics: Flame spread index of 25 or less, smoke developed index of 450 or less (Class A), when tested in accordance with ASTM E84.
      6. Basis of Design Product:
         b. Substitutions: See Section 01 6000 - Product Requirements.

2.03 ACCESSORIES
   A. Sealants, Tapes, and Accessories for Sealing Weather Barrier and Sealing Weather Barrier to Adjacent Substrates: As specified or as recommended by weather barrier manufacturer.
   B. Accessory Components: As recommended by primary weather barrier membrane manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION
   A. Verify that surfaces and conditions are ready to accept the work of this Section.
   B. Do not begin installation until substrates have been properly prepared.

3.02 PREPARATION
   A. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.
   B. Prime substrates receiving weather barrier adhered sheets in accordance with weather barrier system manufacturer's requirements to allow proper bond of applied weather barrier system.

3.03 INSTALLATION
   A. Install materials in accordance with manufacturer's instructions, and as otherwise specified in this Section.
      1. Comply with ASTM E2112 for installation of weather barrier materials in conjunction with installation of aluminum storefronts, doors, and louvers.
   B. Air Barriers: Install continuous air tight barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.
   C. Shingle air barrier system membranes over other flashings to provide positive drainage of moisture within the wall assembly.
D. Apply sealants and adhesives within recommended application temperature ranges. Consult manufacturer if temperature is out of this range.

E. Self-Adhered Sheets:
   1. Prepare substrate in manner recommended by sheet manufacturer; fill and tape joints in substrate and between dissimilar materials as recommended by manufacturer and as otherwise specified.
   2. Lap sheets shingle-fashion to shed water and seal laps air tight; lap sheets over separate metal or flexible flashings in shingle fashion to shed water and seal laps.
   3. Once sheets are in place, press firmly into substrate with resilient hand roller; ensure that laps are firmly adhered with no gaps or fishmouths.
   4. Use same material, or other material approved by sheet manufacturer for the purpose, to seal to adjacent construction and as flashing.
   5. At wide joints, provide extra flexible membrane allowing joint movement.

F. Openings and Penetrations in Exterior Weather Barriers:
   1. Install flexible flashing over sills, covering entire sill frame member, extending at least 5 inches onto weather barrier and at least 6 inches up jambs; mechanically fasten stretched edges.
   2. At openings to be filled with frames having nailing flanges, seal head and jamb flanges using a continuous bead of sealant compressed by flange and cover flanges with sealing tape at least 4 inches wide; do not seal sill flange.
   3. At openings to be filled with non-flanged frames, seal weather barrier to all sides of opening framing, using flexible flashing at least 9 inches wide, covering entire depth of framing.
   4. At head of openings, install flexible flashing under weather barrier extending at least 2 inches beyond face of jambs; seal weather barrier to flashing.
   5. At interior face of openings, seal gap between window/door frame and rough framing, using joint sealant over backer rod.
   6. Service and Other Penetrations: Form flexible flashing around penetrating item and seal to weather barrier surface.
   7. Masonry Veneer Wall Ties: Seal penetrations through weather barrier membrane with manufacturer's recommended sealant or sealing system.

3.04 FIELD QUALITY CONTROL
   A. See Section 01 4000 - Quality Requirements, for additional requirements.
   B. Do not cover installed weather barriers until required inspections have been completed.
   C. Obtain approval of installation procedures by the weather barrier manufacturer based on a mock-up installed in place, prior to proceeding with remainder of installation.
   D. Take digital photographs of each portion of the installation prior to covering up.

3.05 PROTECTION
   A. Do not leave materials exposed to weather longer than recommended by manufacturer.

END OF SECTION
SECTION 07 4113
METAL ROOF PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Architectural roofing system of preformed steel panels.

1.02 REFERENCE STANDARDS
   D. ASTM D903 - Standard Test Method for Peel or Stripping Strength of Adhesive Bonds.

1.03 ADMINISTRATIVE REQUIREMENTS
   A. Coordination:
      1. Coordinate roofing work with provisions for roof drainage, flashing, trim, penetrations, and other adjoining work to assure that the completed roof will be free of leaks.

1.04 SUBMITTALS
   A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
   B. Shop Drawings: Show layout and elevations, dimensions and thickness of panels, connections, details and location of joints, sealants and gaskets, method of anchorage, number of anchors, supports, reinforcement, trim, flashings, and accessories.
      1. Indicate panel numbering system.
      2. Differentiate between shop and field fabrication.
      3. Indicate substrates and adjacent work with which the wall system must be coordinated.
      4. Include large-scale details of anchorages and connecting elements.
      5. Include large-scale details or schematic, exploded or isometric diagrams to fully explain flashing at a scale of not less than 1-1/2 inches per 12 inches.
      6. Include design engineer's stamp or seal on shop drawings for attachments and anchors.
   C. Selection Samples: For each roofing system specified, submit color chips representing manufacturer's full range of available colors and patterns.
   D. Verification Samples: For each roofing system specified, submit samples of minimum size 12 inches square, representing actual roofing metal, thickness, profile, color, and texture.
   E. Warranty: Submit specified manufacturer's warranty and ensure that forms have been completed in Owner's name and are registered with manufacturer.
1.05 QUALITY ASSURANCE

A. Design Engineer's Qualifications: Design structural supports and anchorages under direct supervision of a Structural Engineer experienced in design of this type of Work and licensed in Colorado.

B. Basis of Design: Specifications are based on roof panel types by specified basis of design manufacturer. Roof panel types manufactured by other acceptable manufacturers are permitted, subject to compliance with specified requirements; and provided that deviations in design, weight, and profile are minor, and do not detract substantially from the indicated design intent.
   1. Comply with requirements specified in Section 01 4000 and Section 01 6000.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Provide strippable plastic protection on prefinished roofing panels for removal after installation.

B. Store roofing panels on project site as recommended by manufacturer to minimize damage to panels prior to installation.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Finish Warranty: Provide manufacturer's special warranty covering failure of factory-applied exterior finish on metal roof panels and agreeing to repair or replace panels that show evidence of finish degradation, including significant fading, chalking, cracking, or peeling within specified warranty period of five years from Date of Substantial Completion.

C. Waterproofing Warranty: Provide manufacturer's warranty for weathertightness of roofing system, including agreement to repair or replace roofing that fails to keep out water within specified warranty period of five years from Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design Manufacturer:
   1. PAC-CLAD/Petersen: www.pac-clad.com/sle.
   2. Substitutions: See Section 01 6000 - Product Requirements.

B. Other Acceptable Manufacturers:
   5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 ARCHITECTURAL METAL ROOF PANELS

A. Architectural Metal Roofing: Provide complete engineered system complying with specified requirements and capable of remaining weathertight while withstanding anticipated movement of substrate and thermally induced movement of roofing system.
   1. Provide engineered systems tested in accordance with UL 580 or ASTM E1592, and as otherwise required by applicable building code.

B. Metal Panels: Factory-formed panels with factory-applied finish.
   1. Steel Panels:
      a. Aluminum-zinc alloy-coated steel complying with ASTM A792/A792M; minimum AZ50 coating.
      b. Steel Thickness: Minimum 22 gage (0.0299 inch).
   2. Profile: Standing seam; concealed fastener system lapped seam in standing seam profile.
3. Texture: Smooth.
4. Length: Maximum possible length to minimize lapped joints. Where lapped joints are unavoidable, space laps so that each sheet spans over three or more supports.
5. Panel Width: 20 inches, with flat ribs.

2.03 ATTACHMENT SYSTEM
A. Concealed System: Provide manufacturer's standard stainless steel concealed anchor clips designed for specific roofing system and engineered to meet performance requirements, including anticipated thermal movement.

2.04 FABRICATION
A. Panels: Provide factory fabricated panels and accessory items, using manufacturer's standard processes as required to achieve specified appearance and performance requirements.
B. Joints: Provide captive gaskets, sealants, or separator strips at panel joints to ensure weathertight seals, eliminate metal-to-metal contact, and minimize noise from panel movements.

2.05 FINISHES
A. Fluoropolymer Coil Coating System: Polyvinylidene fluoride (PVDF) multi-coat superior performing organic coatings system complying with AAMA 2605, including at least 70 percent PVDF resin, and at least 80 percent of coil coated aluminum surfaces having minimum total dry film thickness (DFT) of 0.9 mil, 0.0009 inch.
   1. Acceptable Products:
      b. PPG Metal Coatings; Duranar: www.ppgmetalcoatings.com/#sle.
      d. Substitutions: See Section 01 6000 - Product Requirements.
   2. Color: Match pre-engineered metal building (PEMB) roof panels.

2.06 ACCESSORIES
A. Miscellaneous Sheet Metal Items: Provide flashings, gutters, downspouts, and trim of the same material, thickness, and finish as used for the roofing panels. Items completely concealed after installation may optionally be made of stainless steel.
   1. Downspouts: Rectangular profile.
B. Concealed Sealants: Non-curing butyl sealant or tape sealant.
D. Underlayment - High-Temperature Type:
   1. Locations: Roof edges contnuously within 4 feet from edges, and continuous underlayment over entire roof surface at roof slopes 3:12 and less.
   2. Thickness: 40 mil (0.040 inch).
   4. Water Vapor Permeance: 0.05 perm, maximum, measured according to ASTM E96/E96M.
   5. Low Temperature Flexibility: Unaffected when tested according to ASTM D1970/D1970M at minus 20 degrees F, 180 degree bend on 1 inch mandrel.
   6. Adhesion to Plywood: 5.0 pounds per inch of width, measured according to ASTM D903.
   7. Adhesives, Sealants, Tapes, and Accessories: As recommended by membrane manufacturer.
   8. Acceptable Products:
      c. Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION
A. Do not begin installation of preformed metal roof panels until substrates have been properly prepared.
B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Broom clean wood sheathing prior to installation of roofing system.
B. Remove protective film from surface of roof panels immediately prior to installation. Strip film carefully, to avoid damage to prefinished surfaces.
C. Separate dissimilar metals by applying a bituminous coating, self-adhering rubberized asphalt sheet, or other permanent method approved by roof panel manufacturer.
D. Where metal will be in contact with wood or other absorbent material subject to wetting, seal joints with sealing compound and apply one coat of heavy-bodied bituminous paint.

3.03 INSTALLATION

A. General: Install roofing system in accordance with panel manufacturer's instructions and recommendations, as applicable to specific project conditions. Anchor all components of roofing system securely in place while allowing for thermal and structural movement.
   1. Install roofing system with concealed clips and fasteners, except as otherwise recommended by manufacturer for specific circumstances.
   2. Minimize field cutting of panels. Where field cutting is absolutely required, use methods that will not distort panel profiles. Use of torches for field cutting is absolutely prohibited.
B. Accessories: Install all components required for a complete roofing assembly, including flashings, gutters, downspouts, trim, and similar roof accessory items.
C. Install specified underlayment on roof deck before installing preformed metal roof panels. Secure by methods acceptable to roof panel and underlayment manufacturer. Apply from eaves to ridge in shingle fashion, overlapping horizontal joints a minimum of 2 inches and side and end laps a minimum of 3 inches.
D. Roof Panels: Install panels in strict accordance with manufacturer's instructions, minimizing transverse joints except at junction with penetrations.
   1. Form weathertight standing seams incorporating concealed clips, using an automatic mechanical seaming device approved by the panel manufacturer.
   2. Provide sealant tape or other approved joint sealer at lapped panel joints.
   3. Install sealant or sealant tape, as recommended by panel manufacturer, at end laps and side joints.

3.04 CLEANING

A. Clean exposed sheet metal work at completion of installation. Remove grease and oil films, excess joint sealer, handling marks, and debris from installation, leaving the work clean and unmarked, free from dents, creases, waves, scratch marks, or other damage to the finish.

3.05 PROTECTION

A. Do not permit storage of materials or roof traffic on installed roof panels. Provide temporary walkways or planks as necessary to avoid damage to completed work. Protect roofing until completion of project.
B. Touch-up, repair, or replace damaged roof panels or accessories before Date of Substantial Completion.

END OF SECTION
SECTION 07 4213
METAL WALL PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Manufactured metal panels for exterior wall panels and subgirt framing assembly, with related flashings and accessory components.

1.02 REFERENCE STANDARDS
B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

1.03 ADMINISTRATIVE REQUIREMENTS
A. Coordination:
   1. Coordinate placement of wall panel system anchors and back-up support framing.
   2. Coordinate installation of vapor retarder and air barrier seals.
   3. Coordinate installation of windows, louvers, and other openings in wall panel system.

1.04 SUBMITTALS
A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Shop Drawings: Show layout and elevations, dimensions and thickness of panels, connections, details and location of joints, sealants and gaskets, method of anchorage, number of anchors, supports, reinforcement, trim, flashings, and accessories.
   1. Indicate panel numbering system.
   2. Differentiate between shop and field fabrication.
   3. Indicate substrates and adjacent work with which the wall system must be coordinated.
   4. Include large-scale details of anchorages and connecting elements.
   5. Include large-scale details or schematic, exploded or isometric diagrams to fully explain flashing at a scale of not less than 1-1/2 inches per 12 inches.
   6. Include design engineer's stamp or seal on shop drawings for attachments and anchors.
C. Samples: Submit two samples of wall panel, 12 inch x 12 inch in size illustrating finish color, sheen, and texture.

1.05 QUALITY ASSURANCE
A. Design Engineer's Qualifications: Design structural supports and anchorages under direct supervision of a Structural Engineer experienced in design of this type of Work and licensed in Colorado.
B. Installer Qualifications: Company specializing in installing the products specified in this Section with minimum three years of documented experience.
C. Basis of Design: Specifications are based on wall panel types by specified basis of design manufacturer. Wall panel types manufactured by other acceptable manufacturers are permitted, subject to compliance with specified requirements, and provided that deviations in design, composition, and profile are minor, and do not detract substantially from the indicated design intent.
   1. Comply with requirements specified in Section 01 4000 and Section 01 6000.

1.06 DELIVERY, STORAGE, AND HANDLING
A. Protect panels from accelerated weathering by removing or venting sheet plastic shipping wrap.
B. Store prefinished material off the ground and protected from weather; prevent twisting, bending, or abrasion; provide ventilation; slope metal sheets to ensure proper drainage.
C. Prevent contact with materials that may cause discoloration or staining of products.
1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective work within a five year period after Date of Substantial Completion for degradation of panel finish, including color fading caused by exposure to weather.

C. Correct defective work within a five year period after Date of Substantial Completion, including defects in water tightness and integrity of seals for metal wall panels.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design Manufacturer:
   1. PAC-CLAD/Petersen: www.pac-clad.com/#sle.
   2. Substitutions: See Section 01 6000 - Product Requirements.

B. Other Acceptable Manufacturers:
   5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MANUFACTURED METAL PANELS

A. Wall Panel System: Factory fabricated prefinished metal panel system, site assembled.
   1. Provide exterior wall panels and subgirt framing assembly.
   2. Design and size components to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of wall.
   3. Design Pressure: In accordance with applicable codes.
   5. Movement: Accommodate movement within system without damage to components or deterioration of seals, movement between system and perimeter components when subject to seasonal temperature cycling; dynamic loading and release of loads; and deflection of structural support framing.
   6. Drainage: Provide positive drainage to exterior for moisture entering or condensation occurring within panel system.
   7. Fabrication: Formed true to shape, accurate in size, square, and free from distortion or defects; pieces of longest practical lengths.
   8. Corners: Factory-fabricated in one continuous piece with minimum 2 inch returns.

B. Exterior Wall Panels:
   1. Profile: Vertical; multi-ribbed style.
   2. Side Seams: Lapped, sealed with continuous bead of sealant.
   3. Material: Precoated steel sheet, 22 gage, 0.0299 inch minimum thickness.
   5. Color: Match pre-engineered metal building (PEMB) panels.

C. Soffit Panels:
   1. Profile: Flush, smooth.
   2. Material: Precoated steel sheet, 22 gage, 0.0299 inch minimum thickness.
   3. Color: Match pre-engineered metal building (PEMB) panels.

D. Subgirts: Profile as indicated; thickness and configuration as required by system manufacturer to attach panel system to building.

E. Internal and External Corners: Same material, thickness, and finish as exterior sheets; profile to suit system; shop cut and factory mitered to required angles.

F. Trim: Same material, thickness and finish as exterior sheets; brake formed to required profiles.
G. Anchors: Galvanized steel.

2.03 MATERIALS

A. Precoated Steel Sheet: Hot-dipped galvanized steel sheet, ASTM A653/A653M, Structural Steel (SS) or Forming Steel (FS), with G90/Z275 coating; continuous coil-coated on exposed surfaces with specified finish coating and on panel back with specified panel back coating.

2.04 FINISHES

A. Panel Backside Finish: Panel manufacturer’s standard siliconized polyester wash coat.

B. Fluoropolymer Coil Coating System: Polyvinylidene fluoride (PVDF) multi-coat superior performing organic coatings system complying with AAMA 2605, including at least 70 percent PVDF resin, and at least 80 percent of coil coated aluminum surfaces having minimum total dry film thickness (DFT) of 0.9 mil, 0.0009 inch.
   1. Acceptable Manufacturers:
      b. PPG Metal Coatings; Duranar: www.ppgmetalcoatings.com/#sle.
      d. Substitutions: See Section 01 6000 - Product Requirements.

2.05 ACCESSORIES

A. Concealed Sealants: Non-curing butyl sealant or tape sealant.

B. Fasteners: Manufacturer’s standard type to suit application; with soft neoprene washers, steel, hot dip galvanized.

C. Field Touch-up Paint: As recommended by panel manufacturer.

D. Bituminous Paint: Asphalt base.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that building framing members are ready to receive panels.

B. Verify that water-resistive barrier has been installed over substrate completely and correctly.

3.02 PREPARATION

A. Install subgirts perpendicular to panel length, securely fastened to substrates and shimmed and leveled to uniform plane. Space at 24 inches on center, maximum.

3.03 INSTALLATION

A. Install panels on walls and soffits in accordance with manufacturer’s instructions.

B. Protect surfaces in contact with cementitious materials and dissimilar metals with bituminous paint. Allow to dry prior to installation.

C. Fasten panels to structural supports; aligned, level, and plumb.
   1. Before installation of subgirt supports over primary weather barrier sheet, apply single continuous strip of self-adhered flexible flashing sheet on primary weather barrier sheet as specified in Section 07 2500. Position strip centered on subgirt and size strip minimum 1 inch wider than subgirt assembly.

D. Locate joints over supports.

E. Lap panel ends minimum 2 inches.

3.04 TOLERANCES

A. Maximum Offset From True Alignment Between Adjacent Members Butting or In Line: 1/16 inch.
B. Maximum Variation from Plane or Location Indicated on Drawings: 1/4 inch.

3.05 CLEANING

A. Remove site cuttings from finish surfaces.
B. Remove protective material from wall panel surfaces.
C. Clean and wash prefinished surfaces with mild soap and water; rinse with clean water.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES
A. Aluminum-composite panels; glazed into aluminum framing systems.

1.02 REFERENCE STANDARDS

1.03 ADMINISTRATIVE REQUIREMENTS
A. Coordination:
   1. Coordinate attachment and seal of perimeter air and vapor barrier materials.
   2. Coordinate with installation of other components that comprise the exterior enclosure.

1.04 SUBMITTALS
A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, and ASTM compliance.
C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, and affected related Work.
D. Samples: Submit two samples 12 inches square illustrating construction and finished aluminum surface of panels.
E. Manufacturer’s Certificate: Certify that the products supplied meet or exceed the specified requirements.
F. Manufacturer Qualifications Statement.

1.05 QUALITY ASSURANCE
A. Designer Qualifications: Design structural support framing components under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed at Colorado.
B. Manufacturer Qualifications: Company specializing in performing work of type specified and with at least 25 years of laminating experience.
C. Installer Qualifications: Company specializing in performing work of type specified and with at least five years of documented experience.
D. Basis of Design: Specifications are based on panel types by specified basis of design manufacturer and product(s). Panel types manufactured by other acceptable manufacturers are permitted, subject to compliance with specified requirements; and provided that deviations in design, weight, and profile are minor, and do not detract substantially from the indicated design intent.
   1. Comply with requirements specified in Section 01 4000 and Section 01 6000.

1.06 DELIVERY, STORAGE, AND HANDLING
A. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.07 WARRANTY
A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
   1. Correct defective Work within a five year period after Date of Substantial Completion.
   2. Provide 10 year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.
PART 2 PRODUCTS

2.01 COMPONENTS

A. Composite Infill Panels: Insulated, aluminum sheet face and back, with edges formed to fit glazing channel and sealed.
   1. Face Sheet: 0.032 inch thick, minimum.
   2. Exterior and Interior Secondary Core Facing: Tempered hardboard.
   3. Core: Isocyanurate insulation core with R-value of 15.
   4. Back Sheet: 0.032 inch thick, minimum.
   5. Panel Thickness: 2-1/4 inches, with integral 1 inch glazing legs all edges.
      a. Factory finish all surfaces that will be exposed in completed assemblies.
      b. Touch-up surfaces cut during fabrication so that no natural aluminum is visible in completed assemblies, including joint edges.
   7. Basis of Design Product:
      b. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS

B. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.
   1. Size gaskets as required by manufacturer of glazing channel frame to provide proper pressure and bite on glazing units.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify dimensions, tolerances, and method of attachment with other work.

3.02 INSTALLATION

A. Install panels in accordance with manufacturer’s instructions.
B. Install panels in accordance with Section 08 8000, using exterior dry glazing method.
C. Provide alignment attachments and shims to permanently fasten system to building structure.
D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.
E. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.03 CLEANING

A. Remove protective material from pre-finished aluminum surfaces.

3.04 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Fiber cement siding systems, including:
      1. Siding panels.
      2. Accessories and trim.

1.02 RELATED REQUIREMENTS
   A. Section 09 9113 - Exterior Painting: Field painting.

1.03 REFERENCE STANDARDS
   C. ASTM E136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace At 750 Degrees C.

1.04 SUBMITTALS
   A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
   B. Product Data: Submit manufacturer's data sheets on each product to be used, including:
      1. Manufacturer's requirements for related materials to be installed by others.
      2. Preparation instructions and recommendations.
      3. Storage and handling requirements and recommendations.
      4. Manufacturer's detailed installation manual, including requirements for all installation methods, including fastening requirements, flashing requirements, and termination details.
   C. Maintenance Instructions: Periodic inspection recommendations and maintenance procedures.
   D. Warranty: Submit copy of manufacturer’s warranty, made out in Owner’s name, showing that it has been registered with manufacturer.

1.05 QUALITY ASSURANCE
   A. Installer Qualifications: Company specializing in performing work of the type specified in this Section with minimum three years of experience.
   B. Basis of Design: Specifications are based on wall panel systems by specified basis of design manufacturer. Wall panel systems manufactured by other acceptable manufacturers are permitted, subject to compliance with specified requirements, and provided that deviations in design, composition, and profile are minor, and do not detract substantially from the indicated design intent.
      1. Comply with requirements specified in Section 01 4000 and Section 01 6000.

1.06 DELIVERY, STORAGE, AND HANDLING
   A. Store products under waterproof cover and elevated above grade, on a flat surface.

1.07 WARRANTY
   A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
B. Correct defective work within a five year period after Date of Substantial Completion.

C. Provide manufacturer's standard limited, transferable warranties for each system component specified.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design Manufacturer - Fiber Cement Siding:
   2. Substitutions: See Section 01 6000 - Product Requirements.

B. Other Acceptable Manufacturers:
   4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 FIBER-CEMENT SIDING

A. Siding System Components: ASTM C1186, Type A, Grade II; with machined edges, for screw attachment unless otherwise specified.
   1. Surface Burning Characteristics: Flame spread index of 0, smoke developed index of 6, maximum; when tested in accordance with ASTM E84 (Class I/A).
   2. Flammability: Noncombustible, when tested in accordance with ASTM E136.
   3. Fly Ash Content: None; not permitted.
   4. Flexural Strength: At least 1450 psi when in equilibrium condition, and at least 1015 psi when in wet condition, tested in accordance with ASTM C1185.
   5. Water Vapor Transmission: Less than 7.0 perm-inch, when tested in accordance with ASTM E96/E96M.
   6. Freeze Thaw Resistance: At least 80 percent flexural strength retained, when tested in accordance with ASTM C1185.
   7. UV Resistance: No cracking, checking, or erosion, when tested for 2000 hours in accordance with ASTM G155.
   8. Water Tightness: No water droplets on underside, when tested in accordance with ASTM C1185.

B. Horizontal and Vertical Siding: Individual boards with specified face texture and finish, for screw attachment.
   1. Style: Standard lap style (horizontal) and ship-lap style (vertical); see Drawings for locations.
   2. Texture: Smooth.
   3. Length: 12 ft, nominal.
   4. Width (Exposure): As indicated on Drawings.
   5. Thickness: 5/16 inch, nominal.

2.03 ACCESSORIES

A. Metal Furring Strips: Galvanized metal channels specified in Section 05 4000.

B. Fiber Cement Trim: Fiber cement board, provided in nominal sizes as indicated on Drawings, cut edges primed; 5/4 inch nominal thickness.
   1. Same material and texture as siding.
   2. Finish: Factory applied primer.
   3. Provide the following trim:
      a. Starter strip for lap siding.
      b. Outside corners, butted to siding.
      c. Opening trim as detailed.
      d. Other trim elements as detailed or indicated.
C. Fasteners: Galvanized or corrosion resistant type; length as required to penetrate minimum 1-1/4 inch into solid backing, except as otherwise specified.
   1. Use of siding manufacturer's recommended fasteners is required, to establish and maintain specified warranty, and for proper and complete installation.

D. Sealant: Elastomeric, polyurethane or silyl-terminated polyether/polyurethane, or as otherwise recommended by siding system manufacturer; capable of being painted. Comply with general requirements specified in Section 07 9200.

E. Insect Screen Mesh: Vinyl-coated fiberglass, 18 x 16 mesh.

F. Weather Barrier: Specified in Section 07 2500.

G. Sheet Metal Flashing: Specified in Section 07 6200.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrate, clean and repair as required to eliminate conditions that would be detrimental to proper installation.

B. Verify that weather barrier system has been installed over substrate completely and correctly.

C. Do not begin until unacceptable conditions have been corrected.

D. If substrate preparation is responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

E. Prime or pre-paint field-cut edges prior to installation.

F. Install sheet metal flashing properly lapped with other components of the weather barrier system, and properly sloped to drain and weep moisture to the exterior.
   1. Above door and window trim and casings.
   2. Above horizontal trim in field of siding.
   3. Components specifically required or recommended by siding manufacturer for installation conditions indicated. Include kick-out flashing at locations where eave edges intersect approximately perpendicular to vertical wall surfaces on which fiber cement siding is indicated. Comply with siding manufacturers standard details if details are not otherwise indicated.
   4. Install insect screen mesh at bottom and open edges of installations.

3.02 INSTALLATION

A. Install siding system in accordance with manufacturer's instructions and recommendations, including wood furring strips if required to establish and maintain specified warranty.
   1. Read warranty and comply with terms necessary to maintain warranty coverage.
   2. Install in accordance with conditions stated in model code evaluation report applicable to location of project.
   3. Use trim details indicated on Drawings; if trim details are not indicated, comply with siding manufacturer's standard details in all respects for conditions indicated.
   4. Touch up field cut edges before installing.
   5. Pre-drill nail holes if necessary to prevent breakage.

B. Over Steel Studs: Use hot-dipped galvanized self-tapping screws, with the points of at least three screws penetrating each stud the panel crosses and at panel ends.

C. Allow space for thermal movement between both ends of siding panels that butt against trim; seal joint between panel and trim with specified sealant.

D. Joints in Horizontal Siding: Avoid joints in lap siding except at corners; where joints are inevitable stagger joints between successive courses.
   1. Provide sheet flashing behind joints, extending minimum 1 inch above top of siding course, minimum 3 inch each side of joint, and minimum 1 inch overlap with previous siding course, or as otherwise required by siding manufacturer.
E. Minimum Fastener Penetration: Comply with applicable code, but at minimum as follows:
   1. Metal Studs: 3 full threads.

F. Do not install siding less than 6 inches from surface of ground nor closer than 2 inches to roofs, patios, porches, sidewalks, and other surfaces where water may collect, unless otherwise specifically allowed by siding manufacturer or otherwise detailed on Drawings to comply with siding manufacturer's recommendations.

G. Sealants: After siding system installation, seal all joints except lap joints of lap siding and other joints not required to be sealed according to system manufacturer's installation instructions. Seal around all penetrations through panel system.
   1. Exceptions: Do not seal joints between siding components and sheet metal flashings, between bottom edge of siding panels and adjacent materials, and similar locations where moisture must be allowed to weep out from behind siding system.

H. Finish Painting: Specified in Section 09 9113.

3.03 CLEANING
   A. At completion of work, remove debris caused by siding installation from project site.

3.04 PROTECTION
   A. Protect installed products until Date of Substantial Completion.
   B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES

A. Thermoplastic membrane roofing system, including all components specified.

1.02 DEFINITIONS

A. Roofing Terminology: Refer to ASTM D1079 for definition of terms related to roofing work not otherwise defined in the section.

B. LTTR: Long Term Thermal Resistance, as defined by CAN-ULC-S770.

1.03 REFERENCE STANDARDS


H. ASTM D1004 - Standard Test Method for Tear Resistance (Graves Tear) of Plastic Film and Sheeting.


O. ASTM E136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace At 750 Degrees C.


Q. FM (AG) - FM Approval Guide.


S. FM DS 1-28 - Wind Design.

T. FM DS 1-29 - Roof Deck Securement and Above-Deck Roof Components; Factory Mutual System.
1.04 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Conference: Before start of roofing work, Contractor shall hold a meeting to discuss the proper installation of materials and requirements to achieve the warranty.
   1. Convene under general provisions of Section 01 7000.
   2. Require attendance with all parties directly influencing the quality of roofing work or affected by the performance of roofing work.
   3. Notify Architect well in advance of meeting.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data:
   1. Provide membrane manufacturer's printed data sufficient to show that all components of roofing system, including insulation and fasteners, comply with the specified requirements and with the membrane manufacturer's requirements and recommendations for the system type specified; include data for each product used in conjunction with roofing membrane.
   2. Where UL or FM requirements are specified, provide documentation that shows that the roofing system to be installed is UL-Classified or FM-approved, as applicable; include data itemizing the components of the classified or approved system.
   3. Installation Instructions: Provide manufacturer's instructions to installer, marked up to show exactly how all components will be installed; where instructions allow installation options, clearly indicate which option will be used.

C. Samples: Submit samples of each product to be used.

D. Shop Drawings: Provide:
   1. The roof membrane manufacturer's standard details customized for this project for all relevant conditions, including flashings, base tie-ins, roof edges, terminations, expansion joints, penetrations, and drains.
   2. For tapered insulation, provide project-specific layout and dimensions for each board.

E. Specimen Warranty: Submit prior to starting work.

F. Installer Qualifications: Letter from manufacturer attesting that the roofing installer meets the specified qualifications.

G. Pre-Installation Notice: Copy to show that manufacturer's required Pre Installation Notice (PIN) has been accepted and approved by the manufacturer.

H. Executed Warranty.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Roofing installer shall have the following:
   1. Current approval, license, or authorization as applicator by the manufacturer.
   2. At least five years experience in installing specified system.

B. Basis of Design: Specifications are based on roofing systems by specified basis of design manufacturer and product(s). Roofing systems manufactured by other acceptable manufacturers are permitted, subject to compliance with specified requirements; and provided that deviations in design, weight, performance, and profile are minor, and do not detract substantially from the indicated design intent.
   1. Comply with requirements specified in Section 01 4000 and Section 01 6000.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Comply with all warranty procedures required by manufacturer, including notifications, scheduling, and inspections.
C. Warranty: Firestone Limited Warranty covering membrane, roof insulation, and other indicated components of the system, for the term indicated.
   1. Limit of Liability: No dollar limitation.
   2. Warranty Period: Full system warranty; Basis of Design manufacturer's 20 year Red Shield Limited Warranty covering membrane, roof insulation, membrane accessories, and metal edging and coping associated with membrane roofing system.
   3. Scope of Coverage: Repair leaks in the roofing system caused by:
      a. Ordinary wear and tear of the elements.
      b. Manufacturing defect in manufacturer's branded materials.
      c. Defective workmanship used to install these materials.
      d. Damage due to winds up to 55 mph.
      e. Hail up to 2 inches in diameter.
   4. Not Covered:
      a. Damage due to winds in excess of 55 mph.
      b. Damage due hurricanes or tornadoes.
      c. Intentional damage.

D. Insulation Warranty: Separate insulation warranty with warranty term coinciding with roofing system warranty.
   1. Limit of Liability: No dollar limitation.
   2. Scope of Coverage: Provide replacement for insulation that warps, bows, or is on the point of causing a roof leak as a result of manufacturing defect.

E. Metal Roof Edging: Manufacturer's full-system warranty for roof edge system, covering blow-off from winds up to 150 mph.

PART 2 PRODUCTS

2.01 MANUFACTURERS

   1. Substitutions: See Section 01 6000 - Product Requirements.
   2. Roofing systems manufactured by others are acceptable provided the roofing system is equivalent in materials and warranty conditions and the manufacturer meets the following qualifications:
      a. Specializing in manufacturing the roofing system to be provided.
      b. Able to provide a no dollar limit, single source roof system warranty that is backed by corporate assets in excess of one billion dollars.
   3. Roofing systems manufactured by the companies listed below are acceptable provided they are equivalent in materials and warranty conditions:
      e. Substitutions: See Section 01 6000 - Product Requirements.

B. Manufacturer of Insulation and Cover Boards: Same manufacturer as roof membrane.

C. Manufacturer of Metal Roof Edging: Same manufacturer as roof membrane.
   1. Metal roof edging products by other manufacturers are not acceptable.
   2. Field- or shop-fabricated metal roof edgings are not acceptable.

2.02 ROOFING SYSTEM DESCRIPTION

A. Roofing System: Thermoplastic polyolefin (TPO) single-ply membrane.
   1. Membrane Attachment: Fully adhered.
   2. Comply with applicable local building code requirements.
   4. Provide assembly complying with Factory Mutual Corporation (FM) Roof Assembly Classification, FM DS 1-28 and FM DS 1-29, and meeting minimum requirements of FM 1-90 wind uplift rating.
B. Roofing System Components: Listed in order from the top of the roof down:
   1. Membrane: Thickness as specified.
   2. Insulation Cover Board: High density polyisocyanurate; cold adhesive attached.
   3. Insulation:
      a. Maximum Board Thickness: 3 inches; use as many layers as necessary; stagger joints in adjacent layers.
      b. Tapered: Slope as indicated; provide minimum R-value at thinnest point; place tapered layer on bottom.
      c. Total R-Value: 30, minimum.
      d. Top Layer: Polyisocyanurate foam board, non-composite; cold adhesive attached.
      e. Intermediate Layer(s), If Any: Polyisocyanurate foam board, non-composite; cold adhesive attached.
      f. Bottom Layer: Polyisocyanurate foam board, non-composite; mechanically fastened.
      g. Crickets: Tapered insulation of same type as specified for top layer; slope as indicated.
   5. Deck Cover Board: Gypsum-based board, 1/4 inch thick; cold adhesive attached; at locations indicated on Drawings.

2.05 MEMBRANE MATERIALS
A. Membrane: Flexible, heat weldable sheet composed of thermoplastic polyolefin polymer and ethylene propylene rubber; complying with ASTM D6878/D6878M, with polyester weft inserted reinforcement and the following additional characteristics:
   1. Thickness: 0.060 inch plus/minus 10 percent, with coating thickness over reinforcement of 0.024 inch plus/minus 10 percent.
   2. Sheet Width: Provide the widest available sheets to minimize field seaming.
   5. Acceptable Product: UltraPly TPO.
B. Membrane Fasteners: Type and size as required by roof membrane manufacturer for roofing system and warranty to be provided; use only fasteners furnished by roof membrane manufacturer.
C. Curb and Parapet Flashing: Same material as membrane, with encapsulated edge which eliminates need for seam sealing the flashing-to-roof splice; precut to 18 inches wide.
D. Formable Flashing: Non-reinforced, flexible, heat weldable sheet, composed of thermoplastic polyolefin polymer and ethylene propylene rubber.
   1. Thickness: 0.060 inch plus/minus 10 percent.
   2. Tensile Strength: 1550 psi, minimum, when tested in accordance with ASTM D638 after heat aging.
   3. Elongation at Break: 650 percent, minimum, when tested in accordance with ASTM D638 after heat aging.
   4. Tearing Strength: 12 lbf, minimum, when tested in accordance with ASTM D1004 after heat aging.
E. Tape Flashing: 5-1/2 inch nominal wide TPO membrane laminated to cured rubber polymer seaming tape, overall thickness 0.065 inch nominal; TPO QuickSeam Flashing.
F. Bonding Adhesive: Neoprene and SBR rubber blend, formulated for compatibility with the membrane other substrate materials, including masonry, wood, and insulation facings; UltraPly Bonding Adhesive.
G. Pourable Sealer: Two-part polyurethane, two-color for reliable mixing; Pourable Sealer.
H. Seam Plates: Steel with barbs and Galvalume coating; corrosion-resistance complying with FM 4470.
I. Termination Bars: Aluminum bars with integral caulk ledge; 1.3 inches wide by 0.10 inch thick; Firestone Termination Bar.
J. Cut Edge Sealant: Synthetic rubber-based, for use where membrane reinforcement is exposed; UltraPly TPO Cut Edge Sealant.
K. General Purpose Sealant: EPDM-based, one part, white general purpose sealant; UltraPly TPO General Purpose Sealant.

L. Molded Flashing Accessories: Unreinforced TPO membrane pre-molded to suit a variety of flashing details, including pipe boots, inside corners, outside corners, etc.; UltraPly TPO Small and Large Pipe Flashing.

M. Roof Walkway Pads: Non-reinforced TPO walkway pads, 0.130 inch by 30 inches by 40 feet long with patterned traffic bearing surface; UltraPly TPO Walkway Pads.

2.04 VAPOR RETARDER MATERIALS

A. Self-Adhering Flexible Vapor Retarder Sheet:
   1. Thickness: 40 mil (0.040 inch).
   2. Sheet Width: 36 inches.
   3. Water Vapor Permeance: 0.05 perm, maximum, measured according to ASTM E96/E96M.
   4. Low Temperature Flexibility: Unaffected when tested according to ASTM D1970/D1970M at minus 20 degrees F, 180 degree bend on 1 inch mandrel.
   5. Adhesion to Plywood: 5.0 pounds per inch of width, measured according to ASTM D903.
   6. Adhesives, Sealants, Tapes, and Accessories: As recommended by membrane manufacturer.
   7. Acceptable Products:
      d. Substitutions: See Section 01 6000 - Product Requirements.

2.05 ROOF INSULATION AND COVER BOARDS

A. Polyisocyanurate Board Insulation: Closed cell polyisocyanurate foam with black glass reinforced mat laminated to faces, complying with ASTM C1289 Type II Class 1, with the following additional characteristics:
   1. Thickness: As required to achieve specified r-value.
   2. Tapered Boards: Slopes and configurations as indicated on Drawings; type as recommended by roofing system manufacturer for specified roofing system.
      a. Exception: Insulation to be attached using adhesive or asphalt may be no larger than 48 inches by 48 inches, nominal.
   4. R-value (LTTR):
      a. 1.0 inch Thickness: 5.7, minimum.
      b. 1.5 inch Thickness: 8.6, minimum.
      c. 2.0 inch Thickness: 11.4, minimum.
      d. 3.0 inch Thickness: 17.4, minimum.
      e. 3.5 inch Thickness: 20.5, minimum.
   5. Compressive Strength: Minimum 20 psi when tested in accordance with ASTM C1289.
   6. UL-Classified and FM-approved for direct to steel deck applications.
   7. Ozone Depletion Potential: Zero; made without CFC or HCFC blowing agents.
   8. Recycled Content: 19 percent post-consumer and 15 percent pre-consumer (post-industrial), average.

B. Gypsum-Based Cover Board: Non-combustible, water resistant gypsum core with embedded glass mat facers, complying with ASTM C1177/C1177M, and with the following additional characteristics:
   1. Size: 48 inches by 96 inches, nominal.
      a. Exception: Board to be attached using adhesive or asphalt may be no larger than 48 inches by 48 inches, nominal.
   2. Thickness: As indicated elsewhere.
   3. Surface Water Absorption: 2.5 g, maximum, when tested in accordance with ASTM C473.
   4. Spanning Capability: Recommended by manufacturer for following minimum flute spans:
      a. 1/2 inch Thickness: 5 inches, minimum.
   5. Surface Burning Characteristics: Flame spread index of 0 (zero), smoke developed index of 0 (zero), when tested in accordance with ASTM E84.
   6. Combustibility: Non-combustible, when tested in accordance with ASTM E136.
   7. Factory Mutual approved for use with FM 1-60 and 1-90 rated roofing assemblies.
8. Mold Growth Resistance: Zero growth, when tested in accordance with ASTM D3273 for minimum of 4 weeks.
9. Pre-primed for better adhesion.

C. Insulation Fasteners: Type and size as required by roof membrane manufacturer for roofing system and warranty to be provided; use only fasteners furnished by roof membrane manufacturer.

D. Adhesive for Insulation Attachment: Type as required by roof membrane manufacturer for roofing system and warranty to be provided; use only adhesives furnished by roof membrane manufacturer.

2.06 METAL ACCESSORIES
A. Parapet Copings: Formed metal coping with galvanized steel anchor/support cleats for capping any parapet wall; watertight, maintenance free, without exposed fasteners; butt type joints with concealed splice plates; mechanically fastened as indicated; Firestone PTCF.
   1. Wind Performance:
      a. At least minimum required when tested in accordance with ANSI/SPRI/FM 4435/ES-1 using test method RE-3.
      b. Provide product listed in FM (AG) with at least FM 1-90 rating.
   2. Description: Coping sections allowed to expand and contract freely while locked in place on anchor cleats by mechanical pressure from hardened stainless steel springs factory attached to anchor cleats; 8 inch wide splice plates with factory applied dual non-curing sealant strips capable of providing watertight seal.
   3. Material and Finish: Minimum 24 gage, 0.024 inch thick galvanized steel with Kynar 500 finish in manufacturer's standard color; matching concealed joint splice plates; factory-installed protective plastic film.
   4. Dimensions:
      a. Wall Width: As indicated on Drawings.
      b. Piece Length: Minimum 144 inches.
      c. Curved Application: Factory fabricated in true radius.
   5. Anchor/Support Cleats: 20 gage, 0.036 inch thick prepunched galvanized cleat with 12 inch wide stainless steel spring mechanically locked to cleat at 72 inches on center.
   6. Special Shaped Components: Provide factory-fabricated pieces necessary for complete installation, including miters, corners, intersections, curves, pier caps, and end caps; minimum 14 inch long legs on corner, intersection, and end pieces.
   7. Fasteners: Factory-furnished; electrolytically compatible; minimum pull out resistance of 240 pounds for actual substrate used; no exposed fasteners.

2.07 ACCESSORIES
A. Cant Strips and Tapered Edge Strips: 45 degree face slope and minimum 5 inch face dimension; provide at all angle changes between vertical and horizontal planes that exceed 45 degrees.
   1. Type: Non-flammable perlite, complying with ASTM C728.
   2. Install using hot asphalt (Type IV), roofing mastic, or mechanically fastened using fasteners and plates approved by roofing manufacturer.

PART 3 EXECUTION
3.01 GENERAL
A. Commencement of work by Contractor constitutes acknowledgement that this specification can be satisfactorily executed, under the project conditions and with all necessary prerequisites for warranty acceptance by roofing membrane manufacturer. No modification of the Contract Sum will be made for failure to adequately examine the Contract Documents or the project conditions.

B. Install roofing, insulation, flashings, and accessories in accordance with roofing manufacturer’s published instructions and recommendations for the specified roofing system. Where manufacturer provides no instructions or recommendations, follow good roofing practices and industry standards. Comply with federal, state, and local regulations.

C. Obtain all relevant instructions and maintain copies at project site for duration of installation period.
D. Do not start work until Pre-Installation Notice has been submitted to manufacturer as notification that this project requires a manufacturer's warranty.

E. Perform work using competent and properly equipped personnel.

F. Temporary closures, which ensure that moisture does not damage any completed section of the new roofing system, are the responsibility of the applicator. Completion of flashings, terminations, and temporary closures shall be completed as required to provide a watertight condition.

G. Install roofing membrane only when surfaces are clean, dry, smooth and free of snow or ice; do not apply roofing membrane during inclement weather or when ambient conditions will not allow proper application; consult manufacturer for recommended procedures during cold weather. Do not work with sealants and adhesives when material temperature is outside the range of 60 to 80 degrees F.

H. Protect adjacent construction, property, vehicles, and persons from damage related to roofing work; repair or restore damage caused by roofing work.
   1. Protect from spills and overspray from bitumen, adhesives, sealants and coatings.
   2. Particularly protect metal, glass, plastic, and painted surfaces from bitumen, adhesives, and sealants within the range of wind-borne overspray.
   3. Protect finished areas of the roofing system from roofing related work traffic and traffic by other trades.

I. Until ready for use, keep materials in their original containers as labeled by the manufacturer.

J. Keep all adhesives, sealants, primers and cleaning materials away from all sources of ignition.

3.02 EXAMINATION

A. Examine roof deck to determine that it is sufficiently rigid to support installers and their mechanical equipment and that deflection will not strain or rupture roof components or deform deck.

B. Verify that surfaces and site conditions are ready to receive work. Correct defects in the substrate before commencing with roofing work.

C. Examine roof substrate to verify that it is properly sloped to drains.

D. Verify that the specifications and drawing details are workable and not in conflict with the roofing manufacturer's recommendations and instructions; start of work constitutes acceptable of project conditions and requirements.

3.03 PREPARATION

A. Take appropriate measures to ensure that fumes from adhesive solvents are not drawn into the building through air intakes.

B. Prior to proceeding, prepare roof surface so that it is clean, dry, and smooth, and free of sharp edges, fins, roughened surfaces, loose or foreign materials, oil, grease and other materials that may damage the membrane.

C. Before installing roofing system, install foamed-in-place insulation in deck flute locations where indicated on Drawings.
   1. Foamed-in-Place Insulation: Specified in Section 07 2119.

D. Fill all surface voids in the immediate substrate that are greater than 1/4 inch wide with fill material acceptable insulation to membrane manufacturer.

E. Seal, grout, or tape deck joints, where needed, to prevent bitumen seepage into building.

3.04 VAPOR RETARDER

A. Before installing insulation install vapor retarder directly over deck cover board according to vapor retarder manufacturer's installation instructions.

B. Install vapor retarder sheet with all joints, edges, and penetrations taped and sealed to adjacent surfaces and adjoining vapor retarder membranes as applicable.

C. Ensure that all penetrations and edge conditions are sealed to prevent moisture and air drive into the roofing system.
3.05 INSULATION AND COVER BOARD INSTALLATION
A. Install insulation in configuration and with attachment method(s) specified in PART 2, under Roofing System.
B. Install insulation in a manner that will not compromise the vapor retarder integrity.
C. Install only as much insulation as can be covered with the completed roofing system before the end of the day's work or before the onset of inclement weather.
D. Lay roof insulation in courses parallel to roof edges.
E. Neatly and tightly fit insulation to all penetrations, projections, and nailers, with gaps not greater than 1/4 inch. Fill gaps greater than 1/4 inch with acceptable insulation. Do not leave the roofing membrane unsupported over a space greater than 1/4 inch.
F. Mechanical Fastening: Using specified fasteners and insulation plates engage fasteners through insulation into deck to depth and in pattern required by Factory Mutual for FM Class specified in PART 2 and membrane manufacturer, whichever is more stringent.
G. Cold Adhesive Attachment: Apply in accordance with membrane manufacturer's instructions and recommendations; "walk-in" individual roof insulation boards to obtain maximum adhesive contact.

3.06 SINGLE-PLY MEMBRANE INSTALLATION
A. Beginning at low point of roof, place membrane without stretching over substrate and allow to relax at least 30 minutes before attachment or splicing; in colder weather allow for longer relax time.
B. Lay out the membrane pieces so that field and flashing splices are installed to shed water.
C. Install membrane without wrinkles and without gaps or fishmouths in seams; bond and test seams and laps in accordance with membrane manufacturer's instructions and details.
D. Install membrane adhered to the substrate, with edge securement as specified.
E. Adhered Membrane: Bond membrane sheet to substrate using membrane manufacturer's recommended bonding material, application rate, and procedures.
F. Edge Securement: Secure membrane at all locations where membrane terminates or goes through an angle change greater than 2 in 12 inches using mechanically fastened reinforced perimeter fastening strips, plates, or metal edging as indicated or as recommended by roofing manufacturer.
   1. Exceptions: Round pipe penetrations less than 18 inches in diameter and square penetrations less than 4 inches square.
   2. Ensure anchorage of membrane as intended by roofing manufacturer.

3.07 FLASHING AND ACCESSORIES INSTALLATION
A. Install flashings, including laps, splices, joints, bonding, adhesion, and attachment, as required by membrane manufacturer's recommendations and details.
B. Metal Accessories: Install metal edgings, gravel stops, and copings in locations indicated on the Drawings, with horizontal leg of edge member over membrane and flashing over metal onto membrane.
   1. Follow roofing manufacturer's instructions.
   2. Remove protective plastic surface film immediately before installation.
   3. Install water block sealant under the membrane anchorage leg.
   4. Flash with manufacturer's recommended flashing sheet unless otherwise indicated.
   5. Where single application of flashing will not completely cover the metal flange, install additional piece of flashing to cover the metal edge.
   6. If the roof edge includes a gravel stop and sealant is not applied between the laps in the metal edging, install an additional piece of self-adhesive flashing membrane over the metal lap to the top of the gravel stop; apply seam edge treatment at the intersections of the two flashing sections.
   7. When the roof slope is greater than 1:12, apply seam edge treatment along the back edge of the flashing.
C. Roofing Expansion Joints: Install as shown on Drawings and as recommended by roofing manufacturer.
D. Flashing at Walls, Curbs, and Other Vertical and Sloped Surfaces: Install weathertight flashing at all walls, curbs, parapets, curbs, skylights, and other vertical and sloped surfaces that the roofing membrane abuts to; extend flashing at least 8 inches high above membrane surface.
   1. Use the longest practical flashing pieces.
   2. Evaluate the substrate and overlay and adjust installation procedure in accordance with membrane manufacturer's recommendations.
   3. Complete the splice between flashing and the main roof sheet with specified splice adhesive before adhering flashing to the vertical surface.
   4. Provide termination directly to the vertical substrate as shown on Drawings.

E. Roof Drains:
   1. Taper insulation around drain to provide smooth transition from roof surface to drain. Use specified pre-manufactured tapered insulation with facer or suitable bonding surface to achieve slope; slope not to exceed manufacturer's recommendations.
   2. Position membrane, then cut a hole for roof drain to allow 1/2 to 3/4 inch of membrane to extend inside clamping ring past drain bolts.
   3. Make round holes in membrane to align with clamping bolts; do not cut membrane back to bolt holes.
   4. Apply sealant on top of drain bowl where clamping ring seats below the membrane.
   5. Install roof drain clamping ring and clamping bolts; tighten clamping bolts to achieve constant compression.

F. Flashing at Penetrations: Flash all penetrations passing through the membrane; make flashing seals directly to the penetration.
   1. Pipes, Round Supports, and Similar Items: Flash with specified pre-molded pipe flashings wherever practical; otherwise use specified self-curing elastomeric flashing.
   2. Pipe Clusters and Unusual Shaped Penetrations: Provide penetration pocket at least 2 inches deep, with at least 1 inch clearance from penetration, sloped to shed water.
   3. Structural Steel Tubing: If corner radii are greater than 1/4 inch and longest side of tube does not exceed 12 inches, flash as for pipes; otherwise, provide a standard curb with flashing.
   4. Flexible and Moving Penetrations: Provide weathertight gooseneck set in sealant and secured to deck, flashed as recommended by manufacturer.
   5. High Temperature Surfaces: Where the in-service temperature is, or is expected to be, in excess of 180 degrees F, protect the elastomeric components from direct contact with the hot surfaces using an intermediate insulated sleeve as flashing substrate as recommended by membrane manufacturer.

3.08 FINISHING AND WALKWAY INSTALLATION

A. Install walkways at access points to the roof, around rooftop equipment that may require maintenance, and where indicated on the drawings.
   1. Use specified walkway pads unless otherwise indicated.
   2. Do not install walkway pads within 10 feet of any roof edge or perimeter -- these areas require loose-laid pavers as walking surfaces.

B. Walkway Pads: Adhere to the roofing membrane, spacing each pad at minimum of 1.0 inch and maximum of 3.0 inches from each other to allow for drainage.
   1. If installation of walkway pads over field fabricated splices or within 6 inches of a splice edge cannot be avoided, adhere another layer of flashing over the splice and extending beyond the walkway pad a minimum of 6 inches on either side.
   2. Prime the membrane, remove the release paper on the pad, press in place, and walk on pad to ensure proper adhesion.

3.09 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Inspection by Manufacturer: Provide final inspection of the roofing system by a Technical Representative employed by roofing system manufacturer specifically to inspect installation for warranty purposes (i.e. not a sales person).

C. Perform all corrections necessary for issuance of warranty.
3.10 CLEANING
   A. Clean all contaminants generated by roofing work from building and surrounding areas, including bitumen, adhesives, sealants, and coatings.
   B. Repair or replace building components and finished surfaces damaged or defaced due to the work of this Section; comply with recommendations of manufacturers of components and surfaces.
   C. Remove leftover materials, trash, debris, equipment from project site and surrounding areas.

3.11 PROTECTION
   A. Where construction traffic must continue over finished roof membrane, provide durable protection and replace or repair damaged roofing to original condition.

END OF SECTION
SECTION 07 6200
SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Fabricated sheet metal items, including flashings and counterflashings.
B. Sealants for joints within sheet metal fabrications.
C. Design of attachment systems to comply with specified requirements.

1.02 RELATED REQUIREMENTS
A. 07 5423 - Thermoplastic-Polyolefin Roofing (TPO): Metal copings and flashings associated with TPO roofing system.

1.03 REFERENCE STANDARDS
C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

1.04 ADMINISTRATIVE REQUIREMENTS
A. Coordination:
   1. Coordinate with roofing work for scheduling installation of counterflashing, rain drainage and similar items related to roofing.
   2. Coordinate with the work of Section 07 9200 for installation of related sealants.
B. Sequencing: Do not proceed with installation of flashing and sheet metal work until substrate construction, cant, blocking, reglets, and other construction are ready to receive the work of this Section.

1.05 SUBMITTALS
A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.
C. Samples: Submit two samples 6 x 6 inch in size illustrating metal finish color.

1.06 QUALITY ASSURANCE
A. Perform work in accordance with SMACNA (ASMM) requirements and standard details, except as otherwise indicated.
B. Fabricator and Installer Qualifications: Company specializing in sheet metal work with three years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING
A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
B. Prevent contact with materials that could cause discoloration or staining.
1.08 WARRANTY
   A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
   B. Correct defective Work within a five year period after Date of Substantial Completion. Defective work includes failure of watertightness or seals.
   C. Provide 20 year manufacturer warranty for prefinished sheet metal materials. Warranty shall include degradation of metal finish.

PART 2 PRODUCTS

2.01 SHEET METAL FLASHING AND TRIM ASSEMBLIES
   A. Flashing Assemblies:
      1. Capable of withstanding structural movement, thermally induced movement, and exposure to wind and weather without failure or permanent deformation.
      2. Physically protect roofing systems, roof accessories, and other building elements and systems from damage that would permit water leakage into building enclosure assemblies under all weather conditions.
   B. Roof Edge Flashing and Coping Assemblies:
      1. Pull-Off Resistance: Tested in accordance with ANSI/SPRI/FM 4435/ES-1, RE-1, RE-2, and RE-3 as applicable to positive and negative design wind pressure as defined by applicable code.
      2. Capable of withstanding structural movement, thermally induced movement, and exposure to wind and weather without failure or permanent deformation.
      3. Physically protect roofing systems, roof accessories, and other building elements and systems from damage that would permit water leakage to building interior under all weather conditions.

2.02 SHEET MATERIALS
   A. Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 24 gage, (0.0239 inch) thick base metal.
      1. Applications: Flashings and counterflashings at roofing locations, concealed from public view, and similar locations.
   B. Pre-Finished Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 24 gage, (0.0239) inch thick base metal, shop pre-coated with PVDF coating.
      1. Applications: Flashings and counterflashings exposed to public view, and where specifically indicated on Drawings.
      2. PVDF (Polyvinylidene Fluoride) Coating: Superior Performance Organic Finish, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system.
      3. Color: As selected by Architect from manufacturer’s full colors.

2.03 FABRICATION
   A. Form sections true to shape, accurate in size, square, and free from distortion or defects.
   B. Fabricate cleats and starter strips of same material as exposed sheet, one gage thickness heavier than exposed sheet, and interlockable with exposed sheet.
      1. Provide continuous cleat strips for metal copings and flashings.
   C. Form pieces in longest possible lengths.
   D. Hem exposed edges on underside 1/2 inch; miter and seam corners.
   E. Form material with flat lock seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.
   F. Fabricate corners from one piece with minimum 18 inch long legs; seam for rigidity, seal with sealant.
   G. Fabricate vertical faces with bottom edge formed outward 1/4 inch and hemmed to form drip.
   H. Fabricate flashings to allow toe to extend minimum 2 inches over roofing terminations. Return and brake edges.
I. Roof Equipment Supports: Cover raised bases and equipment supports with specified galvanized steel sheet. Fabricate with one inch riveted and soldered flat seams. Extend counterflashings over roof base flashings 4 inches minimum, and fold back bottom edge 1/2 inch. Where metal is penetrated for bolt or other fastener connections, use 4 lb sheet lead washers 2 inches larger than fastener hole.
   1. Comply with SMACNA (ASMM) Figure 4-17.

J. Formed Metal Copings: Fabricate cross joints between coping sheets with 3/16 inch expansion joint between sheets, and 6 inch wide cover plate formed to profile of coping. Form cross joints in coping according to SMACNA (ASMM). Miter, seam, and seal corners of coping.
   1. Comply with SMACNA (ASMM) Figure 3-7A.

K. Provide for thermal expansion/contraction of all exposed sheet metal work exceeding 15 feet in running length, except as otherwise indicated.
   1. Wall Caps, Flashing and Trim: 10 feet maximum spacing, and not closer than 24 inches from corners and intersections.

2.04 ACCESSORIES
   A. Fasteners: Galvanized steel, with soft neoprene washers.
   B. Primer: Zinc chromate type.
   C. Concealed Sealants: Non-curing butyl sealant.
   D. Exposed Sealants: ASTM C920; elastomeric sealant, with minimum movement capability as recommended by manufacturer for substrates to be sealed; color to match adjacent material.
   E. Plastic Cement: ASTM D4586/D4586M, Type I.

PART 3 EXECUTION

3.01 EXAMINATION
   A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.
   B. Verify roofing termination and base flashings are in place, sealed, and secure.
   C. Metal Wall Caps and Copings: Verify that wood grounds and nailing boards are secured to building framing sufficiently to resist specified pull-off resistance requirements.

3.02 PREPARATION
   A. Install starter and edge strips, and cleats before starting installation.
   B. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil.

3.03 INSTALLATION - GENERAL
   A. Conform to Drawing details; if not detailed on Drawings, comply with standard details of the following:
      1. Steel Sheet Metal: SMACNA (ASMM).
   B. Lapped Seams - General: Overlap seams 4 inches, and seal with two continuous beads of non-curing butyl sealant spaced 2 inches apart and located 1 inch from end of each metal sheet.
   C. Cleats and Edge Strips: Secure edges of sheet metal members over 12 inches wide, and at other indicated locations with cleats. Fasten cleats at maximum 12 inches on center unless otherwise indicated. Provide continuous edge strips at eaves and gable ends for attaching exposed terminating edge of copings, gravel stops, or fascias. Provide minimum 1/8 inch butt joints as required to accommodate thermal movement.
   D. Formed Metal Copings: Extend front and back edges of coping down over continuous interlocking edge strip. Terminate rear edge with hemmed and folded edge over roof base flashings, or interlock with adjacent flashings as indicated. Miter, seam, and seal corners.
   E. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted.
F. Apply plastic cement compound between metal flashings and felt flashings.

G. Isolate sheet metal from cementitious materials and dissimilar metals with underlayment or protective coating that is compatible with all other materials with which it will come in contact.

H. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.

I. Seal metal joints watertight.

3.04 INSTALLATION - PRE-FINISHED SHEET METAL

A. Take special care in the handling and installation to avoid damage to finish.

B. Remove protective film from each unit after installation, but not before adjacent construction is complete.

C. Touch up minor damage or defects to match factory finish. Replace units which are excessively damaged as determined by Architect.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES
A. Roof hatches.
B. Snow guards.

1.02 ADMINISTRATIVE REQUIREMENTS
A. Coordination: Coordinate with installation of roofing system and related flashings for weather tight installation.

1.03 SUBMITTALS
A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Manufacturer's data sheets on each product to be used.
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.
   4. Maintenance requirements.
C. Shop Drawings: Submit detailed layout developed for this project and provide dimensioned location and number for each type of roof accessory.
   1. Snow Guards: Submit design calculations for loadings and spacings based on manufacturer testing.

1.04 DELIVERY, STORAGE, AND HANDLING
A. Store products in manufacturer's unopened packaging until ready for installation.
B. Store products under cover and elevated above grade.

PART 2 PRODUCTS

2.01 ROOF HATCHES
A. Acceptable Manufacturers:
   7. Substitutions: See Section 01 6000 - Product Requirements.
B. Roof Hatches - General: Factory-assembled aluminum frame and cover, complete with operating and release hardware.
   1. Style: Provide flat metal covers unless otherwise indicated.
   3. Thermally Broken Hatches: Added insulation to frame and cover; available in each manufacturer's standard, single leaf sizes; special sizes available upon request.
   4. Sizes: As indicated on Drawings; single-leaf style unless indicated as double-leaf.
C. Extension Post: Extension post for mounting to top rungs of ladder.
   1. Finish: Powder coated; safety yellow color.
   2. Basis of Design Product:
      b. Substitutions: See Section 01 6000 - Product Requirements.
D. Frames and Curbs: One-piece curb and frame with integral cap flashing to receive roof flashings; extended bottom flange to suit mounting.
   1. Material: Mill finished aluminum, 11 gage, 0.0907 inch thick.
   2. Insulation: Manufacturer's standard; 1 inch rigid glass fiber, located on outside face of curb.
   3. Curb Height: 12 inches from finished surface of roof, minimum.

E. Metal Covers: Flush, insulated, hollow metal construction.
   1. Capable of supporting 40 psf live load.
   2. Material: Mill finished aluminum; outer cover 11 gage, 0.0907 inch thick, liner 0.04 inch thick.
   3. Insulation: Manufacturer's standard 1 inch rigid glass fiber.

F. Hardware: Type 316 stainless steel, unless otherwise indicated or required by manufacturer.
   1. Lifting Mechanisms: Compression or torsion spring operator with shock absorbers that automatically opens upon release of latch; capable of lifting covers despite 10 psf load.
   2. Hinges: Heavy duty pintle type.
   3. Hold open arm with vinyl-coated handle for manual release.

2.02 SNOW GUARDS

A. Fence Type Snow Guard: Continuous snow guard; manufacturer's standard pipe, bar, channel, or solid rod, set in brackets or posts, with optional plates and metal trim to match roof.
   2. Pipe or Square Tube: Aluminum, mill finish.
      a. Outside Diameter, Round: 1 inch, nominal.
      b. Pipe or Tube Wall Thickness: Manufacturer's standard thickness for specified fence type.
      c. Threaded Couplings: Match pipe or tube, manufacturers standard.
      d. End Collars and Caps: Metal to match tube.
   3. Supplemental Plates and Clips: Attached to horizontal component; match finish of pipe, tube, rod, or channel.
   4. Clamps for Standing Seam Roof: Stainless steel clamps and required accessory components designed specifically for attachment to standing seams of roof panels; for attachment of fence type snow guard.
      a. Seam Profile: Selected by Architect from manufacturer's full range; match profile of metal roof.
      b. Clamp Spacing: Every panel seam; maximum spacing of 20 inches.
   5. Acceptable Manufacturer:
      b. Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 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.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using methods recommended by manufacturer for achieving acceptable results for applicable substrate under project conditions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions, in manner that maintains roofing system weather-tight integrity.
B. Apply bituminous paint on surfaces of units in contact with cementitious materials or dissimilar metals.

3.04 ADJUSTING

A. Adjust hardware for smooth operation.

3.05 CLEANING

A. Clean installed work to like-new condition.

3.06 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION
SECTION 07 8400
FIRESTOPPING

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Firestopping systems, materials, and accessories.
B. Firestopping at electrical junction boxes in fire-rated walls.
C. Firestopping of all penetrations and interruptions to fire rated assemblies, whether indicated on Drawings or not, and other openings indicated.
D. Contractor’s responsibility for determining required scope of firestopping system work, and for determining applicable tested/listed systems for the entire project, and for securing jurisdictional authority approval of firestopping systems.

1.02 DEFINITIONS
A. Firestopping: A material or combination of materials used to retain the integrity of fire- and smoke-rated construction by maintaining an effective barrier against the spread of flame, and to impede the passage of smoke, gases, and moisture through penetrations, blank openings, construction joints, and perimeter fire/smoke containment in or adjacent to fire-and smoke-rated wall, floor, ceiling, and other rated construction assemblies.
B. Assembly: Particular arrangement of materials specific to type of construction described or detailed in referenced UL or other approved design.
C. Barrier: Time-rated fire walls, smoke barrier walls, time-rated floor/ceiling assemblies, and structural floors.
D. Penetration: Opening or foreign material passing through or into barrier or structural floor such that full thickness of rated materials is interrupted.
E. Membrane Penetration: An opening made through one side of an assembly without passing completely through the assembly.
F. Construction Gaps: Gaps between adjacent sections of walls, exterior walls, top of wall and ceiling, structural floors or roof decks, and adjacent sections of structural floors.
G. System: Specific products and applications, classified and numbered by UL or other approved testing agency to close specific barrier penetrations.
H. Sleeve: Metal fabrication or pipe section extending through thickness of barrier used to permanently guard penetration.
I. VOC: Volatile organic compound(s).

1.03 REFERENCE STANDARDS
K. ITS (DIR) - Directory of Listed Products.
L. FCIA - Firestop Contractors International Association Manual of Practice.
M. FM (AG) - FM Approval Guide.
N. UL 1479 - Standard for Fire Tests of Penetration Firestops.
P. UL (DIR) - Online Certifications Directory.

1.04 ADMINISTRATIVE REQUIREMENTS
A. Coordination: Coordinate installation of firestopping systems with affected trades and adjacent work.
B. Sequencing: Sequence work to permit firestopping materials to be installed after adjacent and surrounding work is complete.
   1. Do not cover or conceal firestopping installations until Owner's inspection agency and jurisdictional authority have inspected each installation.

1.05 SUBMITTALS
A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Schedule of Firestopping: List each type of penetration, fire rating of the penetrated assembly, and firestopping test or design number.
C. Product Data: Provide data on product characteristics, performance ratings, and limitations.
D. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.
E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
F. Jurisdictional Authority Submittal: After review and approval of specified submittals by Architect, submit to jurisdictional authority and local fire department complete product data indicating proposed product characteristics, performance characteristics, limitation criteria, and documentation of proposed firestop materials and systems for actual project conditions.
   1. Include manufacturer's complete installation instructions and UL Design or other approved testing agency data sheets for each proposed firestop system.
   2. Include complete test data forms or jurisdictional acceptance for proposed assemblies not conforming to specific UL Design numbers or other approved testing agency system designs.
   3. Submit certificate from authority having jurisdiction indicating approval of materials and systems to be used, with one complete copy, for information only, of the approved jurisdictional authority submittal.
G. Installer Qualification: Submit qualification statements for installing mechanics.

1.06 QUALITY ASSURANCE
A. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with methods indicated.
   1. Listing in UL (FRD), FM (AG), or ITS (DIR) will be considered as constituting an acceptable test report.
   2. Valid evaluation report published by ICC Evaluation Service, Inc. (ICC-ES) at www.icc-es.org will be considered as constituting an acceptable test report.
   3. Submission of actual test reports is required for assemblies for which none of the above substantiation exists.
B. Installer Qualifications: Company specializing in performing the work of this Section and:
   1. Trained by manufacturer.
   2. Approved by Factory Mutual Research Corporation under FM 4991, or meeting any two of the following requirements:
      a. Verification of minimum three years documented experience installing work of this type.
      b. Verification of at least five satisfactorily completed projects of comparable size and type.
      c. Licensed by local authorities having jurisdiction (AHJ).

C. Obtain firestop systems for each type and condition of penetration from a single manufacturer; intermixing of system components for each type and condition of penetration by different manufacturers is not permitted.

D. Listed and tested assemblies and systems must be utilized, if they exist, before alternative systems requiring Engineering Judgement (EJ) or Equivalent Fire Resistance Rated Assembly (EFRRA) will be considered. Comply with IFC and FCIA for EJ and EFRRA design and submittal requirements.

1.07 DELIVERY, STORAGE, AND PROTECTION
A. Deliver materials in original unopened containers identified with manufacturer's brand designation and applicable UL label.
B. Do not use damaged or expired materials.

1.08 FIELD CONDITIONS
A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation; maintain minimum temperature before, during, and for three days after installation of materials.
B. Provide ventilation in areas where solvent-cured materials are being installed.

1.09 WARRANTY
A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
B. Include agreement to repair or replace joint sealers which fail in joint adhesion, extrusion resistance, migration resistance, general durability, or apparent deterioration beyond manufacturer's printed limitations for stipulated warranty period from Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS
A. Acceptable Manufacturers:
   1. 3M Fire Protection Products: www.3m.com/firestop.
   12. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS - GENERAL
A. Firestopping Materials: Any materials meeting requirements specified.
   1. Comply with ASTM E814, UL 1479, and UL 2079 as applicable to achieve indicated fire ratings.
B. Mold and Mildew Resistance: Provide firestoppping materials with mold and mildew resistance rating of zero(0) in accordance with ASTM G21.
C. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials as required for tested firestopping assembly.

D. Fire Ratings: Refer to Drawings for required systems and ratings.

2.03 FIRESTOPPING ASSEMBLY REQUIREMENTS

A. General: Use firestopping systems which are acceptable for those applications for which they are specifically designed. Use of other UL listed systems is Contractor's Option, subject to compliance with specified performance, regulatory, and quality assurance requirements.

1. Where there is no specific tested and classified firestop system for an indicated condition, obtain from the firestopping system manufacturer an Engineering Judgement (EJ) or Equivalent Fire Resistance Rated Assembly (EFRRA) according to IFC and FCIA.

B. Scope: Install firestopping at all locations requiring protected openings where piping, conduit, cables, sleeves, ductwork and similar items penetrate fire-resistive, fire-rated, and smoke assemblies, including but not limited to:

1. Penetrations through wall, floor, and roof assemblies, including empty openings and openings containing penetrations.
2. Membrane penetrations where items penetrate one side of the barrier assembly.
3. Joints between rated assemblies to allow independent movement.
4. Perimeter barriers between exterior wall assemblies and floor and roof assemblies.
5. Joints, through-penetrations, and membrane penetrations in smoke-rated assemblies.

C. Perimeter Fire Containment Firestopping: Use system that has been tested according to ASTM E2307 to have fire resistance F Rating equal to required fire rating of floor assembly.

1. Movement: Provide systems that have been tested to show movement capability as indicated.
2. Temperature Rise: Provide systems that have been tested to show T Rating as indicated.
3. Air Leakage: Provide systems that have been tested to show L Rating as indicated.
4. Where floor assembly is not required to have a fire rating, provide systems that have been tested to show L Rating as indicated.

D. Head-of-Wall Joint System Firestopping at Joints Between Fire-Rated Wall Assemblies and Non-Rated Horizontal Assemblies: Use system that has been tested according to ASTM E2837 to have fire resistance F Rating equal to required fire rating of floor or wall, whichever is greater.

1. Movement: Provide systems that have been tested to show movement capability as indicated.

E. Floor-to-Floor, Wall-to-Wall, and Wall-to-Floor Joints, Except Perimeter, Where Both Are Fire-Rated: Use system that has been tested according to ASTM E1966 or UL 2079 to have fire resistance F Rating equal to required fire rating of the assembly in which the joint occurs.

1. Movement: Provide systems that have been tested to show movement capability as indicated.
2. Air Leakage: Provide systems that have been tested to show L Rating as indicated.
3. Watertightness: Provide systems that have been tested to show W Rating as indicated.
4. Listing by FM (AG), ITS (DIR), UL (DIR), or UL (FRD) in their certification directories will be considered evidence of successful testing.

F. Through Penetration Firestopping: Use system that has been tested according to ASTM E814 to have fire resistance F Rating equal to required fire rating of penetrated assembly.

1. Temperature Rise: Provide systems that have been tested to show T Rating as indicated.
2. Air Leakage: Provide systems that have been tested to show L Rating as indicated.
3. Watertightness: Provide systems that have been tested to show W Rating as indicated.
4. Listing by FM (AG), ITS (DIR), UL (DIR), or UL (FRD) in their certification directories will be considered evidence of successful testing.

G. Fire Rated Joint Systems: Integrity and indicated fire-resistance ratings as determined by UL 2079, ASTM E1399, or ASTM E1996 as applicable.

H. Fire Rated Construction: Maintain barrier and structural floor fire resistance ratings including resistance to cold smoke at all penetrations, connections with other surfaces and types of construction, at separations required to permit building movement and sound or vibration absorption, and at other construction gaps.
I. Smoke Barrier Construction: Maintain barrier and structural floor resistance to cold smoke at all penetrations, connections with other surfaces and types of construction, at separations required to permit building movement and sound or vibration absorption, and at other construction gaps.

J. Other General Characteristics:
   1. Surface Burning: ASTM E84 and UL 723; flame spread less than 25, smoke developed less than 450.
   2. Air Leakage of Perimeter Firestopping Barriers and Penetrations: UL 2079; L-rating less than 2.0 cfm/sf or 5.0 cfm/lf as applicable to the type and location of joint.

2.04 MATERIALS

A. Putty Compound: 100 percent solids intumescent or vinyl-type formulation, free of asbestos, silicones, solvents, halogens, PCB's, and inorganic fibers; flame spread/smoke developed rating 0/0 when tested in accordance with ASTM E84; paintable, not sensitive to freezing after set.

B. Sealant Compound: One-part intumescent, endothermic, ablative, or elastomeric acrylic water-based caulking material required by applicable UL Design; flame spread/smoke developed rating 0/0 when tested in accordance with ASTM E84.

C. Spray-Applied Compound: Water-based, flexible coating which dries to form a flexible seal; tested in accordance with ASTM E1399, complying with wind sway and thermal category, 500 cycles at minimum 10 cycles/minute.

D. Foam Compound: Two-part, liquid-silicone elastomer formulated to foam in place when mixed; flame spread/smoke developed rating 0/0 when tested in accordance with ASTM E84.

E. Plastic Pipe Device: Intumescent strip material, factory or site fabricated in flexible metal collar with adjustable, screw-tightened stainless steel clamp; UL classified for use with PVC, CPVC, CCPVC, CCABS, PVDF, PP, PB, and FRPP plastic pipe.

F. Fire-Safing Insulation: ASTM C612, Type I; high-melt mineral fibers and resinous binders formed into blankets, density not less than 4.0 lbs/cu ft, tested for 3-hour fire containment for required depths and dimensions.

G. Firestopping Pads: Intumescent, dielectric fire putty formed to 7 x 7 or 9.5 x 9.5 inch self-adhering pads, 2-hour fire rating listed by UL.

2.05 ACCESSORIES

A. Provide necessary accessory materials specified in UL Design to achieve complete firestop system at each penetration. Include collars, sleeves, attachment devices, intumescent materials, and other items required.

B. Primers, Sleeves, Forms, and Accessories: Type required for tested assembly design, and as recommended by firestopping manufacturer for specific substrate surfaces.

C. Dam Material: Mineral fiberboard, mineral fiber matting, sheet metal, alumina silicate fire board, or other permanent material required as part of the firestopping system, or removable if not specifically required as part of the firestopping system.

D. Retainers: Impale type clips to support mineral fiber safing blankets.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify openings are ready to receive the work of this Section.

3.02 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other materials that could adversely affect bond of firestopping material.
B. Remove incompatible materials that could adversely affect bond.
C. Install backing or damming materials required to arrest liquid material leakage.

3.03 INSTALLATION - GENERAL
A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.
B. Apply firestopping materials in sufficient thicknesses to achieve scheduled fire ratings, to uniform density and texture.
C. Install material at openings which contain penetrating sleeves, piping, ductwork, conduit and other items requiring firestopping.
D. Remove dam material after firestopping material has cured only if dam material is not required as part of the firestopping system; otherwise dam material to remain permanently in place.
E. Do not cover installed firestopping until inspected by authorities having jurisdiction.
F. Install labeling required by code.

3.04 INSTALLATION - FIRE SAFING INSULATION
A. Install safing insulation to completely fill spaces between floor slab edges and spandrel construction as detailed.
B. Install safing insulation to completely fill voids between floor and roof deck flutes and top of wall construction where wall ratings are indicated.
C. Install and support safing insulation permanently in position to comply with tested fire assembly and applicable building code requirements.

3.05 INSTALLATION - FIRESTOPPING PADS
A. Install firestopping pads on back side of electrical junction boxes in fire-rated walls where boxes are located in same stud space on opposite sides of same wall, and elsewhere required by jurisdictional authority and local fire department.

3.06 CLEANING
A. Clean adjacent surfaces of firestopping materials.

3.07 PROTECTION
A. Protect adjacent surfaces from damage by material installation.

END OF SECTION
SECTION 07 9200
JOINT SEALANTS

PART 1  GENERAL

1.01  SECTION INCLUDES

A. Nonsag gunnable joint sealants.
B. Self-leveling gunnable and pourable joint sealants.
C. Joint backings and accessories.

1.02  DEFINITIONS

A. Nonsag Sealant: Permits application in joints on vertical surfaces without sagging or slumping.
B. Self-leveling Sealant: Pourable or self-leveling sealant that has sufficient flow to form a smooth, level surface when applied in a horizontal joint.

1.03  REFERENCE STANDARDS

I. SWRI - Sealant, Waterproofing and Restoration Institute; Sealants: The Professionals' Guide.

1.04  ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate sealant work with other work requiring sealants, and with other Sections referencing this Section; do not obstruct indicated or required moisture weepage systems under any circumstances.
   2. Coordinate sealant surface preparation of exterior joint sealants scheduled for paint finish with Section 09 9113. Provide advice and recommendations on compatibility of specified preparation procedures with sealants used.

1.05  SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data for Sealants: Submit manufacturer's technical data sheets for each product to be used, that includes the following.
   1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
   2. List of backing materials approved for use with the specific product.
   3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
   4. Substrates the product should not be used on.
   5. Substrates for which use of primer is required.
C. Product Data for Accessory Products: Submit manufacturer's technical data sheet for each product to be used, including physical characteristics, installation instructions, and recommended tools.
D. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.

1.06 QUALITY ASSURANCE

A. Conform to SWRI recommendations for materials and installation.

B. Installer Qualifications: Company specializing in performing the work of this Section with minimum three years documented experience.

C. System Compatibility: Assume responsibility for confirming that sealants are compatible with each other as a system, and also compatible with substrate surfaces with which they will be in contact, including but not limited to wall and sheathing surfaces, opening materials, other flashings and weather barrier materials.
   1. Assure that system components are compatible as specified prior to preparing and making specified submittals.
   2. Assume responsibility for removal of incompatible system components and installation of properly compatible components at no additional cost to Owner regardless of when incompatibility is discovered.

1.07 MOCK-UP

A. Comply with general mock-up requirements specified in Section 01 4000.

B. Mock-up: Provide mock-up of sealant joints in conjunction with window, wall, and air barrier system under provisions of Section 01 4000.
   1. Construct mock-up with specified sealant types and with other components noted.
   2. Locate where directed.
   3. Mock-up may remain as part of the Work.

1.08 FIELD CONDITIONS

A. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.
   1. Install sealants only when temperature is in lower third of manufacturer's recommended installation temperature range wherever joint width is affected by ambient temperature variations.
   2. Install sealants only when ambient temperature conditions can be maintained at or above 40 degrees F during installation and 48 hours immediately following installation.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in original, unopened containers or bundles with labels indicating manufacturer, product name and designation, expiration period for use, pot life, curing time, and mixing instructions for multi-component materials.

1.10 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective work within a five year period after Date of Substantial Completion.

C. Warranty: Include coverage of installed sealants and accessories which fail to achieve air tight and watertight seal, exhibit loss of adhesion, cohesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, general durability, or which appear to deteriorate in any other manner not clearly specified by submitted manufacturer's data as an inherent quality of the material for the exposure indicated.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers:
11. Substitutions: See Section 01 6000 - Product Requirements.

2.02 JOINT SEALANT APPLICATIONS

A. Sealant Scope:
   1. Exterior Joints: Seal open joints, whether or not the joint is indicated on Drawings, unless specifically indicated not to be sealed. Exterior joints to be sealed include, but are not limited to, the following items.
      a. Wall expansion and control joints.
      b. Joints between door, window, and other frames and adjacent construction.
      c. Joints between different exposed materials.
      d. Openings below ledge angles in masonry.
      e. Other joints indicated below.
   2. Interior Joints: Do not seal interior joints unless specifically indicated to be sealed. Interior joints to be sealed include, but are not limited to, the following items.
      a. Joints between door, window, and other frames and adjacent construction.
      b. Joint between suspended ceiling wall angle and soffit or wall surface; concealed.
      c. Other joints indicated below.
   3. Do not seal the following types of joints:
      a. Intentional weep holes in masonry.
      b. Joints indicated to be treated with manufactured expansion joint cover or some other type of sealing device.
      c. Joints where sealant is specified to be provided by manufacturer of product to be sealed.
      d. Joints where installation of sealant is specified in another Section.
      e. Joints between suspended panel ceilings/grid and walls.

B. Exterior Joints: Use non-sag non-staining silicone sealant, unless otherwise indicated.
   1. Lap Joints in Sheet Metal Fabrications: Butyl rubber, non-curing.
   2. Lap Joints between Manufactured Metal Panels: Butyl rubber, non-curing.
   3. Control and Expansion Joints in Concrete Paving: Self-leveling polyurethane "traffic-grade" sealant.
   4. Movement Joint Surrounding Water Flume Ride Tube: Non-staining silicone sealant; specific product as specified in this Section.

C. Interior Joints: Use non-sag polyurethane sealant, unless otherwise indicated.
   3. Floor Joints in Wet Areas: Non-sag polyurethane "non-traffic-grade" sealant suitable for continuous liquid immersion.
   4. Joints between Fixtures in Wet Areas and Floors, Walls, and Ceilings: Mildew-resistant silicone sealant.
   5. Narrow Control Joints in Interior Concrete Slabs: Self-leveling epoxy sealant.

D. Definitions of Special Use Areas:
   1. Interior Wet Areas: Include bathrooms, restrooms, kitchens, food service areas, and food processing areas; fixtures in wet areas include plumbing fixtures, food service equipment, countertops, cabinets, and other similar items.

2.03 JOINT SEALANTS - GENERAL

A. Hardness: As recommended by manufacturer for applications shown.

B. Modulus of Elasticity: Provide lowest available modulus of elasticity for indicated requirements and consistent with exposure to weathering, indentation, abrasion and support of loading.

C. Compatibility: Provide sealants, joint fillers, and related materials that are compatible with one another and with substrates and other materials to which they will be exposed in the joint system.
D. Grade: For each application, provide grade of sealant complying with ASTM C920, and as recommended by manufacturer for indicated conditions, to achieve best possible performance. Types, grades, classes, and uses specified are for normal conditions.

E. Colors: As selected from manufacturer’s full line, unless otherwise specified.

2.04 NONSAG JOINT SEALANTS

A. Non-Staining Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
1. Movement Capability: Plus and minus 50 percent, minimum.
2. Non-Staining To Porous Stone: Non-staining to light-colored natural stone when tested in accordance with ASTM C1248.
3. Dirt Pick-Up: Reduced dirt pick-up compared to other silicone sealants.
4. Hardness Range: 15 to 35, Shore A, when tested in accordance with ASTM C661 or ASTM D2240.
5. Cure Type: Single-component, neutral moisture curing.
6. Service Temperature Range: Minus 20 to 180 degrees F.
7. Acceptable Product:
   b. Substitutions: See Section 01 6000 - Product Requirements.

B. Mildew-Resistant Silicone Sealant: ASTM C920, Grade NS, Uses M and A; single component, mildew resistant; not expected to withstand continuous water immersion or traffic.

C. Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multi-component; not expected to withstand continuous water immersion or traffic.
   1. Movement Capability: Plus and minus 50 percent, minimum.

D. Polyurethane Sealant for Continuous Water Immersion: ASTM C920, Grade NS, Uses M and A; single or multicomponent; explicitly approved by manufacturer for continuous water immersion; suitable for traffic exposure when recessed below traffic surface.
   1. Movement Capability: Plus and minus 35 percent, minimum.
   2. Hardness Range: 20 to 35, Shore A, when tested in accordance with ASTM C661 or ASTM D2240.
   3. Service Temperature Range: Minus 40 to 180 degrees F.

E. Acrylic Emulsion Latex: Water-based; ASTM C834, single component, non-staining, non-bleeding, non-sagging; not intended for exterior use.

F. Non-Curing Butyl Sealant: Solvent-based, single component, non-sag, non-skinning, non-hardening, non-bleeding; non-vapor-permeable; intended for fully concealed applications.

2.05 SELF-LEVELING SEALANTS

A. Self-Leveling Polyurethane Sealant: ASTM C920, Grade P, Uses M and A; single component; explicitly approved by manufacturer for traffic exposure; not expected to withstand continuous water immersion.
   2. Hardness Range: 35 to 55, Shore A, when tested in accordance with ASTM C661 or ASTM D2240.
   3. Service Temperature Range: Minus 40 to 180 degrees F.

B. Semi-Rigid Self-Leveling Epoxy Joint Filler: Epoxy or epoxy/polyurethane copolymer; intended for filling cracks and control joints not subject to significant movement; rigid enough to support concrete edges under traffic.
   1. Composition: Multi-component, 100 percent solids by weight.
   2. Durometer Hardness: Minimum of 85 for Type A or 35 for Type D, after seven days when tested in accordance with ASTM D2240.
   4. Joint Depth: Provide product suitable for joints from 1/8 inch to 2 inches in depth including space for backer rod.
2.06 ACCESSORIES

A. Backer Rod: Cylindrical cellular foam rod with surface that sealant will not adhere to, compatible with specific sealant used, and recommended by backing and sealant manufacturers for specific applications.
   1. Type for Joints Not Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type B - Bi-Cellular Polyethylene.
   2. Type for Joints Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type B - Bi-Cellular Polyethylene.
   3. Closed Cell and Bi-Cellular: 25 to 33 percent larger in diameter than joint width.

B. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.

C. Masking Tape: Self-adhesive, nonabsorbent, non-staining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.

D. Joint Cleaner: Non-corrosive and non-staining type, type recommended by sealant manufacturer; compatible with joint forming materials.

E. Primers: Type recommended by sealant manufacturer to suit application; non-staining.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that joints are ready to receive work.

B. Verify that backing materials are compatible with sealants.

C. Verify that backer rods are of the correct size.

3.02 PREPARATION

A. Remove loose materials and foreign matter that could impair adhesion of sealant.

B. Clean joints, and prime as necessary, in accordance with manufacturer’s instructions.

C. Perform preparation in accordance with manufacturer’s instructions and ASTM C1193.

D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.

3.03 INSTALLATION

A. Perform work in accordance with sealant manufacturer’s requirements for preparation of surfaces and material installation instructions.

B. Perform installation in accordance with ASTM C1193.

C. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.
   1. Provide joints sized for width/depth ratios according to ASTM C1472.

D. Multiple backer rods are not permitted; use single backer rod properly sized to joint width.

E. Install bond breaker backing tape where backer rod cannot be used.

F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.

G. Do not obstruct indicated or required moisture weepage systems under any circumstances.

H. Do not install sealant when ambient temperature is outside manufacturer’s recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer’s approval is obtained and instructions are followed.
I. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

J. Concrete Floor Joint Filler: After full cure, shave joint filler flush with top of concrete slab.

3.04 POST-OCCUPANCY

A. Post-Occupancy Inspection: Perform visual inspection of entire length of project sealant joints at a time that joints have opened to their greatest width; i.e. at low temperature in thermal cycle. Report failures immediately and repair.

END OF SECTION
SECTION 07 9513
EXPANSION JOINT COVER ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Expansion joint cover assemblies.

1.02 REFERENCE STANDARDS
D. ITS (DIR) - Directory of Listed Products.
E. UL (DIR) - Online Certifications Directory.

1.03 ADMINISTRATIVE REQUIREMENTS
A. Installation Templates: For frames and anchors to be embedded in concrete or masonry, furnish templates to relevant installers; include installation instructions and tolerances.

1.04 SUBMITTALS
A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide joint assembly profiles, profile dimensions, anchorage devices and available colors and finish.
C. Shop Drawings: Indicate joint and splice locations, miters, layout of the work, [].
D. Manufacturer's Installation Instructions: Indicate rough-in sizes and required tolerances for item placement.

PART 2 PRODUCTS

2.01 MANUFACTURERS
A. Acceptable Manufacturers:
6. Substitutions: See Section 01 6000 - Product Requirements.

2.02 EXPANSION JOINT COVER ASSEMBLIES
A. Expansion Joint Cover Assemblies - General: Factory-fabricated and assembled; designed to completely fill joint openings, sealed to prevent passage of air, dust, water, smoke; suitable for traffic expected.
1. Joint Dimensions and Configurations: As indicated on Drawings.
2. Joint Cover Sizes: Selected to suit joint width and configuration, based on manufacturer's published recommendations and limitations.
3. Joint Cover Styles: As indicated on Drawings.
4. Joint Movement Capability: If not indicated, provide minimum plus/minus 25 percent joint movement capability.
5. Lengths: Provide covers in full lengths required; avoid splicing wherever possible.
6. Anchors, Fasteners, and Fittings: Provided by cover manufacturer.
B. Floor Joint Covers: Coordinate with indicated floor coverings.
   1. If floor covering is not indicated, obtain instructions from Architect before proceeding.
   2. If style is not indicated, provide extruded aluminum frame both sides, resilient seals, and minimize exposed metal.

C. Resilient Seal Type Covers: Having flat exposed surface without crevices that could collect dirt; designed to withstand expected movement without extrusion of seal from joint assembly; for floors, provide style that is flush with top of floor covering; for exterior joints, weathertight.

D. Sliding Cover Plate Type Covers: Provide plate with beveled edges and neat fit that does not collect dirt.

E. Covers In Gypsum Board Assemblies: Provide style with anchoring wings that can be completely covered by joint compound.

F. Covers In Fire Rated Assemblies: Provide cover assembly having fire rating equivalent to that of assembly into which it is installed.
   1. Acceptable Evaluation Agencies: UL (DIR) and ITS (DIR).

2.03 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper; or ASTM B308/B308M, 6061 alloy, T6 temper.
   1. Exposed Finish Outdoors: Natural anodized.
   2. Exposed Finish at Floors: Mill finish or natural anodized.
   3. Exposed Finish at Walls and Ceilings: Natural anodized.

B. Resilient Seals:
   1. For Ceilings: Any resilient material, flush, pleated, or hollow gasket.
   2. For Pedestrian Traffic Applications: EPDM rubber, Neoprene, or Santoprene; no PVC; Shore A hardness of 40 to 50 Durometer.

C. Anchors and Fasteners: As recommended by cover manufacturer.

D. Threaded Fasteners: Stainless steel.

E. Backing Paint for Aluminum Components in Contact with Cementitious Materials: Asphalitic type.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that joint preparation and dimensions are acceptable and in accordance with manufacturer's requirements.

B. Verify that frames and anchors installed by others are in correct locations and suitable for installation of remainder of assembly.

3.02 INSTALLATION

A. Install components and accessories in accordance with manufacturer's instructions.

B. Align work plumb and level, flush with adjacent surfaces.

C. Rigidly anchor to substrate to prevent misalignment.

3.03 PROTECTION

A. Do not permit traffic over unprotected floor joint surfaces.

B. Provide strippable coating to protect finish surface.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES
A. Non-fire-rated hollow metal doors and frames.
B. Hollow metal frames for wood doors.
C. Fire-rated hollow metal doors and frames.
D. Thermally insulated hollow metal doors with frames.
E. Hollow metal borrowed lites glazing frames.

1.02 ABBREVIATIONS AND ACRONYMS
A. HMMA: Hollow Metal Manufacturers Association.
C. SDI: Steel Door Institute.

1.03 REFERENCE STANDARDS
A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design.
B. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors.
C. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100).
D. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
J. BHMA A156.115 - American National Standard for Hardware Preparation in Steel Doors and Steel Frames.
L. ITS (DIR) - Directory of Listed Products.
M. NAAMM HMMA 805 - Recommended Selection and Usage Guide for Hollow Metal Doors and Frames.
N. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames.
O. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames.
Q. NAAMM HMMA 850 - Fire-Protection and Smoke Control Rated Hollow Metal Door and Frame Products.
S. NFPA 257 - Standard on Fire Test for Window and Glass Block Assemblies.
T. NFPA 80 - Standard for Fire Doors and Other Opening Protectives.
U. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives.
V. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies.
W. SDI - Steel Door Institute.
Y. UL (DIR) - Online Certifications Directory.
Z. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies.
AA. UL 1784 - Standard for Air Leakage Tests of Door Assemblies.

1.04 ADMINISTRATIVE REQUIREMENTS
A. Coordination:
   1. Coordinate with wall construction for anchor placement.
   2. Coordinate installation of hardware.

1.05 SUBMITTALS
A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced standards/guidelines.
C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.
D. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.
E. Manufacturer's Certificate: Certification that products meet or exceed specified requirements.

1.06 QUALITY ASSURANCE
A. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.
B. Maintain at project site copies of reference standards relating to installation of products specified.

1.07 DELIVERY, STORAGE, AND HANDLING
A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.
C. Inspect hollow metal products upon delivery for damage. Minor damage may be repaired provided refinishing is equal in all respects to new work and is acceptable to Architect; otherwise replace damaged items with new products as specified.

PART 2 PRODUCTS

2.01 MANUFACTURERS
A. Acceptable Manufacturers:
   1. Any listed member of SDI or NAAMM/HMMA in good standing; www.sdi.com or www.naamm.org/hmma.
   2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 GENERAL DOOR AND FRAME REQUIREMENTS
A. Requirements for Hollow Metal Doors and Frames:
1. **Steel Sheet**: Comply with one or more of the following requirements; galvannealed steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.

2. **Accessibility**: Comply with ICC A117.1 and ADA Standards.

3. **Exterior Door Top Closures**: Flush end closure channel, with top and door faces aligned.

4. **Door Edge Profile**: Manufacturers standard for application indicated.

5. **Thermal Break Frames**: Composed of two separate frame sections joined together with continuous, interlocking, 3/16 inch thick PVC thermal break extrusion.
   a. No concealed or exposed fasteners.
   b. Provide replaceable, flexible vinyl weatherstripping compatible with PVC thermal break extrusion; coordinate with door hardware schedule.
   c. Frame Anchors: As specified or required for indicated opening construction; separate anchors for each frame section, not connected to each other to eliminate thermal bridge between door frame sections.

6. **Typical Door Face Sheets**: Flush, unless otherwise indicated on Drawings.

7. **Glazed Lights**: Non-removable stops on non-secure side; sizes and configurations as indicated on Drawings.

8. **Hardware Preparations, Selections and Locations**: Comply with NAAMM HMMA 830 and NAAMM HMMA 831 or BHMA A156.115 and ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
   a. Prepare doors and frames for hardware in accordance with templates provided under Section 08 7100.

9. **Zinc Coating for Typical Interior and/or Exterior Locations**: Provide metal components zinc-coated (galvanized) and/or zinc-iron alloy-coated (galvannealed) by the hot-dip process in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness, unless noted otherwise for specific hollow metal doors and frames.
   a. Based on SDI Standards: Provide at least A40/ZF120 (galvannealed) when necessary, coating not required for typical interior door applications, and at least A60/ZF180 (galvannealed) for corrosive locations.
   b. Based on NAAMM HMMA Custom Guidelines: Provide at least A25/ZF75 (galvannealed) for interior applications, and at least A60/ZF180 (galvannealed) or G60/Z180 (galvanized) for corrosive locations.

B. **Hollow Metal Panels**: Same construction, performance, and finish as doors.

C. **Combined Requirements**: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; where two requirements conflict, comply with the most stringent.

### 2.03 HOLLOW METAL DOORS

A. **Door Finish - General**: Factory primed and field finished.

B. **Exterior Doors**: Thermally insulated.

1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
   a. Level 3 - Extra Heavy-duty.
   b. Physical Performance Level A, 1,000,000 cycles; in accordance with ANSI/SDI A250.4.
   c. Model 1 - Full Flush.
   d. Door Face Metal Thickness: 16 gage, 0.053 inch, minimum.

2. Based on NAAMM HMMA Custom Guidelines:
   b. Performance Level 4 - Maximum Duty, in accordance with NAAMM HMMA 805.
   c. Physical Performance Level A, 1,000,000 cycles; in accordance with ANSI/SDI A250.4.
   d. Door Face Metal Thickness: 16 gage, 0.053 inch, minimum.

3. **Door Core Material**: Polyurethane, 1.8 lbs/cu ft minimum density.
   a. Foam Plastic Insulation: Manufacturer's standard board insulation with maximum flame spread index (FSI) of 75, and maximum smoke developed index (SDI) of 450 in accordance with ASTM E84, and completely enclosed within interior of door.

4. **Door Thermal Resistance**: R-Value of 8.7, minimum, for installed thickness of polyurethane.

5. **Door Thickness**: 1-3/4 inch, nominal.
7. Door Finish: Factory primed and field finished.

C. Interior Doors, Non-Fire-Rated:
   1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
      a. Level 2 - Heavy-duty.
      b. Physical Performance Level B, 500,000 cycles; in accordance with ANSI/SDI A250.4.
      c. Model 1 - Full Flush.
      d. Door Face Metal Thickness: 18 gage, 0.042 inch, minimum.
   2. Based on NAAMM HMMA Custom Guidelines:
      b. Performance Level 3 - Heavy Duty, in accordance with NAAMM HMMA 805.
      c. Physical Performance Level B, 500,000 cycles; in accordance with ANSI/SDI A250.4.
      d. Door Face Metal Thickness: 18 gage, 0.042 inch, minimum.
   3. Door Core Material: Manufacturers standard core material/construction and in compliance with requirements.

D. Interior Doors, Fire-Rated:
   1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
      a. Level 2 - Heavy-duty.
      b. Physical Performance Level B, 500,000 cycles; in accordance with ANSI/SDI A250.4.
      c. Model 1 - Full Flush.
      d. Door Face Metal Thickness: 18 gage, 0.042 inch, minimum.
   2. Based on NAAMM HMMA Custom Guidelines: Comply with NAAMM HMMA 850 requirements for fire-rated doors.
      b. Performance Level 3 - Heavy Duty, in accordance with NAAMM HMMA 805.
      c. Physical Performance Level B, 500,000 cycles; in accordance with ANSI/SDI A250.4.
      d. Door Face Metal Thickness: 18 gage, 0.042 inch, minimum.
   3. Fire Rating: As indicated on Door Schedule, tested in accordance with UL 10C and NFPA 252 ("positive pressure fire tests").
      a. Provide units listed and labeled by UL (DIR) or ITS (DIR).
      b. Attach fire rating label to each fire rated unit.
      c. Smoke and Draft Control Doors: Self-closing or automatic closing doors in accordance with NFPA 80 and NFPA 105, with fire-resistance-rated wall construction rated the same or greater than the fire-rated doors, and the following:
         1) Maximum Air Leakage: 3.0 cfm/sq ft of door opening at 0.10 inch w.g. pressure, when tested in accordance with UL 1784 at both ambient and elevated temperatures.
         2) Gasketing: Provide gasketing or edge sealing as necessary to achieve leakage limit.
         3) Label: Include the "S" label on fire-rating label of door.
   4. Door Core Material: Manufacturers standard core material/construction in compliance with requirements.

2.04 HOLLOW METAL FRAMES

A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.

B. Exterior Door Frames: Full profile/continuously welded type.
   1. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with A60/ZF180 coating.
   2. Frame Metal Thickness: 16 gage, 0.053 inch, minimum.
   3. Frame Finish: Factory primed and field finished.
   4. Weatherstripping: Separate, see Section 08 7100.

C. Interior Door Frames, Non-Fire Rated: Face welded type.
   1. Frame Metal Thickness: 18 gage, 0.042 inch, minimum.
   2. Frame Finish: Factory primed and field finished.

D. Interior Door Frames, Fire-Rated: Face welded type.
   1. Fire Rating: Same as door, labeled.
2. Frame Metal Thickness: 18 gage, 0.042 inch, minimum.
3. Frame Finish: Factory primed and field finished.

E. Frames for Wood Doors: Comply with general interior metal frame requirements in accordance with corresponding wood door; minimum 18 gage thickness, unless otherwise indicated.

F. Borrowed Lites Glazing Frames: Construction and face dimensions to match typical interior metal door frames, and as indicated on Drawings; minimum 18 gage thickness, unless otherwise indicated.

2.05 FINISHES
A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer’s standard.
B. Bituminous Coating: Asphalt emulsion or other high-build, water-resistant, resilient coating.

2.06 ACCESSORIES
A. Louvers: Roll formed steel with overlapping frame; finish same as door components; factory-installed.
  1. In Fire-Rated Doors: UL (DIR) or ITS (DIR) listed fusible link louver, same rating as door.
  2. Style: Sightproof inverted V blade.
B. Glazing: As specified in Section 08 8000.
C. Removable Stops: Formed sheet steel, shape as indicated on Drawings, mitered or butted corners; prepared for countersink style tamper proof screws.
D. Grout for Frames: Portland cement grout with maximum 4 inch slump for hand troweling; thinner pumpable grout is prohibited.
E. Silencers: Resilient rubber, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.
F. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

PART 3 EXECUTION
3.01 EXAMINATION
A. Verify existing conditions before starting work.
B. Verify that opening sizes and tolerances are acceptable.
C. Verify that finished walls are in plane to ensure proper door alignment.

3.02 PREPARATION
A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.

3.03 INSTALLATION
A. Install doors and frames in accordance with manufacturer’s instructions, regulatory requirements, and related requirements of specified door and frame standards or custom guidelines indicated.
B. Install doors and frames in accordance with manufacturer’s instructions, regulatory requirements, and specified industry standards.
  1. Install fire rated units in accordance with NFPA 80.
  2. Install fire-rated window assemblies in accordance with NFPA 257 for fire rated class indicated.
  3. Install smoke control frame and door assemblies in accordance with NFPA 105.
  4. Install exterior doors in accordance with ASTM E2112.
C. Grout frames in masonry construction, using hand trowel methods; brace frames so that pressure of grout before setting will not deform frames.
D. Install door hardware as specified in Section 08 7100.
E. Comply with glazing installation requirements of Section 08 8000.
3.04  TOLERANCES

A. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with SDI 117 or NAAMM HMMA 861.

B. Maximum Diagonal Distortion (Warp): 1/8 inch measured with straight edge, corner to corner.

3.05  ADJUSTING

A. Adjust for smooth and balanced door movement.

3.06  SCHEDULE

A. Refer to Door and Frame Schedule on Drawings.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Wood doors, stile and rail design; non-fire rated.
   B. Panels of wood and glass.

1.02 REFERENCE STANDARDS
   A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards.

1.03 ADMINISTRATIVE REQUIREMENTS
   A. Coordination:
      1. Coordinate the work with door opening construction, door frame and door hardware installation.
      2. Coordinate installation of glazing.

1.04 SUBMITTALS
   A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
   B. Product Data: Indicate stile and rail core materials and construction; veneer species, type and characteristics.
   C. Shop Drawings: Illustrate door opening criteria, elevations, sizes, types, swings, undercuts required, special beveling, special blocking for hardware, factory machining criteria, factory finishing criteria, identify cutouts for glazing.
   D. Samples: Submit two samples of door veneer, 12 by 12 inch in size illustrating wood grain, stain color, and sheen.
   E. Installer's Qualification Statement.
   F. Warranty, executed in Owner's name.

1.05 QUALITY ASSURANCE
   A. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING
   A. Package, deliver, and store doors in accordance with quality standard specified.
   B. Protect doors with resilient packaging sealed with heat shrunk plastic. Do not store in damp or wet areas; or in areas where sunlight might bleach veneer. Seal top and bottom edges with tinted sealer if stored more than one week. Break seal on site to permit ventilation.

1.07 WARRANTY
   A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
   B. Interior Doors: Provide manufacturer's warranty for the life of the installation.
   C. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.
PART 2 PRODUCTS

2.01 MANUFACTURERS
A. Acceptable Manufacturers:
   6. Substitutions: See Section 01 6000 - Product Requirements.

2.02 DOORS
A. Quality Standard: Premium Grade, [] performance, in accordance with [], unless otherwise indicated.
B. Exterior Doors: 1-3/4 inches thick unless otherwise indicated; solid lumber construction; mortise and tenon joints; water repellent treated. Transparent finish as indicated on drawings.
C. Interior Doors: 1-3/4 inches thick unless otherwise indicated; solid lumber construction; mortise and tenon joints. Transparent finish.
   1. Wood veneer facing with factory transparent finish.

2.03 DOOR AND PANEL FACINGS
A. Veneer Facing for Transparent Finish: Maple, veneer grade in accordance with quality standard indicated, plain sliced (flat cut), with book match between leaves of veneer, running match of spliced veneer leaves assembled on door or panel face.
   1. Pairs: Pair match each pair; set match pairs within 10 feet of each other when doors are closed.
B. Adhesive: Type I - Waterproof.

2.04 DOOR CONSTRUCTION
A. Vertical Exposed Edge of Stiles: Of same species as veneer facing.
B. Fit door edge trim to edge of stiles after applying veneer facing.
C. Bond edge banding to cores.
D. Panels: Flat.
E. Factory machine doors for finish hardware in accordance with hardware requirements and dimensions. Do not machine for surface hardware.
F. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.
G. Glazed Openings: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings.

2.05 FACTORY FINISHING
A. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:
   1. Transparent:
      a. System - 12, Polyurethane, Water-based.
      b. Stain: As selected by Architect.
      c. Sheen: Satin.
B. Factory finish doors in accordance with approved sample.
2.06 ACCESSORIES
   A. Hollow Metal Door Frames: As specified in Section 08 1113.
   B. Glazing: As specified in Section 08 8000.
   C. Panel or Glass Retention Molding: Wood of same species as door facing, flat bead stop, with butted corners; prepared for countersink style tamper proof screws.
   D. Door Hardware: As specified in Section 08 7100.

PART 3 EXECUTION

3.01 EXAMINATION
   A. Verify existing conditions before starting work.
   B. Verify that opening sizes and tolerances are acceptable.
   C. Do not install doors in frame openings that are not plumb or are out of tolerance for size or alignment.

3.02 INSTALLATION
   A. Install doors in accordance with manufacturer's instructions and specified quality standards.
   B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.
   C. Adjust width of non-rated doors by cutting equally on both jamb edges.
   D. Trim door height by cutting bottom edges to a maximum of 3/4 inch.
   E. Machine cut for hardware.

3.03 TOLERANCES
   A. Comply with specified quality standard for fit, clearance, and joinery tolerances.
   B. Maximum Width Distortion (Cup): 1/8 inch measured with straight edge or taut string, edge to edge, over an imaginary 36 by 84 inch surface area.

3.04 ADJUSTING
   A. Adjust doors for smooth and balanced door movement.
   B. Adjust closers for full closure.

END OF SECTION
SECTION 08 3100
ACCESS DOORS AND PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Wall and ceiling access door and frame units.

1.02 REFERENCE STANDARDS
A. ITS (DIR) - Directory of Listed Products.
B. UL (FRD) - Fire Resistance Directory.

1.03 ADMINISTRATIVE REQUIREMENTS
A. Coordination:
   1. Coordinate installation with work of other trades, and obtain information on door sizes and exact locations from other trades.
   2. Coordinate placement of rough-in openings with Architect in tiled walls and gypsum board ceilings.
   3. Coordinate placement of access doors and panels with locations of toilet partitions and urinal screens so that doors or panels are not placed in conflict with partition or screen locations.

1.04 SUBMITTALS
A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.
C. Manufacturer's Installation Instructions: Indicate installation requirements and rough-in dimensions.

PART 2 PRODUCTS

2.01 MANUFACTURERS
A. Acceptable Manufacturers:
   13. Substitutions: See Section 01 6000 - Product Requirements.

2.02 ACCESS DOORS AND PANELS ASSEMBLIES
A. Wall-Mounted Units:
   1. Material: Steel.
   2. Size: 12 inch by 12 inch, unless otherwise indicated on Drawings.
   3. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.

B. Walls in Wet and Humid Areas:
   1. Locations: Include natatorium, natatorium restrooms, locker rooms, shower areas, family changing areas, and other locations indicated on Drawings.
   2. Material: Stainless steel, Type 304.
3. Size: 12 inch by 12 inch, unless otherwise indicated on Drawings.
4. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.
5. In All Wall Types: Surface mounted face frame and door surface flush with frame surface; gasketed door to frame all 4 sides.

C. Fire Rated Walls: See Drawings for wall fire ratings.
1. Material: Steel or stainless steel as specified for various locations.
2. Size: 12 inch by 12 inch, unless otherwise indicated on Drawings.
3. Door/Panel: Insulated double-surface panel, with tool-operated spring or cam lock and no handle.

D. Ceilings, Unless Otherwise Indicated: Same type as for walls in corresponding functional locations.

2.03 WALL AND CEILING MOUNTED UNITS

A. Wall and Ceiling Mounted Units: Factory fabricated door and frame, fully assembled units with corner joints welded, filled and ground flush; square and without rack or warp; coordinate requirements with type of installation assembly being used for each unit.
1. Door Style: Single thickness with rolled or turned in edges.
2. Frames: 16 gage, 0.0598 inch, minimum thickness.
3. Single Steel Sheet Door Panels: 1/16 inch, minimum thickness.
4. Units in Fire-Rated Assemblies: Fire rating as required by applicable code for fire-rated assembly that access doors are being installed.
   a. Provide products listed by ITS (DIR) or UL (FRD) as suitable for purpose indicated.
5. Steel Finish: Primed.
6. Stainless Steel Finish: No. 4 brushed finish.
7. Hardware:
   a. Hinge for Fire-Rated-Units: 175 degree steel hinges with non-removable pin.
   b. Hinges for Non-Fire-Rated Units: Concealed, constant force closure spring type.
   c. Latch/Lock: Tamperproof tool-operated cam latch.
   d. Number of Locks/Latches Required: As recommended by manufacturer for size of unit.
   e. Gasketing: Extruded neoprene, around perimeter of door panel.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that rough openings are correctly sized and located.
B. Begin installation only after substrates have been properly prepared, and if the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
C. Review access panel locations during wall framing rough-in to confirm location is coordinated with interior wall finishes.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to proceeding with this work.
B. Prepare surfaces using methods recommended by manufacturer for applicable substrates in accordance with project conditions.

3.03 INSTALLATION

A. Install units in accordance with manufacturer's instructions.
B. Install frames plumb and level in openings, and secure units rigidly in place.
C. Position units to provide convenient access to concealed equipment when necessary.
D. Adjust hardware and panels for proper operation.
E. Wet Locations: Seal frame to host wall all around; clear silicone sealant as specified in Section 07 9200.

END OF SECTION
PART 1  GENERAL

1.01  SECTION INCLUDES

A.  Bi-fold hanger doors, hydraulically operated.
B.  Operating hardware and supports.
C.  Wiring from electric circuit disconnect to operator to control station.
D.  Electrical controls.

1.02  REFERENCE STANDARDS

A.  ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
B.  NEMA MG 1 - Motors and Generators; National Electrical Manufacturers Association.
D.  UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems.

1.03  ADMINISTRATIVE REQUIREMENTS

A.  Coordination:  
   1.  Coordinate installation of electrical service.  Complete power and control wiring from disconnect to unit components.
   2.  Coordinate installation of sealants and backing materials at frame perimeter as specified in Section 07 9200.

1.04  SUBMITTALS

A.  See Section 01 3000 - Administrative Requirements, for submittal procedures.
B.  Shop Drawings:  Indicate opening dimensions and required tolerances, connection details, anchorage spacing, hardware locations, and installation details.
C.  Product Data:  Show component construction, anchorage method, and hardware.
D.  Manufacturer's Installation Instructions:  Include any special procedures required by project conditions.
E.  Operation Data:  Include normal operation, troubleshooting, and adjusting.
F.  Maintenance Data:  Include data for motor and transmission, shaft and gearing, lubrication frequency, spare part sources.

1.05  QUALITY ASSURANCE

A.  Installer:  Company specializing in performing the work of this Section with minimum three years of experience.
B.  Products Requiring Electrical Connection:  Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified.
C.  Basis of Design:  Specifications are based on door types and model numbers by the specified basis of design manufacturer.  Door types manufactured by other acceptable manufacturers are permitted, subject to compliance with specified requirements, and provided that deviations in dimensions and profile are minor, and do not detract substantially from the indicated design intent.
   1.  Comply with requirements specified in Section 01 4000 and Section 01 6000.

1.06  REGULATORY REQUIREMENTS

A.  Conform to applicable code for motor and motor control requirements.
1.07 WARRANTY
A. See Section 01 7800 - Closeout Submittals for warranty requirements.
B. Correct defective Work within a two year period after Date of Substantial Completion.
C. Warranty: Include coverage for electric motor and transmission.

PART 2 PRODUCTS

2.01 MANUFACTURERS
A. Basis of Design Manufacturer:
   2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 DOOR COMPONENTS
A. Door Sections: ASTM A500/A500M; structural steel tube frames to comply with applied wind code.
   1. Optional: Stainless steel tube frame for highly corrosive environments.
B. Door Frames: Structural steel tubing designed to the same loading requirements for live, dead and wind loads as the surrounding construction with a maximum vertical member of 6-foot centers.
   1. Thickness: 5-1/2 inch thickness, maximum.
   2. Factory-welded at all joints and connections, with smooth welds not to exceed 1/4 inch thickness.
   3. Primed with rust-resistant galvanized primer to provide corrosion resistance and prepared for field finishing.
   4. Furnished with factory-applied, mechanically fastened horizontal neoprene seals. Adhesive fastened seals are unacceptable.
C. Track: Galvanized steel angles, 0.094 inch thick; 2-5/16 x 4 inch size, continuous one piece per side; galvanized steel mounting brackets 1/4 inch thick.
   1. Standard track configuration.
   2. Track configurations as indicated on Drawings; coordinated with available head clearances.
D. Hinge and Roller Assemblies: Heavy duty hinges and adjustable roller holders of galvanized steel; floating hardened steel bearing rollers, located at top and bottom of each panel, each side.
E. Jamb Weatherstripping: Roll formed steel section full height of jamb, fitted with resilient weatherstripping, placed in moderate contact with door panels.
F. Head Weatherstripping: Neoprene, one piece full length.
G. Panel Joint Weatherstripping: Neoprene foam seal, one piece full length.

2.03 OPERATION
A. Operator, Controls, Actuators, and Safeties: Comply with UL 325; provide products listed by a testing agency acceptable to authorities having jurisdiction.
B. Hydraulic Operation: Hydraulic lift arms that are mechanically fastened to the door frame.
   1. Lift Arms: Locate on the top half of the door only.
   2. Lift Devices: Lift cables or straps; horizontal top and bottom drive shafts are unacceptable.
   4. Cable or Strap "Kick Outs": Not permitted.
   5. Door Speed: Not less than 18 feet per minute.
   6. Locking: By means of the hydraulic cylinders providing a minimum of 1000 lbs of closing force; manual locks, catches or door latches are not permitted.
C. Power Operator: Comply with NFPA 70 (National Electrical Code Section 513).
   1. Hydraulic Power Unit: 220 volt, single phase, "up-down" push button or spring-loaded master keyed stations for separate mounting.
   2. Each Door Operator: Thermal overload protection for the motor.
3. Motor: Pre-wired and factory tested and provided with supply cables for final hookup under Division 26.

D. Electrical Characteristics:
   1. 2 hp motor; manually operable in case of power failure.
   2. 208/230 volts, single/three phase, 60 Hz.

E. Motor: NEMA MG1, Type 4.

F. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70.

G. Disconnect Switch: Factory mount disconnect switch in control panel.

H. Electric Operator: Located on bottom door panel, with adjustable safety friction clutch; brake system actuated by independent voltage solenoid controlled by motor starter; enclosed gear driven limit switch; enclosed magnetic cross line reversing starter; mounting brackets and hardware.

I. Control Station: Push button or spring loaded master keyed switch, wall mounted using hydraulic lift arms.
   1. 24 volt circuit.
   2. Surface mounted.
   3. Locate at inside door jamb.
   4. Provide optional remote control function in addition to manual control station.

J. Hand Held Transmitter: Digital control, resettable.

PART 3 EXECUTION

3.01 EXAMINATION
   A. Verify that wall openings are ready to receive work and opening dimensions and tolerances are within specified limits.
   B. Verify that electric power is available and of the correct characteristics.

3.02 PREPARATION
   A. Prepare opening to permit correct installation of door unit to perimeter air and vapor barrier seal.
   B. Apply primer to wood frame.

3.03 INSTALLATION
   A. Install door unit assembly in accordance with manufacturer's instructions.
   B. Anchor assembly to wall construction and building framing without distortion or stress.
   C. Securely brace door tracks suspended from structure. Secure tracks to structural members only.
   D. Fit and align door assembly including hardware.
   E. Install perimeter trim and closures.

3.04 TOLERANCES
   A. Maximum Variation from Plumb: 1/16 inch.
   B. Maximum Variation from Level: 1/16 inch.
   C. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch from 10 ft straight edge.
   D. Maintain dimensional tolerances and alignment with adjacent work.

3.05 ADJUSTING
   A. Adjust door assembly for smooth operation and full contact with weatherstripping.
   B. Have manufacturer's field representative present to confirm proper operation and identify adjustments to door assembly for specified operation.
3.06 CLEANING
   A. Clean doors and frames and glazing.
   B. Remove temporary labels and visible markings.

3.07 PROTECTION
   A. Protect installed products from damage during subsequent construction.
   B. Do not permit construction traffic through overhead door openings after adjustment and cleaning.

END OF SECTION
SECTION 08 3613
OVERHEAD SECTIONAL DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Overhead sectional doors, electrically operated.
B. Operating hardware and supports.

1.02 REFERENCE STANDARDS
A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

1.03 ADMINISTRATIVE REQUIREMENTS
A. Coordination:
   1. Coordinate installation of sealants and backing materials at frame perimeter as specified in Section 07 9200.

1.04 SUBMITTALS
A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Shop Drawings: Indicate opening dimensions and required tolerances, connection details, anchorage spacing, hardware locations, and installation details.
C. Product Data: Show component construction, anchorage method, and hardware.
D. Manufacturer's Installation Instructions: Include any special procedures required by project conditions.
E. Operation Data: Include normal operation, troubleshooting, and adjusting.

1.05 QUALITY ASSURANCE
A. Installer Qualifications: Company specializing in performing work of type specified and with at least three years documented experience.

1.06 WARRANTY
A. See Section 01 7800 - Closeout Submittals for warranty requirements.
B. Correct defective Work within a five year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS
A. Acceptable Manufacturers:
   10. Substitutions: See Section 01 6000 - Product Requirements.

2.02 COMPONENTS
A. Track: Rolled galvanized steel, 0.090 inch minimum thickness; 2 inch wide, continuous one piece per side; galvanized steel mounting brackets 1/4 inch thick.
1. Track configurations as indicated on Drawings; coordinated with available head clearances.

B. Hinge and Roller Assemblies: Heavy duty hinges and adjustable roller holders of galvanized steel; floating hardened steel bearing rollers, located at top and bottom of each panel, each side.

C. Lift Mechanism: Torsion spring on cross head shaft, with braided galvanized steel lifting cables.

D. Sill Weatherstripping: Resilient hollow rubber strip, one piece; fitted to bottom of door panel, full length contact.

E. Jamb Weatherstripping: Roll formed steel section full height of jamb, fitted with resilient weatherstripping, placed in moderate contact with door panels.

F. Head Weatherstripping: EPDM rubber seal, one piece full length.

G. Panel Joint Weatherstripping: Neoprene foam seal, one piece full length.

H. Lock: Inside side mounted, adjustable keeper, spring activated latch bar with feature to retain in locked or retracted position.

2.03 MATERIALS

A. Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G60/Z180 coating, plain surface.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that wall openings are ready to receive work and opening dimensions and tolerances are within specified limits.

3.02 INSTALLATION

A. Install door unit assembly in accordance with manufacturer’s instructions.

B. Anchor assembly to wall construction and building framing without distortion or stress.

C. Securely brace door tracks suspended from structure. Secure tracks to structural members only.

D. Fit and align door assembly including hardware.

3.03 TOLERANCES

A. Maximum Variation from Plumb: 1/16 inch.

B. Maximum Variation from Level: 1/16 inch.

C. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch from 10 ft straight edge.

D. Maintain dimensional tolerances and alignment with adjacent work.

3.04 ADJUSTING

A. Adjust door assembly for smooth operation and full contact with weatherstripping.

3.05 CLEANING

A. Clean doors and glazing.

B. Remove temporary labels and visible markings.

3.06 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

B. Do not permit construction traffic through overhead door openings after adjustment and cleaning.

END OF SECTION
SECTION 08 4313
ALUMINUM STOREFRONT AND CURTAINWALL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Aluminum-framed storefront and curtain wall framing systems.
B. Infill panels of metal and aluminum sheet.
C. Aluminum doors and frames.
D. Weatherstripping.
E. Design engineering of framing system and load-bearing connections to building structural frame system.

1.02 REFERENCE STANDARDS

A. AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site.
C. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate attachment and seal of perimeter air and vapor barrier materials.
   2. Coordinate with installation of other components that comprise the exterior enclosure.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, door hardware, and internal drainage details.
C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related work, expansion and contraction joint location and details, and field welding required.
D. Design Data: Provide framing member structural and physical characteristics, engineering calculations, and dimensional limitations.
E. Field Quality Control Submittals: Report of field testing for water penetration and air leakage.

1.05 QUALITY ASSURANCE

A. Designer Qualifications: Design structural support framing components under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed at Colorado.

B. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

C. Basis of Design: Drawing details are based on profiles by specified basis of design manufacturer. Similar profiles by other acceptable manufacturers are permitted, subject to compliance with all specified performance characteristics, and provided that deviations in dimension, profile, and finish are minor, and do not detract from the indicated design intent.
   1. Comply with requirements specified in Section 01 4000 and Section 01 6000.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Handle products of this Section in accordance with AAMA CW-10.

B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.07 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F. Maintain this minimum temperature during and 48 hours after installation.

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

C. Provide 10 year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design Manufacturer:
      a. Type A - Frame Series: TriFab VG 451T, center pane, outside glazed, stacking system.
      b. Type B - Frame Series: 1600 Wall System 1, outside pane, outside glazed, screw spline system.
      c. Door Style: 190 Narrow Stile.
   2. Substitutions: See Section 01 6000 - Product Requirements.

B. Other Acceptable Manufacturers:
   5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 STOREFRONT SYSTEM

A. Aluminum-Framed Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
   1. Glazing Rabbet: For 1 inch insulating glazing.
   2. Finish: Class I color anodized.
      a. Factory finish all surfaces that will be exposed in completed assemblies.
3. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors and hardware; fasteners and attachments concealed from view; reinforced as required for imposed loads.
   a. Fabricate individual system frame members, comp heads, sill pans, and other system components in single, continuous pieces; splices are not permitted unless specifically required by project installation conditions.
5. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
6. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.
7. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.
8. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
9. Air and Vapor Seal: Maintain continuous air barrier and vapor retarder throughout assembly, primarily in line with inside pane of glazing and heel bead of glazing compound.

B. Design Requirements: Design and size components to withstand the specified load requirements without damage or permanent set, when tested in accordance with ASTM E330/E330M, using loads 1.5 times the design wind loads and 10 second duration of maximum load.
   1. Design Wind Loads: Comply with requirements of applicable code.
   2. Member Deflection: Limit member deflection to L/175 of clear span, 3/4 inch total, or to flexure limit of glass in any direction, whichever is less, with full recovery of glazing materials.
   3. Provide reinforced mullion sections as may be required to comply with specified design requirements, for manufacturer's specified system.

C. Condensation Resistance Factor of Framing: 50, minimum, measured in accordance with AAMA 1503.

D. Overall U-factor Including Glazing: 0.35 Btu/(hr sq ft deg F), maximum.

2.03 COMPONENTS

A. Aluminum Framing Members: Tubular aluminum sections, thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.
   1. Framing members for interior applications need not be thermally broken.
   2. Glazing Stops: Flush.
   3. Type A System Cross-Section: 2 x 4-1/2 inch nominal dimension.
   4. Type B System Cross-Section: 2-1/2 x 6 inch nominal dimension.
   5. Sills Directly On Floor Cross-Section: 4-1/4 inch nominal height dimension, and depth to match framing system; with sill pans and all specified and required water management components.
   6. Corner Assemblies:
      a. 90-Degree Corners: Manufacturer's standard combination of two pocket corner extrusions.
      b. Corners Other Than 90 Degrees: Manufacturer's standard varying degree pocket corner extrusions with aluminum sheet metal fillers and closures.
   7. Reinforced Mullions: As required or recommended by manufacturer using manufacturer's standard profile of extruded aluminum with internal reinforcement of steel shaped structural section.

B. Glazing: As specified in Section 08 8000.

C. Infill Panels: Insulated, aluminum sheet face and back, with edges formed to fit glazing channel and sealed.
   1. Face Sheet: 0.032 inch thick, minimum.
   2. Core: Glass fiber insulation core with R-value of 4.0.
   3. Back Sheet: 0.032 inch thick, minimum.
   4. Finish: Same as storefront.
   5. Basis of Design Product:
      b. Substitutions: See Section 01 6000 - Product Requirements.
D. Swing Doors: Glazed aluminum.
   2. Top Rail: 2-1/4 inches wide; 7-1/2 inch wide where parallel arm closer is specified.
   5. Bottom Rail: 10 inches wide.
   7. Finish: Same as storefront.
   8. Design exterior doors for one inch insulating glass units and thermally broken, and interior doors for 1/4 inch glass and non-thermally broken.

E. Exterior Mullion Caps: Manufacturer's standard or custom-fabricated extrusions designed for installation on exterior mullions; sizes, shapes, and configurations as indicated on Drawings.

2.04 MATERIALS

C. Fasteners: Stainless steel.
D. Exposed Flashings: Aluminum sheet, 20 gage, 0.032 inch minimum thickness; finish to match framing members.
E. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.
   1. Size gaskets as required by manufacturer of glazing channel frame to provide proper pressure and bite on glazing units.
F. Glazing Accessories: As specified in Section 08 8000.

2.05 ACCESSORIES

A. Reinforcement: Where fasteners screw-anchor into aluminum less than 1/8 inch thick, reinforce the interior with aluminum or non-magnetic stainless steel to receive screw threads, or provide standard non-corrosive, pressed-in splined grommet nuts.
B. Brackets: High-strength aluminum brackets and reinforcements where possible; otherwise provide non-magnetic stainless steel or galvanized steel complying with ASTM A123/A123M.
C. Inserts: Cast iron, malleable iron, or 12 gage galvanized steel for required anchorage to concrete or masonry.
D. Sill Pans: Manufacturer's standard extruded profile, thermally broken, designed to direct moisture to the exterior at sill conditions; including splice sleeves and continuously sealed end dams.
   1. Provide with sill pan clips for installation without the use of penetrating fasteners.
E. Comp-Heads: Manufacturer's standard extruded profile, thermally broken, designed to accommodate minimum one inch deflection of building elements at head conditions.
F. Water Deflectors: Manufacturer's standard internal system accessory specifically designed to route internal water drainage away from top surfaces of insulated glass units.
G. Expansion Anchors: Lead shield or toothed steel, drilled in type expansion bolts for required attachment to concrete or masonry.
H. Bituminous Coatings: Cold-applied asphalt mastic, compounded for 30 mil thickness per coat.
I. Internal System Sealants and Gaskets: As recommended by manufacturer for use within the framing system for fabrication, assembly, and installation. Use products which will remain permanently elastic, non-shrinking, and waterproof.

2.06 FINISHES

A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils thick.
B. Touch-Up Materials: As recommended by coating manufacturer for field application.

2.07 HARDWARE

A. For each door, include weatherstripping and sill sweep strip.
B. Door Hardware: As specified in Section 08 7100, except as specified in this Section.
C. Weatherstripping: Wool pile, continuous and replaceable; provide on all doors.
D. Sill Sweep Strips: Resilient seal type, retracting, of neoprene; provide on all doors.
E. Reinforce components internally for door hardware and door operators.
F. Finishing: Apply factory finish to all surfaces that will be exposed in completed assemblies, including exposed fasteners.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify dimensions, tolerances, and method of attachment with other work.
B. Verify that wall openings and adjoining air and vapor seal materials are ready to receive work of this Section.

3.02 INSTALLATION

A. Install wall system in accordance with manufacturer's instructions.
   1. Install storefronts in accordance with ASTM E2112.
B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
C. Provide alignment attachments and shims to permanently fasten system to building structure.
D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.
E. Provide thermal isolation where components penetrate or disrupt building insulation.
F. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.
G. Install sill pans with end dams; do not obstruct weep paths with sealants. Locate sill pan joints, if required, minimum 12 inches from centerline of vertical mullions. Seal to adjacent work to form water tight dam.
H. Install comp-head units where detailed; do not secure comp-heads to primary storefront head frames.
I. Install internal system sealants as installation progresses. Seal sill pan splices, end dams, water deflectors, and other components to ensure that proper water weepage paths are established and maintained within the system.
J. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.03 TOLERANCES

A. Maximum Variation from Plumb: 0.06 inch per 3 feet non-cumulative or 0.06 inch per 10 feet, whichever is less.
B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.
C. Location: Limit variation from plane or dimensioned location to 1/8 inch in 12 feet, non-cumulative, and 1/2 inch in overall length of member.

3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for independent field testing and inspection requirements, and requirements for monitoring quality of specified product installations.
B. Provide field testing of installed storefront system by AAMA accredited independent laboratory in accordance with AAMA 503 during construction process and before installation of interior finishes.
   1. Perform a minimum of two tests in each designated area as indicated on drawings.
   2. Conduct tests in each area prior to 50 percent and 90 percent completion of this work.
   3. Field test for water penetration in accordance with ASTM E1105 with uniform static air pressure difference (Procedure A) not less than 4.18 psf.
      a. Maximum allowable rate of water penetration in 15-minute test is 0.5 ounce that is not contained in an area with provisions to drain to exterior, or collected on surface of interior horizontal framing member.

C. Repair or replace storefront components that have failed designated field testing, and retest to verify performance complies with specified requirements.

3.05 ADJUSTING
   A. Adjust operating hardware for smooth operation.

3.06 CLEANING
   A. Remove protective material from pre-finished aluminum surfaces.
   B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths, and take care to remove dirt from corners and to wipe surfaces clean.

3.07 PROTECTION
   A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION
SECTION 08 4500
TRANSLUCENT WALL AND ROOF ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Self supporting aluminum framed vertical wall and sloped roof system.
   B. Sandwich panels of translucent skins separated with an aluminum grid.
   C. Design engineering of framing system and load-bearing connections to building structural frame system.

1.02 REFERENCE STANDARDS
   B. AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site.
   D. AAMA 501.2 - Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems.

1.03 ADMINISTRATIVE REQUIREMENTS
   A. Coordination:
      1. Coordinate installation of air stop at edge of construction.
      2. Coordinate attachment and seal of perimeter air and vapor barrier materials.

1.04 SUBMITTALS
   A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
   B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, panel configuration, and internal drainage details.
   C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, anticipated deflection under load, affected related work, weep drainage network, expansion and contraction joint location and details, and field welding required.
D. Samples: Submit two samples of framing and translucent panels, 12 x 12 inch in size, illustrating prefinished aluminum surface, specified panel with skins, glazing materials illustrating edge and corner.

E. Installation Data: Special installation requirements.

1.05 QUALITY ASSURANCE
A. Perform work in accordance with AAMA CW-DG-1.
B. Designer Qualifications: Design structural support framing components under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in Colorado.
C. Installer Qualifications: Company specializing in performing the work of this Section and approved by manufacturer.
D. Basis of Design: Drawing details are based on profiles and panels by specified basis of design manufacturer. Similar profiles by other acceptable manufacturers are permitted, subject to compliance with all specified performance characteristics, and provided that deviations in dimension, profile, and finish are minor, and do not detract from the indicated design intent.
1. Comply with requirements specified in Section 01 4000 and Section 01 6000.

1.06 DELIVERY, STORAGE, AND HANDLING
A. Handle work of this Section in accordance with AAMA CW-10.
B. Protect prefinished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings which bond when exposed to sunlight or weather. Puncture wrappings at ends for ventilation.

1.07 FIELD CONDITIONS
A. Do not install sealants when ambient temperature is less than 40 degrees F.
B. Maintain this minimum temperature during and after installation of sealants.

1.08 WARRANTY
A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
B. Correct defective Work within a five year period after Date of Substantial Completion.
C. Provide five year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS
2.01 MANUFACTURERS
A. Basis of Design Manufacturer:
   a. Interior Face Panel Color: Manufacturer's standard crystal.
   b. Exterior Face Panel Color: Manufacturer’s standard crystal.
2. Substitutions: See Section 01 6000 - Product Requirements.
B. Other Acceptable Manufacturer:
2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 TRANSLUCENT ASSEMBLIES
A. Design Requirements: Design and size components to withstand dead loads and live loads caused by snow, hail, and positive and negative wind loads acting on plane of panel without damage or permanent set.
1. Design Loads: Calculate in accordance with applicable code.
   a. Measure performance in accordance with ASTM E330/E330M, using test load of 1.5 times the design wind pressure and 10 second duration of maximum load.
2. Deflection: Limit mullion deflection to 3/4 inch with full recovery of glazing materials.
3. System Assembly: Accommodate without damage to system, components or deterioration of seals; movement within system; movement between system and perimeter framing components; dynamic loading and release of loads; deflection of structural support framing, tolerance of supporting components, shortening of building concrete structural columns.

B. Performance Requirements:
   1. Light Transmission: Maximum 33 percent.
   2. Assembly U-factor: 0.20, maximum.
   3. Solar Heat Gain Coefficient: 0.24, minimum.
   4. Air Infiltration: Limit air infiltration through assembly to 0.06 cu ft/min sq ft of sloped glazed area, measured at a reference differential pressure across assembly of 1.57 psf as measured in accordance with ASTM E283.
   5. Condensation Resistance Factor: CRF of 50 when measured in accordance with AAMA 1503.
   6. Water Leakage: None, when measured in accordance with AAMA 501.1 with a test pressure difference of 2.86 lbf/sq ft.
   7. Expansion / Contraction: System to provide for expansion and contraction within system components caused by a cycling temperature range of 170 degrees F over a 12 hour period without causing detrimental effect to system components.
   8. System Internal Drainage: Drain water entering joints, condensation occurring in framing system, or migrating moisture occurring within system, to the exterior by a weep drainage network.
   9. Not Permitted: Vibration harmonics, wind whistles, noises caused by thermal movement, thermal movement transmitted to other building elements, loosening, weakening, or fracturing of attachments or components of system.

2.03 COMPONENTS
   A. Panels: Bonded to both sides of structural extruded aluminum grid of indicated pattern; exposed surfaces of exterior sheet chemically and permanently treated to protect against surface erosion and extreme weather conditions; polyvinyl fluoride film coated.
   B. Reinforced Mullions: As recommended by manufacturer using manufacturer's standard profile of extruded aluminum with internal reinforcement of steel shaped structural section.
   C. Battens, Cover Strips, Cover Plates, and Integral Flashings: Extruded aluminum, to suit location and application; sized to rigidly retain panels in place.

2.04 FRAMING MATERIALS
   C. Fasteners: Stainless steel.

2.05 ACCESSORIES
   A. Reinforcement: Where fasteners screw-anchor into aluminum less than 1/8 inch thick, reinforce the interior with aluminum or non-magnetic stainless steel to receive screw threads, or provide standard non-corrosive, pressed-in splined grommet nuts.
   B. Brackets: High-strength aluminum brackets and reinforcements where possible; otherwise provide non-magnetic stainless steel or galvanized steel complying with ASTM A123/A123M.
   C. Inserts: Cast iron, malleable iron, or 12 gage galvanized steel for required anchorage to concrete or masonry.
   D. Sill Pans: Manufacturer's standard extruded profile, thermally broken, designed to direct moisture to the exterior at sill conditions; include end dams.
   E. Comp-Heads: Manufacturer's standard extruded profile, thermally broken, designed to accommodate minimum one inch deflection of building elements at head conditions.
   F. Expansion Anchors: Lead shield or toothed steel, drilled in type expansion bolts for required attachment to concrete or masonry.
G. Bituminous Coatings: Cold-applied asphalt mastic, compounded for 30 mil thickness per coat.

H. Sealants and Gaskets: As recommended by manufacturer for use within the framing system for fabrication, assembly, and installation. Use products which will remain permanently elastic, non-shrinking, and weatherproof. Perimeter and glazing sealants are specified in other Sections.

2.06 FABRICATION

A. Fabricate system components with minimum clearances and shim spacing around perimeter of assembly, and ensure proper installation and dynamic movement of perimeter seals.

B. Accurately fit and secure joints and corners. Make joints flush and hairline.

C. Develop drainage paths with moisture weep to exterior.

D. Prepare components to receive fabricated anchor devices.

E. Locate fasteners and attachments to ensure concealment from view.

F. Reinforce framing members for external imposed loads.

2.07 FINISHES

A. Superior Performing Organic Coatings: AAMA 2605 multiple coat, thermally cured polyvinylidene fluoride system.
   1. Color: To be selected by Architect from manufacturer's full range.

B. Touch-Up Materials: As recommended by coating manufacturer for field application.

C. Apply one coat of bituminous paint to concealed aluminum surfaces in contact with cementitious or dissimilar materials.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify dimensions, tolerances, and method of attachment with other work.

B. Verify wall openings and adjoining air barrier and vapor retarder materials are ready to receive work of this Section.

3.02 INSTALLATION

A. Install translucent panel system in accordance with manufacturer instructions. Install cellular panels with cells vertical.

B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

C. Provide alignment attachments and shims to permanently fasten system to building structure.

D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances and align with adjacent work.

E. Provide thermal isolation where components penetrate or disrupt building insulation.

F. Install sill pans where detailed; do not obstruct weep paths with sealants.

G. Install comp-head units where detailed; do not secure comp-heads to primary storefront head frames.

3.03 TOLERANCES

A. Maximum Variation from Plumb: 0.06 inches every 3 ft non-cumulative or 0.5 inches per 100 ft, whichever is less.

B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.

3.04 FIELD QUALITY CONTROL
   A. Provide the services of the manufacturer’s field representative to observe installation and make report.
   B. Independent inspection will be provided under provisions of Section 01 4000 - Quality Requirements.
   C. Test installed curtain wall for water leakage in accordance with AAMA 501.2.
   D. Replace curtain wall components that have failed field testing and retest until performance is satisfactory.

3.05 CLEANING
   A. Remove protective material from prefinished aluminum surfaces.
   B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.

3.06 PROTECTION
   A. Protect finished work from damage until Date of Substantial Completion.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Skylights with integral frame.
   B. Integral insulated curb.
   C. Fall protection screens.

1.02 REFERENCE STANDARDS
   B. AAMA 501.2 - Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems.
   H. ASTM D2843 - Standard Test Method for Density of Smoke from the Burning or Decomposition of Plastics.
   I. ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position.

1.03 SUBMITTALS
   A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
   B. Product Data: Provide structural, thermal, and daylighting performance values.
   C. Shop Drawings: Indicate configurations, dimensions, locations, fastening methods, and installation details.
   D. Grade Substantiation: Prior to submitting shop drawings or starting fabrication, submit one of the following showing compliance with specified grade:
      1. Evidence of AAMA Certification.
      2. Evidence of WDMA Certification.
      3. Evidence of CSA Certification.
4. Test report(s) by independent testing agency itemizing compliance and acceptable to authorities having jurisdiction.

E. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

1.04 QUALITY ASSURANCE
A. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years documented experience.

B. Basis of Design: Specifications are based on skylight types by specified basis of design manufacturer and product(s). Skylight types manufactured by other acceptable manufacturers are permitted, subject to compliance with specified requirements; and provided that deviations in design, weight, performance, and profile are minor, and do not detract substantially from the indicated design intent.
   1. Comply with requirements specified in Section 01 4000 and Section 01 6000.

1.05 WARRANTY
A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturer warranty, including coverage for leakage due to defective skylight materials or construction.

PART 2 PRODUCTS

2.01 MANUFACTURERS
A. Basis of Design Manufacturer:
   1. Sunoptics Prismatic Skylights, a Division of Acuity Brands; Signature Series Skylights - SIG: www.sunoptics.com/#sle.
   2. Substitutions: See Section 01 6000 - Product Requirements.

B. Other Acceptable Manufacturers:
   1. FAKRO America LLC: www.fakrousa.com/#sle.
   6. Substitutions: See Section 01 6000 - Product Requirements.

2.02 SKYLIGHTS
A. Skylights: Factory-assembled glazing in aluminum frame, free of visual distortion, and weathertight.
   1. Shape: Rectangular dome.
   2. Glazing: Double.
   3. Operation: None; fixed.
   4. Nominal Size: As indicated on Drawings.

2.03 PERFORMANCE REQUIREMENTS
A. Provide unit skylights that comply with the following:
   1. Grade: AAMA/WDMA/CSA 101/I.S.2/A440 requirements for specific skylight type:
      a. Performance Grade (PG): 100, with minimum design pressure (DP) of 100.25 psf.
   2. Air Infiltration: ASTM E283; not to exceed 0.5 cfm/lin ft of skylight perimeter at minimum 1.57 psf pressure.
   3. Water Penetration: ASTM E331; no leakage.
   4. Drain water entering joints, condensation occurring in frame channels, or migrating moisture occurring within system, to exterior.
   5. Allow for expansion and contraction within system components caused by a cycling surface temperature range of 170 degrees F without causing detrimental effects to system or components.
   6. Hall Rating: Provide this optional feature in accordance with manufacturer's requirements.
   7. Skylight Approval: Comply with FM 4431.
B. Flammability: Non-metal parts complying with the following:
   1. Roof-Top Components: Class B when tested in accordance with ASTM E108 or UL 790.
   2. Self-Ignition Temperature: Greater than 650 degrees F, when tested in accordance with ASTM D1929.
   3. Smoke Developed Index: Maximum of 450, when tested in accordance with ASTM E84; or maximum rating of 75, when tested in accordance with ASTM D2843.
   4. Combustibility - Light Transmitting Parts: Burning extent of 1 inch or less (ICC Class CC-1), when tested in accordance with ASTM D635 in the thickness intended for use.
   5. Combustibility - Non-Light Transmitting Parts: Minimum 2.5 inches/min (ICC Class CC-2), when tested in accordance with ASTM D635.

2.04 COMPONENTS

A. Double Glazing: Acrylic plastic; factory sealed.
   2. Inner Glazing: White translucent.
   3. Thermal Transmittance (U-Value): 0.50, maximum.

B. Frames: ASTM B221 (ASTM B221M) Extruded aluminum thermally broken, reinforced and welded corner joints, integral curb frame mounting flange and counterflashings to receive roofing flashing system, with integral condensation collection gutter, glazing retainer; clear anodized finish.

2.05 ACCESSORIES

A. Fasteners and Anchorage Devices: Aluminum, non-magnetic stainless steel, or galvanized steel as recommended by manufacturer, and compatible with items being fastened. Do not use exposed fasteners unless unavoidable for the assembly of units, and installation of hardware. Finish fasteners to match the exposed item being fastened.

B. Counterflashings: Same metal type and finish as skylight frame.

C. Fall Protection Screen: Galvanized, 3 inch x 4 inch heavy-gage welded wire mesh, arched screen assembly, fully covering exterior of skylight; designed for attachment to inside of skylight frame in gymnasium and on outside of skylight frame at all other locations, with corrosion-resistant clip system.
   2. Acceptable Manufacturers:
      c. Substitutions: See Section 01 6000 - Product Requirements.

D. Protective Back Coating: Zinc molybdate alkyd.

E. Sealant: Elastomeric, silicone or polyurethane, compatible with material being sealed.

2.06 FABRICATION

A. Fabricate free of visual distortion and defects.

B. Fabricate to achieve leakproof, weathertight assembly.

C. Fabricate components to allow for expansion and contraction with minimum clearance and shim spacing around perimeter of assembly.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that openings and substrate conditions are ready to receive work of this Section.

3.02 PREPARATION

A. Apply protective back coating on aluminum surfaces of skylight units that will be in contact with cementitious materials or dissimilar metals.
3.03 INSTALLATION
   A. Install unit skylights and specified accessories in accordance with manufacturer's instructions and ASTM E2112.
   B. Install aluminum curb assembly, fastening securely to roof decking; flash curb assembly into roofing system.
   C. Apply sealant to achieve watertight assembly.

3.04 FIELD QUALITY CONTROL
   A. See Section 01 4000 - Quality Requirements, for general requirements for testing and inspection.
   B. Test installed skylight for water leakage in accordance with AAMA 501.2.

3.05 CLEANING
   A. Upon completion of installation, thoroughly clean skylight aluminum surfaces in accordance with AAMA 609 & 610.
   B. Remove protective material from prefinished aluminum surfaces.
   C. Wash down exposed surfaces; wipe surfaces clean.
   D. Remove excess sealant.

END OF SECTION
SECTION 08 6223
TUBULAR SKYLIGHTS

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Tubular skylights, consisting of skylight dome, reflective tube, and diffuser assembly.

1.02 REFERENCE STANDARDS
D. ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position.
F. ASTM D2843 - Standard Test Method for Density of Smoke from the Burning or Decomposition of Plastics.
L. UL (DIR) - Online Certifications Directory.

1.03 SUBMITTALS
A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. 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.
C. Shop Drawings: Indicate configurations, dimensions, locations, fastening methods, and installation details.
D. Grade Substantiation: Prior to submitting shop drawings or starting fabrication, submit one of the following showing compliance with specified grade:
   1. Evidence of AAMA Certification.
   2. Evidence of WDMA Certification.
   3. Evidence of CSA Certification.
   4. Test report(s) by independent testing agency itemizing compliance and acceptable to authorities having jurisdiction.
E. Test Reports: Prior to submitting shop drawings or starting fabrication, submit test report(s) by independent testing agency showing compliance with performance requirements in excess of those prescribed by specified grade.
1.04 QUALITY ASSURANCE
   A. Basis of Design: Specifications are based on skylight types by specified basis of design manufacturer and product(s). Skylight types manufactured by other acceptable manufacturers are permitted, subject to compliance with specified requirements; and provided that deviations in design, weight, performance, and profile are minor, and do not detract substantially from the indicated design intent.
      1. Comply with requirements specified in Section 01 4000 and Section  .

1.05 DELIVERY, STORAGE, AND HANDLING
   A. Store products in manufacturer's unopened packaging until ready for installation.
   B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.06 FIELD 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 absolute limits.

1.07 WARRANTY
   A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
   B. Skylights: Manufacturer's standard warranty for 10 years.
   C. Electrical Parts: Manufacturer's standard warranty for three years, unless otherwise indicated.

PART 2 PRODUCTS

2.01 MANUFACTURERS
   A. Basis of Design Manufacturer:
         a. Model: S750DS.
      2. Substitutions: See Section 01 6000 - Product Requirements.
   B. Other Acceptable Manufacturers:
      4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 TUBULAR SKYLIGHTS
   A. Tubular Skylights: Transparent roof-mounted skylight dome and curb, reflective tube, and ceiling level diffuser assembly, transferring sunlight to interior spaces.
      1. Fabrication and Assembly of Components: By single manufacturer.
      2. Non-Metal Parts: Flammability less than the following.
         a. Roof-Top Components: Class B when tested in accordance with ASTM E108 or UL 790.
         b. Self-Ignition Temperature: Greater than 650 degrees F, when tested in accordance with ASTM D1929.
         c. Smoke Developed Index: Maximum of 450, when tested in accordance with ASTM E84; or maximum rating of 75, when tested in accordance with ASTM D2843.
         d. Combustibility - Light Transmitting Parts: Burning extent of 1 inch or less (ICC Class CC-1), when tested in accordance with ASTM D635 in the thickness intended for use.
      3. Thermal Movement: Fabricate to allow for thermal movement resulting from temperature differential from minus 30 to 180 degrees F without damage to components, fasteners, or substrates.
   B. Roof Assemblies: Transparent, UV and impact resistant dome with flashing base supporting dome and top of tube.
      1. Glazing: Polycarbonate plastic, 1/8 inch minimum thickness.
2. Low-Angled Sun Reflector: Concentric, light refracting etched lines, minimum 2 inches high, to improve light input when sun is low on horizon.
3. Base: One piece, seamless, leak-proof flashing functioning as base support for dome and top of tube; specified manufacturer's recommended base flashing units for use on flat commercial roof applications to meet required curb height requirements.
4. Base Height: 12 inches.
5. Dome Ring: Attached to top of base section; 0.090 inch nominal thickness injection molded high impact ABS; to prevent thermal bridging between base flashing and tubing and channel condensed moisture out of tubing; weather seal of medium density pile weather stripping.

C. Reflective Tube: ASTM B209 (ASTM B209M) aluminum sheet, thickness between 0.015 inch and 0.020 inch.
   1. Extension Tubes: Basis of design manufacturer's Spectralight Infinity Extension Tubes and Flashing Turret Extensions.
   2. Interior Finish: Exposed interior surfaces of high reflectance specular finish; specular reflectance of 92, total reflectance 95 percent.
   3. Tube Diameter: 10 inches.

D. Diffuser Assemblies: Supporting light transmitting surface at bottom termination of tube, with compression seal to minimize condensation and bug or dirt infiltration.
   1. Diffuser: Basis of design manufacturer's OptiView Diffuser.
   2. Diffuser Trim: Edge and attachment trim for diffuser lens; injection molded high impact ABS.
   3. Diffuser Shape at Solid Ceilings: Round, same diameter as tube.
   4. Diffuser Shape in Lay-In Ceiling Grid: Square, 24 by 24 inches, to fit grid; metal transition box.
   7. Lens Thickness: 0.038 inch, minimum.
   9. Seal: Closed cell EPDM foam rubber.

2.03 PERFORMANCE REQUIREMENTS
A. Grade: AAMA/WDMA/CSA 101/I.S.2/A440 requirements for specific tubular skylight:
   1. Product Type: Tubular Daylighting Device, Closed Ceiling (TDDCC).
   2. Performance Grade (PG): Equivalent to or greater than specified design pressure.
B. Design Pressure (DP): In accordance with applicable codes.
C. No permanent deflection in excess of 0.2 percent of span.
D. Air Infiltration: Maximum 0.10 cu ft/min sq ft per unit area of outside frame dimension at 6.27 psf pressure differential when tested in accordance with ASTM E283.
E. Water Resistance: No uncontrolled water leakage at 6.27 psf pressure differential with water rate of 5 gallons/h/sf, when tested in accordance with ASTM E331; design to ensure that water will not accumulate inside assembly.

2.04 ACCESSORIES
A. Fasteners: Same material as metals being fastened, non-magnetic steel, non-corrosive metal of type recommended by manufacturer, or injection molded nylon.
B. Sealant: Elastomeric, silicone or polyurethane; compatible with materials being sealed.
C. Lighting Fixtures: Bracket mounted inside skylight tube just above diffuser; UL (DIR) listed.
   1. Type: Compact fluorescent fixture, for 26 W lamps, 1 lamp per tube.
   2. Electrical Requirements: 110 V, 15 amp GFCI circuit.
   3. Contractor to furnish lamps.

PART 3 EXECUTION
3.01 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.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's written instructions.
   1. Comply with ASTM E2112 for installation of weather barrier materials in conjunction with installation of skylights.

B. Set roof assembly flashing in continuous bead of sealant.

C. Seal joints exposed to weather in accordance with sealant manufacturer's written instructions.

D. Conduct field test for water tightness; conduct water test in presence of Architect. Correct defective work and re-test until satisfactory.

3.04 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION
SECTION 087100 – DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes commercial door hardware for the following:

1. Swinging doors.
2. Sliding doors.
3. Other doors to the extent indicated.

B. Door hardware includes, but is not necessarily limited to, the following:

1. Mechanical door hardware.
2. Electromechanical door hardware.
3. Automatic operators.
4. Cylinders specified for doors in other sections.

C. Related Sections:

1. Division 06 Section “Rough Carpentry”.
2. Division 06 Section “Finish Carpentry”.
3. Division 08 Section “Operations and Maintenance”.
4. Division 08 Section “Hollow Metal Doors and Frames”.
5. Division 08 Section “Flush Wood Doors”.
6. Division 08 Section “Stile and Rail Wood Doors”.
7. Division 08 Section “Aluminum-Framed Entrances and Storefronts”.
8. Division 08 Section “Automatic Door Operators”.
9. Division 28 Section “Access Control”.

D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

6. NFPA 105 - Installation of Smoke Door Assemblies.
7. UL/ULC and CSA C22.2 – Standards for Automatic Door Operators Used on Fire and Smoke Barrier Doors and Systems of Doors.
8. State Building Codes, Local Amendments.
E. Standards: All hardware specified herein shall comply with the following industry standards:

1. ANSI/BHMA Certified Product Standards - A156 Series
2. UL10C – Positive Pressure Fire Tests of Door Assemblies

1.3 SUBMITTALS

A. Product Data: Manufacturer’s product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.

B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."

2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.

3. Content: Include the following information:

a. Type, style, function, size, label, hand, and finish of each door hardware item.
b. Manufacturer of each item.
c. Fastenings and other pertinent information.
d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
e. Explanation of abbreviations, symbols, and codes contained in schedule.
f. Mounting locations for door hardware.
g. Door and frame sizes and materials.
h. Warranty information for each product.

4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

C. Shop Drawings: Details of electrified access control hardware indicating the following:

1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:

a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
b. Complete (risers, point-to-point) access control system block wiring diagrams.
c. Wiring instructions for each electronic component scheduled herein.

2. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.

D. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.

E. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Submittals.

1.4 QUALITY ASSURANCE

A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.

B. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

C. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.

D. Automatic Operator Supplier Qualifications: Power operator products and accessories are required to be supplied and installed through current members of the manufacturer's "Power Operator Preferred Installer" program. Suppliers are to be factory trained, certified, and a direct purchaser of the specified power operators and be responsible for the installation and maintenance of the units and accessories indicated for the Project.

E. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.

1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.

2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.

F. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.
G. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:

1. Function of building, purpose of each area and degree of security required.
2. Plans for existing and future key system expansion.
3. Requirements for key control storage and software.
4. Installation of permanent keys, cylinder cores and software.
5. Address and requirements for delivery of keys.

H. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.

1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
3. Review sequence of operation narratives for each unique access controlled opening.
4. Review and finalize construction schedule and verify availability of materials.
5. Review the required inspecting, testing, commissioning, and demonstration procedures.

I. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

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 standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.

B. Door Hardware and Electrical Connections: Coordinate the layout and installation of scheduled electrified door hardware and related access control equipment with required connections to
source power junction boxes, low voltage power supplies, detection and monitoring hardware, and fire and detection alarm systems.

C. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.7 WARRANTY

A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:

1. Structural failures including excessive deflection, cracking, or breakage.
2. Faulty operation of the hardware.
3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
4. Electrical component defects and failures within the systems operation.

C. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.

D. Special Warranty Periods:

1. Ten years for mortise locks and latches.
2. Five years for exit hardware.
3. Twenty five years for manual surface door closer bodies.
4. Twenty five years for manual surface door closer bodies.
5. Twenty five years for manual surface door closer bodies.
6. Five years for motorized electric latch retraction exit devices.
7. Two years for electromechanical door hardware.

1.8 MAINTENANCE SERVICE

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 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.
B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:

1. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.

C. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.2 HANGING DEVICES

A. Hinges: ANSI/BHMA A156.1 certified butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.

1. Quantity: Provide the following hinge quantity:
   a. Two Hinges: For doors with heights up to 60 inches.
   b. Three Hinges: For doors with heights 61 to 90 inches.
   c. Four Hinges: For doors with heights 91 to 120 inches.
   d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.

2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:
   a. Widths up to 3’0”: 4-1/2” standard or heavy weight as specified.
   b. Sizes from 3’1” to 4’0”: 5” standard or heavy weight as specified.

3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:
   a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
   b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.

4. Hinge Options: Comply with the following:
   a. Non-removable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the all out-swinging lockable doors.

5. Manufacturers:
   a. Hager Companies (HA) - CB Series.
   b. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) - TA Series.
   c. Stanley Hardware (ST) - CB Series.
B. Continuous Geared Hinges: ANSI/BHMA A156.26 Grade 1-600 certified continuous geared hinge with minimum 0.120-inch thick extruded 6060 T6 aluminum alloy hinge leaves and a minimum overall width of 4 inches. Hinges are non-handed, reversible and fabricated to template screw locations. Factory trim hinges to suit door height and prepare for electrical cut-outs.

1. Manufacturers:
   a. Hager Companies (HA).
   b. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE).

C. Pivots: ANSI/BHMA A156.4, Grade 1, certified. Space intermediate pivots equally not less than 25 inches on center apart or not more than 35 inches on center for doors over 121 inches high. Pivot hinges to have oil impregnated bronze bearing in the top pivot and a radial roller and thrust bearing in the bottom pivot with the bottom pivot designed to carry the full weight of the door. Pivots to be UL listed for windstorm where applicable.

1. Manufacturers:
   a. Dorma Products (DO).
   b. Rixson Door Controls (RF).

2.3 POWER TRANSFER DEVICES

A. Electrified Quick Connect Transfer Hinges: Provide electrified transfer hinges with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.

1. Manufacturers:
   a. Hager Companies (HA) - ETW-QC (# wires) Option.
   b. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) - QC (# wires) Option.
   c. Stanley Hardware (ST) – C Option.

B. Electrified Quick Connect Continuous Geared Transfer Hinges: Provide electrified transfer continuous geared hinges with a 12” removable service panel cutout accessible without de-mounding door from the frame. Furnish with Molex™ standardized plug connectors with sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.

1. Manufacturers:
   a. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) - SER-QC (# wires) Option.
   b. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE) - SER-QC (# wires) Option.
C. Electrified Quick Connect Intermediate Transfer Pivots: Provide electrified offset intermediate transfer pivot hinges with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.

1. Manufacturers:
   a. Rixson Door Controls (RF) - E-M19-QC (# wires).

D. Concealed Quick Connect Electric Power Transfers: Provide concealed wiring pathway housing mortised into the door and frame for low voltage electrified door hardware. Furnish with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.

1. Manufacturers:
   a. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE) – EL-CEPT Series.
   b. Securitron (SU) - EL-CEPT Series.

E. Electric Door Wire Harnesses: Provide electric/data transfer wiring harnesses with standardized plug connectors to accommodate up to twelve (12) wires. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Provide sufficient number and type of concealed wires to accommodate electric function of specified hardware. Provide a connector for through-door electronic locking devices and from hinge to junction box above the opening. Wire nut connections are not acceptable. Determine the length required for each electrified hardware component for the door type, size and construction, minimum of two per electrified opening.

1. Provide one each of the following tools as part of the base bid contract:
   b. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) - Connector Hand Tool: QC-R003.

2. Manufacturers:
   a. Hager Companies (HA) - Quick Connect.
   b. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) – QC-C Series.
   c. Stanley Hardware (ST) – WH Series.

F. Provide mortar guard enclosure on steel frames installed at masonry openings for each electrical hinge specified.

2.4 DOOR OPERATING TRIM

A. Flush Bolts and Surface Bolts: ANSI/BHMA A156.3 and A156.16, Grade 1, certified.
1. Flush bolts to be furnished with top rod of sufficient length to allow bolt retraction device location approximately six feet from the floor.

2. Furnish dust proof strikes for bottom bolts.

3. Surface bolts to be minimum 8” in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable.

4. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.

5. Manufacturers:
   a. Door Controls International (DC).
   b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
   c. Trimco (TC).

B. Coordinators: ANSI/BHMA A156.3 certified door coordinators consisting of active-leaf, hold-open lever and inactive-leaf release trigger. Model as indicated in hardware sets.

1. Manufacturers:
   a. Door Controls International (DC).
   b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
   c. Trimco (TC).

C. Door Push Plates and Pulls: ANSI/BHMA A156.6 certified door pushes and pulls of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.

1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.

2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.

3. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.

4. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets.

5. Manufacturers:
   a. Hiawatha, Inc. (HI).
   b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
   c. Trimco (TC).

2.5 CYLINDERS AND KEYING

A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.

B. Source Limitations: Obtain each type of keyed cylinder and keys from the same source manufacturer as locksets and exit devices, unless otherwise indicated.

C. Cylinders: Original manufacturer cylinders complying with the following:

1. Mortise Type: Threaded cylinders with rings and cams to suit hardware application.
2. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
3. Bored-Lock Type: Cylinders with tailpieces to suit locks.
4. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
5. Keyway: Manufacturer’s Standard.

D. Permanent Cores: Manufacturer's standard; finish face to match lockset; complying with the following:

1. Interchangeable Cores: Core insert, removable by use of a special key; usable with other manufacturers' cylinders.

E. Patented Cylinders: ANSI/BHMA A156.5, Grade 1, certified patented cylinders employing a utility patented and restricted keyway requiring the use of a patented key. Cylinders are to be protected from unauthorized manufacture and distribution by manufacturer’s United States patents. Cylinders are to be factory keyed with owner having the ability for on-site original key cutting.

1. Manufacturers:
   a. Medeco (MC) - X4 Series.

F. Keying System: Each type of lock and cylinders to be factory keyed.

1. Conduct specified "Keying Conference" to define and document keying system instructions and requirements.
2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
3. New System: Key locks to a new key system as directed by the Owner.

G. Key Quantity: Provide the following minimum number of keys:

1. Change Keys per Cylinder: Two (2)
2. Master Keys (per Master Key Level/Group): Five (5).
3. Construction Keys (where required): Ten (10),
4. Construction Control Keys (where required): Two (2).
5. Permanent Control Keys (where required): Two (2).


I. Key Control Cabinet: Provide a key control system including envelopes, labels, and tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet. Key control cabinet shall have expansion capacity of 150% of the number of locks required for the project.

1. Manufacturers:
   a. Lund Equipment (LU).
   b. Telkee (TK).
2.6 MECHANICAL LOCKS AND LATCHING DEVICES

A. Mortise Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.13, Series 1000, Operational Grade 1 certified. Locksets are to be manufactured with a corrosion resistant steel case and be field-reversible for handing without disassembly of the lock body.

1. Mortise locks to be certified Security Grade 1.
2. Extended cycle test: Locks to have been cycle tested in ordinance with ANSI/BHMA 156.13 requirements to 10 million cycles.
3. Manufacturers:
   b. Sargent Manufacturing (SA) – 8200 Series.
   c. Stanley Best (BE) – 40H-UN Series.

2.7 ELECTROMECHANICAL LOCKING DEVICES

A. Electromechanical Mortise Locksets, Grade 1 (Heavy Duty): Subject to same compliance standards and requirements as mechanical mortise locksets, electrified locksets to be of type and design as specified below.

1. Electrified Lock Options: Where indicated in the Hardware Sets, provide electrified options including: outside door lock/unlock trim control, latchbolt and lock/unlock status monitoring, deadbolt monitoring, and request-to-exit signaling. Support end-of-line resistors contained within the lock case. Unless otherwise indicated, provide electrified locksets standard as fail secure.
2. Energy Efficient Design: Provide lock bodies which have a holding current draw of 15mA maximum, and can operate on either 12 or 24 volts. Locks are to be field configurable for fail safe or fail secure operation.
3. High Security Monitoring: Provide lock bodies which have built-in request to exit monitoring and are provided with accompanying door position switches. Provide a resistor configuration which is compatible with the access control system.
4. Manufacturers:
   a. Corbin Russwin Hardware (RU) - ML20900 Series.
   b. Sargent Manufacturing (SA) - 8200 Series.
   c. Stanley Best (BE) - 40HW EL/EU Series.

2.8 AUXILIARY LOCKS

A. Mortise Deadlocks, Small Case: ANSI/BHMA A156.36, Grade 1, small case mortise type deadlocks constructed of heavy gauge wrought corrosion resistant steel. Steel or stainless steel bolts with a 1" throw and hardened steel roller pins. Deadlocks to be products of the same source manufacturer and keyway as other specified locksets.

1. Manufacturers:
2.9 LOCK AND LATCH STRIKES

A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:

1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.

B. Standards: Comply with the following:

2. Strikes for Bored Locks and Latches: BHMA A156.2.
3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
4. Dustproof Strikes: BHMA A156.16.

2.10 CONVENTIONAL EXIT DEVICES

A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:

1. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.

2. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer's catalog and template book for specific requirements.

3. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.

4. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.

5. Energy Efficient Design: Provide lock bodies which have a holding current draw of 15mA maximum, and can operate on either 12 or 24 volts. Locks are to be field configurable for fail safe or fail secure operation.
6. Electromechanical Options: Subject to same compliance standards and requirements as mechanical exit devices, electrified devices to be of type and design as specified in hardware sets. Include any specific controllers when conventional power supplies are not sufficient to provide the proper inrush current.

7. Motorized Electric Latch Retraction: Devices with an electric latch retraction feature must use motors which have a maximum current draw of 600mA. Solenoid driven latch retraction is not acceptable.

8. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.
   a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
   b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.

9. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.

10. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2” wide stiles.


12. Extended cycle test: Devices to have been cycle tested in ordinance with ANSI/BHMA 156.3 requirements to 9 million cycles.

13. Rail Sizing: Provide exit device rails factory sized for proper door width application.

14. Through Bolt Installation: For exit devices and trim to be installed on wood doors.

B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 certified panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Exit device latch to be stainless steel, pullman type, with deadlock feature.

1. Manufacturers:
   a. Corbin Russwin Hardware (RU) - ED4000 / ED5000 Series.
   b. Sargent Manufacturing (SA) - 80 Series.
   c. Von Duprin (VD) - 35A/98 XP Series.

C. Tube Steel Removable Mullions: ANSI/BHMA A156.3 removable steel mullions with malleable-iron top and bottom retainers and a primed paint finish.

1. Provide keyed removable feature where specified in the Hardware Sets.

2. Provide stabilizers and mounting brackets as required.

3. Provide electrical quick connection wiring options as specified in the hardware sets.

4. Manufacturers:
2.11 DOOR CLOSERS

A. All door closers specified herein shall meet or exceed the following criteria:

1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers including installation and adjusting information on inside of cover.

2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.

3. Cycle Testing: Provide closers which have surpassed 15 million cycles in a test witnessed and verified by UL.

4. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the physically handicapped, provide units complying with ANSI ICC/A117.1.

5. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.

6. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.

7. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt type fasteners for closers to be installed on wood doors.

B. Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard.

1. Manufacturers:

   a. Corbin Russwin Hardware (RU) - DC6000 Series.
   b. Sargent Manufacturing (SA) - 351 Series.
   c. Norton Door Controls (NO) - 7500 Series.

2.12 ARCHITECTURAL TRIM

A. Door Protective Trim
1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.

2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2” less than door width (LDW) on stop side of single doors and 1” LDW on stop side of pairs of doors, and not more than 1” less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.

3. Where plates are applied to fire rated doors with the top of the plate more than 16” above the bottom of the door, provide plates complying with NFPA 80. Consult manufacturer’s catalog and template book for specific requirements for size and applications.

4. Protection Plates: ANSI/BHMA A156.6 certified protection plates (kick, armor, or mop), fabricated from the following:
   a. Stainless Steel: 300 grade, 050-inch thick.

5. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.

6. Manufacturers:
   a. Hiawatha, Inc. (HI).
   b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
   c. Trimco (TC).

2.13 DOOR STOPS AND HOLDERS

A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.

B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 certified door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.

1. Manufacturers:
   a. Hiawatha, Inc. (HI).
   b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
   c. Trimco (TC).

C. Overhead Door Stops and Holders: ANSI/BHMA A156.6, Grade 1 certified overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.

1. Manufacturers:
   a. Rixson Door Controls (RF).
b. Sargent Manufacturing (SA).

2.14 ARCHITECTURAL SEALS

A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.

B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.

1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.

C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.


D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.

E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

F. Manufacturers:

1. National Guard Products (NG).
2. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE).

2.15 ELECTRONIC ACCESSORIES

A. Power Supplies: Provide Nationally Recognized Testing Laboratory Listed 12VDC or 24VDC (field selectable) filtered and regulated power supplies. Include battery backup option with integral battery charging capability in addition to operating the DC load in event of line voltage failure. Provide the least number of units, at the appropriate amperage level, sufficient to exceed the required total draw for the specified electrified hardware and access control equipment.

1. Manufacturers:

   a. Corbin Russwin Hardware (RU) - BPS Series.
   b. Sargent Manufacturing (SA) - 3500 Series.
   c. Securitron (SU) - BPS Series.
   d. Von Duprin (VD) - PS.

B. Switching Power Supplies: Provide switching power supplies that are dual voltage, UL listed, supervised units. Units shall be field selectable with a dedicated battery charging circuit that provide 4 Amp at 12VDC or 24VDC continuous, with up to 16 independently controlled power
limited outputs. Units shall tolerate brownout or overvoltage input ± 15% of nominal voltage and have thermal shutdown protection with auto restart. Circuit breaker shall protect against overcurrent and reverse battery faults and units shall be available with a single relay fire trigger or individually triggered relayed outputs. Provide the least number of units, at the appropriate amperage level, sufficient to exceed the required total draw for the specified electrified hardware and access control equipment.

1. Manufacturers:
   a. Securitron (SU) - AQ Series.

2.16 FABRICATION

A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.17 FINISHES

A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.

B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware.

C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.

3.3 INSTALLATION

A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.

   1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.

B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:

   2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
   3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
   4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.

C. Power Operator products and accessories are required to be installed through current members of the manufacturer's "Power Operator Preferred Installer" program.

D. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

E. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

F. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.4 FIELD QUALITY CONTROL

A. Field Inspection: Supplier will perform a final inspection of installed door hardware and state in report whether work complies with or deviates from requirements, including whether door hardware is properly installed, operating and adjusted.

3.5 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
3.6 CLEANING AND PROTECTION

A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.

B. Clean adjacent surfaces soiled by door hardware installation.

C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.7 DEMONSTRATION

A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.8 DOOR HARDWARE SETS

A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

B. The supplier is responsible for handing and sizing all products and providing the correct option for the appropriate door type and material where more than one is presented in the hardware sets. Quantities listed are for each pair of doors, or for each single door.

C. Manufacturer’s Abbreviations:

1. MK - McKinney
2. PE - Pemko
3. SU - Securitron
4. RF - Rixson
5. RO - Rockwood
6. SA - SARGENT
7. AD - Adams Rite
8. MC - Medeco
9. NO - Norton
10. OT - OTHER
11. HS - HES

D. Hardware Schedule Notes:

1. Provide glass bead shim kits for exit devices and closer plates and accessories as required for a complete installation.
2. Provide special template layout with overhead stops and closers, continuous hinges, pivots, etc. as required.
3. Hardware supplier shall coordinate hardware requirements and door and frame preparation with security contractor, general contractor, electrical contractor, and architect.
4. Per Part 2 – Products of this specification section: Provide non-removable pin (NRP) feature for hinges at outswinging, lockable doors as required; provide proper closer arm for installation with optimum aesthetics, in general regular arm for inswinging doors and parallel arm for outswinging doors, unless otherwise noted.
5. Provide thresholds as scheduled or otherwise noted or detailed on the architectural drawings.
6. Coordinate hardware requirements with aluminum storefront/clad door subcontractor including door thicknesses, stile and rail dimensions, etc.
7. Provide the necessary wood blocking in wall for proper wall stop installation.
8. Mount kick plates to align bottom of plate with bottom of door.
9. If protection plates are to be on rated doors, provide appropriate UL label on protection plates.
10. Coordinate power supplies with security contractor.

### Hardware Sets

**Set: 1.0**

Doors: 100A

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<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
<th>Model/Description</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
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<td>147</td>
<td>EM19 QC</td>
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<tr>
<td>2 Electric Side Pivot</td>
<td></td>
<td>55 56 AD8410 862</td>
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<td>1 Electrified Exit Device</td>
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<td>2 Door Bottom</td>
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<tr>
<td>2 Meeting Stile</td>
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<tr>
<td>1 Card Reader</td>
<td></td>
<td>By Security Contractor</td>
<td></td>
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<tr>
<td>1 Power Supply</td>
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Notes: Doors normally closed and locked. Access by authorized use of card reader or by use of authorized key. During certain hours exit devices can be electronically dogged down to allow doors to act as push pull doors. Doors always have free egress.
**Set: 2.0**

Doors: 153B

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Notes: Doors normally closed and locked. Access by authorized use of card reader or by use of authorized key. During certain hours exit devices can be electronically dogged down to allow doors to act as push pull doors. Doors always have free egress.

**Set: 3.0**

Doors: 127A, 151C

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<td>AQD (size and quantity as required)</td>
<td>SU</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 ElectroLynx Harness</td>
<td>QC-CXXXP (size as required)</td>
<td>MK</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 ElectroLynx Harness</td>
<td>QC-C1500P</td>
<td>MK</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes: Door normally closed and locked. Access by authorized use of card reader or by use of authorized key. Door always has free egress.

**Set: 4.0**

Doors: 103C, 112C

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
<th>Description</th>
<th>Set</th>
<th>Finish</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Pivot Set</td>
<td>147</td>
<td>626 RF</td>
<td>RF</td>
<td></td>
</tr>
<tr>
<td>1 Side Pivot</td>
<td>M19</td>
<td>626 RF</td>
<td>RF</td>
<td></td>
</tr>
</tbody>
</table>
1 Electrified Exit Device | 55 56 72 AD8504 862 | US32D | SA
1 Permanent Cylinder Core | 33600006N MK | 06 | MC
1 Door Closer | (P) 7500 | 689 | NO
1 Drop Plate | 7788 (as required) | 689 | NO
1 Overhead Stop | 6-X36 (size as required) | 630 | RF
1 Threshold | 272A X L.A.R. | PE
1 Weatherstrip | Door Manufacturers Standard | OT
1 Door Bottom | Door Manufacturers Standard | OT
1 Card Reader | By Security Contractor | OT
1 Power Supply | AQD (size and quantity as required) | SU
1 ElectroLynx Harness | QC-CXXXP (size as required) | MK
1 ElectroLynx Harness | QC-C1500P | MK
1 Door Position Switch | By Security Contractor | OT

Notes: Door normally closed and locked. Access by authorized use of card reader or by use of authorized key. Door always has free egress.

**Set: 5.0**

Doors: 101A, 101B, 153A

| 2 Pivot Set | 147 | 626 | RF
| 2 Side Pivot | M19 | 626 | RF
| 1 Exit Device (Exit Only) | 16 72 AD8410 862 | US32D | SA
| 1 Exit Device (Night Latch) | 16 72 AD8410 106 x 862 | US32D | SA
| 3 Permanent Cylinder Core | 33600006N MK | 06 | MC
| 2 Door Closer | (P) 7500 | 689 | NO
| 2 Drop Plate | 7788 (as required) | 689 | NO
| 2 Overhead Stop | 6-X36 (size as required) | 630 | RF
| 1 Threshold | 272A X L.A.R. | PE
| 1 Weatherstrip | Door Manufacturers Standard | OT
| 2 Door Bottom | Door Manufacturers Standard | OT
| 2 Meeting Stile | Door Manufacturers Standard | OT
| 2 Door Position Switch | By Security Contractor | OT

**Set: 6.0**

Doors: 153G

| 2 Pivot Set | 147 | 626 | RF
| 2 Side Pivot | M19 | 626 | RF
| 1 Exit Device (Exit Only) | 16 72 AD8410 862 | US32D | SA
| 1 Exit Device (Night Latch) | 16 72 AD8410 106 x 862 | US32D | SA
| 3 Permanent Cylinder Core | 33600006N MK | 06 | MC
| 2 Door Closer | (P) 7500 | 600 x 689 | NO
| 2 Drop Plate | 7786/7788 (as required) | 600 x 689 | NO
| 2 Overhead Stop | 6-X36 (size as required) | 630 | RF
| 1 Threshold | 272A X L.A.R. X Pemkote | PE
| 1 Weatherstrip | Door Manufacturers Standard | OT
| 2 Door Bottom | Door Manufacturers Standard | OT
| 2 Meeting Stile | Door Manufacturers Standard | OT
| 2 Door Position Switch | By Security Contractor | OT

**Set: 7.0**
Doors: 151B

| 1 Pivot Set | 147 | 626 | RF |
| 1 Side Pivot | M19 | 626 | RF |
| 1 Exit Device (Night Latch) | 72 AD8504 862 | US32D | SA |
| 1 Permanent Cylinder Core | 33600006N MK | 06 | MC |
| 1 Door Closer | (P) 7500 | 689 | NO |
| 1 Drop Plate | 7788 (as required) | 689 | NO |
| 1 Overhead Stop | 6-X36 (size as required) | 630 | RF |
| 1 Threshold | 272A X L.A.R. | PE |
| 1 Weatherstrip | Door Manufacturers Standard | OT |
| 1 Door Bottom | Door Manufacturers Standard | OT |

Set: 8.0

Doors: 127B

| 1 Pivot Set | 147 | 626 | RF |
| 1 Side Pivot | M19 | 626 | RF |
| 1 Exit Device (Night Latch) | 16 72 AD8504 862 | US32D | SA |
| 2 Permanent Cylinder Core | 33600006N MK | 06 | MC |
| 1 Door Closer | (P) 7500 | 689 | NO |
| 1 Drop Plate | 7788 (as required) | 689 | NO |
| 1 Overhead Stop | 6-X36 (size as required) | 630 | RF |
| 1 Threshold | 272A X L.A.R. | PE |
| 1 Weatherstrip | Door Manufacturers Standard | OT |
| 1 Door Bottom | Door Manufacturers Standard | OT |

Set: 9.0

Doors: 100B

| 2 Pivot Set | 147 | 626 | RF |
| 2 Side Pivot | M19 | 626 | RF |
| 1 Door Closer | (P) 7500 | 689 | NO |
| 1 Drop Plate | 7788 (as required) | 689 | NO |
| 1 Door Operator | 6021 | 689 | NO |
| 1 Door Switch | 505 | 689 | NO |
| 2 Overhead Stop | 6-X36 (size as required) | 630 | RF |
| 1 Threshold | 272A X L.A.R. | PE |
| 1 Weatherstrip | Door Manufacturers Standard | OT |
| 2 Door Bottom | Door Manufacturers Standard | OT |
| 2 Meeting Stile | Door Manufacturers Standard | OT |

Set: 10.0

Doors: 151A

<p>| 1 Pivot Set | 147 | 626 | RF |
| 1 Side Pivot | M19 | 626 | RF |
| 1 Exit Device (Classroom) | 72 AD8513 ETMD | US32D | SA |
| 1 Permanent Cylinder Core | 33600006N MK | 06 | MC |</p>
<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Quantity</th>
<th>Model</th>
<th>Manufacturer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Door Closer</td>
<td>(P) 7500</td>
<td>1</td>
<td>689</td>
<td>NO</td>
</tr>
<tr>
<td>Drop Plate</td>
<td>7788 (as required)</td>
<td>1</td>
<td>689</td>
<td>NO</td>
</tr>
<tr>
<td>Overhead Stop</td>
<td>6-X36 (size as required)</td>
<td>1</td>
<td>630</td>
<td>RF</td>
</tr>
<tr>
<td>Threshold</td>
<td>271A X L.A.R.</td>
<td>1</td>
<td>PE</td>
<td></td>
</tr>
<tr>
<td>Door Seal</td>
<td>Door Manufacturers Standard</td>
<td>1</td>
<td>OT</td>
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**Set: 11.0**

Doors: 142A

<table>
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<tr>
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<th>Description</th>
<th>Quantity</th>
<th>Model</th>
<th>Manufacturer</th>
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</thead>
<tbody>
<tr>
<td>Continuous Hinge</td>
<td>CFMXXXHD1</td>
<td>1</td>
<td>PE</td>
<td></td>
</tr>
<tr>
<td>Classroom Lock</td>
<td>72 8237 TOMD</td>
<td>1</td>
<td>US26D</td>
<td>SA</td>
</tr>
<tr>
<td>Permanent Cylinder Core</td>
<td>33600006N MK</td>
<td>1</td>
<td>06</td>
<td>MC</td>
</tr>
<tr>
<td>Door Closer</td>
<td>(P) 7500</td>
<td>1</td>
<td>689</td>
<td>NO</td>
</tr>
<tr>
<td>Drop Plate</td>
<td>7786/7788 (as required)</td>
<td>1</td>
<td>689</td>
<td>NO</td>
</tr>
<tr>
<td>Wall Stop</td>
<td>403</td>
<td>1</td>
<td>US26D</td>
<td>RO</td>
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<tr>
<td>Door Seal</td>
<td>Door Manufacturers Standard</td>
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**Set: 12.0**

Doors: 110B

<table>
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<tr>
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<th>Description</th>
<th>Quantity</th>
<th>Model</th>
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<tbody>
<tr>
<td>Continuous Hinge</td>
<td>CFMXXXHD1</td>
<td>1</td>
<td>PE</td>
<td></td>
</tr>
<tr>
<td>Classroom Lock</td>
<td>72 8237 TOMD</td>
<td>1</td>
<td>US26D</td>
<td>SA</td>
</tr>
<tr>
<td>Permanent Cylinder Core</td>
<td>33600006N MK</td>
<td>1</td>
<td>06</td>
<td>MC</td>
</tr>
<tr>
<td>Door Closer</td>
<td>(P) 7500</td>
<td>1</td>
<td>689</td>
<td>NO</td>
</tr>
<tr>
<td>Drop Plate</td>
<td>7786/7788 (as required)</td>
<td>1</td>
<td>689</td>
<td>NO</td>
</tr>
<tr>
<td>Overhead Stop</td>
<td>6-X36 (size as required)</td>
<td>1</td>
<td>630</td>
<td>RF</td>
</tr>
<tr>
<td>Door Seal</td>
<td>Door Manufacturers Standard</td>
<td>1</td>
<td>OT</td>
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**Set: 13.0**

Doors: 139

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<th>Model</th>
<th>Manufacturer</th>
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</thead>
<tbody>
<tr>
<td>Continuous Hinge</td>
<td>CFMXXXHD1</td>
<td>1</td>
<td>PE</td>
<td></td>
</tr>
<tr>
<td>Classroom Lock</td>
<td>72 8237 TOMD</td>
<td>1</td>
<td>US32D</td>
<td>SA</td>
</tr>
<tr>
<td>Permanent Cylinder Core</td>
<td>33600006N MK</td>
<td>1</td>
<td>06</td>
<td>MC</td>
</tr>
<tr>
<td>Door Closer</td>
<td>(P) 7500</td>
<td>1</td>
<td>600 x 689</td>
<td>NO</td>
</tr>
<tr>
<td>Drop Plate</td>
<td>7786/7788 (as required)</td>
<td>1</td>
<td>600 x 689</td>
<td>NO</td>
</tr>
<tr>
<td>Overhead Stop</td>
<td>6-X36 (size as required)</td>
<td>1</td>
<td>630</td>
<td>RF</td>
</tr>
<tr>
<td>Door Seal</td>
<td>Door Manufacturers Standard</td>
<td>1</td>
<td>OT</td>
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</table>

**Set: 14.0**

Doors: 103A, 103B

<table>
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<tr>
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<th>Description</th>
<th>Quantity</th>
<th>Model</th>
<th>Manufacturer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electric Continuous Hinge</td>
<td>CFMXXXHD1 SER X QC</td>
<td>1</td>
<td>PE</td>
<td></td>
</tr>
<tr>
<td>Electric Power Transfer</td>
<td>CEPT-EL</td>
<td>1</td>
<td>SU</td>
<td></td>
</tr>
<tr>
<td>Electrified Lock</td>
<td>RX 72 8271 TOMD</td>
<td>1</td>
<td>US26D</td>
<td>SA</td>
</tr>
<tr>
<td>Permanent Cylinder Core</td>
<td>33600006N MK</td>
<td>1</td>
<td>06</td>
<td>MC</td>
</tr>
<tr>
<td>Door Closer</td>
<td>(P) 7500</td>
<td>1</td>
<td>689</td>
<td>NO</td>
</tr>
<tr>
<td>Drop Plate</td>
<td>7786/7788 (as required)</td>
<td>1</td>
<td>689</td>
<td>NO</td>
</tr>
<tr>
<td>Overhead Stop</td>
<td>6-X36 (size as required)</td>
<td>1</td>
<td>630</td>
<td>RF</td>
</tr>
<tr>
<td>Door Seal</td>
<td>Door Manufacturers Standard</td>
<td>1</td>
<td>OT</td>
<td></td>
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</tbody>
</table>
Notes: Door normally closed and locked. Access by authorized use of card reader or by use of authorized key. Door always has free egress.

### Set: 15.0

Doors: 112A

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
<th>Description</th>
<th>Supplier</th>
</tr>
</thead>
<tbody>
<tr>
<td>Card Reader</td>
<td>1</td>
<td>By Security Contractor</td>
<td>OT</td>
</tr>
<tr>
<td>Power Supply</td>
<td>1</td>
<td>AQD (size and quantity as required)</td>
<td>SU</td>
</tr>
<tr>
<td>ElectroLynx Harness</td>
<td>1</td>
<td>QC-CXXXXP (size as required)</td>
<td>MK</td>
</tr>
<tr>
<td>ElectroLynx Harness</td>
<td>1</td>
<td>QC-C1500P</td>
<td>MK</td>
</tr>
</tbody>
</table>

Notes: Door normally closed and locked. Access by authorized use of card reader or by use of authorized key. Use of intercom can allow staff member to remotely release door to allow entry. Door always has free egress.

### Set: 16.0

Doors: 151D

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
<th>Description</th>
<th>Supplier</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electric Continuous Hinge</td>
<td>1</td>
<td>CFMXXXXHD1 SER X QC</td>
<td>PE</td>
</tr>
<tr>
<td>Electric Power Transfer</td>
<td>1</td>
<td>CEPT-EL</td>
<td>SU</td>
</tr>
<tr>
<td>Electrified Lock</td>
<td>1</td>
<td>RX 72 8271 TOMD</td>
<td>SA</td>
</tr>
<tr>
<td>Permanent Cylinder Core</td>
<td>1</td>
<td>33600006N MK</td>
<td>06 MC</td>
</tr>
<tr>
<td>Door Closer</td>
<td>1</td>
<td>(P) 7500</td>
<td>NO</td>
</tr>
<tr>
<td>Drop Plate</td>
<td>1</td>
<td>7786/7788 (as required)</td>
<td>NO</td>
</tr>
<tr>
<td>Overhead Stop</td>
<td>1</td>
<td>6-X36 (size as required)</td>
<td>RF</td>
</tr>
<tr>
<td>Door Seal</td>
<td>1</td>
<td>Door Manufacturers Standard</td>
<td>OT</td>
</tr>
<tr>
<td>Card Reader</td>
<td>1</td>
<td>By Security Contractor</td>
<td>OT</td>
</tr>
<tr>
<td>Power Supply</td>
<td>1</td>
<td>AQD (size and quantity as required)</td>
<td>SU</td>
</tr>
<tr>
<td>ElectroLynx Harness</td>
<td>1</td>
<td>QC-CXXXXP (size as required)</td>
<td>MK</td>
</tr>
<tr>
<td>ElectroLynx Harness</td>
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<td>QC-C1500P</td>
<td>MK</td>
</tr>
<tr>
<td>Intercom</td>
<td>1</td>
<td>By Security Contractor</td>
<td>OT</td>
</tr>
<tr>
<td>Buzzer</td>
<td>1</td>
<td>By Security Contractor</td>
<td>OT</td>
</tr>
</tbody>
</table>

Notes: Door normally closed and locked. Access by authorized use of card reader or by use of authorized key. Use of intercom can allow staff member to remotely release door to allow entry. Door always has free egress.

### Set: 17.0

Doors: 145A, 145B

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
<th>Description</th>
<th>Supplier</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cylinder</td>
<td>2</td>
<td>Cylinder as Required</td>
<td>US32D SA</td>
</tr>
<tr>
<td>Permanent Cylinder Core</td>
<td>2</td>
<td>33600006N MK</td>
<td>06 MC</td>
</tr>
<tr>
<td>Misc</td>
<td>1</td>
<td>Balance by Door Manufacturer</td>
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</tr>
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</table>
Set: 18.0
Doors: 118A, 118B

<table>
<thead>
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<th>Finish</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hinge</td>
<td>T4A3386 (NRP)</td>
<td>US32D</td>
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</tr>
<tr>
<td>Electric Hinge</td>
<td>T4A3386 QC</td>
<td>US32D</td>
<td>MK</td>
</tr>
<tr>
<td>Removable Mullion</td>
<td>L980</td>
<td>PC</td>
<td>SA</td>
</tr>
<tr>
<td>Mortise Cylinder</td>
<td>72 41 @ Mullion</td>
<td>US32D</td>
<td>SA</td>
</tr>
<tr>
<td>Alarmed Exit Device</td>
<td>AL 8810</td>
<td>US32D</td>
<td>SA</td>
</tr>
<tr>
<td>Alarmed Exit Device</td>
<td>AL 72 8804 FSW</td>
<td>US32D</td>
<td>SA</td>
</tr>
<tr>
<td>Permanent Cylinder Core</td>
<td>33600006N MK</td>
<td>06</td>
<td>MC</td>
</tr>
<tr>
<td>Door Closer</td>
<td>CPS7500</td>
<td>689</td>
<td>NO</td>
</tr>
<tr>
<td>Kick Plate</td>
<td>K1050 10&quot; X 2&quot; L.D.W. 4BE CSK</td>
<td>US32D</td>
<td>RO</td>
</tr>
<tr>
<td>Threshold</td>
<td>273x3AFG X L.A.R.</td>
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<td>PE</td>
</tr>
<tr>
<td>Weatherstrip</td>
<td>2893AV @ Head</td>
<td></td>
<td>PE</td>
</tr>
<tr>
<td>Weatherstrip</td>
<td>2903AV @ Jambs</td>
<td></td>
<td>PE</td>
</tr>
<tr>
<td>Door Bottom</td>
<td>216BDCFG X L.A.R.</td>
<td></td>
<td>PE</td>
</tr>
<tr>
<td>Split Astragal</td>
<td>305CN X L.A.R.</td>
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<tr>
<td>Power Supply</td>
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<td>Wiring Harness</td>
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<tr>
<td>ElectroLynx Harness</td>
<td>QC-CXXXXP (size as required)</td>
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<td>MK</td>
</tr>
<tr>
<td>Exit Device (Exit Only)</td>
<td>LD 8810</td>
<td></td>
<td>SA</td>
</tr>
<tr>
<td>Exit Device (Night Latch)</td>
<td>LD 72 8804 FSW</td>
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<td>SA</td>
</tr>
<tr>
<td>Permanent Cylinder Core</td>
<td>33600006N MK</td>
<td>06</td>
<td>MC</td>
</tr>
<tr>
<td>Door Position Switch</td>
<td>By Security Contractor</td>
<td></td>
<td>OT</td>
</tr>
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</table>

Notes: Doors normally closed and locked. Access by use of authorized key. Doors always have free egress, however egressing without first disabling alarm will set off alarm.

Set: 19.0
Doors: 137B

<table>
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<td>Hinge</td>
<td>T4A3386 (NRP)</td>
<td>US32D</td>
<td>MK</td>
</tr>
<tr>
<td>Removable Mullion</td>
<td>L980</td>
<td>PC</td>
<td>SA</td>
</tr>
<tr>
<td>Mortise Cylinder</td>
<td>72 41 @ Mullion</td>
<td>US32D</td>
<td>SA</td>
</tr>
<tr>
<td>Exit Device (Exit Only)</td>
<td>LD 8810</td>
<td>US32D</td>
<td>SA</td>
</tr>
<tr>
<td>Exit Device (Night Latch)</td>
<td>LD 72 8804 FSW</td>
<td>US32D</td>
<td>SA</td>
</tr>
<tr>
<td>Permanent Cylinder Core</td>
<td>33600006N MK</td>
<td>06</td>
<td>MC</td>
</tr>
<tr>
<td>Door Closer</td>
<td>CPS7500</td>
<td>689</td>
<td>NO</td>
</tr>
<tr>
<td>Armor Plate</td>
<td>K1050 34&quot; X 2&quot; L.D.W. 4BE CSK</td>
<td>US32D</td>
<td>RO</td>
</tr>
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<td>PE</td>
</tr>
<tr>
<td>Weatherstrip</td>
<td>2893AV @ Head</td>
<td></td>
<td>PE</td>
</tr>
<tr>
<td>Weatherstrip</td>
<td>2903AV @ Jambs</td>
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<td>PE</td>
</tr>
<tr>
<td>Door Bottom</td>
<td>216BDCFG X L.A.R.</td>
<td></td>
<td>PE</td>
</tr>
<tr>
<td>Split Astragal</td>
<td>305CN X L.A.R.</td>
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</tr>
<tr>
<td>Door Position Switch</td>
<td>By Security Contractor</td>
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Set: 20.0
Doors: 135, 136

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<tr>
<th>Item</th>
<th>Description</th>
<th>Set</th>
<th>Finish</th>
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<tbody>
<tr>
<td>Hinge</td>
<td>T4A3386 (NRP)</td>
<td>US32D</td>
<td>MK</td>
</tr>
<tr>
<td>Removable Mullion</td>
<td>L980</td>
<td>PC</td>
<td>SA</td>
</tr>
<tr>
<td>Mortise Cylinder</td>
<td>72 41 @ Mullion</td>
<td>US32D</td>
<td>SA</td>
</tr>
<tr>
<td>Item</td>
<td>Model/Part Number</td>
<td>Supplier Code</td>
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<tr>
<td>Exit Device (Exit Only)</td>
<td>LD 8810</td>
<td>US32D SA</td>
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<tr>
<td>Exit Device (Night Latch)</td>
<td>LD 72 8804 FSW</td>
<td>US32D SA</td>
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<tr>
<td>Permanent Cylinder Core</td>
<td>33600006N MK</td>
<td>06 MC</td>
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</tr>
<tr>
<td>Door Closer</td>
<td>CPS7500</td>
<td></td>
<td>600 x 689 NO</td>
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<tr>
<td>Armor Plate</td>
<td>K1050 34&quot; X 2&quot; L.D.W. 4BE CSK</td>
<td>US32D RO</td>
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<tr>
<td>Threshold</td>
<td>273x3AFG X L.A.R. X Pemkote</td>
<td>PE</td>
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</tr>
<tr>
<td>Weatherstrip</td>
<td>2893AV @ Head</td>
<td>PE</td>
<td></td>
</tr>
<tr>
<td>Weatherstrip</td>
<td>2903AV @ Jambs</td>
<td>PE</td>
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</tr>
<tr>
<td>Door Bottom</td>
<td>216BDCFG X L.A.R.</td>
<td>PE</td>
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<tr>
<td>Split Astragal</td>
<td>305CN X L.A.R.</td>
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<td>Door Position Switch</td>
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**Set: 21.0**

Doors: 130B

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<td>Hinge</td>
<td>T4A3386 (NRP)</td>
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<tr>
<td>Exit Device (Night Latch)</td>
<td>LD 72 8804 FSW</td>
<td>US32D SA</td>
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<tr>
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<td>Door Closer</td>
<td>CPS7500</td>
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<td>689 NO</td>
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<td>Armor Plate</td>
<td>K1050 34&quot; X 2&quot; L.D.W. 4BE CSK</td>
<td>US32D RO</td>
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<tr>
<td>Threshold</td>
<td>273x3AFG X L.A.R.</td>
<td>PE</td>
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<tr>
<td>Weatherstrip</td>
<td>2893AV @ Head</td>
<td>PE</td>
<td></td>
</tr>
<tr>
<td>Weatherstrip</td>
<td>2903AV @ Jambs</td>
<td>PE</td>
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<tr>
<td>Door Bottom</td>
<td>216BDCFG X L.A.R.</td>
<td>PE</td>
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<td>Door Position Switch</td>
<td>By Security Contractor</td>
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**Set: 22.0**

Doors: 132

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<td>US32D MK</td>
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<td>Electric Hinge</td>
<td>T4A3386 QC</td>
<td>US32D MK</td>
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<td>Flush Bolt</td>
<td>555</td>
<td>US26D RO</td>
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<td>Dust Proof Strike</td>
<td>570</td>
<td>US26D RO</td>
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<tr>
<td>Electricrified Lock</td>
<td>RX 72 8271 TOMD</td>
<td>US32D SA</td>
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<tr>
<td>Permanent Cylinder Core</td>
<td>33600006N MK</td>
<td>06 MC</td>
<td></td>
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<tr>
<td>Door Closer/Holder</td>
<td>CPS7500T (active leaf)</td>
<td>689 NO</td>
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<td>Armor Plate</td>
<td>K1050 34&quot; X 1&quot; L.D.W. 4BE CSK</td>
<td>US32D RO</td>
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<td>Overhead Stop/Holder</td>
<td>9-X26 (size as required)</td>
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<td>Threshold</td>
<td>273x3AFG X L.A.R.</td>
<td>PE</td>
<td></td>
</tr>
<tr>
<td>Weatherstrip</td>
<td>2893AV @ Head</td>
<td>PE</td>
<td></td>
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<tr>
<td>Weatherstrip</td>
<td>2903AV @ Jambs</td>
<td>PE</td>
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</tr>
<tr>
<td>Door Bottom</td>
<td>216BDCFG X L.A.R.</td>
<td>PE</td>
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<tr>
<td>Astragal</td>
<td>357SP X S88D X L.A.R.</td>
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<td>Card Reader</td>
<td>By Security Contractor</td>
<td>OT</td>
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<tr>
<td>Power Supply</td>
<td>AQD (size and quantity as required)</td>
<td>SU</td>
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<td>ElectroLynx Harness</td>
<td>QC-CXXXXP (size as required)</td>
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<td>ElectroLynx Harness</td>
<td>QC-C1500P</td>
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<tr>
<td>Door Position Switch</td>
<td>By Security Contractor</td>
<td>OT</td>
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</table>

Notes: Doors normally closed and locked. Access through active door leaf by authorized use of card reader or by use of authorized key. Active door leaf always has free egress.
Set: 23.0

Doors: 131B

3 Hinge T4A3386 (NRP) US32D MK
1 Storeroom Lock 72 8204 TOMD US32D SA
1 Permanent Cylinder Core 33600006N MK 06 MC
1 Door Closer CPS7500 689 NO
1 Armor Plate K1050 34” X 2” L.D.W. 4BE CSK US32D RO
1 Threshold 273x3AFG X L.A.R. PE
1 Weatherstrip 2893AV @ Head PE
2 Weatherstrip 2903AV @ Jambs PE
1 Door Bottom 216BDCFG X L.A.R. PE
1 Door Position Switch By Security Contractor OT
1 Latch Protector 320C US32D RO

Set: 24.0

Doors: 130A

3 Hinge T4A3786 (NRP) US26D MK
1 Exit Device (Storeroom) LD 72 8804 ETMD US32D SA
1 Permanent Cylinder Core 33600006N MK 06 MC
1 Door Closer CPS7500 689 NO
1 Armor Plate K1050 34” X 2” L.D.W. 4BE CSK US32D RO
1 Gasketing S88D @ Head & Jambs PE

Set: 25.0

Doors: 133

5 Hinge T4A3786 (NRP) US26D MK
1 Electric Hinge T4A3786 QC US26D MK
2 Flush Bolt 555 US26D RO
1 Dust Proof Strike 570 US26D RO
1 Electrified Lock RX 72 8271 TOMD US26D SA
1 Permanent Cylinder Core 33600006N MK 06 MC
1 Door Closer (P) 7500 (active leaf) 689 NO
2 Kick Plate K1050 10" X 1” L.D.W. 4BE CSK US32D RO
2 Wall Stop 403 US26D RO
1 Threshold 271A X L.A.R. PE
1 Weatherstrip 303AS @ Head & Jambs PE
2 Door Bottom 2343AV X L.A.R. PE
1 Astragal 357SP X S88D X L.A.R. PE
1 Card Reader By Security Contractor OT
1 Power Supply AQD (size and quantity as required) SU
1 ElectroLynx Harness QC-CXXXP (size as required) MK
1 ElectroLynx Harness QC-C1500P MK

Notes: Doors normally closed and locked. Access through active door leaf by authorized use of card reader or by use of authorized key. Active door leaf always has free egress.

Set: 26.0
Doors: 137A, 138

5 Hinge T4A3386 (NRP) US32D MK
1 Electric Hinge T4A3386 QC US32D MK
1 Flush Bolt 2842 US32D RO
1 Dust Proof Strike 570 US26D RO
1 Electrified Lock RX 72 8271 TOMD US32D SA
1 Permanent Cylinder Core 33600006N MK 06 MC
1 Coordinator 2672 Black RO
2 Mounting Bracket 2601AB (as required) Black RO
2 Door Closer (P) 7500 600 x 689 NO
2 Armor Plate K1050 34" X 1" L.D.W. 4BE CSK US32D RO
1 Wall Stop 409 US32D RO
1 Overhead Stop 1-X36 (size as required) 630 RF
1 Threshold 271A X L.A.R. X Pemkote PE
2 Gasketing S88D @ Head & Jambs PE
2 Door Bottom 2343AV X L.A.R. PE
1 Astragal By Door Manufacturer AL OT
1 Card Reader By Security Contractor OT
1 Power Supply AQD (size and quantity as required) SU
1 ElectroLynx Harness QC-CXXXP (size as required) MK
1 ElectroLynx Harness QC-C1500P MK

Notes: Doors normally closed and locked. Access through active door leaf by authorized use of card reader or by use of authorized key. Active door leaf always has free egress.

Set: 27.0

Doors: 110A

2 Hinge T4A3786 (NRP) US26D MK
1 Electric Hinge T4A3786 QC US26D MK
1 Electrified Lock RX 72 8271 TOMD US26D SA
1 Permanent Cylinder Core 33600006N MK 06 MC
1 Door Closer (P) 7500 689 NO
1 Kick Plate K1050 10" X 2" L.D.W. 4BE CSK US32D RO
1 Wall Stop 403 US26D RO
1 Gasketing S88D @ Head & Jambs PE
1 Card Reader By Security Contractor OT
1 Power Supply AQD (size and quantity as required) SU
1 ElectroLynx Harness QC-CXXXP (size as required) MK
1 ElectroLynx Harness QC-C1500P MK

Notes: Door normally closed and locked. Access by authorized use of card reader or by use of authorized key. Door always has free egress.

Set: 28.0

Doors: 107

2 Hinge T4A3786 (NRP) US26D MK
1 Electric Hinge T4A3786 QC US26D MK
1 Electrified Lock RX 72 8271 TOMD US26D SA
1 Permanent Cylinder Core 33600006N MK 06 MC
1 Door Closer/Holder (P) 7500H 689 NO
1 Kick Plate K1050 10" X 2" L.D.W. 4BE CSK US32D RO
1 Wall Stop 403 US26D RO
1 Gasketing S88D @ Head & Jambs PE
1 Card Reader By Security Contractor OT
1 Power Supply AQD (size and quantity as required) SU
1 ElectroLynx Harness QC-CXXXP (size as required) MK
1 Door Position Switch By Security Contractor OT

Notes: Door normally closed and locked. Access by authorized use of card reader or by use of authorized key. Door always has free egress.

**Set: 29.0**

Doors: 120, 121

6 Hinge T4A3786 (NRP) US26D MK
2 Flush Bolt 555 US26D RO
1 Dust Proof Strike 570 US26D RO
1 Storeroom Lock 72 8204 TOMD US26D SA
1 Permanent Cylinder Core 33600006N MK 06 MC
1 Door Closer/Holder CPS7500T (active leaf) 689 NO
2 Armor Plate K1050 34" X 1" L.D.W. 4BE CSK US32D RO
1 Overhead Stop/Holder 9-X26 (size as required) 630 RF
1 Gasketing S88D @ Head & Jambs PE
1 Astragal 357SP X S88D X L.A.R. PE

**Set: 30.0**

Doors: 129

6 Hinge T4A3786 (NRP) US26D MK
2 Flush Bolt 555 US26D RO
1 Dust Proof Strike 570 US26D RO
1 Storeroom Lock 72 8204 TOMD US26D SA
1 Permanent Cylinder Core 33600006N MK 06 MC
1 Door Closer/Holder (P) 7500H (active leaf) 689 NO
2 Armor Plate K1050 34" X 1" L.D.W. 4BE CSK US32D RO
1 Wall Stop 403 US26D RO
1 Overhead Holder/Stop 1-X26 (size as required) 630 RF
1 Gasketing S88D @ Head & Jambs PE
1 Astragal 357SP X S88D X L.A.R. PE

**Set: 32.0**

Doors: 131A

3 Hinge T4A3786 (NRP) US26D MK
1 Storeroom Lock 72 8204 TOMD US26D SA
1 Permanent Cylinder Core 33600006N MK 06 MC
1 Door Closer (P) 7500 689 NO
1 Armor Plate K1050 34" X 2" L.D.W. 4BE CSK US32D RO
1 Wall Stop 403 US26D RO
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<tr>
<th>Set: 33.0</th>
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<tr>
<td>1 Door Closer/Holder</td>
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<tr>
<td>1 Kick Plate</td>
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<td>1 Wall Stop</td>
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<td>1 Gasketing</td>
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<td>1 Permanent Cylinder Core</td>
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<td>1 Door Closer/Holder</td>
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<tr>
<td>1 Kick Plate</td>
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<tr>
<td>1 Wall Stop</td>
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<td>1 Gasketing</td>
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<td>1 Door Closer/Holder</td>
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<td>1 Kick Plate</td>
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<td>1 Door Closer/Holder</td>
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<td>1 Kick Plate</td>
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<td>1 Gasketing</td>
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**Waggener Farm Park - Phase 1**

### DOOR HARDWARE

#### Set: 38.0

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<td>3 Hinge</td>
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<td>TA2714 (NRP)</td>
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<td>1 Office Lock</td>
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<td>T3 72 8205 TOMD</td>
<td>US32D SA</td>
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<td>1 Permanent Cylinder Core</td>
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<td>1 Kick Plate</td>
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<td>K1050 10&quot; X 2&quot; L.D.W. 4BE CSK</td>
<td>US32D RO</td>
</tr>
<tr>
<td>1 Wall Stop</td>
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<td>403</td>
<td>US26D RO</td>
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<tr>
<td>1 Gasketing</td>
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<td>S773D @ Head &amp; Jambs</td>
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<td>1 Coat Hook</td>
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<td>RM802</td>
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**Set: 39.0**

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<td>US32D RO</td>
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<td>1 Privacy Lock</td>
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<td>T3 49 8265 TOMD</td>
<td>US26D SA</td>
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<td>1 Kick Plate</td>
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<td>K1050 10&quot; X 2&quot; L.D.W. 4BE CSK</td>
<td>US32D RO</td>
</tr>
<tr>
<td>1 Mop Plate</td>
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<td>K1050 6&quot; X 1&quot; L.D.W. 4BE CSK</td>
<td>US32D RO</td>
</tr>
<tr>
<td>1 Wall Stop</td>
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<td>403</td>
<td>US26D RO</td>
</tr>
<tr>
<td>1 Overhead Holder/Stop</td>
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<td>1-X26 (size as required)</td>
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**Set: 40.0**

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<td>3 Hinge</td>
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<td>US32D MK</td>
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<tr>
<td>1 Privacy Lock</td>
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<td>T3 49 8265 TOMD</td>
<td>US26D SA</td>
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<tr>
<td>1 Door Closer</td>
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<td>(P) 7500</td>
<td>600 x 689 NO</td>
</tr>
<tr>
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<td>K1050 10&quot; X 2&quot; L.D.W. 4BE CSK</td>
<td>US32D RO</td>
</tr>
<tr>
<td>1 Mop Plate</td>
<td></td>
<td>K1050 6&quot; X 1&quot; L.D.W. 4BE CSK</td>
<td>US32D RO</td>
</tr>
<tr>
<td>1 Wall Stop</td>
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<td>409</td>
<td>US32D RO</td>
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<tr>
<td>1 Gasketing</td>
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<td>S773D @ Head &amp; Jambs</td>
<td>PE</td>
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**Set: 41.0**

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<td>1 Deadlock</td>
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<td>US32D SA</td>
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<td>Model</td>
<td>Finish</td>
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<tr>
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<td>US32D RO</td>
<td>R.O.</td>
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<td>US32D RO</td>
<td>R.O.</td>
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<tr>
<td>Wall Stop</td>
<td>Wall Stop 409</td>
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<td>R.O.</td>
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<tr>
<td>Silencer</td>
<td>Frame Manufacturers Standard</td>
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Notes: Thumb turn on deadlock will not project deadbolt. It will only retract it. Authorized key required to project deadbolt.

**Set: 42.0**

Doors: 102, 112B

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**Set: 43.0**

Doors: 142B, 142C, 142D, 153C, 153D, 153E, 153F

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END OF SECTION 087100
SECTION 08 8000

GLAZING

PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Insulating glass units.
   B. Monolithic glass units.
   C. Plastic films.
   D. Glazing compounds and accessories.

1.02 RELATED REQUIREMENTS
   A. Section 08 4435 - Protective Framed Glazing Assemblies: Glazing fire-tested as part of the wall assembly.

1.03 REFERENCE STANDARDS
   M. GANA (GM) - GANA Glazing Manual.
   N. GANA (SM) - GANA Sealant Manual.
   O. ICC (IBC) - International Building Code.
   P. ITS (DIR) - Directory of Listed Products.
   Q. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies.
   R. NFRC 100 - Procedure for Determining Fenestration Product U-factors.
   U. UL (DIR) - Online Certifications Directory.
   V. UL 10B - Standard for Fire Tests of Door Assemblies.
   W. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data on Insulating Glass Unit Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.

C. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.

D. Samples: Submit two samples 12 by 12 inch in size, showing coloration and design of each type of glass specified.

E. Certificates: Certify that products of this Section meet or exceed specified requirements.

F. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Perform Work in accordance with GANA Glazing Manual and GANA Sealant Manual for glazing installation methods.

B. Installer Qualifications: Company specializing in performing the work of this Section with minimum three years documented experience.

C. Provide each type of glass, primary sealant, and gasket from a single manufacturer with not less than five years documented experience in the production of required materials.

D. Basis of Design: Specifications for certain glass products are based on specific glass types by the specified basis of design manufacturer. Glass types manufactured by other acceptable manufacturers are permitted, subject to compliance with all performance requirements; and provided that deviations in performance and coloration are minor, and do not detract substantially from the indicated design intent.
1. Comply with requirements specified in Section 01 4000 and Section 01 6000.

1.06 MOCK-UPS

A. See Section 01 4000 - Quality Requirements, for additional mock-up requirements.

B. Mock-up: Provide mock-up of specified glazing film installation.
1. Provide on-site glazing mock-up with the specified glazing components.
2. Locate where directed.
3. Mock-ups may remain as part of the Work.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Comply with manufacturer's instructions for shipping, handling, storing, and protection of glass and glazing materials. Exercise exceptional care to prevent edge damage to glass, and damage to coatings.

B. Where insulating glass units will be exposed to substantial altitude changes during shipping, comply with manufacturer's recommendations for venting and sealing.

1.08 FIELD CONDITIONS

A. Do not install glazing when ambient temperature is less than 40 degrees F.

B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

C. Install sealants only when ambient temperature conditions can be maintained at or above 40 degrees F during installation and 48 hours immediately following installation.

1.09 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
B. Insulating Glass Units: Provide a five (5) year manufacturer warranty to include coverage for seal failure, interpane dusting or misting, including providing products to replace failed units.

C. Laminated Glass: Provide a five (5) year manufacturer warranty to include coverage for delamination, including providing products to replace failed units.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS - EXTERIOR GLAZING ASSEMBLIES

A. Provide type and thickness of exterior glazing assemblies to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of glass.
1. Design Pressure: Calculated in accordance with applicable codes.
2. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.
3. Provide glass edge support system sufficiently stiff to limit the lateral deflection of supported glass edges to less than 1/175 of their lengths under specified design load.
4. Design glazing units to reliably perform and remain reliably engaged on all edges under all service and thermal stresses, including those associated with partial shading.
5. Limit center of glass deflection to the lesser of 3/4 inch or L/100 (where L is short side dimension of glass unit), or flexure limit of glass, whichever is less, with full recovery of glazing materials.
6. Assure and confirm compatibility of all materials in contact with each other.
7. Glass thicknesses listed are minimum.

B. Thermal and Optical Performance: Provide exterior glazing products with performance properties as indicated. Performance properties are in accordance with manufacturer's published data as determined with the following procedures and/or test methods:
1. Center of Glass U-Value: Comply with NFRC 100 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
2. Center of Glass Solar Heat Gain Coefficient (SHGC): Comply with NFRC 200 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.

2.02 GLASS MATERIALS

A. Float Glass: Provide float glass based glazing unless otherwise indicated.
1. Annealed Type: ASTM C1036, Type I - Transparent Flat, Class 1 - Clear, Quality - Q3.
4. Fully Tempered Safety Glass: Complies with ANSI Z97.1 or 16 CFR 1201 criteria for safety glazing used in hazardous locations.
6. Thicknesses: As indicated; provide greater thickness as required for exterior glazing wind load design.

B. Laminated Glass: Float glass laminated in accordance with ASTM C1172.
1. Laminated Safety Glass: Complies with ANSI Z97.1 - Class B or 16 CFR 1201 - Category I impact test requirements.
2. Ionoplast Interlayer: 0.060 inch thick, minimum.
   a. Color/Pattern: As specified on Drawings.
3. Acceptable Manufacturers:
   a. 3M Window Film: www.solutions.3m.com/#sle.
   e. Substitutions: See Section 01 6000 - Product Requirements.
2.03 INSULATING GLASS UNIT APPLICATIONS

A. Acceptable Insulating Glass Unit Manufacturers:
   1. Fabricator certified by glass manufacturer for type of glass, coating, and treatment involved and capable of providing specified warranty.
   2. Substitutions: Refer to Section 01 6000 - Product Requirements.

B. Insulating Glass Units: Types as indicated on Drawings.
   1. Basis of Design: As specified in this Section below.
   2. Durability: Certified by an independent testing agency to comply with ASTM E2190.
   3. Coated Glass: Comply with requirements of ASTM C1376 for pyrolytic (hard-coat) or magnetic sputter vapor deposition (soft-coat) type coatings on flat glass; coated vision glass, Kind CV; coated overhead glass, Kind CO; or coated spandrel glass, Kind CS.
   4. Metal Edge Spacers: Aluminum, bent and soldered corners.
   5. Spacer Color: Black.
   6. Edge Seal:
      a. Dual-Sealed System: Provide polyisobutylene sealant as primary seal applied between spacer and glass panes, and silicone sealant as secondary seal applied around perimeter.
      b. Color: Black.
   7. Purge interpane space with dry air, hermetically sealed.
   8. Translucent Inserts: Light-diffusing capillary insert faced with glass fiber tissue on both faces; sized to completely fill air space in designated insulating glass units.
      a. Applications: Where indicated on Drawings.
      b. Basis of Design Manufacturer:
         2) Substitutions: See Section 01 6000 - Product Requirements.
   9. Breather Tubes: Provide tubes from air space for insulating glass units without inert type gas that have a change of altitude greater than 2500 feet between point of fabrication and point of installation to permit pressure equalization of air space.
      a. Breather Tubes: Seal breather tubes upon installation in accordance with insulating glass fabricator's requirements.
   10. Space between lites filled with air.
   11. Total Thickness: 1 inch.

C. Insulating Glass Units: Safety glazing.
   1. Applications:
      a. Glazed lites in exterior doors.
      b. Glazed sidelights and panels next to doors.
      c. Locations required by applicable federal, state, and local codes and regulations.
      d. Other locations specified or indicated on Drawings.
   2. Glass Type: Same as other vision glazing except use fully tempered float glass for both outboard and inboard lites.

2.04 BASIS OF DESIGN - INSULATING GLASS UNITS

A. Basis of Design - Insulating Glass Units: Vision glazing, with Low-E coating.
   1. Applications: Exterior insulating glass glazing unless otherwise indicated.
      a. Low-E Coating: SunGuard SNX 62/27 on #2 surface.
      b. Glass: Clear.
      a. Coating: No coating on inboard lite.
      b. Glass: Clear.
   5. Substitutions: See Section 01 6000 - Product Requirements.
2.05 MONOLITHIC GLAZING UNITS

A. General - Combined Requirements: If a particular glass unit is indicated to comply with more than one type of requirement, such as color, safety characteristics, or other requirements. Comply with all specified requirements for each type as scheduled on Drawings.

B. Monolithic Interior Glazing:
   1. Applications: Interior glazing unless otherwise indicated.
   2. Glass Type: Fully tempered float glass.
   3. Tint: Clear.
   4. Thickness: 1/4 inch, nominal.
   5. Glazing Method: Wet/dry glazing method, preformed tape and sealant.

C. Fire-Resistance-Rated Glazing: Type, thickness, and configuration of glazing that contains flame, smoke, and blocks radiant heat, as required to achieve indicated fire-rating period.
   1. See Section 08 4435 for glazing in fire-rated framing and door assemblies.
   2. Applications:
      a. Glazing in fire-rated door assembly.
      b. Glazing in fire-rated window assembly.
      c. Glazing at other fire-rated locations as indicated on Drawings.
   3. Provide products listed by ITS (DIR) or UL (DIR) and approved by authorities having jurisdiction.
   4. Safety Glazing Certification: 16 CFR 1201 Category II.
   5. Glazing Method: As required for fire rating.
   6. Fire-Rating Period: 60 minutes.
      a. "W" - meets wall assembly criteria of ASTM E119 or UL 263 fire test standards.
      b. "D" - meets fire door assembly criteria of NFPA 252, UL 10B, or UL 10C fire test standards.
      c. "H" - meets fire door assembly hose stream test of NFPA 252, UL 10B, or UL 10C fire test standards.
      d. "T" - meets temperature rise of not more than 450 degrees F above ambient at end of 30 minutes fire exposure in accordance with NFPA 252, UL 10B, or UL 10C fire test standards.
      e. "XXX" - placeholder that represents fire-rating period, in minutes.
   8. Acceptable Manufacturers:
      a. SAFTIFIRST, a division of O'Keeffe's Inc.; SuperLite II-XL 60: www.safti.com/#sle.
      c. Vetrotech North America; Contraflam 60: www.vetrotechusa.com/#sle.
      d. Substitutions: Refer to Section 01 6000 - Product Requirements.

2.06 PLASTIC FILMS

A. Decorative Plastic Film: Vinyl or polyester type.
   1. Application: Locations as indicated on Drawings.
   2. Series Type: Specialty.
   3. Colors: As specified on Drawings.
   4. Thickness Without Liner: 0.002 inch.
   5. Basis of Design Manufacturer:
      a. 3M Window Film; Fasara Decorative Window Film; www.3m.com.
      b. Substitutions: Refer to Section 01 6000 - Product Requirements.

2.07 GLAZING COMPOUNDS

A. General Requirements:
   1. Provide black exposed glazing accessory materials, unless specifically indicated otherwise.
   2. Provide materials of hardness as recommended by manufacturer for required application and condition of installation in each case. Provide only compounds which are known to be fully compatible with surfaces contacted, including glass products, seals, and glazing channel surfaces.

B. Butyl Sealant: Single component; ASTM C920, Grade NS, Class 12-1/2, Uses M and A, Shore A hardness of 10 to 20; black color.
C. Silicone Sealant: Single component; neutral curing; capable of water immersion without loss of properties; non-bleeding, non-staining; ASTM C920, Type S, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 15 to 25; black color.

2.08 ACCESSORIES

A. Setting Blocks: Silicone, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot of glazing or minimum 4 inch by width of glazing rabbet space minus 1/16 inch by height to suit glazing method and pane weight and area.

B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness; ASTM C864 Option II. Minimum 3 inch long by one half the height of the glazing stop by thickness to suit application, self adhesive on one face.

C. Glazing Tape, Back Bedding Mastic Type: Preformed, butyl-based, 100 percent solids compound with integral resilient spacer rod applicable to application indicated; 5 to 30 cured Shore A durometer hardness; coiled on release paper; black color.
   1. Width: As required for application.
   2. Thickness: As required for application.

D. Glazing Gaskets: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option II; color black.
   1. Size gaskets as required by manufacturer of glazing channel frame to provide proper pressure and bite on glazing units.

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS

A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.

B. Verify that the minimum required face and edge clearances are being provided.

C. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.

D. Proceed with glazing system installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean contact surfaces with appropriate solvent and wipe dry within maximum of 24 hours before glazing. Remove coatings that are not tightly bonded to substrates.

B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.

C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

D. Sealed Insulating Glass Units: Seal breather tubes immediately prior to glass unit installation with bead of silicone sealant according to sealed insulating glass unit manufacturers requirements; do not crimp, bend, or otherwise damage breather tubes.

3.03 INSTALLATION - GENERAL

A. Install glazing in compliance with written instructions of glass, gaskets, and other glazing material manufacturers, unless more stringent requirements are indicated, including those in glazing referenced standards.

B. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.

C. Do not exceed edge pressures around perimeter of glass lites as stipulated by glass manufacturer.

D. Set glass lites of system with uniform pattern, draw, bow, and similar characteristics.

E. Set glass lites in proper orientation so that coatings face exterior or interior as indicated.
F. Prevent glass from contact with any contaminating substances that may be the result of construction operations such as, and not limited to the following; weld splatter, fire-safing, plastering, mortar droppings, etc.

3.04 INSTALLATION - DRY GLAZING METHOD (GASKET GLAZING)

A. Application - Exterior and/or Interior Glazed: Set glazing infills from either the exterior or the interior of the building.

B. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners; do not block weep paths.

C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.

D. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

3.05 INSTALLATION - WET/DRY GLAZING METHOD (PREFORMED TAPE AND SEALANT)

A. Application - Exterior Glazed: Set glazing infills from the exterior of the building.

B. Cut glazing tape to length and set against permanent stops, 3/16 inch below sight line. Seal corners by butting tape and dabbing with butyl sealant.

C. Apply heel bead of butyl sealant along intersection of permanent stop with frame ensuring full perimeter seal between glass and frame to complete the continuity of the air and vapor seal.

D. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners; do not block weep paths.

E. Rest glazing on setting blocks and push against tape and heel bead of sealant with sufficient pressure to attain full contact at perimeter of pane or glass unit.

F. Install removable stops, with spacer strips inserted between glazing and applied stops 1/4 inch below sight lines.
   1. Place glazing tape on glazing pane of unit with tape flush with sight line.

G. Fill gap between glazing and stop with butyl type sealant to depth equal to bite of frame on glazing, but not more than 3/8 inch below sight line.

H. Apply cap bead of butyl type sealant along void between the stop and the glazing, to uniform line, flush with sight line. Tool or wipe sealant surface smooth.

3.06 INSTALLATION - PLASTIC FILM

A. Install plastic film with adhesive, applied in accordance with film manufacturer's instructions.

B. Place without air bubbles, creases or visible distortion.

C. Install film tight to perimeter of glass and carefully trim film with razor sharp knife. Provide 1/16 inch to 1/8 inch gap at perimeter of glazed panel unless otherwise required. Do not score the glass.

3.07 CLEANING

A. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.

B. Remove non-permanent labels immediately after glazing installation is complete.

C. Clean glass and adjacent surfaces after sealants are fully cured.

D. Clean glass on both exposed surfaces not more than 4 days prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.
3.08 Protection

A. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

END OF SECTION
SECTION 08 8300
MIRRORS

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Glass mirrors.
   1. Tempered safety glass.

1.02 REFERENCE STANDARDS

1.03 SUBMITTALS
A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data on Mirror Types: Submit structural, physical and environmental characteristics, size limitations, special handling and installation requirements.
C. Samples: Submit two samples, 12 by 12 inch in size, illustrating mirrors design, edging, and coloration.

1.04 QUALITY ASSURANCE
A. Fabricate, store, transport, receive, install, and clean mirrors in accordance with manufacturer's recommendations.

1.05 WARRANTY
A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
B. Provide five year manufacturer warranty for reflective coating on mirrors and replacement of same.

PART 2 PRODUCTS

2.01 MATERIALS
A. Mirror Design Criteria: Select materials and/or provide supports as required to limit mirror material deflection to 1/200, or to the flexure limit of glass, with full recovery of glazing materials, whichever is less.
B. Mirror Glass: Clear, tempered safety glass; ASTM C1048, with copper and silver coatings, and protective overcoating.
   1. Thickness: 1/4 inch.
   2. Edges: Polished.
   3. Sizes: As noted on Drawings.

2.02 ACCESSORIES
A. Mirror Attachment Accessories: Stainless steel clips or J-profile channels.
B. Adhesive: Silicone pre-polymer based, chemically compatible with mirror coating and wall substrate.
   1. Application Temperature: Minus 35 to 140 degrees F at contact surfaces.

PART 3 EXECUTION

3.01 EXAMINATION
A. Verify that mounting surfaces are clean, free of obstructions, and ready for installation of mirrors.

3.02 PREPARATION
A. Clean contact surfaces and wipe dry.

3.03 INSTALLATION
A. Install mirrors in accordance with manufacturer's recommendations.
B. Set mirrors plumb and level, and free of optical distortion.

C. Set mirrors with edge clearance free of surrounding construction including countertops or backsplashes.

D. Frameless Mirrors: Set mirrors with clips or channel assemblies, and anchor rigidly to wall construction.

3.04 CLEANING

A. Remove wet glazing materials from finish surfaces.

B. Remove labels after work is complete.

C. Clean mirrors and adjacent surfaces.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES

A. This Section applies to all floors identified in the contract documents as to receive the following types of floor coverings:
   1. Resilient tile and sheet flooring.
   2. Broadloom carpet.
   3. Carpet tile.
   4. Thin-set ceramic tile and stone tile.
   5. Other adhesively applied flooring.

B. Preparation of new concrete floor slabs for installation of floor coverings.

C. Testing of concrete floor slabs for moisture and alkalinity (pH).
   1. Moisture Vapor Reducing Admixture (MVRA) Testing: MVRA supplier will perform independent moisture testing for its purposes. MVRA manufacturer will issue warranty prior to start of installation of flooring and moisture sensitive adhesives and coatings of any type.
   2. Moisture Vapor Reducing Admixture (MVRA) Testing: MVRA supplier will perform independent adhesive bond testing for its purposes. Warranted moisture sensitive coatings and adhesives must be installed by each subcontractor in coordination with MVRA manufacturer. Bond test results will be evaluated by MVRA manufacturer as part of its warranty issuance process.

D. Remediation of concrete floor slabs due to unsatisfactory moisture or alkalinity (pH) conditions.
   1. Perform all specified remediation of concrete floor slabs. If such remediation is indicated by testing agency's report and is due to a condition not under Contractor's control or could not have been predicted by examination prior to entering into the contract, a contract modification will be issued.

E. Remedial floor coatings.

F. Remedial floor sheet membrane.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Moisture emission reducing curing and sealing compound for slabs to receive adhered flooring, to prevent moisture content-related flooring failures; to remain in place, not to be removed.

1.03 REFERENCE STANDARDS

A. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.

B. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.


1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate scheduling of cleaning and testing, so that preliminary cleaning has been completed for at least 24 hours prior to testing.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Floor Covering and Adhesive Manufacturers' Product Literature: For each specific combination of substrate, floor covering, and adhesive to be used; showing:
   1. Moisture and alkalinity (pH) limits and test methods.
   2. Manufacturer's required bond/compatibility test procedure.
C. Testing Agency's Reports:
   1. Description of areas tested; include floor plans and photographs if helpful.
   2. Summary of conditions encountered.
   3. Moisture and alkalinity (pH) test reports.
   5. Recommendations for remediation of unsatisfactory surfaces.
   6. Submit report directly to Owner.
   7. Submit report not more than two business days after conclusion of testing.

D. Adhesive Bond and Compatibility Test Report.

E. Remedial Materials Product Data: Manufacturer's published data on each product to be used for remediation.
   1. Manufacturer's qualification statement.
   2. Test reports indicating compliance with specified performance requirements, performed by nationally recognized independent testing agency.
   3. Manufacturer's installation instructions.
   4. Specimen Warranty: Copy of warranty to be issued by coating manufacturer and certificate of underwriter's coverage of warranty.

1.06 QUALITY ASSURANCE

A. Moisture and alkalinity (pH) testing will be performed by an independent testing agency employed and paid by Owner.

B. Testing Agency Qualifications: Independent testing agency experienced in the types of testing specified.
   1. Submit evidence of experience consisting of at least 3 test reports of the type required, with project Owner's project contact information.

C. Contractor's Responsibility Relating to Independent Agency Testing:
   1. Provide access for and cooperate with testing agency.
   2. Confirm date of start of testing at least 10 days prior to actual start.
   3. Allow at least 4 business days on site for testing agency activities.
   4. Achieve and maintain specified ambient conditions.
   5. Notify Owner when specified ambient conditions have been achieved and when testing will start.

D. Remedial Coating Installer Qualifications: Company specializing in performing work of the type specified in this Section, trained by or employed by coating manufacturer, and able to provide at least 3 project references showing at least 3 years of experience installing moisture emission coatings.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, handle, and protect products in accordance with manufacturer's instructions and recommendations.

B. Deliver materials in manufacturer's packaging; include installation instructions.

C. Keep materials from freezing.

1.08 FIELD CONDITIONS

A. Maintain ambient temperature in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 65 degrees F or more than 85 degrees F.

B. Maintain relative humidity in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 40 percent and not more than 60 percent.

1.09 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Moisture Emission Reducing Sealing Compound: Provide warranty to cost of flooring delamination failures for 10 years, minimum.
   1. Include cost of repair or removal of failed flooring, remediation with a moisture vapor impermeable surface coating, and replacement of flooring with comparable flooring system.
PART 2 PRODUCTS

2.01 MATERIALS

A. Alternate Flooring Adhesive: Floor covering manufacturer's recommended product, suitable for the moisture and pH conditions present; low-VOC. In the absence of any recommendation from flooring manufacturer, provide a product recommended by adhesive manufacturer as suitable for substrate and floor covering and for conditions present.

B. Remedial Floor Coating: Single- or multi-layer coating or coating/overlay combination intended by its manufacturer to resist water vapor transmission to degree sufficient to meet flooring manufacturer's emission limits, resistant to the level of alkalinity (pH) found, and suitable for adhesion of flooring without further treatment.

C. Remedial Floor Sheet Membrane: Pre-formed multi-ply sheet membrane installed over concrete subfloor and intended by its manufacturer to resist water vapor transmission to degree sufficient to meet flooring manufacturer's emission limits, resistant to the level of alkalinity (pH) found, and suitable for adhesion of flooring without further treatment.

D. Floor Sealer: Clear, penetrating sealer for application to surfaces of concrete intended by its manufacturer to vapor-proof, seal, harden, dust-proof, and weather-proof concrete slabs by closing capillary system of concrete, and eliminating route of moisture vapor emission allowing application of moisture-sensitive adhesives and coatings.

PART 3 EXECUTION

3.01 CONCRETE SLAB PREPARATION

A. See Section 03 3000 - Cast-in-Place Concrete for additional requirements for finishing of concrete slabs.

B. Perform following operations in the order indicated:
   1. Preliminary cleaning.
   2. Moisture vapor emission tests; 3 tests in the first 1000 square feet and one test in each additional 1000 square feet, unless otherwise indicated or required by flooring manufacturer.
   3. Internal relative humidity tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
   4. Alkalinity (pH) tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
   5. Specified remediation, if required.
   6. Patching, smoothing, and leveling, as required.
   7. Other preparation specified.
   9. Protection.

C. Remediations:
   1. Active Water Leaks or Continuing Moisture Migration to Surface of Slab: Correct this condition before doing any other remediation; re-test after correction.
   2. Excessive Moisture Emission or Relative Humidity: If an adhesive that is resistant to the level of moisture present is available and acceptable to flooring manufacturer, use that adhesive for installation of the flooring; if not, apply remedial floor coating or remedial sheet membrane over entire suspect floor area.
   3. Excessive Alkalinity (pH): If remedial floor coating is necessary to address excessive moisture, no additional remediation is required; if not, if an adhesive that is resistant to the level present is available and acceptable to the flooring manufacturer, use that adhesive for installation of the flooring; otherwise, apply a skim coat of specified patching compound over entire suspect floor area.

3.02 PRELIMINARY CLEANING

A. Clean floors of dust, solvents, paint, wax, oil, grease, asphalt, residual adhesive, adhesive removers, film-forming curing compounds, sealing compounds, alkaline salts, excessive laitance, mold, mildew, and other materials that might prevent adhesive bond.

B. Do not use solvents or other chemicals for cleaning.
3.03 MOISTURE VAPOR EMISSION TESTING
   A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
   B. Where this specification conflicts with the referenced test method, comply with the requirements of this Section.
   C. Test in accordance with ASTM F1869 and as follows.
   D. Plastic sheet test and mat bond test may not be substituted for the specified ASTM test method, as those methods do not quantify the moisture content sufficiently.
   E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if test values exceed 3 pounds per 1000 square feet per 24 hours.
   F. Report: Report the information required by the test method.

3.04 INTERNAL RELATIVE HUMIDITY TESTING
   A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
   B. Where this specification conflicts with the referenced test method, comply with the requirements of this Section.
   C. Test in accordance with ASTM F2170 Procedure A and as follows:
      1. Testing with electrical impedance or resistance apparatus may not be substituted for the specified ASTM test method, as the values determined are not comparable to the ASTM test values and do not quantify the moisture content sufficiently.
      2. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if any test value exceeds 75 percent relative humidity.
   D. Report: Report the information required by the test method.

3.05 ALKALINITY TESTING
   A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
   B. The following procedure is the equivalent of that described in ASTM F710, repeated here for the Contractor's convenience.
      1. Use a wide range alkalinity (pH) test paper, its associated chart, and distilled or deionized water.
      2. Place several drops of water on a clean surface of concrete, forming a puddle approximately 1 inch in diameter. Allow the puddle to set for approximately 60 seconds, then dip the alkalinity (pH) test paper into the water, remove it, and compare immediately to chart to determine alkalinity (pH) reading.
      3. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if alkalinity (pH) test value is over 10.

3.06 PREPARATION
   A. See individual floor covering Section(s) for additional requirements.
   B. Comply with requirements and recommendations of floor covering manufacturer.
   C. Fill and smooth surface cracks, grooves, depressions, control joints and other non-moving joints, and other irregularities with patching compound.
   D. Do not fill expansion joints, isolation joints, or other moving joints.

3.07 ADHESIVE BOND AND COMPATIBILITY TESTING
   A. Comply with requirements and recommendations of floor covering manufacturer.
3.08 APPLICATION OF REMEDIAL FLOOR COATING
   A. General: Comply with requirements and recommendations of coating manufacturer.
   B. Apply floor sealer coating in accordance with manufacturer's instructions, matching approved mock-ups for color, special effects, sealing and workmanship.

3.09 INSTALLATION OF REMEDIAL FLOOR SHEET MEMBRANE
   A. Install in accordance with sheet membrane manufacturer's instructions.

3.10 PROTECTION
   A. Cover prepared floors with building paper or other durable covering.

END OF SECTION
SECTION 09 2116
GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal stud wall framing.
B. Metal channel ceiling framing.
C. Acoustic insulation.
D. Gypsum sheathing.
E. Gypsum wallboard.
F. Joint treatment and accessories.

1.02 RELATED REQUIREMENTS

A. Section 06 1053 - Miscellaneous Rough Carpentry: Wood blocking product and execution requirements.
B. Section 09 3000 - Tiling: Tile backing board.

1.03 REFERENCE STANDARDS

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
G. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
L. ASTM C1513 - Standard Specification for Steel Tapping Screws for Cold-Formed Steel Framing Connections; 2013.
S. ICC (IBC) - International Building Code.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate with mechanical and electrical work. Do not attach or support metal framing to ducts, pipes, conduit, or similar items.
   2. Coordinate installation of ceiling suspension system with installation of overhead structural systems to ensure that inserts and other structural anchorage provisions have been installed to receive ceiling anchors in a manner that will develop their full strength and at spacing required to support ceiling.
   3. Coordinate with installation of sprayed-on fireproofing to minimize or eliminate damage to that work due to gypsum board systems installation.
   4. Coordinate gypsum board work with requirements of Section 07 8400 to maintain integrity of fire-rated and smoke-rated partitions required to comply with specified regulatory requirements.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide data on metal framing, gypsum board, accessories, and joint finishing system.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing gypsum board installation and finishing.
B. Copies of Documents at Site: Maintain at the project site a copy of each referenced document that prescribes execution requirements.
C. Stud Framing: Products that do not comply with ASTM C645 or ASTM C754 are not permitted.
D. Basis of Design: Specifications are based on certain gypsum board products by specified basis of design standard manufacturers. Gypsum board products manufactured by other acceptable manufacturers are permitted, subject to compliance with specified requirements; and provided that deviations in design, appearance, and performance are minor, and do not detract substantially from the indicated design intent.
   1. Comply with requirements specified in Section 01 4000 and Section 01 6000.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store and protect products in accordance with referenced standards.
B. Handle gypsum boards to prevent damage to ends, edges, and surfaces.

1.08 FIELD CONDITIONS

A. Maintain ambient temperatures at not less than 40 degrees F for non-adhesive attachment of gypsum board, and not less than 50 degrees F for adhesive attachment.
B. Maintain ambient temperatures at not less than 50 degrees F for a period 48 hours before gypsum board finishing, during installation, and after installation of board materials.

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

A. Provide completed assemblies complying with ASTM C840 and GA-216.
B. Fire Rated Assemblies: Provide completed assemblies specified on Drawings.
   1. ICC IBC Item Numbers: Comply with applicable requirements of ICC IBC for the particular assembly.
   2. Gypsum Association File Numbers: Comply with requirements of GA-600 for the particular assembly.
   3. UL Assembly Numbers: Provide construction equivalent to that listed for the particular assembly in the current UL (FRD).
   4. Where any specified rated assembly requires the use of proprietary gypsum board system products, installation methods or procedures, comply with specified rated assembly requirements including requirements associated with assembly options which may be selected by Contractor.
2.02 METAL FRAMING MATERIALS

A. Acceptable Manufacturers - Metal Framing, Connectors, and Accessories:
   2. CEMCO; California Expanded Metal Company: www.cemcosteel.com.
   8. Substitutions: See Section 01 6000 - Product Requirements.

B. Metal Framing - General: Provide framing materials complying with specified standards and tested assemblies; galvanized sheet steel, 25 gage unless specified, noted, scheduled, or detailed otherwise.
   1. Use minimum 20 gage studs at door jambs, tile backing support, partitions supporting abuse-resistant and impact-resistant board, and other locations indicated on Drawings.

C. Non-Loadbearing Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/120 at 5 psf.
   1. Studs: "C" shaped with flat or formed webs.
   2. Runners: U shaped, sized to match studs.
   3. Stud System Accessories: Manufacturer's standard clips, shoes, ties, reinforcements, fasteners, and other accessories as required for a complete stud framing system.
      a. Stud Fasteners: Comply with ASTM C1513; size and length to suit connecting requirements.

D. Shaft Wall Studs and Accessories: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 and specified performance requirements.

E. Partition Head To Structure Connections: Provide track fastened to structure with legs of sufficient length to accommodate deflection, for friction fit of studs cut short and screwed to secondary deflection channel set inside but unattached to top track.

2.03 CEILING SUSPENSION SYSTEM COMPONENTS

A. Gypsum Board Interior Ceiling Suspension System:
   1. Ceiling Hangers: Type and size as specified in ASTM C754 for conditions and spacing required.
   2. Ceiling Hanger Wire: ASTM A641/A641M, Class 1 coating; soft temper, pre-stretched, yield stress load at least three times design load, but not less than 12 gage.
   3. Ceiling Hanger Angles: Not less than 7/8 x 7/8 inch x 16 gage galvanized steel formed angles; ASTM A653/A653M, G90 coating, with minimum 5/16 diameter bolted connections.
   4. Ceiling Hanger Anchors: Size for three times imposed loads, as determined by ASTM E488/E488M; corrosive resistant materials with loops or holes for attachment of hanger wires.

2.04 BOARD MATERIALS

A. Acceptable Manufacturers - Gypsum-Based Board:
   7. Substitutions: See Section 01 6000 - Product Requirements.

B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
   1. Applications: Use for vertical surfaces and ceilings, unless otherwise indicated.
   2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
      a. Mold resistant board is required at all locations.
3. At Assemblies Indicated with Fire-Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
4. Thickness: As indicated on Drawings.

C. Impact-Resistant Wallboard:
   1. Applications: High-traffic areas indicated on Drawings.
   2. Surface Abrasion: Level 3, minimum, when tested in accordance with ASTM C1629/C1629M.
   3. Indentation: Level 1, minimum, when tested in accordance with ASTM C1629/C1629M.
   4. Soft Body Impact: Level 3, minimum, when tested in accordance with ASTM C1629/C1629M.
   5. Hard Body Impact: Level 2, minimum, when tested in accordance with ASTM C1629/C1629M.
   6. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
   7. Paper-Faced Type: Gypsum wallboard as defined in ASTM C1396/C1396M.
   8. Type: Fire resistance rated Type X, UL or WH listed.
   9. Thickness: As indicated on Drawings.

D. Backing Board for Wet Areas: Specified in Section 09 3000.

E. Gypsum Board For Non-Wet Areas: Water-resistant gypsum backing board as defined in ASTM C1396/C1396M; sizes to minimum joints in place; ends square cut.
   1. Applications: Ceilings and vertical surfaces in "wet" areas but not behind thinset tile.
   2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
   3. At Assemblies Indicated with Fire-Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
   4. Thickness: As indicated on Drawings.

F. Exterior Sheathing Board: Sizes to minimize joints in place; ends square cut.
   1. Applications: Exterior sheathing and parapet sheathing, unless otherwise indicated.
   2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
   4. Glass Mat Faced Sheathing: Glass mat faced gypsum substrate as defined in ASTM C1177/C1177M.
   5. At Assemblies Indicated with Fire-Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
   6. Thickness: As indicated on Drawings.

G. Shaftwall and Coreboard: Type X; 1 inch thick by 24 inches wide, beveled long edges, ends square cut.
   1. Paper-Faced Type: Gypsum shaftliner board or gypsum coreboard as defined ASTM C1396/C1396M; water-resistant faces.
   2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.

2.05 ACOUSTICAL ACCESSORIES

A. Acoustic Insulation - General: Use type of acoustical insulation to comply with indicated assembly requirements.
   1. Where any specified rated assembly requires the use of proprietary acoustical insulation products, installation methods or procedures, comply with specified rated assembly requirements including requirements associated with assembly options which may be selected by Contractor.

B. Acoustic Insulation: ASTM C665; preformed glass fiber, friction fit type, unfaced.
   1. Thickness: Full thickness of indicated wall framing.

C. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.

2.06 INSTALLATION AND FINISHING ACCESSORIES

A. Finishing Accessories: ASTM C1047, galvanized steel or rolled zinc, unless noted otherwise.
   1. Types: As detailed or required for finished appearance.
   2. Special Shapes: In addition to conventional corner bead and control joints, provide U-bead at exposed panel edges.
   3. Control Joints: One-piece, v-grooved control joint with integral perforated flanges; removable tape to protect v-groove during finishing.
      a. Applications: Locations specifically noted on Drawings; also located at internal corners, wall locations at re-entrant soffit corners, and ceiling locations at re-entrant soffit corners whether or not specifically noted on Drawings.
4. Structural Laminate Corner System: High-strength tapered copolymer core, with joint tape on inside contact surfaces and manufacturer’s formulated surface paper on outside (finish) surfaces; impact-resistant corner accessory designed for adhesive application to outside gypsum board corners to receive specified gypsum board finishing system; minimum 2 inch leg width.
   a. Include required corner configurations as indicated on Drawings.
   b. Basis of Design Product:
      2) Substitutions: See Section 01 6000 - Product Requirements.

B. Joint Materials: ASTM C475/C475M, and as recommended by gypsum board manufacturer for project conditions.
   1. Interior Gypsum Board Tape: 2 inch wide, creased paper tape for joints and corners, except as otherwise indicated or specified for proprietary finishing systems.
   2. Joint Compound for Wet and Exterior Locations: Chemical quick-setting type for first 2 coats, and vinyl type top coat specially formulated for finishing topping.

C. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inch in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion resistant.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that project conditions are appropriate for work of this Section before commencing work of this Section.

3.02 SHAFT WALL INSTALLATION

A. Shaft Wall Framing: Install in accordance with GA-600 requirements.
   1. Fasten runners to structure with short leg to finished side, using appropriate power-driven fasteners at not more than 24 inches on center.
   2. Install studs at spacing required to meet performance requirements.

B. Shaftwall Coreboard: Cut panels to accurate dimension and install sequentially between special friction studs.
   1. On walls over sixteen feet high, screw-attach studs to runners top and bottom.
   2. Seal perimeter of shaft wall and penetrations with acoustical sealant.

C. At elevator shafts where shaft system cannot be positioned within 2 inches of structural beams, floor edges and similar projections into shaft, provide 5/8 inch gypsum board cants to cover tops of projections. Slope not more than 15 degrees from vertical. Set base edge in drywall adhesive and secure top with screws at 24 inches on center maximum.

D. Seal perimeter of shaftwall work where it abuts other work following requirements of Section 07 8400 - Firestopping for firestopping and fire-resistive joint sealant as applicable. Use exposed acoustic sealant at joints exposed to view on finished side.

3.03 FRAMING INSTALLATION

A. Metal Framing: Install in accordance with ASTM C754 and manufacturer's instructions.

B. Building Expansion Joints: Do not bridge building expansion joints with support system. Frame both sides of joints with furring and other support as indicated.

C. Suspended Ceilings and Soffits:
   1. Level ceiling and soffit system to a tolerance of 1/600.
   2. Laterally brace entire suspension system.
   3. Install bracing as required at exterior locations to resist wind uplift.
   4. Space ceiling framing and furring members 16 inches on center, except as otherwise indicated.
   5. Space ceiling framing and furring members at water-resistant gypsum board locations not to exceed 12 inches on center.
D. Studs: Space studs as permitted by standard or as specified below.
   1. Space studs 16 inches on center, except as otherwise indicated or required by specified tested assemblies, and secure to floor and ceiling runners with screws.
   2. Provide supplemental framing matching primary wall framing to support cut edges of gypsum boards not supported by primary vertical wall framing members.
   3. Extend partition framing to structure where indicated and to ceiling in other locations.
   4. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.
   5. Partitions Terminating at Structure: Attach extended leg top runner to structure, maintain clearance between top of studs and structure, and brace both flanges of studs with continuous bridging.
   6. Isolate stud system from transfer of structural loading to system, both horizontally and vertically. Provide slip or cushioned type joints to attain lateral support free from axial loading. Install each steel framing and furring member so that fastening surfaces do not vary more than 1/8 inch from plane of faces of adjacent framing.
   7. At partitions supported by on-grade slabs, provide top slip joint to accommodate 1-1/2 inch vertical movement. Provide deflection tracks or firestop tracks at slip joints where specified, or detailed on Drawings.

E. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.
   1. Access Doors: Coordinate placement of openings for access doors and hatches with Architect before framing opening. Avoid placing openings at highly visible locations on wall and ceilings. Refer to Section 08 3100.

F. Standard Wall Furring: Install at concrete and masonry walls scheduled to receive gypsum board, not more than 4 inches from floor and ceiling lines and abutting walls. Secure in place on alternate channel flanges at maximum 24 inches on center.

3.04 ACOUSTIC ACCESSORIES INSTALLATION
A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.
B. Acoustic Sealant: Install as follows:
   1. Place one bead continuously on substrate before installation of perimeter framing members.
   2. Place continuous bead at perimeter of each layer of gypsum board.
   3. Seal around all penetrations by conduit, pipe, ducts, and rough-in boxes, except where firestopping is provided.

3.05 BOARD INSTALLATION
A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.
   1. Space fasteners in accordance with ASTM C840 and manufacturer's recommendations, unless fastener spacing is otherwise specified on structural Drawings for structural load-bearing walls.
   2. Locate exposed end-butt joints as far from center of walls and ceilings as possible, and stagger not less than 24 inches in alternate courses of board.
B. Fire-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.
   1. Limit annular space between gypsum wall board edges and electrical device boxes to maximum 1/8 inch, or as limited by applicable Code.
C. Exposed Gypsum Board in Interior Wet Areas: Seal joints, cut edges, and holes with water-resistant sealant.
D. Exterior Sheathing Board Applications: Comply with ASTM C1280. Install sheathing vertically, with edges butted tight and ends occurring over firm bearing.
   1. Seal joints, cut edges, and holes with water-resistant sealant.
   2. Paper-Faced Sheathing: Immediately after installation, protect from weather by application of water-resistive barrier.
E. Installation on Metal Framing: Use screws for attachment of gypsum board.
3.06 INSTALLATION OF TRIM AND ACCESSORIES
   A. Control Joints: Place control joints consistent with lines of building spaces as indicated on Drawings; if not specifically indicated, provide control joints as follows:
      1. Not more than 30 feet apart on walls and ceilings over 50 feet long.
   B. Corner Beads: Install at external corners, using longest practical lengths.
   C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

3.07 JOINT TREATMENT
   A. Paper Faced Gypsum Board: Use paper joint tape, embed with drying type joint compound and finish with drying type joint compound.
   B. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
      1. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated or specified.
      2. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.
      3. Level 1: Wall areas above finished ceilings, whether or not accessible in the completed construction.
   C. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
      1. Feather coats of joint compound so that camber is maximum 1/32 inch.
      2. Taping, filling, and sanding is not required at surfaces behind adhesive applied ceramic tile and fixed cabinetry.
      3. Taping, filling and sanding is not required at base layer of double layer applications.

3.08 TOLERANCES
   A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES
A. Tile for floor applications.
B. Tile for wall applications.
C. Tile for shower receptors.
D. Cementitious backer board as tile substrate.
E. Non-ceramic trim.

1.02 REFERENCE STANDARDS

1.03 DEFINITIONS
A. Module Size: Actual tile size, with minor facial dimension as measured by ASTM C499, plus joint width indicated.
B. Facial Dimension: Actual tile size, with minor facial dimension as measured by ASTM C499.
C. Large Format Tile: Any tile unit that maintains an edge of 15 inches or greater in any dimension.

1.04 ADMINISTRATIVE REQUIREMENTS
A. Coordination:
   1. Coordinate location of tiling movement joints on concrete floor substrates with locations of concrete floor expansion and control joints; align substrate joints and tiling system joints where required by specified reference standards.
   2. Coordinate installation of drain components of shower receptor waterproofing system with Division 22.
B. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this Section; require attendance by all affected installers.
   1. Convene under general provisions of Section 01 7000.
   2. Review installation procedures and coordination requirements.

1.05 SUBMITTALS
A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide manufacturer's data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.
C. Samples: Submit manufacturer’s color boards consisting of actual tiles showing full range of colors, textures, and patterns available for each type and composition of tile specified.
   1. Include samples of specified accessories requiring color selection.
   2. Submit manufacturer’s color samples of available grout consisting of actual sections of grout showing full range of colors available for each type of grout specified.
D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
E. Installer's Qualification Statement:
   1. Submit documentation of National Tile Contractors Association (NTCA) or Tile Contractors’ Association of America (TCAA) accreditation.
F. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods.

1.06 QUALITY ASSURANCE

A. Installer Qualifications:
1. Company specializing in performing tile installation, with minimum of five years of documented experience.
2. Accredited Five-Star member of the National Tile Contractors Association (NTCA) or Trowel of Excellence member of the Tile Contractors’ Association of America (TCAA).

B. Provide materials obtained from only one manufacturer for each type and color of tile, and for each type of mortar, grout, adhesive, and sealant.

1.07 MOCK-UP

A. Comply with general mock-up requirements specified in Section 01 4000.

B. Mock-up: Construct tile mock-up where indicated on Drawings, incorporating all components specified for the location.
1. Minimum size of mock-up is indicated on Drawings.
2. Approved mock-up may remain as part of the Work.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Protect adhesives from freezing or overheating in accordance with manufacturer’s instructions.

1.09 FIELD CONDITIONS

A. Comply with referenced standards and manufacturer’s recommendations for protection and maintenance of environmental conditions during and after installation.

B. Do not install solvent-based products in an unventilated environment.

C. Maintain ambient and substrate temperature of 50 degrees F during installation, and for at least seven days after installation. Maintain higher temperatures for proprietary mortars and grouts when recommended by manufacturer.

D. Vent temporary heaters to the exterior to prevent damage to tile work due to carbon dioxide accumulation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers:
1. Manufacturers and products specified on Drawings.
2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 TRIM AND ACCESSORIES

A. Metal Trim: Satin natural anodized extruded aluminum, style, configuration, and dimensions to suit application, for setting using tile mortar or adhesive.
1. Applications:
   a. Open edges of floor tile.
   b. Transition between floor finishes of different heights.
   c. Floor to wall joints, where specified floor and wall tile do not have manufactured coved units, unless otherwise indicated on Drawings.
   d. Borders and other trim as indicated on Drawings.
2. Acceptable Manufacturers:
   c. Substitutions: See Section 01 6000 - Product Requirements.
2.03 SETTING MATERIALS

A. Setting Materials - General:
   1. Use only the types of mortar bed materials to set the types of tile for which the mortar is labeled.

   1. Applications: For floor applications in new construction; high-bond Portland cement mortar.
      a. Acceptable Products:
         1) Custom Building Products; MegaLite Crack Prevention Mortar, ProLite Tile & Stone Mortar, or Complete Contact Fortified Mortar.
         2) LATICRETE International, Inc.; 255 MultiMax or Sure Set.
         3) Mapei Corporation; Ultralite or Ultracontact.
         4) Substitutions: See Section 01 6000 - Product Requirements.

2. Applications: For wall applications; non-sagging, latex Portland cement mortar.
   a. Acceptable Products:
      1) Custom Building Products; MegaLite or FlexBond Crack Prevention Mortar.
      2) LATICRETE International, Inc.; LATICRETE 254 Platinum.
      3) Mapei Corporation; Ultraflex 3.
      4) Substitutions: See Section 01 6000 - Product Requirements.

C. Mortar Bed Materials: Pre-packaged mix of Portland cement, sand, latex additive, and water.
   1. Acceptable Products:
      a. ARDEX Engineered Cements; A 38: www.ardexamericas.com/#sl.
      c. Merkrete, by Parex USA, Inc; Merkrete Underlay C: www.merkrete.com/#sl.
      d. Proflex Products, Inc; MSI - Mud Set Installation: www.proflex.us/#sl.
      e. Substitutions: See Section 01 6000 - Product Requirements.

2.04 GROUTS

A. Single Component Grout: Complies with performance criteria of ANSI A118.3, ANSI A118.6, and ANSI A118.7; polymer and inorganic component cement grout.
   1. Applications: Use this type of grout at all grout locations where epoxy grout is specified required.
   2. Use sanded grout for joints 1/8 inch wide and larger; use unsanded grout for joints less than 1/8 inch wide.
   3. Prohibitions: Do not use grout sealers with this grout type.
   4. Color(s): As selected by Architect from manufacturer's full line.
   5. Acceptable Products:
      c. Substitutions: See Section 01 6000 - Product Requirements.

B. Epoxy Grout: ANSI A118.3 chemical resistant and water-cleanable epoxy grout.
   1. Applications: Use this type of grout at shower floor and wall applications, and other wet area locations indicated on Drawings.
   2. Use sanded grout for joints 1/8 inch wide and larger; use unsanded grout for joints less than 1/8 inch wide.
   3. Prohibitions: Do not use grout sealers with this grout type.
   4. Color(s): As selected by Architect from manufacturer's full line.
   5. Acceptable Products:
      a. Custom Building Products; CEG-IG 100% Solids Industrial Grade Epoxy Grout: www.custombuildingproducts.com/#sl.
      d. Substitutions: See Section 01 6000 - Product Requirements.
2.05 ACCESSORY MATERIALS

A. Concrete Floor Slab Crack Isolation Membrane: Material complying with ANSI A118.12; not intended as waterproofing.
   1. Crack Resistance: No failure at 1/8 inch gap, minimum.
   2. Fluid or Trowel Applied Type:
      a. Thickness: 20 mils, maximum.
      b. Acceptable Products:
         1) LATICRETE International, Inc; LATICRETE Blue 92 Anti-Fracture Membrane: www.laticrete.com/#sle.
         2) Merkrete, by Parex USA, Inc; Merkrete Fracture Guard: www.merkrete.com/#sle.
         3) Substitutions: See Section 01 6000 - Product Requirements.

B. Waterproofing Membrane at Floors and Walls: Specifically designed for bonding to cementitious substrate under thick mortar bed or thin-set tile; complying with ANSI A118.10.
   1. Crack Resistance: No failure at 1/16 inch gap, minimum; comply with ANSI A118.12.
   2. Fluid or Trowel Applied Type:
      a. Material: Synthetic rubber or Acrylic.
      b. Thickness: 25 mils, minimum, dry film thickness.
      c. Acceptable Products:
         2) LATICRETE International, Inc; LATICRETE HYDRO BAN: www.laticrete.com/#sle.
         3) Substitutions: See Section 01 6000 - Product Requirements.

C. Reinforcing Mesh: 2 by 2 inch size weave of 16/16 wire size; welded fabric, galvanized.

D. Backer Board: Cementitious type complying with ANSI A118.9; high density, glass fiber reinforced, 1/2 inch thick; 2 inch wide coated glass fiber tape for joints and corners.
   1. Acceptable Products:
      a. Custom Building Products; WonderBoard Lite Backerboard: www.custombuildingproducts.com/#sle.
      c. USG Corporation; Durock: www.usg.com.
      d. Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that sub-floor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive tile.

C. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of setting materials to sub-floor surfaces.

D. Cementitious Sub-floor Surfaces: Verify that substrates are dry enough and ready for tile flooring installation by testing for moisture and pH.
   1. Test in accordance with Section 09 0561.
   2. Obtain instructions if test results are not within limits recommended by tile flooring manufacturer and adhesive materials manufacturer.

E. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Protect surrounding work from damage.

B. Prepare floor substrates for installation of flooring in accordance with Section 09 0561.
C. Install backer board in accordance with ANSI A108.11 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of setting material to a feather edge.

3.03 INSTALLATION - GENERAL

A. Install tile and grout in accordance with applicable requirements of ANSI A108.1a through ANSI A108.13, manufacturer's instructions, and TCNA (HB) recommendations.

B. Blending: For tile exhibiting color or pattern variations within the ranges of accepted submittals, verify that tile has been blended in the packages so that tile units taken from one package show same range in colors or patterns as those taken from other packages. If not blended in the packages, blend tile in the field before installation.

C. Floor System Coverage: Where specified for individual setting methods, install floor tile units with 100 percent mortar coverage by complying with applicable special requirements for back buttering of tile units in referenced ANSI A108 specifications.

D. Install crack isolation membrane to comply with ANSI A118.10 and membrane manufacturer's written instructions for full floor coverage.

E. Movement Joints: Comply with TCNA (HB) Method EJ171F requirements for locations, spacing, and installation of applicable movement joints, whether or not specifically indicated or detailed on Drawings, and as follows:
   1. Spacing - Interior: Maximum 24 feet on center in each direction; reduce spacing to maximum 10 feet on center in areas exposed to direct sunlight or moisture.
   2. Spacing - Above-Ground Concrete Slabs: Maximum 10 feet on center in each direction.
   3. Joint Width: Match adjacent grouted joint widths, unless TCNA EJ171 requires a specific joint width based on joint location or joint service conditions.
   4. Apply sealant joint to junction of tile and dissimilar materials and junction of dissimilar planes, including but not limited to floor to wall joints, corners, and metal trim and non-ceramic accessory items.
   5. Keep movement joints free of setting adhesive and grout.
   6. Form internal angles and corners square, not grouted, with sealant joint.
   7. Form external angles and corners square, not grouted, with sealant joint.
   8. Apply specified sealant to joints.

F. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.

G. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly.
   1. Where floor and wall tile are of same dimensional module, align floor and wall joints.

H. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.

I. Install non-ceramic trim in accordance with manufacturer's instructions.

J. Sound tile after setting. Remove and replace hollow sounding units.

K. Keep control and expansion joints free of mortar, grout, and adhesive.

L. Prior to grouting, allow installation to completely cure; minimum of 48 hours.

M. Grout tile joints, except where movement joints are indicated or specified.

N. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.

O. Allow completed tiling assemblies to cure full 72 hours before allowing heavy foot or equipment traffic on final installations.

P. Seal joints between tile work and other work with sealant specified in Section 07 9200.

Q. Remove tiling installations that do not conform to specified requirements and tolerances, particularly lippage tolerances, and re-install in compliance with specified requirements.
3.04 INSTALLATION - FLOORS - THIN-SET METHODS
A. Over interior concrete substrates, install in accordance with TCNA (HB) Method F113, latex-Portland cement bond coat.
   2. Provide 100 percent coverage of setting mortar over tile back surfaces.
   3. Use crack isolation membrane under all tile meeting or exceeding definition of large format tile units in nominal face dimension, and also where specified.

3.05 INSTALLATION - FLOORS - MORTAR BED METHODS
A. Over interior concrete substrates, install in accordance with TCNA (HB) Method F112, bonded.
   1. Grout Type: Epoxy grout.

B. Over interior concrete substrates at curbless shower receptors, install in accordance with TCNA (HB) Method B422C, bonded.
   1. Grout Type: Epoxy grout.

3.06 INSTALLATION - SHOWER WALLS
A. At shower walls install in accordance with TCNA (HB) Method B412, over cementitious backer units with waterproofing membrane.
   1. Grout Type: Epoxy grout.

3.07 INSTALLATION - WALL TILE
A. Over coated glass mat backer board on studs, install in accordance with TCNA (HB) Method W245.

3.08 TOLERANCES
A. Comply with applicable requirements of ANSI A108.2, unless otherwise specified in this Section.

B. Flatness - Finished Tiling Surfaces:
   1. Ceramic Tile: 1/4 inch in 10 feet.
   2. Stone Tile: 1/8 inch in 10 feet.

C. Lippage - Adjacent Tile Units:
   1. Glazed Wall Tile and Mosaic Tile: 1/32 inch; joint width 1/16 inch to 1/8 inch; 1 x 1 inch to 6 x 6 inch tile size.
   2. Pressed Floor Tile and Porcelain Tile: 1/32 inch; joint width 1/16 inch to less than 1/4 inch; all tile sizes.
   3. Pressed Floor Tile and Porcelain Tile: 1/16 inch; joint width greater than 1/4 inch; all tile sizes.

3.09 CLEANING
A. Clean tile and grout surfaces.

B. Unglazed tile may be cleaned with sulfamic acid solutions only when permitted by the tile and grout manufacturer's printed instructions, but not sooner than 14 days after completion of installation. Protect metal surfaces, iron, and vitreous fixtures from effects of acid cleaning. Flush surfaces with clean water before and after acid cleaning.

C. Leave finished installation clean and free of cracked, chipped, broken, un-bonded, or otherwise defective tile work.

3.10 PROTECTION
A. Do not permit traffic over finished floor surface for minimum 7 days after installation.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Suspended metal grid ceiling system.
   B. Acoustical units.
   C. Supplementary acoustical insulation above ceiling.

1.02 REFERENCE STANDARDS
   A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   E. ASTM E1264 - Standard Classification for Acoustical Ceiling Products.

1.03 ADMINISTRATIVE REQUIREMENTS
   A. Coordination: Coordinate the location of hangers with other work.
   B. Sequencing: Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.
      1. Do not install acoustical units until after interior wet work is dry.

1.04 SUBMITTALS
   A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
   B. Product Data: Provide data on suspension system components and acoustical units.
   C. Samples: Submit two samples minimum 6 x 6 inch in size illustrating material and finish of acoustical units.
   D. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.
   E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
      1. See Section 01 6000 - Product Requirements, for additional provisions.
      2. Extra Acoustical Units: 80 sq ft of each type and size.

1.05 QUALITY ASSURANCE
   A. System Installer Qualifications: Company specializing in the installation of products specified in this Section with minimum three years documented experience.
   B. Basis of Design: Specifications are based on ceiling types by specified basis of design manufacturer and product(s). Ceiling types manufactured by other acceptable manufacturers are permitted, subject to compliance with specified requirements; and provided that deviations in design, performance, and profile are minor, and do not detract substantially from the indicated design intent.
      1. Comply with requirements specified in Section 01 4000 and Section 01 6000.
1.06 FIELD CONDITIONS

A. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 20 to 40 percent prior to, during, and after acoustical unit installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers - Acoustic Panels:
   5. USG Corporation: www.usg.com/#sle.
   6. Substitutions: See Section 01 6000 - Product Requirements.

B. Acceptable Manufacturers - Suspension Systems:
   1. Same as for acoustical units.
   2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 ACOUSTICAL CEILINGS

A. Acoustical Units - General: ASTM E1264, Class A.

2.03 CEILING PANEL MATERIALS

A. Acoustical Panels - Type SAT-1: Painted mineral fiber, ASTM E1264 Type III, Form 1, with the following characteristics:
   1. Size: 24 x 48 inches.
   2. Thickness: 3/4 inches.
   3. Light Reflectance: 86 percent, determined as specified in ASTM E1264.
   4. NRC Range: 0.65 to 0.75, determined as specified in ASTM E1264.
   7. Surface Color: White.
   8. Surface Pattern: Medium texture.
   10. Basis of Design Product:
        a. Armstrong World Industries, Inc.; Cirrus Tegular, or corresponding product manufactured by other acceptable manufacturer.
        b. Substitutions: See Section 01 6000 - Product Requirements.

B. Acoustical Panels - Type SAT-2: Painted mineral fiber, ASTM E1264 Type III, Form 1, with the following characteristics:
   1. Size: 24 x 48 inches.
   2. Thickness: 3/4 inches.
   3. Light Reflectance: 85 percent, determined as specified in ASTM E1264.
   4. NRC Range: 0.60 to 0.70, determined as specified in ASTM E1264.
   7. Surface Color: White.
   8. Surface Pattern: Medium texture.
   10. Basis of Design Product:
        a. Armstrong World Industries, Inc.; Cirrus Second Look, or corresponding product manufactured by other acceptable manufacturer.
        b. Substitutions: See Section 01 6000 - Product Requirements.
C. Acoustical Panels - Type SAC-1: Painted mineral fiber, ASTM E1264 Type XII, Form 2, with the following characteristics:
   1. Size: As indicated on Drawings.
   2. Thickness: 7/8 inch.
   3. Edge: Square.
   6. Suspension System: Pre-assembled extrusions in back of panels; manufacturer's standard suspension system designed for panel type.
   7. Basis of Design Product:
      a. Armstrong World Industries, Inc.; Soundscapes Shapes, or corresponding product manufactured by other acceptable manufacturer.
      b. Substitutions: See Section 01 6000 - Product Requirements.

2.04 SUSPENSION SYSTEMS

A. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with perimeter moldings, hold down clips, stabilizer bars, clips, and splices as required.

B. Exposed Suspension System: Hot-dipped galvanized steel grid with aluminum cap.
   1. Structural Classification: Intermediate-duty, when tested in accordance with ASTM C635/C635M.
   2. Profile: Tee; 15/16 inch face width.
   3. Finish: Baked enamel.

2.05 ACCESSORIES

A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.

B. Hanger Wire: 12-gage 0.08 inch galvanized steel wire.

C. Hold-Down Clips: Manufacturer's standard clips to suit application.

D. Perimeter Trim Profiles: Same material and finish as grid.
   1. Size: As required for installation conditions.
   2. Angle Molding: L-shaped, for mounting at same elevation as face of grid.

E. Metal Edge Trim: Extruded aluminum; provide attachment clips, splice plates, and preformed corner pieces for complete trim system.
   1. Trim Height: As indicated on Drawings for each type.
   2. Finish: Baked enamel.
   4. Acceptable Products:
      b. Substitutions: See Section 01 6000 - Product Requirements.

F. Acoustical Insulation: ASTM C665, friction fit type, unfaced batts.
   1. Thickness: 3-1/2 inches.
   2. Size: To fit acoustical suspension system.

G. Touch-up Paint: Type and color to match acoustical and grid units.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that layout of hangers will not interfere with other work.
3.02 PREPARATION
   A. Install after major above-ceiling work is complete.

3.03 INSTALLATION - SUSPENSION SYSTEM
   A. Install suspension system in accordance with ASTM C636/C636M and manufacturer's instructions and as supplemented in this section.
   B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.
   C. Locate system on room axis according to reflected plan.
   D. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
      1. Install in bed of acoustical sealant.
      2. Use longest practical lengths.
      3. Overlap and rivet corners.
   E. Suspension System, Non-Seismic: Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
   F. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.
   G. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.
   H. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.
      1. Support all fixtures weighing less than 56 lb by at least two supplementary No. 12 gage hangers if required by applicable building code; hangers may be slack.
   I. Do not eccentrically load system or induce rotation of runners.

3.04 INSTALLATION - ACOUSTICAL UNITS
   A. Install acoustical units in accordance with manufacturer's instructions.
   B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.
   C. Lay directional patterned units with pattern parallel to shortest room axis, unless otherwise indicated or directed.
   D. Fit border trim neatly against abutting surfaces.
   E. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.
   F. Cutting Acoustical Units:
      1. Cut to fit irregular grid and perimeter edge trim.
      2. Make field cut edges of same profile as factory edges; finish cut edges to match factory finished edges if cut edge is exposed to view.
   G. Lay acoustical insulation for a distance of 48 inches either side of acoustical partitions.
   H. Install hold-down clips on panels within 20 ft of an exterior door.

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

END OF SECTION
SECTION 09 5426
SUSPENDED WOOD CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Linear wood planks.
   B. Metal suspension system.

1.02 REFERENCE STANDARDS
   A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   F. CISCA (WC) - Wood Ceilings Technical Guidelines.

1.03 ADMINISTRATIVE REQUIREMENTS
   A. Coordination:
      1. Coordinate the installation of ceiling system with size, location and installation of fire sprinkler system.
      2. Coordinate the location of hangers with other work.
   B. Sequencing:
      1. Sequence work to ensure ceilings are not installed until building is enclosed, dust generating activities have terminated, and overhead work is completed.
      2. Do not install ceiling until after interior wet work is dry.

1.04 SUBMITTALS
   A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
   B. Shop Drawings: Indicate grid layout and related dimensioning, attachment of wood ceiling components to grid, accessory attachments, junctions with other ceiling finishes, and mechanical and electrical items installed in the ceiling.
   C. Product Data: Provide data on wood ceiling components and suspension system components.
   D. Samples: Submit two full size samples illustrating material and finish of wood ceiling components.
   E. Manufacturer’s Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

1.05 QUALITY ASSURANCE
   A. Installer Qualifications: Company specializing in performing the work of this Section.
      1. Minimum three years documented experience.
   B. Basis of Design: Specifications are based on linear wood ceiling systems by specified basis of design manufacturer. Systems manufactured by other acceptable manufacturers are permitted, subject to compliance with specified requirements; and provided that deviations in design, finish, weight, and profile are minor, and do not detract substantially from the indicated design intent.
      1. Comply with requirements specified in Section 01 4000 and Section 01 6000.
1.06 DELIVERY, STORAGE, AND HANDLING
A. Deliver wood ceiling components to project site in original, unopened packages.
B. Store in fully enclosed space, flat, level and off the floor.

1.07 FIELD CONDITIONS
A. Do not install suspended wood ceiling system until wet construction work is complete and permanent heat and air conditioning is installed and operating.
B. Maintain room temperature between 60 degrees F and 75 degrees F and relative humidity between 35 to 55 percent before, during, and after installation.

PART 2 PRODUCTS
2.01 MANUFACTURERS
A. Basis of Design Manufacturer:
   2. Substitutions: See Section 01 6000 - Product Requirements.
B. Other Acceptable Manufacturers:
   1. 9Wood: www.9wood.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 SUSPENDED WOOD CEILING SYSTEM
A. Performance Requirements:
   1. Design for maximum deflection of 1/360 of span.
   2. Surface Burning Characteristics: Flame spread index of 25, smoke developed index of 450, when tested in accordance with ASTM E84.
B. Wood-Based Materials:
   1. Solid Wood: Clear, dry, sound, plain sawn, selected for compatible species, grain and color, no defects.
C. Linear Wood Planks: Composite wood core with wood veneer finish.
   1. Type: Pre-assembled module of linear planks with battens attached perpendicularly to back of planks.
      a. Module Size: 24 by 96 inches, nominal.
      c. Plank Width: 5-1/4 inch, nominal.
      e. Acoustical Backer: Manufacturer's bio-acoustic fill, 1 inch thick.
         1) Color: Black.
   2. Veneer Species and Cut: Selected from manufacturer's full line.
      a. End Matching: Manufacturer's recommended matching.
      b. Factory Finish: Clear sealer.
   3. Attachment to Suspension Grid: Manufacturer's recommended method according to panel product selected.
   4. Suspension System: Type specified below.
D. Metal Suspension System:
   1. General: Comply with ASTM C635/C635M; die cut and interlocking components, with perimeter moldings, hold down clips, stabilizer bars, clips, and splices as required.
      a. Materials:
         1) Steel Grid: ASTM A653/A653M, G30 coating, unless otherwise indicated.
         2) Finish/Color: Baked enamel, black.
      b. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement.
E. Accessories: Manufacturer's standard accessories for installation method indicated, seismic requirements and above-ceiling accessibility.

2.03 FABRICATION
A. Shop fabricate wood ceiling components to the greatest extent possible.
B. Fabricate components to allow access to ceiling plenum as required.

PART 3 EXECUTION
3.01 EXAMINATION
A. Verify existing conditions before starting work.
B. Do not install ceiling until after interior wet work is dry.

3.02 PREPARATION
A. Layout wood ceiling components in pattern according to reflected ceiling plan and as shown on shop drawings.
B. Acclimate wood ceiling materials by removing from packaging in installation area a minimum of 48 hours prior to installation.

3.03 INSTALLATION
A. General: Install suspended wood ceiling system in accordance with CISCA (WC).
B. Suspension System:
   1. Install suspension system in accordance with ASTM C636/C636M, ASTM E580/E580M, and manufacturer's instructions and as supplemented in this section.
   2. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.
   3. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
   4. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.
   5. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.
   6. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.
   7. Do not eccentrically load system or induce rotation of runners.
C. Wood Ceiling:
   1. Install wood ceilings in accordance with manufacturer's instructions.
   2. Fit wood components in place, free from damaged edges or other defects detrimental to appearance and function.
   3. Install components in uniform plane, and free from twist, warp, and dents.
   4. Cut to fit irregular grid and perimeter edge trim.
   5. Make field cut edges of same profile as factory edges, seal and finish according to manufacturer.
   6. Install acoustical backer above wood ceiling components; fit tight between grid members.

3.04 TOLERANCES
A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.

3.05 CLEANING
A. Clean and touch up minor finish damage. Remove and replace components that cannot be successfully cleaned and repaired.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Wood strip flooring, nailed.
   B. Secondary subflooring.
   C. Shock pad systems.
   D. Sheet vapor retarder.
   E. Surface finishing.

1.02 REFERENCE STANDARDS
   A. MFMA (SPEC) - Guide Specifications for Maple Flooring Systems.
   B. NWFA (IG) - Installation Guidelines.

1.03 ADMINISTRATIVE REQUIREMENTS
   A. Coordination: Coordinate slab depression requirements for each specified flooring system with affected trades.

1.04 SUBMITTALS
   A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
   B. Product Data: Provide data for flooring.
   C. Shop Drawings: Indicate floor joint pattern and termination details.
      1. Indicate provisions for expansion and contraction, base, base corner details, and game insert or socket devices.
      2. Indicate location, size, design, and color of game markings.
   D. Samples: Submit two samples 12 by 12 inch in size illustrating floor finish, color, and sheen.
   E. Installation Instructions: Indicate standard and special installation procedures.
   F. Maintenance Data: Include maintenance procedures and recommended maintenance materials.

1.05 QUALITY ASSURANCE
   A. Perform work of this Section in accordance with MFMA (SPEC).
   B. Installer Qualifications: Company specializing in performing work of this Section with minimum five years experience.
   C. Basis of Design: Specifications are based on flooring types by specified basis of design manufacturer and product(s). Flooring types types manufactured by other acceptable manufacturers are permitted, subject to compliance with specified requirements; and provided that deviations in design, weight, and profile are minor, and do not detract substantially from the indicated design intent.
      1. Comply with requirements specified in Section 01 4000 and Section 01 6000.

1.06 FIELD CONDITIONS
   A. Do not install wood flooring until wet construction work is complete and ambient air at installation space has moisture content stabilized at maximum moisture content of 40 percent.
   B. Provide heat, light, and ventilation prior to installation.
   C. Store materials in area of installation for minimum period of 72 hours prior to installation.
D. Commence installation only after building is completely enclosed, HVAC systems are operational, and design level building temperature and relative humidity levels are established and stabilized, and can be maintained throughout installation and until Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design Manufacturer:
   2. Substitutions: See Section 01 6000 - Product Requirements.

B. Other Acceptable Manufacturers:
   4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS

A. Wood Strip Flooring:
   1. Species: KD Northern Hard Maple; unfinished, continuous strip XL450 flooring with specified manufacturer's XL-plus technology to reduce or eliminate routine spacing for expansion.
   2. Grade: Second and better, graded according to MFMA-FJ rules.
   3. Moisture Content: 7 to 9 percent.
   5. Actual Width: 2-1/4 inches.
   6. Edge: Square, tongue and groove.
   7. End: Square.
   8. Backs: Channeled (kerfed) for stress relief.
   9. Length: Random; minimum length complying with specified grade.

B. Flooring Fasteners: Type recommended by flooring manufacturer.
   1. Flooring: Minimum 1-1/4 inch, 18 gage cleats or staples.
   2. Subfloor:
      a. WSF-1 System: Specified manufacturer's Powers SPIKE channel anchors.

C. Shock Pad: Specified manufacturer's Zero/G Shock Pad product, designed for installation under subflooring.
   1. 5/8 inch thick, bio-profiled product.

D. Secondary Subflooring: Preservative treated, tongue and groove edges, Exposure 1, sanded faces; panel products specifically recommended or required by flooring manufacturer for indicated applications.
   1. Subflooring: 3/4 inch thick; manufacturer’s recommended special subflooring for specified flooring system, factory prepared to accept anchor channels; board size 24 x 96 inches.

E. Anchor Channels: Specified manufacturer's 14 gage metal LP Anchor Channels designed for use with specified flooring system.

2.03 ACCESSORIES

A. Ventilating Base: Molded rubber, 4 inch high with a 3 inch toe, ventilating type, with adhesives and accessories, black color.

B. Wood Plugs: Round shape, 3/4 inch diameter by 1/8 inch thick, of same species as flooring.

C. Floor Sealer and Finish: Oil modified polyurethane, to achieve low sheen surface; type recommended by flooring manufacturer.

D. Floor Stain: Dura-Seal penetrating type recommended by flooring manufacturer; color selected by Architect from manufacturer's full line.
2.04 SOURCE QUALITY CONTROL
   A. Inspect and stamp species and grade on underside of each piece of wood flooring at factory.

PART 3 EXECUTION

3.01 EXAMINATION
   A. Verify existing conditions before starting this work.
   B. Verify that concrete subfloor surface is smooth and flat to plus or minus 1/8 inch in 10 feet.
   C. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION
   A. Shock Pad System:
      1. Place vapor retarder over subfloor surface, lapping edges and ends minimum 6 inches and tape seal; staple in place.
      2. Place shock pad system over vapor retarder; space non-continuous shock pads as recommended by flooring manufacturer; do not secure to subfloor.
   B. Secondary Subflooring: Place one or two layers of plywood subflooring according to manufacturer's specifications for each specified flooring system, over shock pad system.
      1. Lay the first layer perpendicular to finish flooring direction according to specified manufacturer's flooring system specifications, staggered and spaced as recommended by flooring manufacturer.
         a. Place specified anchor channels in factory-prepared location in subfloor panels, according to flooring manufacturer's specifications.
      2. Lay the second layer for applicable flooring system on diagonal according to specified manufacturer's flooring system specifications, with edge joints offset and staggered as recommended by flooring manufacturer; use adhesive and fasteners as recommended by flooring manufacturer.
   C. Prepare substrate to receive wood flooring in accordance with manufacturer's and NWFA instructions.
   D. Broom clean substrate.

3.03 INSTALLATION
   A. Wood Flooring:
      1. Install in accordance with manufacturer's, MFMA, and NOFMA instructions; blind nail to wood sub-floor.
      2. Lay flooring in patterns indicated on Drawings. Verify alignment as work progresses.
      3. Arrange flooring with end matched grain set flush and tight.
      4. Terminate flooring at centerline of door openings where adjacent floor finish is dissimilar; provide divider strips and transition strips in accordance with flooring manufacturer's recommendations and as indicated.
      5. Install edge strips at unprotected or exposed edges, and where flooring terminates.
      7. Install flooring tight to floor access covers.
      8. Provide minimum 1-1/2 inch expansion space at fixed walls and other interruptions, or space as recommended by flooring manufacturer for indicated installation conditions.
   B. Install base at floor perimeter to cover expansion space in accordance with manufacturer's instructions. Miter inside and outside corners.
   C. Finishing:
      1. Mask off adjacent surfaces before beginning sanding.
      2. Sand flooring to smooth even finish with no evidence of sander marks. Take precautions to contain dust. Remove dust by vacuum.
      3. Apply finish in accordance with floor finish manufacturer's instructions.
      4. Apply filler and three finish coats.
      5. Apply first coat, allow to dry, then buff lightly with steel wool to remove irregularities. Vacuum clean and wipe with damp cloth before applying succeeding coat.
      6. Lightly buff between coats with steel wool and vacuum clean before applying succeeding coat.
7. Apply colored game lines and logo to layout indicated on Drawings.
8. Apply game lines specified in Section 09 9123 after application of filler, stain, and sealer coats, but prior to application of finish coats.
9. Apply last coat of finish.

3.04 CLEANING
A. Clean and polish floor surfaces in accordance with floor finish manufacturer's instructions.

3.05 PROTECTION
A. Prohibit traffic on floor finish for 48 hours after installation.
B. Place protective coverings over finished floors; do not remove coverings until Date of Substantial Completion.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES
A. Resilient flooring.
B. Resilient wall base.
C. Flooring system accessories.

1.02 ADMINISTRATIVE REQUIREMENTS
A. Sequencing:
   1. Install resilient flooring and accessories after other finishing operations, including painting have been completed.
   2. Do not install resilient flooring over concrete slabs until slabs have been fully cured, and are sufficiently dry to achieve proper bond with adhesive as determined by resilient flooring manufacturer's recommended bond and moisture test.

1.03 REFERENCE STANDARDS

1.04 SUBMITTALS
A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.
C. Verification Samples: Submit two samples, minimum 12 x 12 inch in size illustrating color and pattern for each resilient flooring product specified.
D. Certification: Prior to installation of flooring, submit written certification by flooring manufacturer and adhesive manufacturer that condition of sub-floor is acceptable.
E. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.
F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Flooring Material: 50 square feet of each type and color.
   3. Extra Wall Base: 24 linear feet of each type and color.
   4. Clearly identify each package.

1.05 QUALITY ASSURANCE
A. Installer Qualifications: Company specializing in installing specified flooring with minimum three years documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING
A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.
B. Deliver and store materials in manufacturer's original unopened containers, with brand names and production lot numbers clearly marked.
C. Store all materials off of the floor in an acclimatized, weather-tight space until ready for installation. Maintain storage space within lower and upper temperature and humidity limits required by flooring manufacturer.
D. Store materials for not less than 48 hours prior to installation in area of installation at a minimum temperature of 65 degrees F to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F and not exceeding 85 degrees F, unless otherwise restricted by flooring manufacturer. Maintain temperature and relative humidity at the same levels during installation, and after installation.
1. Protect roll materials from damage by storing on end.
2. Do not double stack pallets.

1.07 WARRANTY
A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
B. Resilient Flooring: Provide manufacturer's warranty, as follows:
1. Materials: Minimum 2 years from date of purchase.
2. Installation: Minimum 2 years from date of installation; warrant entire installation against loss of adhesion to substrates.

PART 2 PRODUCTS
2.01 MANUFACTURERS
A. Acceptable Manufacturers:
1. Manufacturers and products specified on Drawings.
2. Substitutions: Not permitted.

2.02 RESILIENT BASE
A. Resilient Base: ASTM F1861, Type TS rubber, vulcanized thermoset; top set, Style B, Cove.
1. Height: 4 inch.
2. Thickness: 0.125 inch.
4. Length: Roll.
5. Color: To be selected by Architect from manufacturer's full range.

2.03 ACCESSORIES
A. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.
B. Adhesive: Type recommended by wall covering manufacturer to suit application to substrate, zero (0) VOC content, non-water-based type.
C. Moldings and Edge Strips: Homogeneous vinyl or rubber type; tapered or bullnose edge; one inch wide; color selected by Architect.

PART 3 EXECUTION
3.01 EXAMINATION
A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.
B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.
C. Cementitious Sub-floor Surfaces: Verify that substrates are dry enough and ready for resilient flooring installation by testing for moisture and pH.
1. Test in accordance with Section 09 0561.
2. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.
D. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION
A. Prepare floor substrates for installation of flooring in accordance with Section 09 0561.
3.03 INSTALLATION - GENERAL
   A. Starting installation constitutes acceptance of sub-floor conditions.
   B. Install in accordance with manufacturer's written instructions.
   C. Adhesive-Applied Installation:
      1. Spread only enough adhesive to permit installation of materials before initial set.
      2. Fit joints and butt seams tightly.
      3. Set flooring in place, press with heavy roller to attain full adhesion.
   D. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door.
   E. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.
      1. Resilient Strips: Attach to substrate using adhesive.
   F. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.
   G. At movable partitions, install flooring under partitions without interrupting floor pattern.

3.04 INSTALLATION - SHEET FLOORING
   A. Lay flooring with joints and seams parallel to longer room dimensions, to produce minimum number of seams. Lay out seams to avoid widths less than 1/3 of roll width; match patterns at seams.
   B. Seams are prohibited in bathrooms, kitchens, toilet rooms, and custodial closets.
   C. Cut sheet at seams in accordance with manufacturer's instructions.
   D. Seal seams by heat welding where indicated or required by manufacturer for applicable flooring products.
   E. Chemically bond seams using seam sealer where indicated or required by manufacturer for applicable flooring products.

3.05 INSTALLATION - TILE AND PLANK FLOORING
   A. Mix tile from container to ensure shade variations are consistent when tile is placed, unless otherwise indicated in manufacturer's installation instructions.
   B. Lay flooring with joints and seams parallel to building lines to produce symmetrical pattern, unless otherwise indicated.
   C. Install square tile to basket weave pattern. Allow minimum 1/2 full size tile width at room or area perimeter.
   D. Install plank tile with a random offset of at least 6 inches from adjacent rows.

3.06 INSTALLATION - RESILIENT BASE
   A. Fit joints tightly and make vertical. Install in longest lengths possible; maintain minimum dimension of 18 inches between joints.
   B. Miter internal corners. At external corners, 'V' cut back of base strip to 2/3 of its thickness and fold.
   C. Install base on solid backing. Bond tightly to wall and floor surfaces.
   D. Scribe and fit to door frames and other interruptions.

3.07 CLEANING
   A. Remove excess adhesive from floor, base, and wall surfaces without damage.
   B. Clean in accordance with manufacturer's written instructions.

3.08 PROTECTION
   A. Prohibit traffic on resilient flooring for 48 hours after installation.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES

A. Rubber sheet flooring, adhesively installed.
B. Rubber tile, adhesively installed.

1.02 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Manufacturer's printed data sheets for products specified.
C. Verification Samples: Actual flooring material specified, not less than 12 inch square, mounted on solid backing.
D. Concrete Sub-floor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.

1.03 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer certified in writing by the flooring manufacturer to be qualified for installation of specified flooring system.
B. Basis of Design: Specifications for flooring products are based on systems by the specified basis of design manufacturer. Flooring types manufactured by other acceptable manufacturers are permitted, subject to compliance with all performance requirements; and provided that deviations in composition and coloration are minor, and do not detract substantially from the indicated design intent.
   1. Comply with requirements specified in Section 01 4000 and Section 01 6000.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to project site in unopened containers clearly labeled with manufacturer's name and identification of contents.
B. Store materials in dry and clean location until needed for installation. During installation, handle in a manner that will prevent marring and soiling of finished surfaces.

1.05 FIELD CONDITIONS

A. Install resilient flooring and accessories after other finishing operations, including painting have been completed.
B. Do not install resilient flooring over concrete slabs until slabs have been fully cured for at least 60 days, and are sufficiently dry to achieve proper bond as determined by flooring manufacturer's recommended bond and moisture test.
C. Maintain temperature in spaces to receive adhesively installed resilient flooring within range of 70 to 95 degrees F for not less than 48 hours before the beginning of installation and for not less than 48 hours after installation has been completed. Subsequently, do not allow temperature in installed spaces to drop below 50 degrees F or to go above 100 degrees F.

1.06 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
B. Resilient Flooring: Provide manufacturer's warranty, as follows:
   1. Materials: Minimum 2 years from date of purchase.
   2. Installation: Minimum 2 years from date of installation; warrant entire installation against loss of adhesion to substrates.
PART 2 PRODUCTS

2.01 MANUFACTURERS
   A. Basis of Design Manufacturers:
      1. As specified on Drawings for each flooring product.
      2. Substitutions: Not permitted.

2.02 ACCESSORIES
   A. Leveling Compound: Latex-modified cement formulation as recommended by flooring manufacturer for
      substrate conditions.
   B. Adhesive: Waterproof; types recommended by flooring manufacturer.
   C. Primers and Adhesives: Waterproof; types specifically required and supplied by flooring manufacturer for
      use under indicated project conditions, and to provide specified warranty regardless of moisture content of
      substrates at time of installation.

PART 3 EXECUTION

3.01 EXAMINATION
   A. Examine substrates for conditions detrimental to installation of athletic flooring. Proceed with installation
      only after unsatisfactory conditions have been corrected.
   B. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might
      telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other
      chemicals that might interfere with bonding of athletic flooring to substrate.
   C. Cementitious Sub-floor Surfaces: Verify that substrates are dry enough and ready for resilient flooring
      installation by testing for moisture and pH.
      1. Test in accordance with Section 09 0561.
      2. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer
         and adhesive materials manufacturer.

3.02 PREPARATION
   A. Prepare floor substrates for installation of flooring in accordance with Section 09 0561.

3.03 INSTALLATION
   A. Starting installation constitutes acceptance of sub-floor conditions.
   B. Install in accordance with manufacturer's written instructions.
   C. Resilient Sheet Flooring:
      1. Unroll flooring and allow to relax before beginning installation.
      2. Mix adhesive thoroughly and apply to substrate with notched trowel. Roll flooring into fresh adhesive,
         butting factory edges and compression fitting.
      3. Roll entire flooring surface with steel roller to assure adhesion to substrate and eliminate air bubbles.
      4. Immediately remove any adhesive from flooring surface, using chemical recommended by flooring
         manufacturer.
      5. Weld seams using techniques and equipment recommended by manufacturer.
      6. Lay out game lines using tape and taping machine approved by flooring manufacturer. Apply game
         line paint with roller, and allow to dry before removing tape.
      7. Apply transparent top coat over flooring if recommended by manufacturer, to achieve a uniform
         finished appearance.
   D. Rubber Tile Flooring:
      1. Lay out center lines in spaces to receive tile flooring, based on location of principal walls. Start tile
         installation from center, and adjust as necessary to avoid tiles less than one-half width at perimeter.
      2. Lay tiles square with room axis, matching for color and pattern by selecting from cartons and mixing as
         recommended by manufacturer.
3. Spread only enough adhesive to permit installation of materials before initial set.
4. Fit joints and butt seams tightly; press with heavy roller to attain full adhesion.

3.04 CLEANING
   A. Clean flooring using methods recommended by manufacturer.

3.05 PROTECTION
   A. Protect finished athletic flooring from construction traffic to ensure that it is without damage upon Date of Substantial Completion.

END OF SECTION
SECTION 09 6766
INDOOR PROTECTIVE SURFACING

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Protective surfacing for indoor playground area.
B. Subbase under resilient surfacing.
C. Containment curbs.
D. Design engineering.

1.02 REFERENCE STANDARDS
A. ASTM D2047 - Test Method for Static Coefficient of Friction of Polish-Coated Floor Surfaces as Measured by the James Machine.

1.03 DEFINITIONS
A. Use Zone: The area beneath and immediately adjacent to a play structure or equipment (play event) that is designated for unrestricted circulation around equipment, and on whose surface it is predicted that a user would land when falling from or exiting the equipment.
B. Critical Fall Height: The maximum fall height at which the protective surfacing meets the requirements of ASTM F1292.
C. High Play Activity Area: Areas where the fall height is especially great, such as at swings. A high play activity area is defined only where the protective surfacing of the entire playground area is not designed for the greatest fall height. High play activity areas are defined on the Drawings.
D. Fall Height: The vertical distance between the finished elevation of the designated play surface and the finished elevation of the protective surfacing beneath it as defined by ASTM F1487.
E. Protective Surfacing: Resilient ground surfacing. The characteristics of the protective surfacing are based on the fall height of the playground equipment. Changes in either the surfacing or the fall height, particularly reducing the resilience of the protective surfacing or increasing the fall height, will reduce safety-related performance.
F. Subbase: A layer under the resilient layer of the protective surfacing but over the subgrade; may be rigid, as in concrete or bituminous, or aggregate.
G. Subgrade: The surface of the ground on which the protective surfacing is installed.

1.04 ADMINISTRATIVE REQUIREMENTS
A. Preinstallation Meeting: Convene a meeting one week before starting earthwork for playground to discuss coordination between various installers.
   1. Convene under general provisions of Section 01 7000.
   2. Require attendance by personnel responsible for grading and installers of playground equipment, protective surfacing, footings, and adjacent work.
   3. Include representatives of Contractor.
   4. Notify Architect at least 2 weeks prior to meeting.

1.05 SUBMITTALS
A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: For all manufactured surfacing products, provide manufacturer’s product data showing materials of construction, compliance with specified standards, installation procedures, and safety limitations.
   1. Include IPEMA certifications where required.

C. Product Data: For natural surfacing materials, provide supplier's certification or mill certificate showing compliance with specified requirements.

D. Samples: For each product for which color must be selected provide actual samples showing full range of colors.

E. Maintenance Data:
   1. For manufactured surfacing products, provide manufacturer’s recommended maintenance instructions and list of repair products, with address and phone number of source of supply.

1.06 QUALITY ASSURANCE

A. Maintain one copy of the latest edition of ASTM F1487 and CPSC Pub. No. 325 at project site.

B. Manufacturer Qualifications: Company regularly engaged in manufacturing products specified in this Section, with not less than three years of documented experience.

C. Installer Qualifications: Company certified by manufacturer for training and experience installing the protective surfacing; provide installer's company name and address, and training and experience certificate.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store protective surfacing to project site in accordance with manufacturer's recommendations.

B. Store materials in a dry, covered area, elevated above grade.

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide minimum two year warranty for playground surfacing.

PART 2 PRODUCTS

2.01 DESIGN CRITERIA

A. Because the safety of the playground depends on strict conformance to the design criteria, this information is provided for Contractor's information.
   1. The protective surfacing constitutes a resilient layer installed over a non-resilient layer, which is installed over the subgrade, with the top of playground equipment footings and anchorage devices covered by full depth of the resilient portion of the protective surfacing.
   2. The total depth available for protective surfacing, from surface of subgrade, is indicated on the Drawings.
   3. The top elevation of the protective surfacing is intended to be flush with adjacent grades.
   4. Use Zone: The protective surfacing has been designed to provide acceptable impact attenuation as defined in ASTM F1292 for Critical Height of 5 feet.

B. If deviation from specified depth is required, it is the Contractor's responsibility to make all changes required to maintain specified top elevation and required impact attenuation at no extra cost to Owner; obtain approval prior to proceeding; follow approval request procedure as specified for substitutions.

2.02 MATERIALS

A. Poured-In-Place Membrane Surfacing: Weather-resistant wear layer over impact attenuating substrate over rigid subbase.
   1. Wear Layer: 100 percent recycled styrene butadiene rubber (SBR) and urethane particles adhered with a ultraviolet-stabilized polyurethane binder to produce an even, uniformly colored surface.
   3. Coefficient of Friction: 0.8, minimum, when tested in accordance with ASTM D2047.
4. Wear Layer Color(s): As selected from manufacturer's full range of bright colors.
5. Impact Attenuating Substrate: 100 percent recycled shredded styrene butadiene rubber (SBR) shreds or granules with 100 percent solids polyurethane binder to form a resilient material; do not use foam rubber.
6. Resilient Depth: As required to achieve specified Critical Fall Height as defined in ASTM F1292 but not more than depth indicated; maintain top elevation flush with adjacent grades.
   a. Floor Recess Depth: As indicated on Drawings.
7. Certification: Provide IPEMA certification of ASTM F1292 Critical Fall Height at thickness specified.
8. Acceptable Manufacturers:
   b. Substitutions: See Section 01 6000 - Product Requirements.

B. Containment Curbs: Cast-in-place concrete; free of sharp vertical edges, protruding elements, and trip hazards.
   1. Size(s): As indicated on Drawings.
   2. Minimum Edge Radius: 1/2 inch.

C. Rigid Subbase: Concrete, as specified in Section 03 3000.

PART 3 EXECUTION

3.01 PREPARATION

A. Correct subgrade irregularities to ensure that required depth of protective surfacing can be installed, and subgrade elevation is in accordance with manufacturer's requirements.

B. Inside Use Zones remove all obstructions that would extend into the resilient protective surfacing.

C. Remove rocks, debris, and other similar items.

D. Install containment curbs with top surface flush with intended elevation of top surface of protective surfacing.

3.02 SUBBASE

A. Install with top surface of subbase no higher than grades and levels indicated and not more than 1/4 inch lower than grades and levels indicated.

B. Install in true, even plane, sloped to provide positive drainage.

C. Flatness Tolerance: 1/4 inch in 10 feet, maximum.

D. Cure subbase at least 7 days but not less than required by manufacturer of resilient surfacing.

3.03 RESILIENT SURFACING LAYER

A. Install in accordance with CPSC Pub. No. 325, ASTM F1487, manufacturer's instructions, and requirements of authorities having jurisdiction.

B. Install proper thickness throughout Use Zone(s).

C. Clean and dry surface of subbase.

D. Poured In Place Surfacing:
   1. Mix components mechanically on-site in accordance with manufacturer's directions; do not mix by hand.
   2. Install seamlessly; ensure complete bond to subbase.
   3. Cover footings and foundations and adhere tightly around penetrating elements.
   4. Maintain full thickness of resilient layers within Use Zone; cover or abut containment curbs as indicated on Drawings; completely cover tapered transition edges.
   5. Hand trowel exposed surface to smooth, even finish.
   6. Impact Attenuation Layer: Install entire layer in one continuous pour on the same day.
7. Wear Surface: Bond wear surface to substrate with adhesive. Apply adhesive in small quantities so that wear surface can be applied before adhesive dries.
   a. Install surfacing seamlessly. When wear surface is composed of different color patterns, pour surface continuously and seamlessly.
   b. When seams are required due to color change or field conditions, place adjacent wear surface as soon as possible, before initial pour has cured. Coat edge of initial pour with adhesive and apply wear surface mixture immediately.
   c. Add a minimum of 1/16 inch depth to specified surfacing depth to ensure required impact attenuation performance is met.
   d. Install wear surface to cover foundations and adhere tightly around elements penetrating the surface.

3.04 FIELD QUALITY CONTROL
   A. Owner or Owner's representative will inspect playground surfacing after installation to verify that surfacing is of proper type and depth and that playground meets specified design safety and accessibility requirements.
   B. Repair or replace rejected work until compliance is achieved.

3.05 CLEANING AND PROTECTION
   A. Restore adjacent existing areas that have been damaged from the construction.
   B. Clean playground equipment of construction materials, dirt, stains, filings, and blemishes due to shipment or installation. Clean in accordance with manufacturer's instructions, using cleaning agents as recommended by manufacturer.
   C. Clean playground area of excess construction materials, debris, and waste.
   D. Remove excess and waste material and dispose of off-site in accordance with requirements of authorities having jurisdiction.
   E. Protect installed products until Substantial Completion.
   F. Replace damaged products before Substantial Completion.

END OF SECTION
SECTION 09 6813
TILE CARPETING

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Carpet tile, fully adhered.

1.02 REFERENCE STANDARDS
A. CRI 104 - Standard for Installation of Commercial Carpet.

1.03 SUBMITTALS
A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.
C. Samples: Submit two carpet tiles illustrating color and pattern design for each carpet color selected.
D. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.
E. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.
F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Carpet Tiles: Quantity equal to 5 percent of total installed of each color and pattern installed.

1.04 QUALITY ASSURANCE
A. Installer Qualifications: Company specializing in installing carpet tile with minimum three years documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING
A. Deliver carpeting materials in original mill protective wrapping, with mill register numbers and tags attached.
B. Store inside, in well ventilated area, protected from weather, moisture, and soiling.

1.06 FIELD CONDITIONS
A. Stage materials in area of installation for minimum period of 24 hours prior to installation.
B. Maintain minimum 70 degrees F ambient temperature 24 hours prior to, during and 24 hours after installation.
C. Ventilate installation area during installation and for 72 hours after installation.
D. Do not commence with carpet installation until painting and finishing work is complete and ceilings and overhead work has been tested, approved, and completed.

PART 2 PRODUCTS

2.01 MANUFACTURERS
A. Acceptable Manufacturers:
   1. Manufacturers and products specified on Drawings.
   2. Substitutions: Not permitted.

2.02 ACCESSORIES
A. Sub-Floor Filler: White premix latex; type recommended by flooring material manufacturer.
B. Non-Metallic Edge Strips: Extruded or molded heavy duty vinyl or rubber type; 1-1/2 inch wide, with minimum 2 inch wide anchorage flange; colors selected by Architect from manufacturer’s standards.

C. Resilient Wall Base: Specified in Section 09 6500.

D. Adhesives:
   1. Carpet Tile Adhesive: Recommended by carpet tile manufacturer; releasable and non-water-based type.

E. Miscellaneous Materials: Provide other items recommended by carpet manufacturer and installer for the indicated conditions of carpet use, and as required for complete installation.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that sub-floor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive carpet tile.

B. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to sub-floor surfaces.

C. Cementitious Sub-floor Surfaces: Verify that substrates are dry enough and ready for flooring installation by testing for moisture and pH.
   1. Test in accordance with Section 09 0561.
   2. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.

D. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Prepare floor substrates for installation of flooring in accordance with Section 09 0561.

3.03 INSTALLATION

A. Starting installation constitutes acceptance of sub-floor conditions.

B. Install carpet tile in accordance with manufacturer’s instructions and CRI 104 (Commercial).

C. Blend carpet from different cartons to ensure minimal variation in color match.

D. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.

E. Lay carpet tile in indicated pattern, with pile direction alternating to next unit, set parallel to building lines unless otherwise indicated on Drawings.

F. Locate change of color or pattern between rooms under door centerline.

G. Fully adhere carpet tile to substrate.

H. Trim carpet tile neatly at walls and around interruptions.

I. Complete installation of edge strips, concealing exposed edges.

3.04 CLEANING

A. Remove excess adhesive without damage, from floor, base, and wall surfaces.

B. Clean and vacuum carpet surfaces.

END OF SECTION
SECTION 09 8412
ACOUSTICAL ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Lapendary panels.
B. Wall panels.
C. Ceiling baffles.

1.02 REFERENCE STANDARDS

1.03 SUBMITTALS
A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. 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.
   4. Independent testing agency test reports.
C. Selection Samples: For each product specified, two complete sets of color samples representing manufacturer's full range of available colors and patterns.
D. Verification Samples: For each product specified, two samples, minimum size 6 inches square, representing actual product, color, and patterns.

1.04 QUALITY ASSURANCE
A. Installer Qualifications: Acceptable to the manufacturer of the acoustical products being installed.
B. Basis of Design: Specifications are based on acoustical accessory types by specified basis of design manufacturer. Acoustical accessory types manufactured by other acceptable manufacturers are permitted, subject to compliance with specified requirements; and provided that deviations in design, weight, profile, and performance are minor, and do not detract substantially from the indicated design intent.
   1. Comply with requirements specified in Section 01 4000 and Section 01 6000.

1.05 MOCK-UP
A. Comply with general mock-up requirements specified in Section 01 4000.
B. Mock-up: Provide a mock-up for evaluation of installed appearance.
   1. Install acoustical products in areas designated by Architect.
   2. Do not proceed with remaining work until Architect approves workmanship and appearance.
   3. Mock-up may remain as part of the Work.

1.06 DELIVERY, STORAGE, AND HANDLING
A. Protect acoustical products from moisture during shipment, storage, and handling.
B. Store products in manufacturer's unopened packaging until ready for installation.
   1. Store materials flat, in dry, well-ventilated space.
   2. Do not stand panels on end.
   3. Protect edges from damage.
C. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.
1.07  FIELD CONDITIONS

A. Do not begin installation of acoustical products until building has been enclosed and environmental conditions approximate those that will prevail when building is occupied.

B. 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 absolute limits.

PART 2  PRODUCTS

2.01  MANUFACTURERS

A. Basis of Design Manufacturers:
   1. As specified in this Section for each product.
   2. Substitutions: See Section 01 6000 - Product Requirements.

B. Provide all acoustical products specified herein by a single manufacturer.

2.02  ACOUSTICAL ACCESSORIES - GENERAL

A. Acoustical Absorption: Perform testing in accordance with ASTM C423, Type A mounting method unless otherwise indicated or specified.

B. Flame Spread Rating: Provide all components with Class A flame spread rating when tested in accordance with ASTM E84, unless otherwise indicated or specified.

2.03  ACOUSTICAL WALL PANELS

A. Insulated Cementitious Wood Fiber Wall Panels: Aspen wood fibers bonded with inorganic hydraulic cement.
   1. Core Thickness: 1-1/2 inch base board; NRC 0.80.
   2. Size: As indicated.
   3. Color: Field-painted; color as scheduled on Drawings.
   5. Mounting: Manufacturer’s standard C-20 mounting.
   6. Acceptable Product:
      b. Substitutions: See Section 01 6000 - Product Requirements.

2.04  CEILING PRODUCTS

A. Lapendary Panels (Aquatics Areas): Wrapped fiberglass batts of 1.2 pcf.
   1. Core Thickness: 2 inches; NRC 0.95, minimum.
   2. Size: As indicated on Drawings.
   3. Finish Material: Manufacturer’s standard PVC sheet (pool application), encapsulated both sides.
   4. Colors: Two colors as selected from manufacturer's full line.
   7. Acceptable Product:
      b. Substitutions: See Section 01 6000 - Product Requirements.

2.05  ACCESSORIES

A. Mounting Adhesive: Water-based, zero VOC content, heavy-bodied adhesive as recommended by manufacturer of acoustical panels.

B. Two-Part Z-Clips: Manufacturer's standard mounting bar and matching clips for mounting on rear of acoustical panels.
PART 3 EXECUTION

3.01 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.

3.02 PREPARATION
   A. Clean surfaces thoroughly prior to installation.
   B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION
   A. Install acoustical units in accordance with manufacturer's instructions.
   B. Adhesive Mounting: Size back of panels at 18 inch on center in both directions with thin coating of adhesive in 4 inch squares. Center adhesive dabs the size of a large egg on each sized area, and press panel firmly against substrate, flattening adhesive. Block panel for not less than 24 hours until adhesive has set.
   C. Two-Part Clips: Fasten bars to wall at 48 inches on center in both directions. Impale matching mechanical clips into back of panels in matching pattern and drop panel into position so clips fully engage into wall-mounted bars.

3.04 PROTECTION
   A. Protect installed products until completion of project.
   B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION
SECTION 09 9113
EXTERIOR PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.
B. Field application of paints.

1.02 DEFINITIONS

A. Comply with ASTM D16 for interpretation of terms used in this section.
B. Gloss Ratings: ASTM D523; on 85 and 60 degree gloss meters:
   1. Flat: 0 to 15 (85 degree gloss meter).
   2. Eggshell: 5 to 20 (60 degree gloss meter).
   3. Satin: 15 to 35 (60 degree gloss meter).
   4. Semi-Gloss: 30 to 65 (60 degree gloss meter).
   5. Gloss (High): 65 and Greater (60 degree gloss meter).

1.03 REFERENCE STANDARDS


1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide complete list of products to be used, with the following information for each:
   1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
   2. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
   3. Manufacturer's installation instructions.
C. Samples: Submit two painted samples, illustrating selected colors and textures for each color and system selected with specified coats cascaded. Submit on aluminum sheet, 8 x 10 inch in size.
D. Manufacturer's Instructions: Indicate special surface preparation procedures and substrate conditions requiring special attention.
E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Paint and Finish Materials: 1 gallon of each color; from the same product run, store where directed.
   3. Label each container with color in addition to the manufacturer's label.

1.05 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing the type of work specified with minimum three years experience.
B. Basis of Design: Specifications are based on paint types and systems by specified basis of design manufacturer. Paint types and systems manufactured by other acceptable manufacturers are permitted, subject to compliance with specified requirements; and provided that deviations in formulation, compatibility, and performance are minor, and do not detract substantially from the indicated design intent.
   1. Comply with requirements specified in Section 01 4000 and Section 01 6000.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.07 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply exterior paint and finishes during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.

D. Minimum Application Temperatures for Latex Paints: 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.

B. Acceptable Manufacturers:
   5. Substitutions: See Section 01 6000 - Product Requirements.

C. Acceptable Manufacturers - Primers and Sealers: Same manufacturer as top coats; no exceptions.

2.02 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready mixed, unless required to be a field-catalyzed paint.
   1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
   2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
   3. Supply each paint material in quantity required to complete entire project's work from a single production run.
   4. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

B. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.

C. Colors: As scheduled on Drawings.

2.03 PAINT SYSTEMS

A. Exterior Surfaces to be Painted, Unless Otherwise Indicated: Including fiber cement siding.
   1. See Section 09 9600 for additional exterior painting requirements.
   2. Top Coat(s): Self-Cleaning Acrylic Latex Coating.
      a. Satin: Two top coats over primed fiber cement.
      b. Acceptable Product:
         1) Sherwin-Williams Loxon Self-Cleaning Acrylic Coating; LX14-50 Series.
         2) Substitutions: Section 01 6000 - Product Requirements.
3. Top Coat Sheen:
   a. Satin: MPI gloss level 4; use this sheen at all locations.

2.04 ACCESSORY MATERIALS
   A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.
   B. Patching Material: Latex filler.
   C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION
3.01 EXAMINATION
   A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
   B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
   C. Test shop-applied primer for compatibility with subsequent cover materials.
   D. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
      1. Fiber Cement Siding: 12 percent.

3.02 PREPARATION
   A. Clean surfaces thoroughly and correct defects prior to application.
   B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
   C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces for finishing.
   D. Seal surfaces that might cause bleed through or staining of topcoat.
   E. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
   F. Fiber Cement Siding: Remove dirt, dust and other foreign matter with a stiff fiber brush. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.

3.03 APPLICATION
   A. Apply products in accordance with manufacturer's written instructions.
   B. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
   C. Apply each coat to uniform appearance.
   D. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply additional coats until complete hide is achieved.
   E. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
   F. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 CLEANING
   A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.
3.05 PROTECTION

A. Protect finishes until completion of project.

B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES

   A. Surface preparation.
   B. Field application of paints.

1.02 DEFINITIONS

   A. Comply with ASTM D16 for interpretation of terms used in this section.
   B. Gloss Ratings: ASTM D523; on 85 and 60 degree gloss meters:
      1. Flat: 0 to 15 (85 degree gloss meter).
      2. Eggshell: 5 to 20 (60 degree gloss meter).
      3. Satin: 15 to 35 (60 degree gloss meter).
      4. Semi-Gloss: 30 to 65 (60 degree gloss meter).
      5. Gloss (High): 65 and Greater (60 degree gloss meter).

1.03 REFERENCE STANDARDS

   F. SSPC-SP 1 - Solvent Cleaning.

1.04 SUBMITTALS

   A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
   B. Product Data: Provide complete list of products to be used, with the following information for each:
      1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
      2. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
      3. Manufacturer's installation instructions.
   C. Samples: Submit two painted samples, illustrating selected colors for each color and system selected with specified coats cascaded. Submit on tempered hardboard, 8 x 10 inch in size.
   D. Certification: By manufacturer that paints and finishes comply with VOC limits specified.
   E. Manufacturer's Instructions: Indicate special surface preparation procedures and substrate conditions requiring special attention.
   F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
      1. See Section 01 6000 - Product Requirements, for additional provisions.
      2. Extra Paint and Finish Materials: 1 gallon of each color; from the same product run, store where directed.
      3. Label each container with color in addition to the manufacturer's label.

1.05 QUALITY ASSURANCE

   A. Applicator Qualifications: Company specializing in performing the type of work specified with minimum three years experience.
B. Basis of Design: Specifications are based on paint types and systems by specified basis of design manufacturer. Paint types and systems manufactured by other acceptable manufacturers are permitted, subject to compliance with specified requirements; and provided that deviations in formulation, compatibility, and performance are minor, and do not detract substantially from the indicated design intent.
   1. Comply with requirements specified in Section 01 4000 and Section 01 6000.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.07 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply materials when relative humidity exceeds 85 percent; at temperatures less than 5 degrees F above the dew point; or to damp or wet surfaces.

D. Minimum Application Temperatures for Paints: 50 degrees F for interiors unless required otherwise by manufacturer's instructions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.

B. Acceptable Manufacturers:
   5. Substitutions: See Section 01 6000 - Product Requirements.

C. Acceptable Manufacturers - Primer Sealers: Same manufacturer as top coats; no exceptions.

2.02 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready mixed, unless intended to be a field-catalyzed paint.
   1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
   2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
   3. Supply each paint material in quantity required to complete entire project's work from a single production run.
   4. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

B. Volatile Organic Compound (VOC) Content:
   1. Provide paints and finishes that comply with the most stringent requirements specified in the following:
2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.

C. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.

D. Colors: As scheduled on Drawings.

2.03 PAINT SYSTEMS

A. Interior Surfaces to be Painted, Unless Otherwise Indicated: Including gypsum board, wood, and shop primed steel.
   1. Two top coats and one coat primer.
   2. Top Coat(s): Institutional Low Odor/VOC Interior Latex.
      a. Acceptable Products:
         1) Sherwin-Williams ProMar 200 Zero VOC Interior Latex, Flat.
         4) Substitutions: Section 01 6000 - Product Requirements.
   3. Top Coat Sheen:
      a. Flat: MPI gloss level 1; use this sheen for ceilings and other overhead surfaces.
      b. Eggshell: MPI gloss level 3; use this sheen at all locations unless otherwise indicated or specified.
      c. Semi-Gloss: MPI gloss level 5; use this sheen at painted doors and frames, painted wood trim, metal fabrications not otherwise specified, and other scheduled locations.
   4. Primer: As recommended by top coat manufacturer for specific substrate.

B. Medium Duty Door/Trim: For surfaces subject to frequent contact by occupants, including metals and wood:
   1. Medium duty applications include steel doors and door frames, unless otherwise scheduled to receive high performance coatings.
   2. Two top coats and one coat primer.
   3. Top Coat(s): High Performance Architectural Interior Latex.
      a. Acceptable Products:
         1) Sherwin-Williams Pro Industrial Pre-Catalyzed Waterbased Epoxy, Semi-Gloss. (MPI #141)
         2) Substitutions: Section 01 6000 - Product Requirements.

2.04 ACCESSORY MATERIALS

A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin application of paints and finishes until substrates have been properly prepared.

B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.

D. Test shop-applied primer for compatibility with subsequent cover materials.

E. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
   1. Gypsum Wallboard: 12 percent.
   2. Interior Wood: 6 to 8 percent, measured in accordance with ASTM D4442.
3.02 PREPARATION
   A. Clean surfaces thoroughly and correct defects prior to application.
   B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the
      substrate under the project conditions.
   C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons,
      and fittings, prior to preparing surfaces or finishing.
   D. Seal surfaces that might cause bleed through or staining of topcoat.
   E. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.
   F. Ferrous Metal:
      1. Solvent clean according to SSPC-SP 1.
      2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make
         touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces.
   G. Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch
      streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between
      coats. Back prime concealed surfaces before installation.
   H. Wood Doors to be Field-Finished: Seal wood door top and bottom edge surfaces with clear sealer.

3.03 APPLICATION
   A. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI
      Architectural Painting Specification Manual".
   B. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.
   C. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
   D. Apply each coat to uniform appearance in thicknesses specified by manufacturer.
   E. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply as many coats as
      necessary for complete hide.
   F. Sand wood and metal surfaces lightly between coats to achieve required finish.
   G. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying
      next coat.
   H. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to
      finishing.

3.04 CLEANING
   A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily
      from site.

3.05 PROTECTION
   A. Protect finishes until completion of project.
   B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES
   A. High performance coatings.
   B. Surface preparation.
   C. Post-occupancy inspection requirements.

1.02 DEFINITIONS
   A. Dry Film Thickness: Thickness of one coat of paint fully cured, measured in mils (1/1000 inch).

1.03 ADMINISTRATIVE REQUIREMENTS
   A. Coordination:
      1. Coordinate work with concrete floor placement and concrete curing, for compatibility of substrates.
      2. Coordinate work with priming of steel products to receive coatings, for compatibility of primed substrates.
   B. Preinstallation Meeting: Convene one week before starting work of this Section. Require attendance by all relevant installers.
      1. Convene under general provisions of Section 01 7000.
      2. Review the following:
         a. Environmental requirements.
         b. Protection of surfaces not scheduled to be coated.
         c. Surface preparation.
         d. Application methods and procedures.
         e. Repair methods and procedures.
         f. Field quality control.
         g. Cleaning methods and procedures.
         h. Protection of coating systems.
         i. One year inspection requirements.

1.04 SUBMITTALS
   A. See Section 01 3000 - Administrative Requirements for submittal procedures.
   B. Product Data: Provide complete list of all products to be used, with the following information for each:
      1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "epoxy").
      2. Cross-reference to specified coating system(s) product is to be used in; include description of each system.
      3. Manufacturer's installation instructions.
   C. Samples: Submit two sets of samples 6 x 6 inch in size, illustrating colors available for selection.
   D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
   E. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.
   F. Maintenance Data: Include cleaning procedures and repair and patching techniques.
   G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
      1. See Section 01 6000 - Product Requirements, for additional provisions.
      2. Extra Coating Materials: 1 gallon of each type and color.
      3. Label each container with manufacturer's name, product number, color number, and room names and numbers where used.
1.05 QUALITY ASSURANCE
   A. Applicator Qualifications: Company specializing in performing the work of this Section with minimum five years documented experience.
   B. Basis of Design: Specifications are based on coating types by specified basis of design manufacturer and products. Coating types manufactured by other acceptable manufacturers are permitted, subject to compliance with specified requirements; and provided that deviations in formulation and performance are minor, and do not detract substantially from the indicated design intent.
      1. Comply with requirements specified in Section 01 4000 and Section .

1.06 DELIVERY, STORAGE, AND HANDLING
   A. Deliver materials in manufacturer's original, unopened containers and packaging, with labels clearly identifying:
      1. Coating or material name.
      2. Manufacturer.
      3. Color name and number.
      4. Date of manufacture.
      5. Batch or lot number.
      6. Mixing and thinning instructions.
   B. Store materials in a clean dry area and within temperature range in accordance with manufacturer's instructions.
      1. Keep containers sealed until ready for use.
      2. Do not use materials beyond manufacturer's shelf life limits.
   C. Protect materials during handling and application to prevent damage or contamination.

1.07 ENVIRONMENTAL REQUIREMENTS
   A. Weather:
      1. Air and Surface Temperatures: Prepare surfaces and apply and cure coatings within air and surface temperature range in accordance with manufacturer's instructions.
      2. Surface Temperature: Minimum of 5 degrees F (3 degrees C) above dew point.
      3. Relative Humidity: Prepare surfaces and apply and cure coatings within relative humidity range in accordance with manufacturer's instructions.
      4. Precipitation: Do not prepare surfaces or apply coatings in rain, snow, fog, or mist.
      5. Wind: Do not spray coatings if wind velocity is above manufacturer's limit.
   B. Ventilation: Provide ventilation during coating evaporation stage in confined or enclosed areas in accordance with manufacturer's instructions.
   C. Dust and Contaminants:
      1. Schedule coating work to avoid excessive dust and airborne contaminants.
      2. Protect work areas from excessive dust and airborne contaminants during coating application and curing.

1.08 FIELD CONDITIONS
   A. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
   B. Maintain required temperature range 24 hours before, during, and 72 hours after installation of coating.
   C. Provide lighting level of 80 ft candles measured mid-height at substrate surface.
   D. Restrict traffic from area where coating is being applied or is curing.

1.09 WARRANTY
   A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
   B. Correct defective Work within a five year period after Date of Substantial Completion.
   C. Warranty: Include coverage for bond to substrate.
PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design Manufacturer:
      a. Paint Systems: As specified in this Section for each application.
   2. Substitutions: Section 01 6000 - Product Requirements.

B. Other Acceptable Manufacturers:
   2. PPG Paints: www.ppgpaints.com/#sle.
   3. Substitutions: Section 01 6000 - Product Requirements.

2.02 HIGH PERFORMANCE COATING SYSTEMS

A. Coatings Systems - General: Provide complete multi-coat systems formulated and recommended by manufacturer for the applications indicated, in the thicknesses indicated; number of coats specified does not include primer or filler coat.
   1. Lead Content: Not greater than 0.06 percent by weight of total nonvolatile content.
   2. Chromium Content: As hexavalent chromium, zinc chromate, or strontium chromate; none.
   3. Low Temperature Applications: When high performance coatings must be applied in ambient or substrate temperatures below manufacturers recommendations or as specified for environmental requirements in this Section, use manufacturer's special low-temperature formulations designed specifically for application to substrates at required application temperatures (ie., Tnemec L69F, etc.).
   4. Colors: Selected from manufacturer's standard colors.

B. High-Performance Coating - Type 1A: Epoxy-polyamidoamine intermediate coats with hybrid polyurethane finish system, semi-gloss sheen finish.
   1. Exterior Applications: Exposed galvanized and non-galvanized steel, including previously primed steel, hollow metal doors and frames, and other locations noted on Drawings.
   2. Factory Base Primers: Specified in Sections 05 1200, 05 2100, and 08 1113.
   3. Surface Preparation:
      a. Non-Galvanized Steel: Prepare surfaces according to SSPC-SP 6; apply one shop coat of Tnemec 94-H20 or Tnemec 90-97 Tneme-Zinc at 2.5 to 3.5 mils DFT.
      b. Galvanized Steel: Prepare surfaces according to SSPC-SP 16; apply one shop coat of Tnemec L69/N69-1255 HBE II at 2.0 to 3.0 mils DFT.
   4. Field Primer Coat: Tnemec L69-1255 HBE II at 3.0 to 5.0 mils DFT.
   5. Field Finish Coat: Tnemec 750-Color UVX at 2.0 to 3.0 mils DFT.
   6. Total System Thickness (including primer coats): 7.0 to 11.5 mils DFT.

C. High-Performance Coating - Type 2A: Epoxy-polyamidoamine finish system, semi-gloss sheen finish.
   1. Natatorium Interior Applications: Exposed to view non-galvanized structural steel and steel joists, including previously primed steel, hollow metal doors, frames and windows, and other locations noted on Drawings.
   2. Factory Base Primer: Specified in Sections 05 1200 and 05 2100.
   3. Surface Preparation:
      a. Non-Galvanized Steel: Prepare surfaces according to SSPC-SP 6; apply one shop coat of Tnemec 94-H20 or Tnemec 90-97 Tneme-Zinc at 2.5 to 3.5 mils DFT.
   4. First Coat: Tnemec L69-Color HBE II at 4.0 to 6.0 mils DFT.
   5. Field Finish Coat: Tnemec L69-Color HBE II at 4.0 to 6.0 mils DFT.
   6. Total System Thickness (including primer coats): 10.5 to 15.5 mils DFT.

D. High-Performance Coating - Type 3: Epoxy-polyamidoamine finish system, satin sheen finish.
   1. Natatorium Interior Applications: Galvanized steel decking, ductwork, structural steel, and other locations noted on Drawings.
2. Factory Base Primer: Specified in Sections 05 1200, 05 2100, and 05 3100; see Section 05 3100 for priming options:
   a. If Option 1 is selected, no intermediate coat (primer) is required, and prepare surfaces according to SSPC-SP 16 as specified in this Section.
   b. If Option 2 is selected, provide factory primer as specified in Section 05 3100, and provide adhesion approval of high performance coating manufacturer prior to application of high performance finish coating system specified in this Section.

3. Surface Preparation:
   a. Shop Preparation: Remove visible deposits of oil, grease, or other contaminants according to SSPC-SP 1.
   b. Repair welds, burned, and damaged areas; spot prime with Tnemec Series 1 Omnithane.
   c. Galvanized Steel: Prepare surfaces according to SSPC-SP 16 to achieve uniform anchor profile of 1.0 to 2.0 mils; prepared surfaces must be clean, dry, and contaminant-free prior to application of field-applied finish coats.

4. First Coat: Tnemec L69-Color HBE II at 2.0 to 3.0 mils DFT.
5. Field Finish Coat: Tnemec L69-Color HBE II at 2.0 to 3.0 mils DFT.
6. Total System Thickness (including primer coats): 5.0 to 8.0 mils DFT.

E. High-Performance Coating - Type 4: Epoxy-polyamidoamine finish system, satin sheen finish.
1. Natatorium and Other Interior Applications: Non-prefinished aluminum, and other locations noted on Drawings.
2. Surface Preparation:
   a. Aluminum: Remove soluble contaminants according to SSPC-SP 1. Prepared surfaces must be clean, dry, and contaminant-free prior to application of field-applied finish coats.
3. First Coat: Tnemec L69-Color HBE II at 2.0 to 3.0 mils DFT.
4. Field Finish Coat: Tnemec L69-Color HBE II at 2.0 to 3.0 mils DFT.
5. Total System Thickness (including primer coats): 4.0 to 6.0 mils DFT.

F. High-Performance Coating - Type 5A: Epoxy-polyamidoamine finish system, semi-gloss sheen finish.
1. Natatorium and Other Interior Applications: Concrete masonry units, and other locations noted on Drawings.
2. Surface Preparation: Level all fins and protrusions.
   a. Block Filler: Apply one complete application of Tnemec Series 130 Envirofill at 80 to 100 sq ft per gallon (approximately 20 mils DFT). Prepared surfaces must be clean, dry, and contaminant-free prior to application of field-applied finish coats.
3. First Coat: Tnemec L69-Color HBE II at 150 to 200 sq ft per gallon (4.0 to 6.0 mils DFT).
   a. Color: Same color family as finish coat but noticeably different.
4. Field Finish Coat: Tnemec L69-Color HBE II at 150 to 200 sq ft per gallon (4.0 to 6.0 mils DFT).
5. Total System Thickness (including primer coats): 28.0 to 32.0 mils DFT.

G. High-Performance Coating - Type 5B/C: Epoxy-polyamidoamine finish system, semi-gloss sheen finish.
1. Natatorium and Other Interior Applications: Precast concrete and cast-in-place concrete, and other locations noted on Drawings.
2. Surface Preparation: Concrete cured minimum 28 days; level all fins and protrusions. Abrasive blast to remove laitance, for release agents, and to conform to ICRI CSP-3.
   a. Bug Hole and Void Filler: Apply one complete application of Tnemec Series 130 Envirofill or Tnemec Series 218 MortarClad at coverage rate sufficient to fill exposed bug holes and voids flush with surrounding surfaces to achieve pin-hole-free substrate condition upon completion of filler application; use of either product is dependent on condition of substrate and subject to confirmation by Architect. Filled surfaces must also be clean, dry, and contaminant-free prior to application of field-applied finish coats.
3. First Coat: Tnemec L69-Color HBE II at 150 to 200 sq ft per gallon (4.0 to 6.0 mils DFT).
   a. Color: Same color family as finish coat but noticeably different.
4. Field Finish Coat: Tnemec L69-Color HBE II at 150 to 200 sq ft per gallon (4.0 to 6.0 mils DFT).
5. Total System Thickness (including primer coats): 8.0 to 12.0 mils DFT.

H. High-Performance Coating - Type 6: Water-borne epoxy primer and epoxy-polyamidoamine finish system, semi-gloss sheen finish.
1. Natatorium an Other Interior Applications: Glass mat-faced gypsum board, and other locations noted on Drawings.
2. Surface Preparation: Prepared surfaces must be clean, dry, and contaminant-free prior to application of field-applied finish coats.
3. Primer: Tnemec Series 151-1051 Elasto-Grip at 200 to 400 sq ft per gallon (0.7 to 1.5 mils DFT).
4. First Coat: Tnemec L69-Color HBE II at 150 to 200 sq ft per gallon (3.0 to 6.0 mils DFT).
   a. Color: Same color family as finish coat but noticeably different.
5. Field Finish Coat: Tnemec L69-Color HBE II at 150 to 200 sq ft per gallon (3.0 to 6.0 mils DFT).
6. Total System Thickness (including primer coats): 6.7 to 11.5 mils DFT.

I. High-Performance Coating - Type 7: Not Used.

J. High-Performance Coating - Type 8: Epoxy-polyamide finish system, semi-gloss sheen finish.
   1. Natatorium and Other Interior Applications: PVC, plastic, sprinkler piping, conduit, and other locations noted on Drawings.
   2. Surface Preparation: Clean and dry according to SSPC-SP 1. Degloss as required with 150 to 200 grit sandpaper. Prepared surfaces must be clean, dry, and contaminant-free prior to application of field-applied finish coats.
   3. First Coat: Tnemec L69-Color HBE II at 250 to 300 sq ft per gallon (2.0 to 4.0 mils DFT).
      a. Color: Same color family as finish coat but noticeably different.
   4. Field Finish Coat: Tnemec L69-Color HBE II at 250 to 300 sq ft per gallon (2.0 to 4.0 mils DFT).
   5. Total System Thickness (including primer coats): 4.0 to 8.0 mils DFT.

K. High-Performance Coating - Type 9: Epoxy-polyamide finish system, semi-gloss sheen finish.
   1. Natatorium and Exterior Applications: Fiberglass doors, and other fiberglass locations noted on Drawings.
   2. Surface Preparation: Clean and dry according to SSPC-SP 1. Degloss as required with 150 to 200 grit sandpaper. Prepared surfaces must be clean, dry, and contaminant-free prior to application of field-applied finish coats.
   3. First Coat: Tnemec L69-Color HBE II at 250 to 300 sq ft per gallon (2.0 to 4.0 mils DFT).
      a. Color: Same color family as finish coat but noticeably different.
   4. Field Finish Coat: Tnemec L69-Color HBE II at 250 to 300 sq ft per gallon (2.0 to 4.0 mils DFT).
      a. Exterior Exposure: Add finish top coat; Tnemec Series 750-Color UVX at 250 to 275 sq ft per gallon (2.0 to 3.0 mils DFT).
   5. Total System Thickness (including primer coats): 4.0 to 8.0 mils DFT.
      a. Exterior Exposure: 6.0 to 11.0 mils DFT.

L. High-Performance Coating - Type 10: Acrylic polymer finish system, semi-gloss sheen finish.
   1. Applications: Fiber cement surfaces; exterior and interior.
   2. Surface Preparation: Prepared surfaces must be clean, dry, and contaminant-free prior to application of field-applied finish coats; silicone sealants not permitted.
   3. First Coat: Tnemec 1029/1026-Color Enduratone at 210 to 320 sq ft per gallon (2.0 to 3.0 mils DFT).
   4. Field Finish Coat: Tnemec 1029/1026-Color Enduratone at 210 to 320 sq ft per gallon (2.0 to 3.0 mils DFT).
   5. Total System Thickness (including primer coat): 4.0 to 6.0 mils DFT.

2.03 ACCESSORY MATERIALS
   A. Accessory Materials: Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of coated surfaces.

PART 3 EXECUTION

3.01 EXAMINATION
   A. Verify existing conditions before starting work.
   B. Do not begin application of coatings until substrates have been properly prepared.
   C. Verify that substrate surfaces are ready to receive work as instructed by the coating manufacturer. Obtain and follow manufacturer's instructions for examination and testing of substrates.
   D. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
E. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

F. Test shop-applied primer for compatibility with subsequent cover materials.

G. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
   1. Cementitious Substrates: Do not begin application until substrate has cured 28 days minimum and measured moisture content is not greater than 16 percent, unless otherwise specified.
   2. Gypsum Board: 12 percent, maximum.

H. Masonry: Verify masonry joints are struck flush.

I. Proceed with coating application only after unacceptable conditions have been corrected.
   1. Commencing coating application constitutes Contractor's acceptance of substrates and conditions.

3.02 PREPARATION

A. Clean surfaces of loose foreign matter.

B. Remove substances that would bleed through finished coatings. If unremovable, seal surface with shellac.

C. Remove finish hardware, fixture covers, and accessories and store.

D. Surface Preparation: Prepare surfaces to receive high-performance coatings as specified in this Section for each high-performance coating system.

E. Protect adjacent surfaces and materials not receiving coating from spatter and overspray; mask if necessary to provide adequate protection. Repair damage.

3.03 PRIMING

A. Apply primer to specified surfaces. Apply in accordance with coating manufacturer's instructions and as specified in this Section.

B. Apply specified primer for each applicable substrate to surfaces that will be concealed or embedded within or immediately adjacent to corrosive Natatorium environment; locations and applications include but are not limited to chases behind CMU pilasters, beam pockets, and within other similar enclosures.

3.04 COATING APPLICATION

A. Apply coatings in accordance with manufacturer's instructions, to minimum thicknesses and coverage rates 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.

3.05 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Inspector's Services:
   1. Verify coatings and other materials are as specified.
   2. Verify surface preparation and application are as specified.
   3. Verify DFT of each coat and total DFT of each coating system are as specified using wet film and dry film gauges.
   4. Coating Defects: Check coatings for film characteristics or defects that would adversely affect performance or appearance of coating systems.
   5. Report:
      a. Submit written reports describing inspections made and actions taken to correct nonconforming work.
      b. Report nonconforming work not corrected.
      c. Submit copies of report to Architect and Contractor.

C. Manufacturer's Field Services: Manufacturer's representative will provide technical assistance and guidance for surface preparation and application of coating systems.
3.06 CLEANING
   A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.
   B. Clean surfaces immediately of overspray, splatter, and excess material.
   C. After coating has cured, clean and replace finish hardware, fixtures, and fittings previously removed.

3.07 PROTECTION
   A. Protect finished work from damage.

3.08 POST-OCCUPANCY INSPECTION
   A. Owner will set date for inspection of coating systems approximately one year from Date of Substantial Completion.
      1. Attendance: Owner, Architect, Contractor, and manufacturer's representative.
      2. Repair deficiencies in coating systems (if any) as determined by Architect according to manufacturers instructions.

END OF SECTION
SECTION 10 1400
SIGNAGE

PART 1 GENERAL
1.01 SECTION INCLUDES
A. Room and door signs.
B. Interior directional and informational signs.
C. Emergency evacuation maps.
D. Building identification signs.
E. Signs required for Building Code compliance and building occupancy.

1.02 REFERENCE STANDARDS
B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design.
C. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
D. ICC (IBC) - International Building Code.
F. NAAMM AMP 500-06 - Metal Finishes Manual.

1.03 SUBMITTALS
A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Manufacturer's printed product literature for each type of sign, indicating sign styles, font, foreground and background colors, locations, overall dimensions of each sign.
C. Signage Schedule: Provide information sufficient to completely define each sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.
   1. When room numbers to appear on signs differ from those on Drawings, include the drawing room number on schedule.
   2. When content of signs is indicated to be determined later, request such information from Owner through Architect at least 2 months prior to start of fabrication; upon request, submit preliminary schedule.
   3. Submit for approval by Owner through Architect prior to fabrication.
D. Samples: Submit two samples of each type of sign, of size similar to that required for project, illustrating sign style, font, and method of attachment.

1.04 QUALITY ASSURANCE
A. Basis of Design: Specifications are based on sign types by specified basis of design manufacturer. Sign types manufactured by other acceptable manufacturers are permitted, subject to compliance with specified requirements; and provided that deviations in design, profile, and finishes are minor, and do not detract substantially from the indicated design intent.
   1. Comply with requirements specified in Section 01 4000 and Section 01 6000.

1.05 DELIVERY, STORAGE, AND HANDLING
A. Package signs as required to prevent damage before installation.
B. Package room and door signs in sequential order of installation, labeled by floor or building.
C. Store tape adhesive at normal room temperature.
1.06 FIELD CONDITIONS
   A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.
   B. Maintain this minimum temperature during and after installation of signs.

PART 2 PRODUCTS
2.01 MANUFACTURERS
   A. Basis of Design Manufacturer:
      1. Styles and Design: As indicated on Drawings.
      2. Substitutions: See Section 01 6000 - Product Requirements.
   B. Other Acceptable Manufacturers:
      5. FASTSIGNS: www.fastsigns.com/#sle.
      9. Substitutions: See Section 01 6000 - Product Requirements.
   C. Unless otherwise specified for an individual product or material, supply all products specified in this Section from the same manufacturer.

2.02 CODE-REQUIRED SIGNAGE APPLICATIONS
   A. Accessibility Compliance: Signs are required to comply with ADA Standards and ICC A117.1 and applicable building codes, unless otherwise indicated; in the event of conflicting requirements, comply with the most comprehensive and specific requirements.
   B. Emergency Evacuation Maps:
      1. Comply with 2015 ICC (IBC) Section 1023.10 requirements.
      2. Allow for one map per elevator lobby.
      3. Provide map content, including "YOU ARE HERE" designations, direction pathway arrows, fire extinguisher locations, pull station locations, and other content required by local jurisdiction; content will not be generated or provided by Owner or Architect. Architect will provide electronic drawing backgrounds for use in generating map content.
         a. Map locations must be approved by Owner prior to fabrication.
   C. Code-Required Door and Room Identification Signs: Provide all signs required by Authority Having Jurisdiction (AHJ) for building occupancy; determine requirements and report to Owner and Architect prior to making specified submittals. Include cost of these signs in Contract Sum.
      1. Sign Type: Flat signs with applied character panel media as specified for other signs.
      2. Sign Types Required:
         a. Room identification with symbols.
         b. Room names.
         c. Exit signs.
         d. Emergency evacuation maps.
         e. Maximum occupancy.
         f. Changeable message room identifications.
         g. Wayfinding directional and area identification.
         h. Changeable information sign holders with message inserts.
         i. Exterior room identification signs.
2.03 SIGN STANDARDS

A. It is the intent of these specifications to establish a sign standard for the Owner including but not limited to primary and secondary directories, wall mounted and overhead directionals, flag mounted directionals, primary room identification, restrooms, conference room, work station ID's and all code compliant signage. The Owner may not obtain all signs and sign types indicated; provide design for all indicated signs and submit specified shop drawings for all indicated signs.

B. Typography:
   1. Type Style and Copy: True, clean, accurate reproduction of typeface(s) specified. Provide upper and lower case or all caps. Set normal letter spacing and interline spacing by manufacturer.
   2. Arrows, Symbols and Logo Art: Provided in style, sizes, colors and spacing as shown on Drawings.
   3. Grade II Braille: Perfectly round, clear insertion beads.

C. Color and Finishes:
   1. Colors, Patterns and Artwork: See Drawings.
   3. Finishes: Comply with current federal ADA and all state and local requirements.

2.04 INTERIOR SIGNS

A. Signage System:
   1. Incorporate 3Form Varia Ecoresin sign background panels with applied graphics including all tactile requirements in compliance with ADA specifications.
   2. Provide all signs, including work station and room identifications, overheads and flag mounts, directionals and directories with matching appearance and constructed utilizing same manufacturing process to assure consistent look throughout.

B. Materials:
   1. Sign Background and Face: 0.5 inch thick substrate with high pressure laminate or painted surface.
   2. Sign Edges: Painted with contrasting color from sign face.
   3. Tactile Lettering: Precision machined, raised 1/32 inch thick matte PETG, and subsurface colored for scratch resistance.

C. Construction:
   1. Sign Surfaces: Precision machined to a 90-degree angle; smooth edges, without chips, burrs, sharp edges, and marks.
   2. Utilize an acrylic sphere for Grade II Braille inserted directly into sign face. Pressure fit Braille dots in high tolerance drilled holes.
   3. Braille Dots: Half hemispherical domed and protruding a minimum 0.025 inch.
   4. Utilize pressure activated adhesive; non-hazardous and allowing for flexing and deflection of adhered components due to changes in temperature and moisture without bond failure.
   5. Provide signs with appropriate mounting hardware; finished, architectural in appearance, and suitable for indicated mounting surfaces.
   6. Some signs may be installed on glass. Place blank sign panel on opposite side of glass to cover tape and adhesive; match sign in size and shape.

D. Printed Inserts:
   1. Capable of accepting paper or acetate inserts to allow changing and updating as required.
   2. Insert Components: 0.080 inch thick non-glare acrylic window, inlayed flush to sign face for smooth, seamless appearance.
   3. Provide and install all signage inserts.
   4. Provide template containing layout, font, color, artwork and trim lines to allow Owner to produce inserts on laser or ink jet printer. Provide template in Adobe Acrobat or Word format (.pdf).

E. Color and Font: Unless otherwise indicated:
   1. Character Font: Futura Medium, or other sans serif font.
   2. Background Panels:
      a. 3-Form: www.3-form.com.
      1) Product: Varia Ecoresin Panels; Bliss/Ghost Sandstone finish.
      b. Substitutions: Not permitted.
4. Character Color: Black color, or as noted on Drawings.

2.05 EXTERIOR SIGNS

A. Building Identification Signs: Illuminated; concealed light source.
   1. Use individual fabricated metal characters as indicated on Drawings.
   2. Stainless Steel Sheet: ASTM A666, Type 316; stretcher-leveled.

B. Illuminated Characters: Backlighted construction with LED neon tube lighting including transformers, insulators, and other accessories for operability, with provision for servicing and concealing connections to building electrical system. Use tight or sealed joint construction to prevent unintentional light leakage. Space lamps apart from each other and away from sign surfaces as needed to illuminate evenly.
   1. Faces: Solid face; removable cans.
   2. Backs: Translucent polycarbonate sheet; 0.177 inch thick, minimum.
   3. Edges: Match faces; welded and finished to blend edges with faces and edges.

C. Stainless Steel Finish:
   1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
   2. Polished Finishes: Comply with NAAMM AMP 500-06; grind and polish surfaces to uniform finish free of cross scratches. Run grain of directional finishes with long dimension of each item.
      a. Directional Satin: No. 4.
   3. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

D. Mount on outside wall according to manufacturer's instructions, in location shown on Drawings.
   1. Mounting System: Permanent; semi-concealed in completed installation; not visible from straight-on vantage point.

2.06 ACCESSORIES

A. Mounting Devices: Except as specified for each sign type, provide mounting devices specifically recommended by manufacturer for indicated application; concealed upon finished installation.

B. Tape Adhesive: Double sided tape, permanent adhesive.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install neatly, with horizontal edges level.

C. Locate signs and mount at heights in accordance with ADA Standards and ICC A117.1.

D. Locate signs where indicated:
   1. Room and Door Signs: Locate on wall at latch side of door with tactile characters located minimum 48 inches above finished floor and maximum 60 inches above finished floor, and 3 inches from door frame, unless indicated otherwise.
   2. Emergency Evacuation Maps: Locate centered between elevator doors, or where indicated on Drawings.
   3. If no location is indicated obtain Architect's instructions.

E. Protect from damage until Substantial Completion; repair or replace damaged items.

END OF SECTION
SECTION 10 2113.18
REINFORCED COMPOSITE TOILET COMPARTMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Solid color, reinforced composite toilet compartments.
B. Urinal screens.

1.02 REFERENCE STANDARDS
A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design.
B. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

1.03 ADMINISTRATIVE REQUIREMENTS
A. Coordination:
   1. Coordinate the work with placement of support framing and anchors in walls and ceilings.
   2. Coordinate location and installation of toilet accessories mounted on or in immediate proximity to toilet partitions.

1.04 SUBMITTALS
A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall supports, door swings.
C. Product Data: Provide data on panel construction, hardware, and accessories.
D. Samples: Submit manufacturer's full range of available colors and patterns, for selection.
E. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

PART 2 PRODUCTS

2.01 MANUFACTURERS
A. Acceptable Manufacturers:
   6. Substitutions: Section 01 6000 - Product Requirements.

2.02 COMPONENTS
A. Toilet Compartments: Solid color, reinforced composite panels, floor-mounted headrail-braced.
   1. Comply with ASTM E84, Class B, for finish surfaces of partition systems.
B. Reinforced Composite Doors, Panels, and Pilasters: Dyed organic fibrous material reinforced with polycarbonate and phenolic resins between clear melamine surface sheets fused at high temperature and pressure to form a homogeneous, non-delaminating panel, with homogeneous color throughout; stain resistant to domestic chemicals and cleaners.
   1. Color: As selected by Architect from manufacturer's full range of available standards; satin finish.
C. Door and Panel Dimensions:
   1. Thickness: 3/4 inch.
   2. Door Width: 24 inch.
3. Door Width for Handicapped Use: 36 inch, out-swinging.
4. Height: 58 inch.
5. Thickness of Pilasters: 1/2 inch.

D. Urinal Screens: Wall mounted with continuous panel brackets.
   1. Minimum Size: 24 inches wide x 48 inches high, bottom edge positioned 12 inches above floor surface.

2.03 ACCESSORIES
A. Pilaster Shoes: Formed ASTM A 666, Type 304 stainless steel with No. 4 finish, 3 inches high, concealing floor fastenings.
   1. Provide adjustment for floor variations with screw jack through steel saddles integral with pilaster.
B. Head Rails: Hollow stainless steel tube, 1 x 1-5/8 inch size, with anti-grip strips and cast socket wall brackets.
C. Wall and Pilaster Brackets: Satin stainless steel.
D. Attachments, Screws, and Bolts: Stainless steel, tamper proof type.
   1. For attaching panels and pilasters to brackets: Through-bolts and nuts; tamper proof.
E. Steel Plate Reinforcement: Carbon steel, prepared for fasteners, 1/8 inch thick.
F. Hardware: Satin stainless steel:
   1. Pivot hinges, gravity type, adjustable for door close positioning; two per door.
   2. Continuous full-height stainless steel hinges with angle brackets and u-channel keepers, self-closing type, adjustable for door close positioning; two per door.
   3. Nylon bearings.
   4. Thumb turn door latch with exterior emergency access feature. Comply with ADA Standards at accessible compartment stalls.
   5. Door strike and keeper with rubber bumper; mounted on pilaster in alignment with door latch.
   6. Coat hook with rubber bumper; one per compartment, mounted on door.
   7. Provide door pull for outswinging doors.

PART 3 EXECUTION
3.01 EXAMINATION
A. Verify that field measurements are as indicated on Drawings.
B. Verify correct spacing of and between plumbing fixtures.
C. Verify correct location of built-in framing, anchorage, and bracing.

3.02 INSTALLATION
A. Install partitions secure, rigid, plumb, and level in accordance with manufacturer's instructions.
B. Maintain 3/8 to 1/2 inch space between wall and panels and between wall and end pilasters.
C. Attach panel brackets securely to walls using anchor devices. Adjust locations of brackets as required to eliminate conflict with wall tile edges and other transitions between dissimilar wall finish materials.
D. Attach panels and pilasters to brackets. Locate head rail joints at pilaster center lines.
E. Field touch-up of scratches or damaged finish will not be permitted. Replace damaged or scratched materials with new materials.

3.03 TOLERANCES
A. Maximum Variation From True Position: 1/4 inch.
B. Maximum Variation From Plumb: 1/8 inch.

3.04 ADJUSTING
A. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch.
B. Adjust hinges to position doors in partial opening position when unlatched. Return out-swinging doors to closed position.

C. Adjust adjacent components for consistency of line or plane.

END OF SECTION
SECTION 10 2619
WALL PROTECTION

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Corner guards.

1.02 REFERENCE STANDARDS

1.03 SUBMITTALS
A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Indicate physical dimensions, features, wall mounting brackets with mounted measurements, anchorage details, and rough-in measurements.
C. Shop Drawings: Include plans, elevation, sections, and attachment details. Show design and spacing of supports for protective corridor handrails, required to withstand structural loads.
D. Samples: Submit samples illustrating component design, configurations, joinery, color and finish.
   1. Submit two sections of corner guards, 12 inches long.
E. Maintenance Data: For each type of product. Include information regarding recommended and potentially detrimental cleaning materials and methods.

1.04 DELIVERY, STORAGE, AND HANDLING
A. Deliver wall and door protection items in original, undamaged protective packaging. Label items to designate installation locations.
B. Do not deliver products to project site until areas for storage and installation are fully enclosed, and interior temperature and humidity are in compliance with manufacturer's recommendations for each type of item.
C. Store products in either horizontal or vertical position, in compliance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 MANUFACTURERS
A. Acceptable Manufacturers - Corner Guards:
   7. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PERFORMANCE CRITERIA
A. Impact Strength: Unless otherwise noted, provide protection products and assemblies that have been successfully tested for compliance with applicable provisions of ASTM D256 and/or ASTM F476.
B. Chemical and Stain Resistance: Unless otherwise noted, provide protection products and assemblies with chemical and stain resistance complying with applicable provisions of ASTM D543.
C. Fungal Resistance: Unless otherwise noted, provide protection products and assemblies which pass ASTM G21 testing.

2.03 PRODUCT TYPES

A. Corner Guards - Surface Mounted:
   1. Material: Type 304 stainless steel, No. 4 finish, minimum 12 gage, 0.01 inch thick.
   2. Width of Wings: 2 inches.
   3. Corner: Square.
   4. Length: One piece.

B. Wall Protection Sheet: Impact-resistant, heavy polyester/cotton knit; 0.33 inch thick.
   1. Basis of Design Manufacturer:
      1) Product: Simplicity.
      b. Substitutions: Refer to Section 01 6000 - Product Requirements.

C. Adhesives and Primers: As recommended by manufacturer.

2.04 SOURCE QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Provide wall and door protection systems of each type from a single source and manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as instructed by the manufacturer.

B. Verify that substrate surfaces for adhered items are clean and smooth.
   1. Test painted or wall covering surfaces for adhesion in inconspicuous area, as recommended by manufacturer. Follow adhesive manufacturer's recommendations for remedial measures at locations and/or application conditions where adhesion test's results are unsatisfactory.

C. Start of installation constitutes acceptance of project conditions.

3.02 INSTALLATION

A. Install components in accordance with manufacturer's instructions, level and plumb, secured rigidly in position to supporting construction.

B. Position corner guard 4 inches above finished floor to 60 inches high, unless otherwise indicated on Drawings.

3.03 TOLERANCES

A. Maximum Variation From Required Height: 1/4 inch.

B. Maximum Variation From Level or Plane For Visible Length: 1/4 inch.

3.04 CLEANING

A. Clean wall and door protection items of excess adhesive, dust, dirt, and other contaminants.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES
A. Commercial toilet accessories.
B. Commercial shower and bath accessories.
C. Utility room accessories.

1.02 REFERENCE STANDARDS
B. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

1.03 ADMINISTRATIVE REQUIREMENTS
A. Coordination:
1. Coordinate locations of accessories with other work to avoid interference, and to assure proper operation and servicing of accessory units.
2. Coordinate location and installation of toilet accessories mounted on or in immediate proximity to toilet partitions.
3. Coordinate the work with the placement of internal wall reinforcement, concealed ceiling supports, and reinforcement of toilet partitions to receive anchor attachments.

1.04 SUBMITTALS
A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.
C. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.

1.05 QUALITY ASSURANCE
A. Provide accessories by the same manufacturer for each type of accessory unit, and for units exposed in the same areas, to ensure matching of finishes.
B. Comply with ASTM F446 for grab bars and accessories, including, anchorage, test methods, and performance.
C. Basis of Design: Specifications and Drawings are based on accessory types and model numbers by the specified basis of design manufacturer. Accessory types manufactured by other acceptable manufacturers are permitted, subject to compliance with specified requirements, and provided that deviations in dimensions and profile are minor, and do not detract substantially from the indicated design intent.
1. Comply with requirements specified in Section 01 4000 and Section 01 6000.
1.06 DELIVERY, STORAGE, AND HANDLING
   A. Do not deliver accessories to site until rooms in which they are to be installed are ready to receive them.
   B. Pack accessories individually in a manner to protect accessory and its finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS
   A. Basis of Design Manufacturer:
         a. Products: As scheduled on Drawings.
      2. Substitutions: Section 01 6000 - Product Requirements.
   B. Other Acceptable Manufacturers:
      5. Substitutions: Section 01 6000 - Product Requirements.

2.02 MATERIALS
   A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
      1. Grind welded joints smooth.
      2. Fabricate units made of metal sheet of seamless sheets, with flat surfaces.
   B. Keys: Provide two keys for each accessory to Owner.
   C. Stainless Steel Sheet: ASTM A666, Type 304.
   D. Stainless Steel Tubing: ASTM A269/A269M, Grade TP304 or TP316.
   E. Mirror Glass: Annealed float glass, ASTM C1036 Type I, Class 1, Quality Q2, with silvering, protective and physical characteristics complying with ASTM C1503.
   F. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof; security type.
   G. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.

2.03 FINISHES
   A. Stainless Steel: Satin finish, unless otherwise noted.
   B. Chrome/Nickel Plating: ASTM B456, SC 2, satin finish, unless otherwise noted.
   C. Back paint components where contact is made with building finishes to prevent electrolysis.

PART 3 EXECUTION

3.01 EXAMINATION
   A. Verify existing conditions before starting work.
   B. Verify exact location of accessories for installation.
   C. For electrically-operated accessories, verify that electrical power connections are ready and in the correct locations.
   D. Verify that field measurements are as indicated on Drawings.
   E. See Section 06 1053 and 09 2116, as applicable, for installation of blocking, reinforcing plates, and concealed anchors in walls and ceilings.
3.02 PREPARATION
A. Deliver inserts and rough-in frames to site for timely installation.
B. Provide templates and rough-in measurements as required.
C. Before starting work notify Architect in writing of any conflicts detrimental to installation or operation of units.
D. Verify with Architect exact locations of accessories.

3.03 INSTALLATION
A. Install accessories in accordance with manufacturers’ instructions in locations indicated on drawings.
B. Install plumb and level, securely and rigidly anchored to substrate.
C. Mounting Heights: As required by accessibility regulations, unless otherwise indicated on Drawings.
D. Use concealed fasteners wherever possible.
E. Where exposed mounting devices and fasteners are necessary, provide such devices finished to match accessory; use security type fasteners for all exposed accessory mountings.
F. Unless otherwise indicated, align accessory units with adjacent fixtures and other elements within the same area. Conform to ICC A117.1 for mounting structural strength, positions, and mounting heights.

3.04 PROTECTION
A. Protect installed accessories from damage due to subsequent construction operations.
B. Protect adjacent or adjoining finished surfaces and work from damage during installation of work of this Section.
C. Protect exposed accessory finishes from damage until final acceptance of the Work.

3.05 CLEANING AND ADJUSTMENT
A. Clean and polish all exposed surfaces after installation, and after removal of labels and protective coatings or coverings.
B. Test and adjust accessories for proper and smooth operation.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES
A. Manufactured fireplaces.
B. Accessories, including firestop spacer, circulating fan, exposed cladding, and gas flame kits.
C. Insulated chimney flue and associated roof flashings.

1.02 REFERENCE STANDARDS
A. UL (DIR) - Online Certifications Directory.
B. UL 127 - Standard for Factory-Built Fireplaces.

1.03 SUBMITTALS
A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide fire box cabinet dimensions, clearances required from adjacent dissimilar construction, applicable regulatory agency approvals, electrical characteristics of fan and other pertinent information.
C. Shop Drawings: Indicate fire box rough opening dimensions, rough opening sizes for chimney flue, and fan size.
D. Manufacturer's Certificate: Certify that fireplace components meet or exceed UL (DIR) requirements.
E. Manufacturer's Instructions: Indicate installation procedures and component installation sequence, clearances and tolerances from adjacent construction.

1.04 QUALITY ASSURANCE
A. Manufacturer Qualifications: Obtain all components of manufactured fireplaces, including flues, fire stops, roof jacks, and rain caps from a single manufacturer.
B. Basis of Design: Specifications are based on specific types and model numbers by the specified basis of design manufacturer. Fireplace types manufactured by other acceptable manufacturers are permitted, subject to compliance with all specified requirements, and provided that deviations in dimensions and other characteristics are minor, and do not detract substantially from the indicated design concept.
   1. Comply with requirements specified in Section 01 4000 and Section 01 6000.

PART 2 PRODUCTS

2.01 MANUFACTURERS
A. Basis of Design Manufacturer:
   2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 REGULATORY REQUIREMENTS
A. Comply with applicable code for clearances from adjacent materials, chimney height above roof line requirements, and unit UL approval.
B. Listed by Underwriters Laboratories Inc. (UL) as complying with UL 127.
C. Products Requiring Electrical Connection: Listed and labeled by UL (DIR), as suitable for the purpose specified and indicated.
2.03 MANUFACTURED FIREPLACES
   A. Fireplace Units: Built-in firebox with concealed flue; include other specified features and accessories.
   B. Fuel: Natural gas.

2.04 COMPONENTS
   A. Fire Box: Formed insulated steel cabinet, rectangular shaped interior, configured to include chimney outlet; single sided.
      1. Hearth Opening: 72 inches wide by 30 inches high by 18 inches deep.
      2. Flue Diameter: 10 inches.
      3. Combustion Air Source: Ducted outside air.
      4. Air Jacket: Steel enclosure surrounding fire box, air inlets and outlets, electrical fan with rheostat switch.
   B. Exposed Cladding: Prepainted steel.
   C. Fire Box Closure: Clear, tempered glass in black steel frame.
   D. Flue Construction: Insulated, double wall, steel sandwich construction, modular sized sections with elbows and spacing collars to permit site assembly, air and fire stop collars, elbows, elbow offsets, tees, supports, roofing storm collar, roof flashing; nominal inside diameter of 10 inches, minimum.
   E. Roof Terminations: Round terminal cap.

2.05 FACTORY FINISHING
   A. Exposed to View Surfaces: Baked enamel, black color.

2.06 ACCESSORIES
   A. Firestop Spacer: Non-combustible device designed to fit between chimney riser and penetrated floor or roof construction framing.
   B. Roof Flashing: Pre-finished sheet metal, configured to fit tightly to chimney riser and seal to shingle roofing system.
   C. Gas Flame Kit: Manufacturer's standard wall mounted on/off control switch.
   D. Fasteners and Anchors: Galvanized steel type.

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS
   A. Verify that prepared openings are ready to receive work and opening dimensions are as indicated on Drawings.
   B. Verify that proper power supply and fuel source are available.

3.02 INSTALLATION
   A. Install unit assembly in accordance with manufacturer's instructions.
   B. Install chimney plumb through prepared openings using fire stop spacers.
   C. Secure chimney in opening framing with appropriate fasteners.
   D. Install roof flashings to ensure moisture is shed from chimney flue.

3.03 TOLERANCES
   A. Maximum Variation of Chimney From Plumb: 1/2 inch.

END OF SECTION
PART 1  GENERAL

1.01  SECTION INCLUDES
A. Fire department lock boxes for emergency key storage.

1.02  SUBMITTALS
A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Manufacturer's catalog literature for specified specialty items, marked to clearly show products to be furnished for this project.
C. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention.

1.03  DELIVERY, STORAGE, AND HANDLING
A. Package hardware items individually; label and identify each package with door opening code to match hardware schedule.

PART 2  PRODUCTS

2.01  FIRE DEPARTMENT LOCK BOX
A. Fire Department Lock Box: Heavy-duty, recessed, solid stainless-steel box with hinged door and interior gasket seal; single drill resistant lock with dust covers and tamper alarm.
2. Finish: Manufacturer's standard dark bronze.
3. Include location stickers as required by local jurisdiction.
4. Acceptable Products:
   b. Substitutions: Not permitted.

PART 3  EXECUTION

3.01  INSTALLATION
A. Install specified items in accordance with manufacturer's instructions and applicable jurisdictional requirements.
   1. Confirm required location with authority having jurisdiction prior to installation.
B. Use templates provided by item manufacturer.
C. Set units level, plumb, and true to line and location. Adjust and reinforce the attachment substrate as required for proper installation and operation.

3.02  ADJUSTING
A. Adjust hardware for smooth operation.
B. Adjust gasketing for complete, continuous seal; replace if unable to make complete seal.
C. Replace units which cannot be adjusted and lubricated to operate freely and smoothly.

3.03  PROTECTION
A. Do not permit adjacent work to damage hardware or finish.

END OF SECTION
SECTION 10 4400
FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Fire extinguishers.
B. Fire extinguisher cabinets.
C. Accessories.

1.02 REFERENCE STANDARDS
A. FM (AG) - FM Approval Guide.
B. NFPA 10 - Standard for Portable Fire Extinguishers.
C. UL (DIR) - Online Certifications Directory.

1.03 SUBMITTALS
A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide extinguisher operational features, extinguisher ratings and classifications, color and finish, anchorage details, and installation instructions.
C. Shop Drawings: Indicate cabinet physical dimensions, cabinet physical dimensions, rough-in measurements for recessed cabinets, locations of individual fire extinguishers, mounting measurements for wall bracket, installation procedures, and accessories required for complete installation.
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, refill or recharge schedules and re-certification requirements.

1.04 FIELD CONDITIONS
A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

PART 2 PRODUCTS

2.01 MANUFACTURERS
A. Acceptable Manufacturers:
   8. Substitutions: See Section 01 6000 - Product Requirements.

2.02 FIRE EXTINGUISHERS
A. General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.
   1. Provide extinguishers labeled by UL (DIR) or FM (AG) for purpose specified and as indicated.

B. Multipurpose Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gauge.
   2. Class: A:B:C type.
   3. Size: 10 pound.
4. Finish: Baked polyester powder coat, red color.
5. Temperature Range: -65 degrees F to 120 degrees F.

2.03 CABINETS

A. Cabinet Construction: Non-fire rated.
   1. Formed steel or stainless steel sheet; 0.036 inch thick base metal.

B. Cabinet Configuration: Semi-recessed type, unless otherwise indicated or specified.
   1. Sized to accommodate scheduled items and accessories.
   2. Semi-Recessed Cabinets: Maximum 4 inch projection from wall surface, including handles and other components.
   3. Trimless type.
   4. Provide cabinet enclosure with right angle inside corners and seams, and with formed perimeter trim and door stiles.

C. Door: 0.036 inch metal thickness, reinforced for flatness and rigidity with nylon catch. Hinge doors for 180 degree opening with two butt hinge.

D. Cabinet Mounting Hardware: Appropriate to cabinet, with pre-drilled holes for placement of anchors.

E. Weld, fill, and grind components smooth.

F. Finish of Cabinet Exterior Trim and Door:
   1. Natatorium and Wet Locations: No. 4 - Brushed stainless steel.
   2. All Non-Wet Locations: Baked enamel, white color.

G. Finish of Cabinet Interior: White colored enamel.

2.04 ACCESSORIES

A. Lettering: "FIRE EXTINGUISHER" decal, or vinyl self-adhering, pre-spaced black lettering in accordance with authorities having jurisdiction (AHJ).

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify rough openings for cabinet are correctly sized and located.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Fire Extinguisher Cabinets: Install cabinets plumb and level in wall openings, maximum 30 inches from finished floor to inside bottom of cabinet.

C. Secure rigidly in place.

D. Place extinguishers in cabinets and on wall brackets as indicated; see Drawings for locations of extinguishers on wall brackets.

END OF SECTION
SECTION 10 5129
PHENOLIC LOCKERS

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Phenolic lockers.
B. Phenolic panel bases, tops, and filler panels.

1.02 REFERENCE STANDARDS
A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design.

1.03 SUBMITTALS
A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Manufacturer's published data on locker construction, sizes and accessories.
C. Shop Drawings: Indicate locker plan layout and numbering plan.
D. Samples: Submit samples 2 x 3 inches in size, of available phenolic colors and patterns, for selection.
E. Manufacturer's Installation Instructions: Indicate component installation assembly.

1.04 QUALITY ASSURANCE
A. Provide all lockers by same manufacturer.
B. Basis of Design: Specifications are based on locker types and model numbers by the specified basis of
design manufacturer. Locker types manufactured by other acceptable manufacturers are permitted, subject
to compliance with all specified requirements; and provided that deviations in dimensions, sizes, style, and
finish are minor, and do not detract substantially from the indicated design intent.
1. Comply with requirements specified in Section 01 4000 and Section 01 6000.

1.05 MOCK-UP
A. Comply with general mock-up requirements specified in Section 01 4000.
B. Mock-up: Provide mock-up of one full size locker, double tier with lighted top detail, in selected colors.
1. Locate where directed.
2. Mock-up may remain as part of the Work.

1.06 DELIVERY, STORAGE, AND HANDLING
A. Protect locker finish and adjacent surfaces from damage.

PART 2 PRODUCTS

2.01 MANUFACTURERS
A. Basis of Design Manufacturer:
a. Locker System: Traditional.
2. Substitutions: See Section 01 6000 - Product Requirements.
B. Other Acceptable Manufacturers:
3. Substitutions: See Section 01 6000 - Product Requirements.
2.02 LOCKER APPLICATIONS

A. Wardrobe Lockers: Phenolic lockers, free-standing for base indicated on Drawings.
   1. Accessibility: Comply with ICC A117.1 and ADA Standards.
   2. Locker Configurations: As indicated on Drawings.
   3. Fittings: Size and configuration as indicated on Drawings.
      a. Single shoe shelf.
      b. Coat rod.
      c. Hooks: Two double prong.
   4. Ventilation: By open space between the back of the door and locker body.
   5. Locking: Padlock hasps, for padlocks provided by Owner.

2.03 PHENOLIC LOCKERS

A. Lockers: Factory assembled, made of phenolic core panels with mortise and tenon joints and stainless steel mechanical joint fasteners; fully finished inside and out; each locker capable of standing alone.
   1. Doors: Full overlay, covering full width and height of locker body; square edges.
   2. Panel Core Exposed at Edges: Machine polished, without chips or tool marks; square edge unless otherwise indicated.
   3. Where locker ends or sides are exposed, finish the same as fronts or provide extra panels to match fronts.
   4. Door Color: As selected by Architect; allow for 2 different colors, including special order or long lead times.
   5. Body Color: Manufacturer's standard white or light color.

B. Component Thicknesses:
   1. Doors: 1/2 inch minimum thickness.
   2. Locker Body: One of the following combinations:
      a. Tops, bottoms, and shelves 1/2 inch; sides 3/8 inch; backs 1/4 inch; minimum.
   3. End Panels and Filler Panels: 1/2 inch minimum thickness.

C. Phenolic Core Panels: Nonporous phenolic resin and paper core formed under high pressure, with through-color finished edges, integral melamine surface, matte finish, and uniform surface appearance; glued laminated panels not acceptable.
   1. Surface Burning Characteristics: Flame spread index of 75 or less, and smoke developed index of 450 or less; when tested in accordance with ASTM E84.

D. Hinges: Stainless steel, black powder coat finish; minimum of 180 degree opening; either exposed barrel 5-knuckle hinge attached to back of door and inside of body with tamperproof screws, or concealed cabinet style hinge attached with tamperproof screws.

E. Coat Hooks: Stainless steel or reinforced nylon; attached with tamperproof screws.

F. Number Plates: Manufacturer's standard, minimum 4-digit, permanently attached with adhesive; may be field installed.

G. Lock Strike: Stainless steel, or black high impact ABS plastic strike plate attached to locker body with throughbolts.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that prepared bases are in correct position and configuration.

B. Verify bases and embedded anchors are properly sized.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Place and secure on prepared base.
C. Install lockers plumb and square.
D. Secure lockers with anchor devices to suit substrate materials. Minimum Pullout Force: 100 pounds.
E. Bolt adjoining locker units together to provide rigid installation.
F. Install end panels, filler panels, and miscellaneous panels.
G. Install accessories.
H. Replace components that do not operate smoothly.

3.03 CLEANING

A. Clean locker interiors and exterior surfaces.

END OF SECTION
SECTION 11 5213
PROJECTION SCREENS

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Front projection screen assemblies.

1.02 ADMINISTRATIVE REQUIREMENTS
A. Coordination:
1. Coordinate screen installation with installation of projection systems.
2. Coordinate installation with adjacent construction and fixtures, including ceilings, walls, lighting, fire suppression, and registers and grilles.

1.03 SUBMITTALS
A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Manufacturer's catalog cuts and descriptive information on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.
   4. Wiring diagrams for motor operators and actuators, and controls and switches.
C. Shop Drawings: For custom installations, indicate dimensions, verified field measurements, mounting details, and interface with adjacent construction.
D. Samples: For screen fabrics, submit two samples 6 by 6 inch in size.
E. Installer's Qualification Statement.
F. Operation and Maintenance Data: Provide manufacturer's operation and maintenance instructions.
G. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.04 QUALITY ASSURANCE
A. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.
B. Basis of Design: Specifications are based on projection equipment types by the specified basis of design manufacturer. Projection equipment types manufactured by other acceptable manufacturers are permitted, subject to compliance with specified requirements, and provided that deviations in dimensions, configurations, function, and profile are minor, and do not detract substantially from the indicated design intent.
   1. Comply with requirements specified in Section 01 4000 and Section 01 6000.

1.05 DELIVERY, STORAGE, AND HANDLING
A. Deliver projection screens to project site in manufacturer's original unopened packaging, and inspect for damage and proper size before accepting delivery.
B. Store in a protected, clean, dry area with temperature maintained above 50 degrees F, and stack in accordance with manufacturer's recommendations.
C. Acclimate screens to building temperatures for 24 hours prior to installation, in accordance with manufacturer's recommendations.

1.06 FIELD CONDITIONS
A. Maintain interior of building between 60 degrees F and 75 degrees F during and after installation of projection screens.
1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturer warranty for projection screen assembly.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design Manufacturer:
   2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 FRONT PROJECTION SCREENS

A. Front Projection Screens: Factory assembled unless otherwise indicated.
   1. Dimensions: As indicated on Drawings.

   1. Material: High contrast gray vinyl on fiberglass backing, with nominal gain of 0.8 over viewing angle not less than 70 degrees from axis, horizontally and vertically.
   2. Seams: No seams permitted in fabric up to 96 inch high by 72 inch wide.

C. Masking Borders: Black, on four sides.

D. Extra Drop: Black; 11 inch wide.

E. Concealed-in-Ceiling Screen Cases: Aluminum, with integral roller brackets.
   1. Door Slat: Self trim; self-closing and -opening.
   2. Case Finish: Baked enamel.
   4. End Caps: Aluminum; finished to match case.

F. Electrically-Operated Screens:
   1. Roller: Steel, 2 inch in diameter, with locking device.
   2. Vertical Tensioning: Screen fabric weighted at bottom with steel bar and plastic end caps.
   3. Horizontal Tensioning: Tab-guided cable system.

G. Provide mounting hardware, brackets, supports, fasteners, and other mounting accessories required for a complete installation, in accordance with manufacturer's recommendations for specified substrates and mountings.

2.03 ELECTRICAL COMPONENTS

A. Electrical Components: Listed and classified by UL as suitable for the purpose specified and indicated.

B. Motors: Direct drive, 110 V, 60 Hz.
   1. Screen Motor: Mounted inside roller; pre-wired; quick reverse type and lifetime lubricated; equipped with thermal overload cut-off, internal junction box, electric brake, and pre-set accessible limit switches.
      a. Motor mounted on sound absorber.
   2. Door and Adjustable Masking Motor: Mounted inside roller; pre-wired; quick reverse type; equipped with thermal overload cut-off.
      a. Motor mounted on sound absorber.

C. Controls: Three (3) position control switch with plate.
   1. Provide two control stations to screen, with internal override to prevent more than one signal reaching the screen.
   2. Remote Control: Radio frequency; provide one transmitter.
   3. Security: Provide key operated switch; provide 2 keys.
PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate is finished and ready to accept screen installation.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Verify that openings for recessed screens are correctly sized.

D. Verify type and location of electrical connections.

E. Do not install projection screens until climate control systems are in place and interior painting and other finishes are completed.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions, using manufacturer's recommended hardware for relevant substrates.

B. Do not field cut screens.

C. Install screens in mountings as specified and as indicated on Drawings.

D. Install plumb and level.

E. Install electrically operated screens ready for connection to power and control systems by others.

F. Adjust projection screens and related hardware in accordance with manufacturer's instructions for proper placement and operation.

G. Test electrical screens for proper working condition. Adjust as needed.

H. Test masking systems for proper format control. Adjust as needed.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Basketball backboards, goals, and support framing.
   B. Gymnasium exercise equipment.
   C. Wall mounted protection pads.
   D. Divider curtains.
   E. Volleyball net assemblies.

1.02 REFERENCE STANDARDS
   B. AWS D1.1/D1.1M - Structural Welding Code - Steel.
   C. NFPA 70 - National Electrical Code.

1.03 ADMINISTRATIVE REQUIREMENTS
   A. Coordination:
      1. Ensure that large components can be moved into final position without damage to other construction.
      2. Coordinate installation of inserts and anchors that must be built in to flooring or subflooring.
      3. Coordinate location and electrical characteristics of service connection.

1.04 SUBMITTALS
   A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
   B. Product Data: Provide manufacturer's data showing configuration, sizes, materials, finishes, hardware, and accessories; include:
      1. Electrical characteristics and connection locations.
      2. Fire rating certifications.
      3. Structural steel welder certifications.
      4. Manufacturer's installation instructions.
   C. Shop Drawings: For custom fabricated equipment indicate, in large scale detail, construction methods; method of attachment or installation; type and gage of metal, hardware, and fittings; plan front elevation; elevations and dimensions; minimum one cross section; utility requirements as to types, sizes, and locations.
   D. Erection Drawings: Detailed dimensional requirements for proper location of equipment.
   E. Samples: Submit samples of wall pad coverings in manufacturer's available range of colors.
   F. Operating and maintenance data, for each operating equipment item.
   G. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
1.05 QUALITY ASSURANCE
   A. Basis of Design: Specifications and Drawings are based on equipment types by the specified basis of design manufacturer. Equipment types manufactured by other acceptable manufacturers are permitted, subject to compliance with specified requirements, and provided that deviations in dimensions, configurations, and profile are minor, and do not detract substantially from the indicated design intent.
      1. Comply with requirements specified in Section 01 4000 and Section 01 6000.

1.06 DELIVERY, STORAGE, AND HANDLING
   A. Deliver products to project site in manufacturer's original packaging with factory original labels attached.
   B. Store products indoors and elevated above floor; prevent warping, twisting, or sagging.
   C. Store products in accordance with manufacturer's instructions; protect from extremes of weather, temperature, moisture, and other damage.

1.07 WARRANTY
   A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
   B. Provide 5 year manufacturer warranty for divider and archery curtains.

PART 2 PRODUCTS

2.01 MANUFACTURERS
   A. Basis of Design Manufacturer: Unless otherwise specified:
         a. Equipment types and model numbers specified in this Section.
      2. Substitutions: See Section 01 6000 - Product Requirements.
   B. Other Acceptable Manufacturers:
      6. Substitutions: See Section 01 6000 - Product Requirements.

2.02 GENERAL REQUIREMENTS
   A. See Drawings for sizes and locations.
   B. Provide mounting plates, brackets, and anchors of sufficient size and strength to securely attach equipment to building structure; comply with requirements of Contract Documents.
   C. Hardware: Heavy duty steel hardware, as recommended by manufacturer.
   D. Electrical Wiring and Components: Comply with NFPA 70; provide UL-listed equipment.
   E. Structural Steel Fabrications: Welded in accordance with AWS D1.1/D1.1M, using certified welders.

2.03 DIVIDER CURTAINS
   A. Curtain: Solid vinyl-coated polyester fabric, 19 oz/sq yd, to 8 feet above floor surface; open polyester mesh with PVC coating, 9 oz/sq yd, from top of solid curtain to top of assembly; fabrics comply with NFPA 701.
      2. Roller Assembly: Manufacturer's standard anodized aluminum tube; diameter to suit application; manufacturer's standard pull-up hoist assembly according to model specified.
      3. Operation: Manufacturer's standard 3/4 HP winch with single touch control panel.
         a. Provide assembly with Model No. 12005 audible motion alarm.
         b. Provide assembly with Model No. 10796 line shaft safety lock.
      4. Mounting: Structure supported; provide mounting kit.
      5. Optional Features: Manufacturer's standard padding feature.
      6. Colors: As selected from manufacturer's standard selection.
2.04 BASKETBALL

A. Ceiling-Suspended Backstop Assemblies:
   1. Basis of Design: Model 90955000 Ceiling Suspended Side Folding-Side-Braced Backstop; 28 to 32 foot height; Sportsonic Controls.
   2. Folding Control System: Electric hoist; folds backstop with 115 volt actuator; integral limit switches provide automatic shut-off in both positions; provide safety catch with automatic reset; winch size and HP to suit indicated application.
      a. Manufacturer's standard key switch.
      b. Provide assembly with Model No. 12005 audible motion alarm.
   3. Height Adjuster: Model 00903506 Center Strut Sportsonic II Switch Height Adjuster; 900 Series.
      a. Function: To raise/lower assembly by 2 feet to adjust goal height.
      b. Manufacturer's standard key switch.
      c. Provide assembly with Model No. 12005 audible motion alarm.
   4. Framing Color: As selected from manufacturer's standard selection.
   5. Strap: Model 00903506.

B. Backboards:
   2. Dimensions: 72 inches wide.
   4. Provide safety padding for bottom edge of backboard.
      a. Model No. 00326xxx Pro-Pad with bolt-on kit for specified backboard.
      b. Color: As selected from manufacturer's standard selection.

C. Goals: Steel rim, mounted to backboard, with attached nylon anti-whip net; complete with mounting hardware.
   1. Basis of Design: Model No. 236154 Powr-Flex.

2.05 VOLLEYBALL

A. Ceiling Suspended Volley Ball Net Assemblies: One court system of adjustable posts, net, and tensioning winch meeting all requirements for FIVB, USA Volleyball, NCAA and NFHS competition requirements.
   2. Framing: Adjustable hanger and bridged frame assembly, with toed-in braces to relieve tension when in raised position.
   3. Height Adjustment; Manufacturer's standard mechanism at both sides of net assembly.
   4. Posts: 3-1/2 inch O.D. schedule 80 aluminum tube with 1 inch height adjustments between 42 and 96 inches.
   5. Net: 4 inch square #36 nylon cord with vinyl coated polyester hem, double stitched around the perimeter.
      b. Bottom Hem Reinforcing: 1/4 inch diameter braided nylon rope with spring loaded, pressure type rope tensioner.
      c. Size: Regulation size.
   7. Antenna and boundary markers.
   8. Folding Control System: Electric hoist; folds net assembly with 115 volt actuator; integral limit switches provide automatic shut-off in both positions; provide safety catch with automatic reset; winch size and HP to suit indicated application.
      a. Manufacturer's standard key switch.
      b. Provide assembly with Model No. 12005 audible motion alarm.
2.06 WALL Padding

A. Wall Padding: Foam filling bonded to backing board, wrapped in covering; each panel fabricated in one piece.
   1. Basis of Design: Model No. 00570-0XX, high-energy, fire resistant, with nailing margins.
   2. Surface Burning Characteristics: Flame spread index (FSI) of 25 or less, smoke developed index (SDI) of 450 or less, Class A, when tested in accordance with ASTM E84 as a complete panel.
   3. Flammability: Comply with NFPA 286.
      a. Color: As selected from manufacturer's standard range.
      c. Fabric Weight: 14 oz/sq yd.
   5. Foam: Urethane, firm, minimum 6 pcf nominal density.
   6. Foam: Open cell polychloroprene (Neoprene), minimum 5.5 pcf nominal density.
   7. Foam Thickness: 2 inches.
   8. Backing Board: Oriented strand board.
      a. Thickness: 3/8 inch.
      b. Surface Burning Characteristics: Flame spread index (FSI) of 25 or less, smoke developed index (SDI) of 450 or less, Class A, when tested in accordance with ASTM E84.
      a. See Drawings for sizing.

B. Specially Shaped Padding: Same construction as standard padding; provide modular panels to fit irregularly shaped members, areas, and protrusions in gymnasium as indicated; provide padding for:
   1. I-beams.
   2. Wall corners.
   3. Stage corners.
   4. Other items indicated on Drawings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Take field measurements to ensure proper fitting of work. If taking field measurements before fabrication will delay work, allow for adjustments within recommended tolerances.

B. Inspect areas and conditions before installation. Notify Architect in writing of unsatisfactory or detrimental conditions. Do not proceed until conditions have been corrected. Commencing installation constitutes acceptance of work site conditions.

C. Do not proceed with this work until conditions have been corrected; commencing installation constitutes acceptance of work site conditions.

D. Verify that electrical services are correctly located and have proper characteristics.

3.02 INSTALLATION

A. Install in accordance with Contract Documents and manufacturer's instructions.

B. Install equipment rigid, straight, plumb, and level.

C. Secure equipment with manufacturer's recommended anchoring devices.

D. Install wall padding securely, with edges tight to wall and without wrinkles in fabric covering.

E. Separate dissimilar metals to prevent electrolytic corrosion.

3.03 ADJUSTING

A. Verify proper placement of equipment.
B. Verify proper placement of equipment anchors and sleeves. Use actual movable equipment to be anchored if available.

C. Adjust operating equipment for proper operation; remove and replace equipment causing noise or vibration. Lubricate equipment if recommended by manufacturer.

3.04 CLEANING

A. Remove masking or protective covering from finished surfaces.

B. Clean equipment in accordance with manufacturer's recommendations.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES
A. Gymnasium scoreboards.

1.02 REFERENCE STANDARDS
A. UL (EAUED) - Electrical Appliance and Utilization Equipment Directory.

1.03 ADMINISTRATIVE REQUIREMENTS
A. Coordination: Coordinate with Division 26 installer for conduit rough-in for scoreboard systems.

1.04 SUBMITTALS
A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide data for each equipment item, describing installation requirements, construction features, accessory components, and other pertinent data.
C. Shop Drawings: Indicate each equipment item showing sizes, dimensions, layouts, setting layouts, and required anchorage based on actual field measurements.
D. Operation and Maintenance Data: Submit data for each equipment item, including spare parts lists and manufacturer's printed warranties.
E. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE
A. Provide each type of equipment from a single manufacturer, and to the extent possible, provide all equipment by a single manufacturer.
B. Basis of Design: Specifications are based on scoreboard types and model numbers by the specified manufacturer for each equipment item. Scoreboard types manufactured by other acceptable manufacturers are permitted, subject to compliance with specified requirements, and provided that deviations in dimensions and configuration are minor, and do not detract substantially from the indicated design intent.
   1. Comply with requirements specified in Section 01 4000 and Section 01 6000.
C. Products Requiring Electrical Connection: Listed and classified by UL as suitable for the purpose specified and indicated.

1.06 FIELD CONDITIONS
A. Do not install scoreboards until finish work is complete, including floor systems.
B. Furnish inserts and anchoring devices which must be set in concrete or other materials for installation of scoreboards. Coordinate delivery to avoid delays in the work.
C. Coordinate with Division 26 for locations of electrical rough-in items for scoreboards.

1.07 WARRANTY
A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
B. Correct defective Work within a two year period after Date of Substantial Completion.
PART 2 PRODUCTS

2.01 MANUFACTURERS
   A. Basis of Design Manufacturer:
         a. Models and features as specified.
      2. Substitutions: See Section 01 6000 - Product Requirements.
   B. Other Acceptable Manufacturers:
      5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 SCOREBOARDS
   A. Gymnasium Scoreboards: Basketball, wrestling, and volleyball display, 100 percent solid state electronics;
      13 inch high fully lighted LED block numerals, time clock minutes and seconds from 00:00 to 59:59, instant
      reset to start time for next period, and time clock adjustment up or down by selecting mode; time of day
      display option; wall mounted; UL listed; color selected from manufacturer's standards.
      1. Provide control cabling, junction boxes, and vibrating horn for each unit.
      2. Optional Features: Include painted and fully finished back panel where scoreboard is mounted on
         running track frame.
         a. Substitutions: See Section 01 6000 - Product Requirements.

2.03 ACCESSORIES
   A. Furnish anchors, trim, and electronic accessories as required for complete, functional installation of each
      scoreboard system.

PART 3 EXECUTION

3.01 PREPARATION
   A. Provide setting drawings, templates, instructions, and directions for installation of scoreboard systems.

3.02 INSTALLATION
   A. Install in accordance with manufacturer's instructions.
   B. Set units in position plumb, square, level, and properly aligned with other elements of the building and game
      court layouts as finally approved or installed.
   C. Secure to building construction as detailed or required and anchor by welding, bolting, or other suitable
      means as indicated or as recommended by manufacturer.

3.03 CLEANING
   A. Clean, test, and adjust to assure proper operation and control.

END OF SECTION
SECTION 11 9900
AQUATICS EQUIPMENT ROOM EQUIPMENT

PART 1 GENERAL
1.01 SECTION INCLUDES
A. Winch located in equipment room.
B. Trolley hoist located in equipment room.

1.02 ADMINISTRATIVE REQUIREMENTS
A. Coordination: Coordinate the installation of equipment items with size, location and installation of service utilities.
B. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

1.03 SUBMITTALS
A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide product data for specified equipment items.
C. Project Record Documents: Accurately record actual locations of embedded utilities and components that will be concealed from view upon completion of work.
D. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

PART 2 PRODUCTS
2.01 EQUIPMENT
   1. Model: 2ZU44.
   1. Model: 0300/3KP82.
   2. Motorized trolley, 4,000 lb load capacity; 230/460 VAC, 3 phase.
C. Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION
3.01 INSTALLATION
A. Install in accordance with manufacturer's instructions.

3.02 ADJUSTING
A. Adjust operating components for smooth operation.

3.03 CLEANING
A. Clean equipment items immediately before Substantial Completion.

3.04 CLOSEOUT ACTIVITIES
A. Demonstrate proper operation of equipment to Owner's designated representative.
B. Demonstration: Demonstrate operation of system to Owner's personnel.
   1. Use operation and maintenance data as reference during demonstration.
   2. Briefly describe function, operation, and maintenance of each component.
C. Training: Train Owner's personnel on operation and maintenance of system.
   1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
   2. Provide minimum of two hours of training.
   3. Instructor: Manufacturer's training personnel.
   4. Location: At project site.

3.05 PROTECTION

A. Protect installed equipment items from subsequent construction operations.

END OF SECTION
SECTION 12 2400
WINDOW SHADES

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Interior manual roller shades.
B. Interior motorized roller shades.
C. Motor controls.

1.02 REFERENCE STANDARDS
A. NFPA 70 - National Electrical Code.
C. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems.
D. WCMA A100.1 - Safety of Window Covering Products.

1.03 ADMINISTRATIVE REQUIREMENTS
A. Coordination:
   1. Where motorized shades are to be controlled by control systems provided under other sections, coordinate the work with other trades to provide compatible products.
   2. Coordinate the work with other trades to provide rough-in of electrical wiring as required for installation of hardwired motorized shades.
   3. Coordinate with window installation and placement of concealed blocking to support shades.
B. Preinstallation Meeting: Convene one week prior to commencing work related to products of this section; require attendance of affected installers.
   1. Convene under general provisions of Section 01 7000.
C. Sequencing:
   1. Do not fabricate shades until field dimensions for each opening have been taken with field conditions in place.
   2. Do not install shades until final surface finishes and painting are complete.

1.04 SUBMITTALS
A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide manufacturer's standard catalog pages and data sheets including materials, finishes, fabrication details, dimensions, profiles, mounting requirements, and accessories.
   1. Motorized Shades: Include power requirements and standard wiring diagrams for specified products.
C. Shop Drawings: Include shade schedule indicating size, location and keys to details, head, jamb and sill details, mounting dimension requirements for each product and condition, and operation direction.
   1. Motorized Shades: Provide schematic system riser diagram indicating component interconnections. Include requirements for interface with other systems.
D. Certificates: Manufacturer's documentation that line voltage components are UL listed or UL recognized.
E. Source Quality Control Submittals: Provide test reports indicating compliance with specified fabric properties.
F. Selection Samples: Include fabric samples in full range of available colors and patterns.
   1. Motorized Shades: Include finish selections for controls.
G. Verification Samples: Minimum size 6 inches square, representing actual materials, color and pattern.
H. Manufacturer's Instructions: Include instructions for storage, handling, protection, examination, preparation, and installation of product.
I. Project Record Documents: Record actual locations of control systems and show interconnecting wiring.

J. Operation and Maintenance Data: List of all components with part numbers, sources of supply, and operation and maintenance instructions; include copy of shop drawings.

K. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of this type with minimum three years of documented experience with shading systems of similar size and type.
   1. Manufacturer's authorized representative.
   2. Factory training and demonstrated experience.

1.06 MOCK-UP

A. Comply with general mock-up requirements specified in Section 01 4000.

B. Mock-Up: Provide full size mock-up of window shade system complete with selected shade fabric including example of seams and batten pockets when applicable.
   1. Obtain Architect's approval of light and privacy characteristics of fabric prior to fabrication.
   2. Full-sized mock-up may become part of the final installation.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver shades in manufacturer's unopened packaging, labeled to identify each shade for each opening.

B. Handle and store shades in accordance with manufacturer's recommendations.

1.08 FIELD CONDITIONS

A. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design Manufacturer:
   1. Insolroll Window Shading Systems: www.insolroll.com
      a. Model: Radiance Shade System; motorized and manual systems.
   2. Substitutions: See Section 01 6000 - Product Requirements.

B. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.

2.02 ROLLER SHADES

A. General:
   1. Provide shade system components that are easy to remove or adjust without removal of mounted shade brackets.
   2. Provide shade system that operates smoothly when shades are raised or lowered.
   3. Motorized Shades: Motor system housed inside roller tube, controlling shade movement via motor controls indicated; listed or recognized to UL 325.
      a. Comply with NFPA 70.
      b. Electrical Components: Listed, classified, and labeled as suitable for the purpose intended. Where applicable, system components to be FCC compliant.
      c. Motors: Size and configuration as recommended by manufacturer for the type, size, and arrangement of shades to be operated; integrated into shade operating components and concealed from view; fully compatible with controls to be installed.
B. Manually Operated Roller Shades:
   1. Description: Single and double roller, manually operated fabric window shades.
      a. Drop Position: Regular roll.
      b. Mounting: As indicated on Drawings.
      c. Fabric: As selected by Architect from manufacturer's full line.
   2. Brackets and Mounting Hardware: As recommended by manufacturer for mounting indicated and to accommodate shade fabric roll-up size and weight.
      a. Material: Steel, 1/8 inch thick.
         1) Light-Filtering Fabric: Room-side of opening.
         2) Room-Darkening Fabric: Glass-side of opening.
      c. Multiple Shade Band Operation: Provide hardware as necessary to operate more than one shade band using a single clutch operator.
   3. Roller Tubes:
      b. Size: As recommended by manufacturer; selected for suitability for installation conditions, span, and weight of shades.
      c. Fabric Attachment: Utilize extruded channel in tube to accept vinyl spline welded to fabric edge. Shade band to be removable and replaceable without removing roller tube from brackets or inserting spline from the side of the roller tube.
      d. Roller tubes to be capable of being removed and reinstalled without affecting roller shade limit adjustments.
   4. Hembars: Designed to maintain bottom of shade straight and flat.
   5. Clutch Operator: Manufacturer's standard material and design integrated with bracket/brake assembly.
      a. Provide a permanently lubricated brake assembly mounted on a oil-impregnated hub with wrapped spring clutch.
      b. Brake must withstand minimum pull force of 50 pounds in the stopped position.
      c. Mount clutch/brake assembly on the support brackets, fully independent of the roller tube components.
   6. Drive Chain: Continuous loop stainless steel beaded ball chain, 95 pound minimum breaking strength. Provide upper and lower limit stops.
      a. Chain Retainer: Chain tensioning device complying with WCMA A100.1.
   7. Managed Lift: Required lifting force of 3 pounds to a maximum of 8.5 pounds for single band or multi-band shades up to 5 bands and a maximum of 30 pounds hanging weight.
   8. Accessories:
      a. Fascias: Size as required to conceal shade mounting.
         1) Style A: Surface mounted as selected by Architect from shade manufacturer's full selection.
         2) Style B: Special or custom trim pocket with bottom edge that functions as ceiling trim aligned with ceiling plane as detailed on Drawings.
         3) Material and Color: To match shade.
      b. Room-Darkening Channels: Extruded aluminum side and center channels with brush pile edge seals, SnapLoc mounting base, and concealed fasteners. Channels to accept one-piece exposed blackout hembar to assure side light control and sill light control.
      c. Fasteners: Non-corrosive, and as recommended by shade manufacturer.

C. Motorized Roller Shades:
   1. Description: Single roller, motor operated fabric window shade system complete with mounting brackets, roller tubes, hembars, hardware, and accessories.
      a. Drop Position: Regular roll.
      b. Mounting: As indicated on Drawings.
      c. Fabric: As selected from manufacturer's full line.
2. Brackets and Mounting Hardware: As recommended by manufacturer for mounting indicated and to accommodate shade fabric roll-up size and weight.
   a. Material: Steel, 1/8 inch thick.
      1) Light-Filtering Fabric: Room-side of opening.
      2) Room-Darkening Fabric: Glass-side of opening.
   c. Multiple Shade Operation: Provide hardware as necessary to operate more than one shade using a single motor.

3. Roller Tubes:
   b. Ingress Protection Rating: At natatorium and other wet locations, provide roller tube assemblies with minimum IP44 rating according to International Electrotechnical Commission (IEC) rating requirements; protected from tools and small wires greater than 1 mm, and protected from water spray from any direction.
   c. Size: As recommended by manufacturer; selected for suitability for installation conditions, span, and weight of shades.
   d. Fabric Attachment: Utilize extruded channel in tube to accept vinyl spline welded to fabric edge. Shade band to be removable and replaceable without removing roller tube from brackets or inserting spline from the side of the roller tube.

4. Hembars: Designed to maintain bottom of shade straight and flat.

5. Intelligent Encoded Electronic Drive System:
   a. Line Voltage EDU (120 VAC):
      1) Audible Noise: 46 dBA or less measured 3 feet from the motor unit, depending on motor torque.
   b. Modes of Operation:
      1) Uniform Mode: Allows for shades to move only to defined intermediate stop positions in order to maintain aesthetic uniformity.
      2) Normal Mode: Allows for shades to move to defined intermediate stop positions plus any position between defined upper and lower limits.
      3) Maintenance Mode: Prevents shade from moving to newly commanded positions via dry contact or network control commands until EDU has been serviced and/or Maintenance Mode has been cleared/disabled.
   c. Control Methods: Support both local isolated dry contact input and network control.
      1) Local isolated dry contact inputs support local switch control and third party system integration without separate interface.
      2) Bi-directional network communication enables commanding the operation of large groups of shades over a common backbone.
      3) Provide a minimum of three customizable preset positions accessible over the local dry contact control inputs and over the network connection.
      4) Provide a minimum of 32 customizable preset positions (including the three local switch presets) accessible via network commands.

6. Accessories:
   a. Fascias: Size as required to conceal shade mounting.
      1) Style A: Surface mounted as selected by Architect from shade manufacturer’s full selection.
      2) Style B: Special or custom trim pocket with bottom edge that functions as ceiling trim aligned with ceiling plane as detailed on Drawings.
      3) Material and Color: To match shade.
   b. Room-Darkening Channels, Standard: Extruded aluminum side and center channels with brush pile edge seals, SnapLoc mounting base, and concealed fasteners. Channels to accept one-piece exposed blackout hembar to assure side light control and sill light control.
   c. Fasteners: Non-corrosive, and as recommended by shade manufacturer.
2.03 SHADE FABRIC
A. Fabric: Non-flammable, color-fast, impervious to heat and moisture, and able to retain its shape under normal operation.
   1. Acceptable Manufacturers:
      e. Substitutions: See Section 01 6000 - Product Requirements.
   2. Material: 100 percent polyester.
   3. Performance Requirements:
      a. Flammability: Pass NFPA 701 large and small tests.
      b. Fungal Resistance: No growth when tested according to ASTM G21.
   4. Openness Factor: 3 percent openness; as selected by Architect from manufacturer's full line.
   5. Roll Width: 72 inches.
   6. Color: As selected by Architect from manufacturer's full range of colors.
   7. Fabrication:
      a. Fabric Orientation: Railroaded, fabric is turned 90 degrees off the roll.
      b. If height of opening requires multiple panels of railroaded fabric, use battens at seams.

2.04 MOTOR CONTROLS
A. Unless specifically indicated to be excluded, provide all required equipment, conduit, boxes, wiring, connectors, hardware, supports, accessories, software, system programming, etc. as necessary for a complete operating system that provides the control intent indicated.
B. Provide all components and connections necessary to interface with other systems as indicated.
C. Manual Controls:
   1. Control Functions:
      a. Open: Automatically open controlled shade(s) to fully open position when button is pressed.
      b. Close: Automatically close controlled shade(s) to fully closed position when button is pressed.
      c. Raise: Raise controlled shade(s) only while button is pressed.
      d. Lower: Lower controlled shade(s) only while button is pressed.
      e. Presets: For selection of predetermined shade positions.
      f. Multiple Shade Groups: Provide individual controls for each shade group as indicated.
   2. Wall Controls: Provided by shade manufacturer.
      a. Finish: To be selected by Architect.
      b. Button Engraving: Manufacturer's standard engraving, unless otherwise indicated.
   3. Handheld Remote Controls: Battery-powered; wireless (radio frequency) or infrared; provided by shade manufacturer.
      b. Finish: Manufacturer's standard finish, unless otherwise indicated.

2.05 ROLLER SHADE FABRICATION
A. Field measure finished openings prior to ordering or fabrication.
B. Dimensional Tolerances: Fabricate shades to fit openings within specified tolerances.
   1. Vertical Dimensions: Fill openings from head to sill with 1/2 inch space between bottom bar and window stool.
   2. Horizontal Dimensions - Inside Mounting: Fill openings from jamb to jamb.
   3. Horizontal Dimensions - Outside Mounting: Cover window frames, trim, and casings completely.
C. At openings requiring continuous multiple shade units with separate rollers, locate roller joints at window mullion centers; butt rollers end-to-end.
PART 3  EXECUTION

3.01  EXAMINATION
A. Examine finished openings for deficiencies that may preclude satisfactory installation.
B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
C. Start of installation shall be considered acceptance of substrates.

3.02  PREPARATION
A. Prepare surfaces using methods recommended by manufacturer for achieving best result for substrate under the project conditions.

3.03  INSTALLATION
A. Install in accordance with manufacturer's instructions and approved shop drawings, using mounting devices as indicated.
B. Replace shades that exceed specified dimensional tolerances at no extra cost to Owner.
C. Adjust level, projection, and shade centering from mounting bracket. Verify there is no telescoping of shade fabric. Ensure smooth shade operation.

3.04  SYSTEM STARTUP
A. Motorized Shade System: Provide services of a manufacturer's authorized representative to perform system startup.

3.05  CLEANING
A. Clean soiled shades and exposed components as recommended by manufacturer.
B. Replace shades that cannot be cleaned to "like new" condition.

3.06  CLOSEOUT ACTIVITIES
A. See Section 01 7900 - Demonstration and Training, for additional requirements.
B. Demonstration: Demonstrate operation and maintenance of window shade system to Owner's personnel.
C. Training: Train Owner's personnel on operation and maintenance of system.
   1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
   2. Provide minimum of two hours training by manufacturer's authorized personnel at location designated by the Owner.

3.07  PROTECTION
A. Protect installed products from subsequent construction operations.
B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION
SECTION 12 3600
COUNTERTOPS AND BENCH TOPS

PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Countertops for architectural wood casework.
   B. Wall-hung counters and vanity tops.
   C. Window sills and other horizontal surfaces.

1.02 REFERENCE STANDARDS
   B. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards.
   C. ISFA 3-01 - Classification and Standards for Quartz Surfacing Material.
   D. MIA (DSDM) - Dimensional Stone Design Manual.
   E. NEMA LD 3 - High-Pressure Decorative Laminates.
   F. PS 1 - Structural Plywood.

1.03 ADMINISTRATIVE REQUIREMENTS
   A. Coordination:
      1. Coordinate sizing and configuration of countertops with associated casework and adjacent construction.
      2. Coordinate sizing and locations of cutouts for plumbing fixtures with base cabinet configurations for proper alignments as indicated on Drawings.

1.04 SUBMITTALS
   A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
   B. 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. Specimen warranty.
   C. Shop Drawings: Complete details of materials and installation; combine with shop drawings of cabinets and casework specified in other Sections.
   D. Verification Samples: For each finish product specified, minimum size 6 inches square, representing actual product, color, and patterns.
   E. Test Reports: Chemical resistance testing, showing compliance with specified requirements.
   F. Installation Instructions: Manufacturer's installation instructions and recommendations.
   G. Maintenance Data: Manufacturer's instructions and recommendations for maintenance and repair of countertop surfaces.

1.05 QUALITY ASSURANCE
   A. Installer Qualifications: Company specializing in performing work of the type specified in this Section, with not less than three years of documented experience.

1.06 MOCK-UP
   A. Comply with general mock-up requirements specified in Section 01 4000.
B. Mock-Up: Full size mock-up of each specified counter top and horizontal surface type, in conjunction with complete base unit.
   1. Locate where directed.
   2. Mock up may remain as part of the work.

1.07 DELIVERY, STORAGE, AND HANDLING
A. Store products in manufacturer's unopened packaging until ready for installation.
B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.08 FIELD 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 absolute limits.

PART 2 PRODUCTS

2.01 COUNTERTOPS
A. Plastic Laminate Countertops: High-pressure decorative laminate (HPDL) sheet bonded to substrate.
   1. Laminate Sheet: NEMA LD 3, Grade HGS, 0.048 inch nominal thickness.
      a. Acceptable Manufacturers: As specified on Drawings.
   2. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
   3. Wear Resistance: In addition to specified grade, comply with NEMA LD 3 High Wear Grade requirements for wear resistance.
   4. Finish: Matte or suede, gloss rating of 5 to 20.
   5. Exposed Edge Treatment: Square, substrate built up to minimum 1-1/4 inch thick; covered with matching laminate.
   6. Colors and Patterns: As scheduled on Drawings.
   7. Back and End Splashes: Same material, same construction; minimum 4 inches high.
   8. Fabricate in accordance with AWI/AWMAC/WI (AWS), Section 11 - Countertops, Custom Grade.
B. Natural Quartz and Resin Composite Countertops: Sheet or slab of natural quartz and plastic resin over continuous substrate.
   1. Flat Sheet Thickness: 1-1/4 inch, minimum.
   2. Natural Quartz and Resin Composite Sheets, Slabs and Castings: Complying with ISFA 3-01 and NEMA LD 3; orthophthalic polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
      a. Acceptable Manufacturers: As specified on Drawings.
   3. Factory fabricate components to the greatest extent practical in sizes and shapes indicated; comply with the MIA Dimension Stone Design Manual.
   4. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
   6. Colors and Patterns: As scheduled on Drawings.
   7. Exposed Edge Treatment: Built up to minimum 1-1/4 inch thick; edge profile as indicated on Drawings.
   8. Back and End Splashes: Same sheet material, square top; minimum 4 inches high.
   9. Fabricate in accordance with AWI/AWMAC/WI (AWS), Section 11 - Countertops, Premium Grade.

2.02 MATERIALS
A. Plywood for Supporting Substrate: PS 1 Exterior Grade, A-C veneer grade, minimum 5-ply; minimum 3/4 inch thick; join lengths using metal splines.
B. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.
C. Joint Sealant: Mildew-resistant silicone sealant, clear color.
2.03 FABRICATION

A. General: Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.
   1. Join lengths of tops using best method recommended by manufacturer.
   2. Fabricate to overhang fronts and ends of cabinets 1 inch except where top butts against cabinet or wall.
   3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.

B. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.
   1. Secure to walls with contact surfaces set in waterproof adhesive.
   2. Height: 4 inches, unless otherwise indicated.

C. Solid Surfacing and Composite Countertops: Fabricate tops up to 144 inches long in one piece; join pieces with adhesive sealant in accordance with manufacturer's recommendations and instructions.

D. Countertop Seams: Arrange seams symmetrically or in orderly locations, minimum 12 inches from edges of sink and similar cutouts.

E. Wall-Mounted Countertops: Provide skirts, aprons, brackets, and braces as indicated on Drawings, finished to match.
   1. Support Brackets: Tempered, fabricated steel brackets designed for surface or flush mounting as indicated; sizes and configurations as indicated.
   2. Acceptable Product:
      b. Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 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.

C. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.

B. Attach plastic laminate countertops using screws with minimum penetration into substrate board of 5/8 inch.

C. Seal joint between back/end splashes and vertical surfaces.

3.04 TOLERANCES

A. Variation From Horizontal: 1/8 inch in 10 feet, maximum.

B. Offset From Wall, Countertops: 1/8 inch maximum; 1/16 inch minimum.

C. Field Joints: 1/8 inch wide, maximum.

3.05 CLEANING

A. Clean countertops surfaces thoroughly.
3.06 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION
SECTION 12 4813
ENTRANCE FLOOR MATS AND FRAMES

PART 1 GENERAL
1.01 SECTION INCLUDES
   A. Carpet link mat.
   B. Recessed mat frames.

1.02 SUBMITTALS
   A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
   B. Product Data: Provide data indicating properties of walk-off surface, component dimensions and recessed frame characteristics.
   C. Shop Drawings: Indicate dimensions and details for recessed frame.
      1. For recessed frames located within a dimensionally restricted area, show dimensions of space within which the frame will be installed.

PART 2 PRODUCTS
2.01 MANUFACTURERS
   A. Acceptable Manufacturer:
      2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 ENTRANCE MATS
   A. Link Mat: Extruded aluminum links fastened with 11 gage galvanized spring steel wire; heavy-duty carpet inset; overall size as indicated on Drawings, 1-1/2 inch thick; shallow pit recessed frame; color as selected from manufacturer's full range of available colors.
   B. Recessed Frame: 1/2 inch thick extruded aluminum exposed top strip, 2-3/4 inch deep, with anchoring features.

2.03 FABRICATION
   A. Construct recessed mat frames square, tight joints at corners, rigid. Coat surfaces with protective coating where in contact with cementitious materials.
   B. Fabricate mats in single unit sizes; fabricate multiple mats where indicated on drawings.

PART 3 EXECUTION
3.01 EXAMINATION
   A. Verify that floor opening for mats are ready to receive work.

3.02 PREPARATION
   A. Mats: Verify size of floor recess before fabricating mats.
   B. Vacuum clean floor recess.

3.03 INSTALLATION
   A. Install frames to achieve flush plane with finished floor surface.
   B. Install walk-off surface in floor recess flush with finish floor after cleaning of finish flooring.
3.04 TOLERANCES

A. Maximum Gap Formed at Recessed Frame From Mat Size: 1/8 inch.

END OF SECTION
SECTION 13 1113
POOL GENERAL

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Project administrative requirements that relate to Division 13 11 Pools.

1.02 RELATED DOCUMENTS
A. Drawings and Contracting Requirements, including General and Supplementary Conditions and Division 01 General Requirements, apply to this Section.

B. The following contain requirements that relate in Division 13 11:
   1. Mechanical/Electrical/Equipment Coordination: General Conditions, Supplementary General Conditions and Division 01 General Requirements
   2. Earth Work and Pool Excavation: Division 31
   3. Concrete Deck Work: Division 03
   4. Mechanical: Plumbing Systems - Division 22, HVAC Systems and Equipment - Division 23
   5. Electrical: Division 26

C. Applicable requirements of the following Codes and Standards apply to Work in Division 13 11:
   1. Association of Pool and Spa Professionals (APSP)
      a. Minimum Standard for Public Swimming Pools
   2. National Electrical Code (NEC)
   3. National Sanitation Foundation (NSF): Seal of Approval Program
   5. Governmental Health and Building Codes
   6. ADA Accessibility Guidelines for Buildings and Facilities
   7. American National Standards Institute

1.03 REFERENCES
A. Refer to individual Division 13 11 sections.

1.04 DESCRIPTION OF WORK
A. Work of Division 13 11 includes, but is not limited to, the following:
   1. Layout of all pool(s) and pool related work required under Division 13 11.
   2. Project benchmarks and control points.
   3. Excavation and stone fill as required for pool tank structure and pipe trenching. Refer to Division 01 and 31 for special conditions.
   4. Pool vessels, as detailed on Contract Drawings and Shop Drawings.
   5. Pool mechanical systems, including piping, recirculation system, filtration system, activity mechanical systems and water chemical treatment system.
   6. Heating system for swimming pool. Coordinate venting and interlocking for pool heater(s) with HVAC Contractor.
   7. Waterslide and water activity mechanical systems including all piping.
   8. Interior pool finishes.
   9. Pool deck equipment and accessory equipment shown and/or specified, including required anchors embedded within the pool deck and coordination with Deck Contractor.
   10. Coordination of all electrical interlocks for pool and pool related equipment.
   11. Miscellaneous pool testing, safety and control equipment.
   12. Low voltage wiring for pool and pool related equipment is installed and connected by the Swimming Pool Contractor unless required otherwise by code. Where code requires that low voltage wiring is installed by a licensed electrical contractor, low voltage wiring is specified in Electrical Documents.

B. Definitions
   1. The term "pool" as used in Division 13 11 shall refer to the following:
      a. Pool A – Lifestyle Pool
      b. Pool B – Lap Pool
2. The term "concrete" as used in Division 13 11 refers to concrete for swimming pool construction only.
3. The term "Architect/Engineer" as used in Division 13 11 refers to the swimming pool designer only.
4. The term "Contractor" as used in Division 13 11 refers to the swimming pool contractor only.
5. The term "Low Voltage Wiring" as used in Division 13 11 includes wiring <= 24V. All Low Voltage Wiring is Provided with the Equipment. Low voltage wiring is shown in Low Voltage Wiring Diagram included in the pool drawings except where specified by Electrical Consultant.
6. The term "Control Wiring" as used in Division 13 11 refers to connections from individual equipment components to the Building Management System (BMS).

C. Applicable Code, Permit, and Inspection Responsibilities.
1. State and/or County Health Department permit fees by Owner.
2. Local Departments of Health inspection fees by Contractor.
3. Other permits/fees required paid by Contractor.
4. Scheduling of Required Inspections – Contractor
5. Documentation and Submission of accepted modifications to approved plans to Permit Authorities – Contractor.

D. Related Work Not in Division 13 11 Specified Elsewhere
1. Pool deck construction, including finishes, sealants, and drains.
2. Potable water or fresh water: Fresh water connection to auto fill and waste water connections (see Contract Drawings).
3. Pool electrical work: Electrical connections shall be by the General Construction Contract Electrical Sub-Contractor. The Pool Contractor shall provide the filter pumps, motors, solenoids, relays, water level probes (with housing), motorized valves, etc., as shown on Contract Drawings and required by pool systems equipment manufacturer. The Electrical Contractor shall install and wire electrical equipment furnished by the Pool Contractor and shall provide motor starters and disconnect switches as indicated or required by Codes. The Electrical Contractor shall provide grounding and bonding per NEC Article 680.
4. Control Wiring for all electrical and HVAC equipment shall be by the control system sub-contractor.
5. Heating system for pools, heater by the Pool Contractor; venting and controls by Division 23.
6. Surge Tank Ventilation System
   a. All surge tank ventilation, plumbing, and equipment shall be purchased and installed by the General Construction Contract Mechanical Sub-Contractor.
   b. All plumbing shall be Schedule 40 PVC.
   c. Exhaust fan shall be of non-corrosive materials, Plastec 20 model PLA 20, or equal.
   d. Pool Contractor to coordinate surge tank penetrations with Mechanical Contractor.
   e. The Electrical Contractor shall provide all wiring, bonding, and grounding per NEC Article 680.

1.05 QUALITY ASSURANCE

A. Qualifications of Pool Contractor:
1. Work of Division 13 11 shall be performed by a Pool Contractor who has a minimum of five (5) projects with a proven five (5) year record of competence and experience in the construction of similar facilities of this size and complexity.
2. Pool Contractor prequalification is required prior to bid. This must be received by the Architect fourteen (14) days prior to the bid date on the appropriate AIA form. (AIA A305)
3. Pool Contractor shall meet all Local and State Certifications and License requirements prior to bidding. Copies of the required Certificates and Licenses shall be made available upon request.

B. Performance Criteria: Certain sections of Division 13 11 contain performance criteria rather than product descriptions. It shall be the obligation of the Pool Contractor to ensure that all criteria are satisfied and the burden of proof of conformance shall rest with the Pool Contractor. The Architect/Engineer shall require complete calculations, past performance records and, if required, inspection trips of similar facilities to substantiate conformance with these criteria. The Architect/Engineer shall be sole judge of conformance, and the Pool Contractor is cautioned that he will be required to provide a finished product meeting all stated criteria and meeting or exceeding Department of Public Health requirements.

C. All work of Division 13 11 shall be performed by the qualified Pool Contractor or a Subcontractor to the qualified Pool Contractor unless otherwise pre-approved in writing by the Architect/Engineer. A representative of the Pool Contractor shall oversee work subcontracted by the Pool Contractor.
D. The following shall be performed during construction of the project.
   1. Refer to General Conditions, Division 01, and other Division 13 11 sections for further requirements.

1.06 SUBMITTALS

A. Submittals Required
   1. Refer to General Conditions, Division 01, and individual Division 13 11 sections for number required.
   2. The Contractor shall submit for approval to the Architect/Engineer complete lists, including descriptions, catalogs, product cut sheets, etc., and where applicable dimensioned shop drawings of all material, fixtures and equipment to be furnished and installed as part of Division 13 11.
   3. Submittals shall adequately and completely describe the equipment, including where necessary or requested complete construction and installation dimensions, complete capacity and performance data, all accessories and auxiliary equipment and all pertinent details of manufacture.
   4. Submittals shall be provided complete and bound in a 3-ring binder or as pre-approved by Architect/Engineer.
      a. Contractor's Option – In lieu of paper copies indicated above, submit in Adobe PDF electronic file format via email file size (10 MB max.). Create PDFs at native size and right-side up; illegible, partial, unlabeled or unorganized submittal sections will be returned rejected. Contractor shall make their own copies from the original returned by the Architect.

B. Product Data: Provide manufacturer's/installer's written installation instructions.

C. Shop Drawings
   1. The drawings accompanying this Specification are diagrammatic in nature and show the general arrangement of all equipment, piping, ductwork, services, etc. Because of the small scale of the drawings, it is not possible to show all offsets, fittings and accessories that may be required. The Contractor shall carefully investigate the structural and finish conditions of his work and shall arrange such work accordingly; furnishing all fittings, pipe and accessories that may be required to meet such conditions. Where conditions necessitate a rearrangement, the Contractor shall obtain the Architect/Engineer's approval.
   2. Shop drawings for equipment shall be submitted, and Engineer's review of shop drawing shall be obtained before proceeding with fabrication. Shop drawings shall not be "doctored" reproductions of Architect/Engineer's drawings.

D. Samples: Submit samples of materials, finishes, and trim as requested by the Architect/Engineer.

E. Schedule of Values
   1. Provide Architect/Engineer with a copy of the Schedule of Values developed for this project relevant to Division 13 11 for approval.

F. Valve Charts: Submit two (2) copies of valve charts for each piping system, consisting of Isometric Drawings or piping layouts showing and identifying each valve and describing its function to the Architect/Engineer for approval.
   1. Upon completion of the Work, one (1) copy of each chart sealed to rigid backboard with clear lacquer placed under glass and framed, shall be hung in a conspicuous location in the equipment room.

G. Furnish to the Architect/Engineer the following:
   1. Refer to individual Division 13 11 sections for additional requirements.
   2. Submittals
      a. Shotcrete Nozzle Man Qualifications and Certifications
      b. Pool Finish Experience/Qualification Requirements
      c. Concrete Mix Design
      d. Non-shrink Grouts
      e. PVC and Pre-formed Plastic Adhesive Waterstop
      f. Expansion/Construction Joint Materials
      g. Caulking/Sealants
      h. Pumps and Strainers
      i. Heater(s)
      j. Chemical Controller(s)
      k. Chemical Feeders
      l. Bulk Chemical Storage Tanks
      m. Valves
n. Gauges
o. Flow Meters
p. Thermometers
q. Pool Water Test Kit
r. Inlets
s. Grating
t. Pre-fabricated Submerged Outlets
u. Under Water Pool Lighting
v. Deck Equipment
w. Safety Equipment
x. Maintenance Equipment
y. Piping Materials (pipe, fittings, solvents, cements)
z. Wall Sleeves and Seals for Piping
aa. Tile Setting Materials and Joint Fillers

3. Shop Drawings
   a. Reinforcing Steel
   b. Water Activities
   c. Filters
d. Stainless Steel Gutter
e. Precast Pool Coping Stone
f. UV Disinfection System
g. Concrete Pump Pit & Surge Tank Penetration Drawings

4. Test Results
   a. Water Treatment Analysis
   b. Compaction
c. Piping Pressure Testing

5. Samples
   a. Special Aggregate – Factory and Field Applied
   b. Tile
c. Gratings

6. Guarantees/Warranties
   a. Standard 1-Year
   b. Standard 5-Year on Quartz Aggregate Finish
c. Standard 2-Year on Pool Finish Application
d. Special Equipment – Standard Manufacturer’s Warranty
e. Future 3-Days of Instruction and Operational Checkout

7. Close Out Documents
   a. O & M Manuals
   b. Record Drawings
   c. Owner’s Certification of Instruction
d. Extra Materials

1.07 SUBSTITUTIONS

A. Refer to General Requirements and Division 01.

B. Along with the Shop Drawings, the Contractor shall submit, in duplicate, a certificate properly attested, stating the material, equipment, and construction comply with the requirements of the Contract Documents, for all equipment and materials proposed as a Substitute for the specified equipment and materials.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Refer to General Requirements and Division 01 of the Specifications for additional requirements.

B. Deliver all materials and equipment to the work site in original packages, fully identified with manufacturer’s label. Store off ground and protect from weather with a suitable covering.

C. Protect plastic pipe from exposure to chemicals (aromatic hydrocarbons, halogenated hydrocarbons and other esters and ketones) that might attack the material. Protect all pipes from mechanical damage and long exposure to sunlight during storage.
1.09 Warranties

A. Warranty: Provide one (1) year warranty covering all pool workmanship, materials, and equipment. Refer to General Requirements and Division 01 of the Specifications for additional requirements.

B. All standard manufacturer’s warranties shall apply to all equipment and products provided by this Contractor.

PART 2 PRODUCTS

2.01 NOT USED

PART 3 EXECUTION

3.01 EQUIPMENT BASES AND SUPPORTS

A. Provide for major equipment, reinforced concrete housekeeping bases poured directly on structural floor slabs (or as required by equipment manufacturer) 4 inches thick minimum; unless noted otherwise on plans, extended 4 inches beyond machinery bedplates. Provide templates, anchor bolts, vibration isolators, and accessories required for mounting and anchoring equipment. Anchorage system shall be in accordance with the equipment manufacturer’s specifications and local code requirements. Consult with equipment manufacturer for length and installation of anchor bolts.

3.02 CLEAN UP AND PROTECTION

A. After work of Division 13 11 has been completed, cleanup work areas and remove all equipment, excess materials, and debris. Protect pool from damage until substantial completion. Remove and replace equipment and finishes that are chipped, cracked, abraded, improperly adhered, or otherwise damaged.

B. At turnover to Owner, Contractor shall be responsible for, but not limited to, the following:
   1. Vacuuming and cleaning all pool floors, steps and walls.
   2. Cleaning all depth marker tiles, pool tile and gutter grating.
   3. Cleaning and waxing of all pool deck equipment, water features and stainless steel products per Manufacturer’s instructions.
   4. See also Division 01 Specification requirements.

END OF SECTION
SECTION 13 1114
POOL START-UP, MAINTENANCE & OPERATIONS TRAINING

PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Pool start-up and chemical balancing of water.
   B. Training of the Owner’s personnel in pool operations procedures.

1.02 RELATED DOCUMENTS
   A. Drawings and Contracting Requirements, including General and Supplementary Conditions and Division 01 - General Requirements, apply to this Section.

1.03 DESCRIPTION OF WORK
   A. Water treatment and balancing.
   B. Operations and maintenance instruction and manuals.

1.04 SUBMITTALS
   A. Operations and Maintenance (O&M) Manual
      1. Pool Contractor shall deliver to the Architect/Engineer water sample location, analysis test results, SI calculation, and chemical adjustment calculations as required per Part 3.02.
      2. Pool Contractor shall deliver to the Architect/Engineer, bound together in a three-ring binder a complete manual, four (4) complete sets of operating and maintenance instructions for the swimming pool structure(s), finishes, and all component equipment. O&M Manual shall include, but is not limited to, the following:
         a. Table of contents.
         b. All equipment cut sheets.
         c. Accurate parts lists.
         d. Pool start-up, emptying, and winterization instructions.
         e. Pool cleaning instructions.
         f. Pool maintenance requirements, divided into the following:
            1) Daily
            2) Weekly
            3) Monthly
            4) Seasonally
            5) Annually
         g. Narrative on the pool operation through all sequences.
         h. A DVD of complete start-up and shut-down procedures and training session.
         i. Trouble shooting information and procedures.
         j. A schematic of piping as installed.
         k. Valve charts for each piping system, consisting of isometric drawings or piping layouts showing and identifying each valve and describing its function.
         l. Copy of Measurement Certification of Permanent Racing Course
         m. Record Drawings
         n. Warranties
PART 2 MATERIALS
2.01 NOT USED

PART 3 EXECUTION
3.01 OPERATIONS & MAINTENANCE INSTRUCTION
A. Provide an experienced swimming pool operator-instructor (NSPF Certified Pool Operator, or equivalent certification) for a period of not less than three (3) days (two (2) full days operations and start-up, and one (1) full day shut-down assistance) after the pool has been filled and initially placed into operation.
   1. During this period, the Owner's designated representative(s) shall be thoroughly instructed in all phases of the pool's operation, including start-up, and emptying procedures.
   2. Prior to this instructor leaving the Site, instructor shall obtain written certification from the Owner's designated representative acknowledging that the instruction period has been completed and all necessary operating information provided.
B. Include the cost of three (3) additional days of instruction and operational checkout/verification by an experienced swimming pool operator-instructor during the first year's operation. Written reports of each of these three (3) visits outlining the pool's operation, competence and performance of the pool's operating personnel and other pertinent comments shall be submitted to the Owner and Architect/Engineer within one week after each visit.
C. Provide a DVD documenting training and operational requirements, including start-up, and emptying procedures.
D. In addition to initial pool instruction listed, the Pool Contractor shall provide the Owner with unit price for complete start-up and pool closing services, including all labor and materials required.

3.02 WATER TREATMENT AND BALANCING
A. Obtain a chemical analysis of the source/pool make-up water supply from a location as close as possible to the actual pool autofill. Conduct laboratory testing for the following parameters:
   1. Total Alkalinity [Parts per Million (ppm)]
   2. pH
   3. Calcium Hardness [ppm]
   5. Total Dissolved Solids (TDS) [ppm]
   6. Iron (Must test to a lower detectable limit of <=0.05 ppm)
   7. Manganese (Must test to a lower detectable limit of <=0.01 ppm)
   8. Copper (Must test to a lower detectable limit of <=0.1 ppm)
B. The following are ideal ranges for the water analysis test results. If results fall outside these ranges the Contractor shall make chemical adjustments to the water during the pool filling process until values within the ideal ranges are obtained.
   1. Total Alkalinity: 80-100 ppm (for high pH disinfectants) 100-120 ppm (for low pH disinfectants)
   2. pH: 7.4-7.6
   3. Calcium Hardness: 200-400 ppm (Pools), 150-250 ppm (Spas)
   4. Free Chlorine: 2.0-4.0 ppm & Combined Chlorine: 0.0-0.2 ppm
   5. Total Dissolved Solids: Acceptable Start-up Range is not applicable (Maintain future TDS levels to within 1200 ppm above the start-up measurement)
   6. Temperature: Ideal Range is ±2 degrees F from the desired pool operating water temperature.
   7. Iron: <=0.05 ppm
   8. Manganese: <=0.01 ppm
   9. Copper: <=0.1 ppm
C. Contractor shall calculate the Langlier Saturation Index (LSI) using values from the water analysis. The formula for LSI is shown below. Calculations may be made easier using through use of Orenda Technologies Mobil App, or a similar calculator. The LSI values shall fall within an acceptable "balanced" range of -0.3 to +0.3. If the LSI is outside this range OR test values are outside the ideal range listed above, the Pool Contractor shall prepare to add chemicals to the pool water volume as required until all parameters are within the ideal ranges previously listed, and the LSI is considered "balanced", Contractor is
responsible for calculating required chemical additions and for adding all adjustment chemicals up until the time of project completion. Owner is responsible for providing the chemicals.

**LSI Equation:**

\[
(pH) + (\text{Temperature} ^{\circ} F) + (\text{Calcium Hardness}) + [(\text{Total Alkalinity}) - (\text{CYA correction factor @ current pH})] - (\text{TDS factor}) = \text{LSI}
\]

<table>
<thead>
<tr>
<th>Temperature (°F)</th>
<th>Temperature Factor</th>
<th>Calcium Hardness (PPM)</th>
<th>Calcium Hardness Factor</th>
<th>Alkalinity (PPM)</th>
<th>Alkalinity Factor</th>
<th>Cyanuric Acid (if present)</th>
<th>Cyanurate Correction Factor</th>
<th>Total Dissolved Solids</th>
<th>TDS Factor</th>
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<tr>
<td>32</td>
<td>0.0</td>
<td>5</td>
<td>0.3</td>
<td>5</td>
<td>0.7</td>
<td>pH Factor</td>
<td></td>
<td>&lt;1000 ppm</td>
<td>12.10</td>
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<td>37</td>
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<td>25</td>
<td>1.0</td>
<td>25</td>
<td>1.4</td>
<td>7.0</td>
<td>0.23</td>
<td>1000 ppm</td>
<td>12.19</td>
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<td>0.2</td>
<td>50</td>
<td>1.3</td>
<td>50</td>
<td>1.7</td>
<td>7.2</td>
<td>0.27</td>
<td>2000 ppm</td>
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<td>75</td>
<td>1.5</td>
<td>75</td>
<td>1.9</td>
<td>7.4</td>
<td>0.31</td>
<td>3000 ppm</td>
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<td>100</td>
<td>1.6</td>
<td>100</td>
<td>2.0</td>
<td>7.6</td>
<td>0.33</td>
<td>4000 ppm</td>
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<td>150</td>
<td>1.8</td>
<td>150</td>
<td>2.2</td>
<td>7.8</td>
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<td>0.6</td>
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<td>1.9</td>
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<td>2.3</td>
<td>8.0</td>
<td>0.36</td>
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<tr>
<td>84</td>
<td>0.7</td>
<td>300</td>
<td>2.1</td>
<td>300</td>
<td>2.5</td>
<td>Note: Only use if CYA is used in your pool. Only applies to &gt;7.6pH. If so, select correction factor based on pool pH.</td>
<td></td>
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<tr>
<td>94</td>
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<td>400</td>
<td>2.2</td>
<td>500</td>
<td>2.6</td>
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<td></td>
<td>Note: most calculators assume 12.1 for under 1000ppm, or 12.2 for anything over 1000.</td>
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<td>2.9</td>
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</tr>
</tbody>
</table>

D. Contractor shall provide a submittal to the Engineer/Architect after receiving the water analysis. Submittal shall include the following:
1. Water sample location and analysis test results,
2. SI Calculation,
3. Chemical adjustment calculations indicating the following:
   a. Pool Volume
   b. Chemical Parameters requiring adjustment
   c. Chemicals required to make the adjustments
   d. Calculations showing amounts of each chemical addition that is required

E. Contractor shall provide list of required balancing chemicals with quantities to the Owner for purchase immediately after receiving the approved submittal from the Engineer/Architect. Owner shall be responsible for providing the pool fill water and chemicals to the Contractor for use during the pool fill and start-up process.

F. Contractor shall make chemical adjustments to the pool water during the pool startup process based on calculations provided in the approved submittal. It is critical to keep the pool water clean and balanced during the initial fill and while the pool plaster finish is curing. Follow all recommendations of the National Pool Plasterers Council for initial adjustments required during the plaster cure time. See additional requirements in Pool Finish Specification Section/s.

G. Stabilize pool water to within a range of 5 to 15 ppm maximum of cyanuric acid.

H. Heat pool water to within 5 degrees Fahrenheit of the desired pool operating temperature. Once this temperature is attained, the Pool Contractor shall enter the chemical controller settings for all chemical parameters. Do not enter chemical controller settings prior to reaching the desired pool operating temperature.

**END OF SECTION**
SECTION 13 1118
POOL CONCRETE

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Cast-in-Place Concrete to be used for pool floor and wall construction and related structures including surge/collector/balance tanks.
   2. Shotcrete alternate to pool wall construction only if Contractor's qualifications have been pre-approved by Architect/Engineer.
   3. Admixtures.
   4. Curing and Treatment Requirements.
   5. Formwork, shoring, bracing, and anchorage.
   6. Concrete reinforcement and accessories.

B. Related Sections:
   1. Applicable provisions of Division 01 – General Requirements shall govern all work under this Section

1.02 REFERENCES

A. Incorporated Guides and References:
   1. American Concrete Institute (ACI):
      a. ACI 302.1R – Guide for Concrete Floor and Slab Construction.
      c. ACI 304.2R - Placing Concrete by Pumping Methods.
      d. ACI 305R - Hot Weather Concreting.
      e. ACI 309R – Guide for the Consolidation of Concrete.
      f. ACI 347 – Guide to Formwork for Concrete.
      g. ACI SP-66 – ACI Detailing Manual.
   2. Concrete Reinforcing Steel Institute (CRSI):
      a. CRSI Manual of Standard Practice
      b. CRSI 63 – Recommended Practice for Placing Reinforcing Bars.

B. Specifications:
   1. American Concrete Institute (ACI):
      a. ACI 117 - Specifications for Tolerances for Concrete Construction and Materials.
      b. ACI 301 - Specifications for Structural Concrete.
      c. ACI 305.1 – Specification for Hot Weather Concreting.
      e. ACI 308.1 – Specification for Curing Concrete.
      f. ACI 315 - Details and Detailing of Concrete Reinforcement.
      g. ACI 318 - Building Code Requirements for Structural Concrete and Commentary.
      h. ACI 350.1 – Specification for Tightness Testing of Environmental Engineering Concrete Containment Structures
      i. ACI 506.2 – Specification for Shotcrete
   2. ASTM International (ASTM):
      a. ASTM A615 – Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
      b. ASTM C31 – Standard Practice for Making and Curing Concrete Test Specimens in the Field.
      f. ASTM C143 – Standard Test Method for Slump of Hydraulic-Cement Concrete
i. ASTM C172 – Standard Practice for Sampling Freshly Mixed Concrete.

j. ASTM C231 – Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.


m. ASTM C494 – Standard Specification for Chemical Admixtures for Concrete.


o. ASTM C672 – Standard Test Method for Scaling Resistance of Concrete Surfaces Exposed to Deicing Chemicals.


3. Corps of Engineers:
   a. CRD C-527 - Corps of Engineers Specification for Polyvinylchloride Water Stop.

4. NSF International (NSF)
   a. NSF/ANSI Standard 61 – Drinking Water System Components

1.03 SUBMITTALS

A. Submit proposed mix design of each class of concrete to Engineer/Architect not later than 10 days after Notice to Proceed or twenty-one (21) days prior to the first concrete placement, whichever comes first.

B. Submit shop drawings of reinforcing steel under provisions of Division 01 – General Requirements.
   1. Initial submittal of reinforcement shop drawings shall be complete. No partial submittals will be accepted.
   2. Indicate reinforcement sizes, spacing, locations and quantities of reinforcing steel, bending and cutting schedules, splicing, supporting and spacing devices. Include additional reinforcement for opening through concrete structures.
   3. Reinforcement placement shop drawings shall conform to ACI SP-66 providing full wall elevations.

C. Material Certificates: For each of the following, signed by the manufacturers:
   1. Cementitious materials.
   2. Admixtures.
   3. Waterstops.
   5. Expansion Joint Materials.

D. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
   1. Aggregates.
   2. Concrete Testing.
   3. Compaction.

E. Shotcrete Nozzleman Qualifications.

F. Pool Finish Experience/Qualification Requirements.

1.04 QUALITY ASSURANCE

A. Perform work in accordance with ACI 301, 305.1, and 306.1.

B. Maintain copy of ACI 301 on site.

C. Qualifications of Pool Contractor
   1. Work of this Section shall be performed by a Contractor who has a proven record of competence and experience in the construction of similar facilities of this size and complexity for not less than five (5) years. Contractors shall have an established record of reliability.

D. Qualifications of Nozzleman and Gunman.
1. Except when shotcrete is applied under a fully automated process, the quality of shotcrete depends largely on the skill of nozzleman and gunman, and the Contractor shall satisfy the Architect/Engineer that the nozzleman has had a minimum of two years’ continuous experience on shotcreting of this type of work, and that the gunman has handled the gun for a period of at least six months. The nozzleman shall show proof of good quality successful shotcreting work similar to that required for this project. Experience gained on shotcrete and ditch construction will not be considered as experience for qualifying the nozzleman.

E. Concrete Testing: The following tests shall be performed during construction of the project. Refer to General Conditions and Division 01 for further requirements.

1. Tests to measure slump, entrained air content and compressive strength shall be conducted by independent testing laboratory employed by the Contractor unless noted otherwise in front-end specifications.
   a. Provide minimum of two 6 by 12 in. cylinders or three 4 by 8 in. cylinders per 150 cubic yard or fraction thereof for each class of concrete poured each day. Comply with ACI 318 (samples secured - ASTM C172, cylinders prepared and cured - ASTM C31, and tested - ASTM C39). Identify samples moist cure at 70 degrees F for five (5) days and ship samples to laboratory.

2. Slump and Air Content Tests
   a. Perform on concrete from same batch as sampled for strength tests and whenever there is consistency of concrete. Slump tests shall be made in accordance with ASTM C143. Air content tests shall be made in accordance with ASTM C231. If measured slump or air content falls outside specified limits, check shall be made immediately on another portion of same sample. In event of second failure, concrete shall not be used in Work.

3. Compliance
   a. Average of any three (3) consecutive strength tests for each class of concrete shall be equal to or greater than specified strength, and no individual test shall fall more than 500 psi below specified strength.
   b. When tests results are below specified requirements or when tests of field cured cylinders indicate deficiencies in protection and curing, Architect/Engineer may require additional tests in accordance with ACI 318.

F. Wet Mix Process Cylinder Sample
1. Where automated wet mix equipment is used, shotcrete cylinders shall be taken from the mixer or ready-mix truck and tested in accordance with the requirements specified in this Section. Wet mix processes shall only be used with approved automated equipment.

G. Pools, surge tanks, and gutters shall have a water tightness performed per ACI 350.1. Documentation of testing and results shall be submitted for review. Refer to Water Tightness Test section of this specification.

1.05 REGULATORY REQUIREMENTS

A. Conform to requirements of local, state and federal rules and regulations applicable to Work and Project location.

1.06 ENVIRONMENTAL REQUIREMENTS

A. Cold Weather Concreting
1. Placement and curing of concrete where (1) average daily temperature for three consecutive days is less than 40 degrees F, and (2) air temperature is not greater than 50 degrees F for more than one-half of a 24-hour period from midnight to midnight shall be in accordance with ACI 306.1.

B. Hot Weather Concreting
1. Placement and curing of concrete subject to a combination of (1) rising air temperature (generally greater than 75 degrees F) and (2) wind and low relative humidity shall be in accordance with ACI 305.1.
2. Contractor shall provide plan for minimizing exposure of concrete to adverse conditions due to combinations of high air temperature, direct sunlight, drying winds, and high concrete temperature.
3. Protect concrete from rapid temperature drop.
4. Pre-wet subgrade and forms.
1.07 Warranties

A. Special 2-Year on Concrete Structure: The Pool Contractor shall guarantee for two (2) years repair of the concrete pool structure.

PART 2 PRODUCTS

2.01 FORM MATERIALS

A. Plywood Forms: Douglas Fir or Spruce-Pine-Fir species: Sound, undamaged sheets with clean true edges, exterior glue, facing material to provide finish specified.

B. Lumber: Douglas Fir or Spruce species; construction grade or better; with grade stamp clearly visible.

C. Preformed Steel Wall Forms: Minimum 16 gage thick, Vertically and horizontally matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and surface appearance.

D. Tubular Column Type: Round, spirally wound laminated fiber material; inside surface treated with release agent.

E. Form Ties for Exposed Surfaces: Plastic cone snap ties with 1-inch outside diameter by 1-inch (nominal) long cones, with no metal within 1-inch of concrete face after removal;
   1. Manufacturers:
      a. Advance Concrete Formwork, Inc.
      b. Dayton Superior.
      c. Symons - A Dayton Superior Company.
      d. Williams Form Engineering Corporation.
      e. Substitutions: As approved by Engineer/Architect.

2.02 SHOTCRETE

A. Mix Design
   1. Wet-mix design only. Dry mix, mixed at the nozzle, shall not be allowed.
   2. A proven mix design shall be used for all Shotcrete applications.
   3. In addition to cylinders, testing of shotcrete shall be done per ACI 506.2.

B. Rebound
   1. Rebound materials shall not be reused in any form for shotcrete work and shall never be worked into the construction by the nozzleman.

2.03 REINFORCING STEEL

A. Reinforcing Steel: ASTM A615, 60 ksi yield grade carbon steel deformed bars; uncoated, finish.

B. Reinforcement Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded wire fabric, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete. Supports shall have a minimum 2” concrete cover on waterside of pool concrete.

2.04 CONCRETE MATERIALS

A. Cementitious Materials
   1. Portland Cement: ASTM C150, gray color, Type I except as specified below.
   2. Fly Ash: ASTM C618, Class C.
   3. Limit cement replacement to 20%.


C. Water: ASTM C1602, clean and not detrimental to concrete.

D. Admixtures
   1. Admixtures to be used in the concrete mixture shall be submitted to the Engineer for approval as part of the mixture proportions.
   2. Admixtures containing intentionally-added chlorides, sulfides, or nitrides are not permitted.
   3. Admixtures shall be certified to NSF/ANSI 61.
5. Water Reducing Admixture: ASTM C494, Type A.
6. Retarding Admixture: ASTM C494, Type B or Type D.
7. Accelerating Admixture: ASTM C494, Type C or Type E.
8. High-Range Water-Reducing Admixture: ASTM C494, Type F.
9. Workability-Retaining Admixture: ASTM C494, Type S.
10. Shrinkage-Reducing Admixture: ASTM C494, Type S.
11. Crystalline Waterproofing Admixture: ASTM C494, Type S.
12. The amount of admixture added to the concrete shall be in accordance with the manufacturer’s recommendations.
13. Admixtures permitted shall be supplied by a single manufacturer for project.
14. Approved Manufacturers:
   a. Axim Italcementi Group.
   b. BASF Corporation
   c. Grace Construction Products.
   d. The Euclid Chemical Company.
   e. Xypex
15. Substitutions: As approved by Engineer/Architect.

2.05 ACCESSORIES

A. Pool Concrete PVC Waterstop
   1. Center bulb type, as shown on Drawings, extruded from an elastomeric plastic compound, the basic resin of which shall be polyvinyl chloride (PVC). The size shall be as shown. Specific gravity shall be approximately 1.37, and the Shore durometer Type A hardness approximately 80. No reclaimed PVC shall be used in the compound. Meet the performance requirements of CRD C-572.
   2. Waterstop shall have a constant thickness from the edge of the bulb to the outside edge. All waterstops shall have a number of parallel ribs or protrusions on each side of the center of the strip. Corrugated type or tapered waterstops are not acceptable. The minimum weight per foot for waterstop shall be 1.62 pounds for 3/8-inch by 6-inch and 2.30 pounds for 3/8-inch by 9-inch.
   3. Manufacturers and suppliers who have provided samples meeting the specified geometry and who have the specified waterstop readily available are listed below. Other products shall not be used without prior review and acceptance by the Architect/Engineer.
      a. Sika Greenstreak Waterstops, P.O. Box 7139, St. Louis, Missouri 63177, phone: (314) 225-9400 or fax: (314) 225-9854. Style 732 for the 6-inch by 3/8-inch and Style 735 for the 9-inch by 3/8-inch.
      b. BoMetals, Inc., 141 Hammond Street, Carrollton, GA. Phone 770-832-2000 or fax (770-832-2095. Style RCB638NT for the 6-inch by 3/8” and style RCB938NT for the 9-inch by 3/8”.

B. Pool Concrete Compressible Waterstop
   a. Use as illustrated in drawing details for the following:
   b. Sealing non-moving cold joints and construction joints between structural elements against penetration of water from wet-face of structure with less than 30-foot hydrostatic head.
   c. Sealing pool piping penetrations against water penetration from wet-face of structure with less than 30-foot hydrostatic head.
   1. Product Description: The product shall be a 0.59” x 0.39” compressible hydrophilic sponge rubber strip composed of vulcanized rubber and urethane polymer as the hydrophilic agent.
   2. Product & Manufacturer:
      a. Adeka KBA-1510FP waterstop, manufactured by Adeka Corporation and distributed by OCM, Inc., Chicago, IL USA.
      b. Website: www.adeka.com
      c. Physical & Swelling Property Requirements: The product shall at a minimum meet the physical properties as shown in the official Adeka literature as follows.
         d. Expansion Pressure: The product shall not produce more than 0.03MPa (4.35 psi) expansion pressure when fully hydrated.
         e. Tensile Strength: At least 0.78 MPa (113 psi),
         f. % Elongation: No greater than 350% when fully hydrated.
g. Volume (thickness) % Change: No greater than 30% volume change or increase in thickness when fully hydrated.

h. Alternative Products:
   1) General: Drawing documents have been completed using the specified Adeka waterstop product as a basis of design. Alternative compressible waterstops shall not be used without approval from Engineer/Architect. Considerations such as concrete coverage requirements and wall thicknesses must be considered when substituting alternative products. Contractor will be responsible for any structural changes required due to alternate product concrete coverage requirements.
   2) Product Requirements: Compressible waterstop alternatives may not contain bentonite materials and may not have swelling properties that exceed the specified product.
   3) Acceptable Alternative: An acceptable alternative may be Synko-Flex SF302 Preformed Plastic Adhesive Waterstop with Synko-Flex SF311 primer or equal, but it must be approved prior to use. Manufacturer: Henry Company, Houston, TX. Website: http://us.henry.com/

C. Non-Shrink Grout: Premixed compound with non-metallic aggregate, cement, water reducing and plasticizing agents; capable of minimum compressive strength of 2400 psi.
   1. Upcon High Flow, the Upco Company, Cleveland, Ohio; MasterFlow 713, BASF Corporation, Cleveland, Ohio; Crystex, L & M Construction Chemicals, Inc., Omaha, Nebraska.

D. Joint Materials:
   1. Waterstop: See Pool Concrete PVC Waterstop.
   2. Expansion Joint Dowel Sleeves: PVC or molded plastic sleeve with end cap/plug. Size sleeve to allow movement of dowel.
   3. Pre-molded Expansion Joint Filler: Multicellular, closed cell, flexible polyethylene plastic foam as manufactured by Dow Chemical Co., Midland, MI. Ethafoam expanded polyethylene closed-cell foam, W.R. Meadows, Elgin, IL, Ceramar or a pre-approved equal.
   4. Backer Rod Joint Backing Material: Closed cell, polyethylene, flexible, rope-like foam joint backing material. Material shall be fully compatible with polysulfide sealant and for use in swimming pools. Product shall be Kool-Rod as Manufactured by W.R. Meadows, Elgin, IL, or pre-approved equal.
   5. Gun Grade Sealant: Two-part polysulfide sealant and primer certified by Manufacturer as suitable for use in pools including submerged locations. “Deck-O-Seal Gun Grade” and “P/G” solvent based primer as manufactured by W.R. Meadows or equal. Color shall be white.
   6. Provide adhesive waterproof bondcoat where indicated on drawings.
      a. Impact strength: 19 lbs / 8.6 kg
      b. Compressive strength: 7050 psi / 48.61 MPa
      c. Tensile strength: 732 psi / 5.05 MPa
      d. Flexural strength: 2380 psi / 16.41 MPa
      e. Adhesive strength (concrete): 1372 psi / 9.46 MPa
      f. Shear bond adhesion: 720 psi / 4.96 MPa
      g. ASTM C321
      h. ASTM C672
      i. ASTM D4541
      j. ASTM E96
   7. Materials
      a. Basecrete or equal.
   8. Provide concrete densifier under tile pool installations and where indicated on drawings.
      a. Basecrete + or equal.

2.06 CURING AND TREATMENT MATERIALS

A. Water: Potable and clean.

B. Burlap shall be clean, evenly woven, free of encrusted concrete or other contaminating materials, and shall be reasonably free of cuts, tears, broken or missing areas.

C. Polyethylene Film: ASTM C171, 6 mil thick, clear.

D. Curing Paper: ASTM C171;
   1. Manufacturers:
b. Sabel Sisalkraft 280.
   308.1 Keep concrete slabs and walls continuously wet for a 7-day period. Intermittent wetting is not substitutions: As approved by Engineer.

2.07 CONCRETE MIXTURE

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture of field test data, or both, according to ACI 301.

B. Mix concrete in accordance with ASTM C94.

C. Concrete mix designs shall be designed and submitted in accordance with Division 01 and included as part of cost of this Work.

D. Mix designs shall be prepared by a qualified agency acceptable to Engineer/Architect. Electronic copies of mix designs shall be submitted for Engineer/Architect’s review prior to placing any concrete.

E. Mix design shall indicate brands, types, and quantities of admixtures included, compressive strength, slump, sieve analysis for fine and coarse aggregate, quantities of all ingredients, type and brand of cement, source of aggregate, whether fine aggregate is natural or manufactured.

F. Design of mix shall assure placing and finishing characteristics that meet Project requirements.

G. Mix designs contained in the Schedule of Mixes may be modified and submitted to Engineer for approval, by use of mid or high range water reducing admixtures to control slumps required for pumping of concrete. Strength, placing and finishing requirements shall be maintained.

H. Concrete mixtures shall be designed to have low shrinkage characteristics and designed to minimize slab curling.

I. Initial and final set times of concrete mix designs shall be coordinated between the contractor and concrete supplier.

2.08 SCHEDULE OF MIXES

A. Pool Structures: Proportion normal-weight concrete mix as follows:
   2. Maximum Aggregate Size: 1 inch.
   3. Maximum Slump (Inch): 3
   4. Air Entrainment: 6 percent air content is required with an acceptable air content of plus or minus 1.5 percent. Required for pool structures subject to freeze/thaw cycles.
   5. Maximum Water-Cementitious Materials Ratio: 0.45.
   6. Additional admixtures may be required as indicated on Structural Drawings.

B. Surge Tanks (Walls and Floor): Proportion normal-weight concrete mix as follows:
   3. Air Entrainment: 6 percent air content is required with an acceptable air content of plus or minus 1.5 percent. Required for tanks subject to freeze/thaw.
   4. MasterLife 300D or Xypex C-500 admixture: Provide dosage per manufacturer’s recommendations.

C. Shotcrete: Proportion normal-weight concrete mix as follows:
   2. Wet-mix design only. Dry mix, mixed at the nozzle, shall not be allowed.
   4. Air Entrainment: 6 percent air content is required with an acceptable air content of plus or minus 1.5 percent. Required for pool structures subject to freeze/thaw cycles.
   5. Additional admixtures may be required as indicated on Structural Drawings.
PART 3 EXECUTION

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

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance per ACI 117.

C. Verify lines, levels, and measurement before proceeding with formwork.

D. Earth forms are not permitted.

E. Align form joints.

F. Do not apply form release agent where concrete surfaces receive special finishes or applied coatings which may be affected by agent.

G. Coordinate work of other Sections in forming and setting openings, slots, recesses, chases, sleeves, bolts, anchors, and other inserts.

3.02 REINFORCEMENT
A. Place, support, and secure reinforcement against displacement.

B. Locate reinforcing splices as shown on Drawings.

C. Place reinforcing steel in conformance with the information on the drawings and CRSI 63 and CRSI, except as modified herein. Minimum length of splices shall be as shown in table on drawings. Tie splices with 18-gauge annealed wire as specified in the referenced CRSI standard. All tie wires shall be “made tight” for electrical bonding purposes, as required by NEC, Article 680.

3.03 WATERSTOP
A. PVC Waterstop
1. Split formwork is generally required for slab-to-slab, slab-to-wall and wall-to-wall joints where ribbed style waterstops are used. The centerline of the waterstop should be aligned with the center of the joint. The split form shall firmly hold the waterstop in position to prevent misalignment of waterstop during concrete placement. Secure waterstop with hog rings or integral wire loops prior to concrete placement. Loop tie wires through the hog ring/wire loops and tie off to adjacent reinforcing steel to prevent displacement of the waterstop during concrete placement. Fasteners through the body of the waterstop are not permitted.

2. Lapping of the waterstop is not permitted. PVC waterstop may be butt spliced in the field with Teflon coated, thermostatically controlled splicing iron. Direct exposure to a flame is not permitted. Factory fabricated fittings are recommended for ells, tees and crosses.

a. The following defects at splices will not be acceptable:
   1) Use of adhesives, solvents, or free lap joints
   2) Misalignment of center bulb greater than 1/16”
   3) Misalignment that reduces waterstop cross section area more than 15%.
   4) Bond failure at joint, deeper than 1/16” or 15% of material thickness.
   5) Combination misalignment and bond failure with net reduction of waterstop cross-section area greater than 15%.
   6) Misalignment of waterstop splice resulting in misalignment of waterstop in excess of 1/2” in 10 feet.
   7) Visible porosity in the weld joint, including pinholes
   8) Charred or burnt material
   9) Bubbles or inadequate bonding detectable with a penknife
   10) Visible signs of splice separation when cooled splices are bent at a sharp angle.
   11) Edge welding

3. Thoroughly consolidate the concrete around the waterstop to prevent voids or honeycombing next to the waterstop. Maintain adequate clearance between reinforcing steel and the waterstop. Typical
clearance should be twice the maximum aggregate size. Maintain continuity of the entire waterstop system. Properly store PVC waterstops prior to installation to prevent UV degradation.

B. Compressible Waterstop – Adeka KBA-1510FP
   1. Non-moving Joint Installation:
      a. Consult manufacturer and follow all recommended installation instructions.
      b. Allow concrete to cure a minimum of 24 hours.
      c. Concrete must be dry and free from form oils, release agents, curing compounds, laitance and other dirt or debris prior installation. Use a wire brush to remove contaminants prior to installation of waterstop.
      d. Use butyl tape to attach KBA-1510FP to a dry and clean substrate. The butyl tape comes in a 3/4" X 1/8" X 82-foot roll (1 roll per roll of KBA-1510FP). Press the butyl strip onto the substrate and remove the release paper. Press the KBA-15010FP firmly onto the butyl tape.
      e. Check for any gaps between the product and the substrate. If gaps are present, fill in using Adeka P-201 applied to the side of the strip. Use P-201 on corner joints and on side-by-side splice joints.
      f. Once installed, keep the product covered, clean, and dry prior to concrete placement. For best results, place the waterstop product immediately before pouring concrete. Check to make sure the waterstop is firmly adhered before placing concrete.
      g. During concrete placement, assure that the concrete is well consolidated around the waterstop at all locations with no voids or gaps.
   2. Penetration Installation:
      a. Consult manufacturer and follow all recommended installation instructions.
      b. Pipe must be dry and free from form oils, release agents, curing compounds, laitance, and other dirt or debris prior to installation.
      c. Press the butyl strip onto the clean pipe completely around the pipe diameter and remove the release paper. Press the KBA-15010FP firmly onto the butyl tape. Tightly butt strip ends together with 1" overlap or side lap.
      d. Once installed, keep the product covered, clean, and dry prior to concrete placement. For best results, place the waterstop product immediately before pouring concrete. Check to make sure the waterstop is firmly adhered before placing concrete.
      e. During concrete placement assure that the concrete is well consolidated around the waterstop at all locations with no voids or gaps.
   3. Alternative Products Installation:
      a. Drawing documents have been completed using the specified Adeka waterstop product as a basis of design. Alternative flexible adhesive waterstops shall not be used without approval from Engineer/Architect. See Section 2 for additional information.
      b. If Synko-Flex has been approved during the submittal process, the following installation requirements shall be met, as well as all manufacturer’s installation instructions.
         1) Allow concrete to cure a minimum of 24 hours before priming with Synko-Flex primer.
         2) Concrete must be dry and free from form oils, release agents, curing compounds, laitance and other dirt or debris prior to priming. Use a wire brush to remove contaminants prior to installation of primer.
         3) Apply Synko-Flex SF311 primer.
         4) Apply Synko-Flex SF302 Preformed Plastic Adhesive Waterstop over primed areas. Place Synko-Flex to primed areas at an approximately 5/8” thickness and approximately 1 ½” width.
         5) Tightly butt strips together with 1” overlap or side lap.

3.04 PLACING CONCRETE
   A. Notify Engineer/Architect a minimum of 48 hours prior to commencement of concreting operations.
   B. Failure to notify Engineer/Architect may result in rejection of concrete placed without observation.
   C. Place concrete in accordance with ACI 301.
   D. Place pumped concrete in accordance with ACI 304.2R. Line coating mix to initiate pumping shall not be used in pour but shall be wasted.
   E. Ensure reinforcement and embedded items are not disturbed during concrete placement.
F. Concrete with excessive honeycomb or embedded debris shall be rejected and replaced at no cost to OWNER.

G. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures and mechanical injury.

H. Placing During Hot Weather:
   1. Place concrete during hot weather conditions in accordance with ACI 305.1.

I. Placing During Cold Weather:
   1. Place concrete during cold weather conditions in accordance with ACI 306.1.

J. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

3.05 POOL WALL SHOTCRETE

A. Wet Mix Process
   1. The delivery equipment shall be of an approved design and size that has given satisfactory results in similar previous work.
   2. The equipment must be capable of discharging mixed material into the hose under close control, and it must be able to deliver a continuous smooth stream of uniformly mixed material at the proper velocity to the discharge nozzle, free from slugs of any kind.
   3. The nozzle shall be of a design and size that will ensure a smooth and uninterrupted flow of materials.
   4. Delivery equipment shall be thoroughly cleaned at the end of each shift.

B. Surface Preparation
   1. Verify forms are true to line and dimensions, adequately braced against vibration, and constructed to permit escape of air and rebound during gunning operations.
   2. Do not place shotcrete on any surface which is frozen, spongy, or where there is free standing water.

C. Alignment Control
   1. Provide alignment wires to establish thickness and plane surface.
   2. Install alignment wires at corners and offsets not established by form work.
   3. Verify alignment wires are tight, true to line, and placed to allow further tightening.

D. Application
   1. Ensure correct placement of reinforcement. Ensure sufficient clearance around reinforcement to permit complete encasement.
   2. Allow easy access to shotcrete surfaces for screeding and finishing, permitting uninterrupted application.
   3. Determine operating procedures for placement in close quarters, extended distances, or around unusual obstructions where placement velocities and mix consistency must be adjusted.
   4. In shotcreting walls, begin application at bottom. Ensure work does not sag.
   5. Hold nozzle as perpendicular to surface as work will permit, to secure maximum compaction with minimum rebound.
   6. Follow routine that will fill and completely encase reinforcement, using maximum layer thickness.
   7. Build up layers by making several passes of nozzle over work area. Completely encase reinforcement with first layer.
   8. After initial set, remove excess material outside of forms and alignment lines.
   9. Allow each layer of shotcrete to take initial set before applying succeeding layers.
  10. Remove laitance that has taken final set, by sandblasting. Clean with air-water jet.
  11. Sound work with hammer for voids. Cut out voids and replace with succeeding layers.
  12. Keep rebound, and other loose or porous material out of new construction.
  13. Remove rebound that does not fall clear to work. Discard salvaged rebound.
  14. Remove trapped rebound at construction and expansion joints.

E. Protection of adjacent surfaces
   1. Contractor shall take every possible precaution to protect adjacent concrete surfaces, equipment, etc., from being damaged by overshooting concrete. Overshot concrete and rebound materials deposited shall be removed at the Contractor's expense.
3.06 EXPANSION & CONTROL JOINTS

A. All control and expansion joints require PVC waterstop.

B. Installation of Joint Filler: At locations where joint sealant is to be applied, the pre-molded joint filler shall be installed in the joint accurately as detailed. Precut the pre-molded expansion joint filler to the required depth. Filler material shall be of sufficient width to completely fill the joint and shall be accurately cut to butt tightly against the waterstop and the side forms. Attach filler material to concrete with a bonding agent. Bonding agent shall be approved in writing by the joint sealant and joint filler manufacturer for compatibility.

C. Concrete shall be thoroughly vibrated along the joint form to produce a dense, smooth surface. Surface irregularities along the joint sealant cavity, due to improper concrete consolidation or faulty form removal, shall be repaired with an approved compound compatible with the joint sealant in a manner that is satisfactory to the sealant manufacturer.

D. All expansion and control joints require gun grade sealant. Cavities for joint sealant shall be formed with precut or pre-molded joint filler that can be removed as needed for sealant. Circular backer rod shall be used in joints as detailed to provide accurate shape for sealant.

3.07 CONSTRUCTION JOINTS

A. Construction joints shall be located as required for the contractor’s scheduling, means and methods.

B. All construction joints require waterstop.

C. Contractor shall provide a submittal showing construction joint locations and detailing for review and approval.

3.08 CURING AND TREATMENT

A. Curing shall begin promptly to prevent drying of concrete. Curing shall continue for seven (7) days after placing.

B. Provide a moist cure for a full seven (7) days in accordance with ACI 308.1. Keep concrete slabs and walls continuously wet for a 7-day period. Intermittent wetting is not acceptable. Material shall completely cover the concrete surface and shall be weighted down to prevent shifting due to wind or other factors.

3.09 REPAIR OF VERTICAL SURFACE DEFECTS

A. Upon stripping of forms, vertical surfaces shall be inspected for defects caused by surface air voids, honeycombing, form tie holes, peeling, and fins.

B. Surface air voids shall be repaired with a unit packaged mixture of sand and cement mixed on job site with water and a unit of acrylic. Mixture shall be brushed uniformly on to surface and into voids. Where surface is to be exposed, surface finish of repair shall match adjacent surface.

C. Honeycombed and other defective concrete shall be removed down to sound concrete and patched to match adjacent surfaces. Cut edges perpendicular to surface at least 1 inch deep – no feathered edges allowed.

1. Areas not subject to water shall be repaired similar to surface air voids as indicated above. A bonding agent shall be used prior to filling the holes. Patches shall be kept moist for a minimum of 7 days.

2. Areas subject to water shall be moist for a period of 24 hours prior to patching. Holes shall be filled with non-shrink grout and cured per recommendations by manufacturer. Concrete surface shall be prepared per recommendations by manufacturer.

D. Form tie holes shall be filled with non-shrink grout. Surface of concrete to prepared per recommendations by manufacturer. Grout shall be cured per recommendations by manufacturer.

3.10 FINISHING

A. Floor slabs shall not vary from level or true plane more than ¼ inch in 10 feet when measured with a straightedge. Floor slabs shall receive a broom finish to accommodate special aggregate mechanical bonding requirements.

B. After removal of forms and repair of defects, surfaces of concrete shall be given finishes specified below.
C. Rough Form Finish: Surface left with texture imparted by forms; form facing material not specified; tie holes and defects shall be patched; all fins shall be chipped or rubbed off. The surface shall be finished in such a way that will leave the surface for the substrate rough, coarse, and porous enough to ensure that subsequent application of the cementitious surface coating can achieve a good mechanical bond to the substrate similar to a broom finish.

D. Tops of walls or buttresses, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces shall be struck smooth after concrete is placed and shall be floated to a texture reasonably consistent with that of formed surface.

E. Final finish on formed surfaces shall continue uniformly across unformed surfaces.

3.11 WATER TIGHTNESS TEST

A. General
1. This test applies to the pool, the surge tank, and the gutter system. A water tightness test shall be completed on each pool, surge tank and gutter system, independently of each other, prior to the application of the pool finish.
2. The cost of the water for one initial water tightness test, and the final fill shall be borne by the Owner. Any subsequent fillings or partial fillings (more than 25%) of the pool shall be by the CONTRACTOR, at its own expense.
3. Contractor shall include and itemize these requirements in the overall construction schedule.
4. The Owner may elect to waive leak test requirements if schedule becomes a critical factor. Only the Owner may waive these requirements. If the Owner elects to waive these requirements the Contractor is still responsible for providing leak-free structures, and at a minimum, all specified applicable warranties shall apply.

B. Water Tightness Test Procedure
1. Preparation
   a. Visually examine the concrete structure and joints for potential leakage prior to fill. Contractor shall repair areas of potential leakage prior to fill.
   b. Allow the concrete structure to cure a minimum of 28 days, or as required to gain sufficient strength to withstand the test load, prior to initiating test.
   c. Securely seal all inlets/outlets and penetrations prior to fill.
   d. The test shall not be scheduled when the weather forecast indicates the water surface could freeze before the test is completed.
2. Fill
   a. Fill the pool with potable water from an approved water source, and then isolate the pool, the surge tank, and the gutter system. The water tightness test and measurement documentation shall begin after the test structure has been filled for a minimum of three (3) days to allow the concrete to absorb water and minimize absorption effects during the testing period.
   b. Fill each structure to the design maximum liquid level or 4 inches below any fixed overflow level.
   c. After the initial fill, remove ground water to a level below the bottom of the structure main drain or floor slab (below lowest concrete plane) utilizing the pool observation tube, the pool de-watering system, or the construction dewatering system. This shall be completed prior to the start of the water tightness test and maintained for the duration of the test.
   d. For elevated pools with secondary containment structure, the secondary containment structure shall be monitored for the presence of water for the duration of the test. Groundwater elevation is not a factor in these pools.
3. Evaporation/Precipitation Measurement Procedure
   a. Partially fill a floating, restrained, calibrated (known volume and surface area), open container (hereafter “container” or “control container”) with water and allow this container to float within the filled structure during the testing period. This will be used to measure total evaporation and precipitation.
   b. Mark and measure the change in container’s water level. If the container water level has gone down (evaporation), this change shall be subtracted from each structure’s water loss measurement. If the container water level has risen (rain), this change shall be added to each structure’s water loss measurement.
4. Measurement
   a. Conduct all measurements with the Architect or Owner’s representative present and document all measurements on the table below.
b. Provide an as-built drawing or sketch the pool, surge tank, and gutter identifying measurement locations and the evaporation control container’s location.

c. The water surface elevation shall be recorded to within 1/16 of an inch, measured from a fixed point on the structure above the water surface.

d. Average multiple sample locations for structures exposed to wind.

e. Repeat and record the measurements for a total of three (3) consecutive days.

<table>
<thead>
<tr>
<th>Measurement Times</th>
<th>Pool Measurements</th>
<th>Gutter System Measurements</th>
<th>Surge Tank Measurements</th>
<th>Control Container Measurements</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 Hrs.</td>
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<tr>
<td>24 Hrs.</td>
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<tr>
<td>36 Hrs.</td>
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<td>48 Hrs.</td>
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<tr>
<td>60 Hrs.</td>
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<tr>
<td>72 Hrs.</td>
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</tbody>
</table>

5. Water Leakage

   a. Calculate water leakage as follows:
      Leakage [Gallons] = \[7.481 \times \text{Structure Surface Area (SF)} \times \left( \text{Structure Loss Measurement}^{*} \text{ (FT)} - \text{Control Container Measurement} \text{ (FT)} \right)\].
         
      - Structure loss measurement is a generic term referring to Pool Measurement, Gutter System Measurement or Surge Tank Measurement independently. Calculate the leakage from the pool, gutter, and surge tank independently.

   b. Add the measurements for two consecutive 12-hour periods to obtain the total daily loss due to leakage.

   c. Record Daily losses due to leakage for Day #1, #2, and #3 in the table below.

<table>
<thead>
<tr>
<th>Total Daily Loss Due To Leakage</th>
<th>Pool Leakage</th>
<th>Gutter Leakage</th>
<th>Surge Tank Leakage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Day 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Day 3</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

6. Submittal

   a. Provide test location as-built/sketch, measurement tables, and Water Leakage calculations to Engineer in the form of a submittal for review and records.

7. Allowable Loss from Leakage

   a. The allowable leakage rate for an unlined, open concrete structure (i.e. backfilled pool, gutter, and surge tank) shall not exceed 0.1 percent of the total water volume in a 24-hour period.
      
      (Example: 0.001 x 200,000-gallon pool = 200 gallons per 24-hour period.)

   b. Elevated pools and gutters with a secondary containment vessel shall have no measurable loss; the drop in the water surface shall not exceed 1/8” over the three-day test period when adjusted for evaporation and precipitation.

8. Repair and Retest

   a. If the leakage volume calculated exceeds the “allowable loss” in section 7, Contractor shall locate and identify leakage points, repair the structure and provide documentation on the location of repaired areas.

   b. After proper curing of all repair work, re-test the water tightness of structure following the procedure specified in this section.
SECTION 13 1120
POOL PIPE AND PIPE FITTINGS

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Pipe, pipe fittings, connections, wall penetrations.

1.02 RELATED DOCUMENTS
A. Drawings and Contracting Requirements, including General and Supplementary Conditions and Division 01 - General Requirements, apply to this Section.

1.03 REFERENCES/PIPE – FITTING REQUIREMENTS
A. The following latest edition reference specifications, guides and standards shall become part of this Specification as if herein written. If provisions conflict, the more stringent provisions shall apply.
   1. ANSI/ASTM D2564 - Solvent Cements and ASTM F656 – Primers for Polyvinyl Chloride (PVC) Plastic Pipe and Fittings
   2. ASTM D2855 – Practice for Making Solvent Cemented Joints with PVC Pipe and Fittings
   5. ASTM D2467 – Socket Type PVC Plastic Pipe Fittings, Schedule 80, Injection Molded, Sizes through 12”, NSF Listed. As manufactured by Spears Manufacturing Company, “or approved equal”.
   7. ASTM B88 – Seamless Copper Water Tube
   9. ASTM D2563 – Fabricated, Fiberglass Wrapped PVC Pipe Fittings 12”, 14”, and above, Schedule 40 or 80 manufactured from PVC pipe conforming to ASTM D1785 and compliant to the most recent publication of the “Spears General Specification for Standard Fabricated Fittings (FAB-7-702)”. Butt-fusion welded fabricated fittings are not acceptable. All fittings shall be certified for potable water service by NSF. As manufactured by Spears Manufacturing Company or “approved equal”.
   10. CLASS 150 - All plastic pipe flanges shall be Class 150 and of the same schedule as the associated pipe with neoprene gaskets where required.

1.04 QUALITY ASSURANCE
A. Qualifications of Pool Contractor
   1. Work of this Section shall be performed by a Contractor who has a proven record of competence and experience in the construction of similar facilities of this size and complexity for not less than 5 years. Contractors shall have an established record of reliability.

B. The following tests shall be performed during construction of the project. Refer to General Conditions and Division 01 for further requirements.
   1. Testing and Flushing of Piping
      a. Contractor shall be responsible for discovering leaks and making necessary repairs.
         1) Pressure piping and suction piping: After the piece is laid, the joints completed and the trench partially backfilled, leaving joints exposed for examination, subject new lines to a hydrostatic pressure of not less than 50 pounds per square inch. Joints shall remain watertight under this pressure for a period of two (2) hours. All air must be expelled from pipes prior to testing.
         2) Gravity lines: A water test shall be applied to all gravity drain piping systems, either in their entirety or in sections. All openings shall be tightly plugged and each system filled with water and tested with at least a 10 foot head of water (4.3 psi). The water shall be kept in the system, or in the portion under test, for at least fifteen (15) minutes before the inspection starts. System shall be water tight at all joints.

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POOL PIPE & PIPE FITTINGS
100% Design Development
3) Leaks shall be repaired and tested repeatedly until leakage or infiltration is approved.
   b. Provide test results to the Architect/Engineer before covering with concrete.

1.05 SUBMITTALS
   A. Refer to General Requirements and Division 01.
   B. Product Data: For each type of manufactured material and product indicated.
   C. Provide Shop Drawings showing all pipe penetration locations through concrete pump pit walls and concrete surge tank walls. Include dimensioned location of pipe penetrations in plan and elevation view, pipe sizes, sleeve sizes, link-seal sizes, and sleeve and link-seal material/product information.
   D. Provide a submittal including system drain valves and location of drain valves for Owner's use during pool shut-down and/or pool winterizing.

1.06 SUBSTITUTIONS
   A. Refer to General Requirements and Division 01.

PART 2 PRODUCTS

2.01 PIPE and FITTINGS
   A. Refer to Section 1.03 for pipe and fitting requirements.
   B. Refer to pipe schedule(s) on drawings for size and type.

2.02 THREAD TAPE
   A. Teflon 2

2.03 SOLVENT CEMENTS AND PRIMERS
   A. PVC pipe shall be installed using solvent weld materials including primers, cleaners, and cements. All solvent weld materials, methods, and applicator tools shall conform to all ASTM Standards for solvent cements used for plastic pipe installations.
   B. Manufacturer: IPS Corporation, Weld-On Product Line

2.04 NOT USED

2.05 WALL SLEEVES
   A. Pipes penetrating all water tight walls shall use "Century Line" thermoplastic wall sleeves in combination with "Link Seals" having stainless steel service designation. As manufactured by Thunderline Corporation, or the Metraflex Company, "or approved equal".

2.06 NON-SHRINK GROUT
   A. Upcon High Flow, The Upco Company, Cleveland, Ohio; Masterflow 713, The Master Builder Company, Cleveland, Ohio; Crystex L & M Construction Chemicals, Inc., Omaha, Nebraska.

2.07 PIPE SIGNAGE
   A. Brady, B-946, custom legend, self-sticking markers and arrows or equal.

PART 3 EXECUTION

3.01 PIPE INSTALLATION
   A. Excavation and Backfill
      1. Excavation for all pool systems and related piping.
         a. Comply with Division 31.
      2. Special backfill and bedding materials.
         a. Existing subsoil materials shall not be used for pipe bedding.
B. Piping Placement and Use
1. Base Bid shall be on pipe materials shown. See the PL Drawings and associated schedules for required pipe material types.
2. All material transitions shall be above-grade, flange to flange connections and include ribbed EPDM type rubber gaskets. Below-grade materials transitions will not be allowed.
3. Piping must be laid on a grade so it will drain completely by gravity. In all instances where gravity drainage is not provided, the contractor shall install drain valves so that all lines can be drained completely. Shop drawings will be required on any such installation.
4. No installation shall be made that will provide a cross connection or inter-connection between distribution supply for drinking purposes and the swimming pool that will permit a backflow of water into the potable water supply. Pipe openings shall be closed with caps or plugs during installation. Equipment and pool fittings shall be tightly covered and protected against dirt, water and chemical or mechanical injury. At the completion of work the fittings, materials and equipment shall be thoroughly clean and adjusted for proper operation.
5. All gutter lines shall drain by gravity to the surge tank.
6. All above grade outdoor piping shall be painted, in accordance with the manufacturer’s recommendations, to protect against ultraviolet degradation.

C. PVC Pipe
1. Cut all pipe with mechanical cutter without damage to pipe.
2. Placing and laying: Inspect pipe for defects before installation. Clean the interior of pipe thoroughly of foreign matter and keep clean during laying operation. Pipe shall not be laid in water or when trench conditions are unstable. Water shall be kept out of the trench until the pipe is installed. When Work is not in progress, open ends of pipe and fittings shall be securely closed so that no trench water, earth or other substance will enter the pipes or fittings.
3. Threaded joints: After cutting and before threading, the pipe shall be reamed and shall have burrs removed. Screw joints shall be made with graphite or inert filler and oil or with an approved graphite compound applied to male threads only. Threads shall be full-cut and not more than 3 threads on the pipe remained exposed. Use Teflon II tape on the male threads of all threaded pipe joints. Caulking of threaded joints to stop or prevent leaks will not be permitted. Unions shall be provided where required for disconnection of exposed piping. Unions will be permitted only where access is provided.
4. All PVC pipe connections shall be flanged or solvent welded.
5. Solvent welded joints shall be made in accordance with the manufacturer’s printed instructions and the following minimum standards:
   a. All fittings shall fit easily on the pipe before applying cement. The outer surface area of pipe and inner wall of fitting shall be dry and clean. Cleaner is to be applied to the outer surface of the pipe and to the inner surface of the fitting. Cement is to be applied to the outer surface of the pipe, or on the male section of fittings only. When the outside surface area of the pipe is satisfactorily covered with cement allow ten (10) seconds open time to lapse before inserting pipe end into fittings. After full insertion of pipe into fitting, turn fitting about the pipe end approximately 1/8 to 1/4 of a turn. Wipe off excess cement at the joint in a neat cove bead. Follow manufacturer's instructions on solvents. Remove all debris, including, containers, brushes, applicators and other items from premises, dispose of properly. Burying of debris on site is not permitted.
   b. In addition to the requirements outlined above, the solvent weld process for pipe sizes of 6” diameter and larger includes additional requirements outlined below. As pipe diameter increases, so does the difficulty in installing it. Follow all of the solvent weld manufacturer's recommendations for larger diameter pipe.
      1) The installer shall use proper size applicators to ensure enough cement is applied to fill the larger gap that exists between the pipe and fittings.
      2) Use the applicable cement for the size of pipe and fittings being installed.
      3) End of pipe must be cut square and chamfered (beveled).
      4) Provide adequate crew size to properly handle and fit pipe installations.
      5) It is important in large diameter joining that the primer and cement be applied simultaneously to the pipe and fittings. Apply a second, full layer of cement to the pipe. Pipe must be bottomed into the fitting.
6) Large diameter pipe and fittings require longer set and cure times. Prefabricate as many joints as possible. If pipe is to be buried, fabricate as many joints as possible above ground, after joints have cured, carefully lower into trench.

c. All joints shall remain completely undisturbed for a minimum of 10 minutes from time of jointing the pipe and fitting. If necessary to apply pressure to a newly made joint, limit to 10% of rated pipe pressure, during the first 24 hours after the joint has been made.

d. Make provisions for expansion and contraction by way of swing joints or snaking.

e. Protect plastic pipe from exposure to aromatic hydrocarbons, halogenated hydrocarbons, and most of esters and keytones that attack the material. Protect all pipe from mechanical damage and long exposure to sunlight during storage.

f. PVC welding is not allowed without prior approval of the Architect/Engineer.

D. Field Coordination

1. It is the Contractor's responsibility to provide piping by means that account for all necessary coordination, including, but not limited to: water stops, oversize sleeves, pipe supports, valves and other attachments, over-excavations required for fusion machinery or other equipment, etc.

2. Provide pipe extensions and temporary caps necessary for pressure testing requirements.

3. Contractor is required to provide coordination and adequate protection as needed to all external services (i.e. ducts, pipes, cables) that run throughout the project site. Plumbing shall be located and placed to prevent damage during and after construction from traffic loads above.

E. Overhead piping in mechanical room/pool room shall be run such that a minimum head clearance of 7'-0" is observed to all piping, pipe fittings and pipe hangers/supports. Piping runs shall not create path obstruction or a tripping hazard.

F. Pipe Identification

1. Provide identification on all piping located in mechanical equipment, chlorine, acid rooms, heater courts, etc.

2. All piping in Mechanical Room to be labeled with description of line and arrows indicating direction of flow.

3. Mark at least once on each line and at 5 ft. intervals minimum. Consult Health Department Code for minimum marking requirements.

4. Color code per Health Department requirements. If code does not identify color coding requirements consult Architect/Engineer.

3.02 SLEEVES AND WALL PENETRATIONS

A. Patch exterior side of wall penetrations with non-shrink grout. Other methods of water tightness shall be pre-approved by the Architect/Engineer.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Pipe Hangers & Supports.

1.02 RELATED DOCUMENTS
   A. Drawings and Contracting Requirements, including General and Supplementary Conditions and Division 01 - General Requirements, apply to this Section.

1.03 SUBMITTALS
   A. Refer to General Requirements and Division 01.
   B. Product data including manufacturer’s specifications, installation instructions.
   C. Shop Drawings showing type and locations.

1.04 SUBSTITUTIONS
   A. Refer to General Requirements and Division 01.

1.05 DELIVERY, STORAGE AND HANDLING
   A. Refer to General Requirements and Division 01.

PART 2 PRODUCTS

2.01 MATERIALS
   A. Hangers and Supports
      1. General
         a. All hangers, pipe supports, threaded rod, hardware, etc. shall be zinc plated or galvanized steel.
         b. All piping connections and support hardware shall be stainless steel inside surge tanks and gutters.
      2. Strut
         b. Finish shall be hot-dip galvanized steel, ASTM A123; or type 304 stainless steel or better grade, ASTM A240.
      3. Strut Clamps
         a. Pipe sizes ½” thru 12”, two-piece clamps with clamping bolt and nut. Pipe sizes 14” and larger, provide “U” bolts, nuts and washers.
         b. Finish shall be hot-dip galvanized steel, ASTM A123; or type 304 stainless steel or better grade, ASTM A240.
      4. Strut Accessories
         a. Flat plate fittings, corner braces, post bases, etc. Finish shall be hot-dip galvanized steel, ASTM A123; or type 304 stainless steel or better grade, ASTM A240.
      5. Wedge Anchors
         a. One-piece assembly, 3/8” minimum body diameter.
         b. Grade 2, zinc plated with stainless steel clips; or type 304 stainless steel or better grade, ASTM A240.
      6. Beam Clamps
         a. Steel “C” clamp type with locknut.
         b. Finish shall be electro-plated galvanized; or type 304 stainless steel or better grade, ASTM A240.
      7. Support Components
         a. All threaded rod, threaded rod couplings, nuts, washers, etc. Finish shall be electro-plated galvanized; or type 304 stainless steel or better grade, ASTM A240.
PART 3 EXECUTION

3.01 GENERAL

A. All mechanical room piping must be properly supported using the schedule indicated on the drawings as a guideline for maximum allowable spacing between supports.

B. It shall be the contractor’s responsibility to properly support piping at all valves, pumps, equipment, overhead areas and changes in direction.

C. All piping must be supported laterally as well as vertically hung.

D. Ring, clevis, roller and J hook type hangers are not acceptable.

E. Comply with manufacturer’s written instructions.

END OF SECTION
SECTION 13 1124
POOL VALVES

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Butterfly Valves
B. Ball Valves
C. Check Valves
D. Expansion Joint/Flexible Connector
E. Modulating Float Valves
F. Modulating Electrical Main Drain Valves
G. Submerged Service Operators
H. Valve Operator Extension
I. Drainage Valves
J. Reducers

1.02 RELATED DOCUMENTS
A. Drawings and Contracting Requirements, including General and Supplementary Conditions and Division 01 - General Requirements, apply to this Section.

1.03 REFERENCES
A. The following latest edition reference specifications, guides and standards shall become part of this Specification as if herein written. If provisions conflict, the more stringent provisions shall apply.
   1. ANSI – American National Standards Institute
   2. ASTM – American Society of Testing Materials

1.04 SUBMITTALS
A. Refer to General Requirements and Division 01.
B. Submit Shop Drawings, clearly indicating make, model, location, type, size, pressure rating, and type of service.
C. Valve charts
   1. Submit two copies of valve charts for each piping system, consisting of isometric Drawings, or piping layouts showing and identifying each valve and describing its function to the Architect/Engineer for approval.
   2. Upon completion of the Work, one copy of each valve chart sealed to rigid backboard with clear lacquer, placed under glass and framed, shall be hung in a conspicuous location in the equipment room.

1.05 SUBSTITUTIONS
A. Refer to General Requirements and Division 01.

1.06 DELIVERY, STORAGE AND HANDLING
A. Refer to General Requirements and Division 01.

1.07 WARRANTIES
A. Standard Manufacturer’s Warranty
PART 2 PRODUCTS

2.01 GENERAL

A. Cast Iron valves 3” and larger shall have an epoxy coated body on all interior and exterior surfaces, ductile iron-nylon II coated disc, one piece 416 stainless steel shaft with Buna-N or EPDM seat minimum, 150 PSI rating, or cast aluminum ASTM S12A housing and fully coated with Rilsan on all interior and exterior surfaces. Internal components include EPDM resilient lining, Rilsan coated ductile iron disc and T304 stainless steel shaft. 150 psi rating.

B. Cast Aluminum valves 3” and larger shall have an ASTM S12A body and coated with Rilsan on all interior and exterior surfaces. Internal components include Buna-N or EPDM resilient lining and seat, Rilsan coated ductile iron disc and T304 stainless steel. 150 psi rating.

C. Thermoplastic valves 3” and larger shall be constructed from PVC Type 1 Cell Classification 12454 or CPVC type 4 cell classification 23447. Thermoplastic valves shall include PVC disc with solid type 316L stainless steel shaft with Buna-N or EPDM seat pressure rated to 150 psi @ 73 degrees Fahrenheit.

2.02 BUTTERFLY VALVES

A. Butterfly valves 3” - 12” shall be wafer or lug bodies and shall be suitable for use between ANSI 125 and 150 lb. Flanges.

B. Bodies of the flangeless design shall be provided with at least two bolt guides to center the valve in the pipeline.

C. All valves shall be as manufactured by Bray Valve (713) 894-5454, Dominion or equal.

D. All bolts and nuts shall be corrosion resistant zinc plated steel with plated washers to be used when secured to PVC flanges.

2.03 UV LAMP STRAINER VALVE

A. EZ Strainer 4” to 12” butterfly type valve with stainless steel strainer disc and shaft, case aluminum rislan (nylon) coated valve housing, with manual locking valve handle as manufactured by Neptune Benson. Install on downstream side of UV lamp per UV installation details.

2.04 BALL VALVES

A. PVC True Union Ball Valves, Ipex, Asahi, Spears or equal.

2.05 CHECK VALVES

A. ½” thru 2 ½” shall be PVC body, true union, ball type, seal material EPDM as manufactured by Ipex, Asahi Spears or equal as indicated on Contract Drawings.

B. 3” thru 20” diameter check valves:
   1. Type: Split disc wafer style
   2. Valve Body: Ductile or cast iron with an epoxy painted exterior
   3. Lining: Fully lined with a Buna N elastomer
   4. Shaft: 316 stainless steel shaft and shaft plug
   5. Plates: 316 stainless steel (3” – 12”) or Aluminum Bronze (14”+)
   6. Spring & Plate Travel Stop: 316 stainless steel
   7. Manufacturer: Center Line Series 800 as manufactured by CRANE ChemPharma & Energy, or Model CVXXK Series by Metraflex, or approved equal.

2.06 EXPANSION JOINT/FLEXIBLE CONNECTOR (where required)

A. Shall be the Metrasphere, Style R with EPDM body and threaded bolt holes, Model #MSREE Series manufactured by Metraflex, as indicated on drawings. Install with a control unit assembly (tie rods) from flange to flange per manufacturer’s instructions to minimize expansion joint damage caused by excessive motion.

2.07 MODULATING FLOAT VALVES

A. Float operated modulating valve shall be designed for submerged service.
B. The housing body shall be fabricated using Sch. 80 PVC pipe with Sch. 80 PVC van stone flanges. The internal wafer shall be 12 gauge T304L material and positioned with 1/8” (+1/16”) clearance around the perimeter. The body shall also incorporate and interior stop plate constructed of PVC to define that allowable range of arm motion. Close fitting Delrin bushings shall be included on the shaft penetration of the body to provide a seal against water loss and air entrance.

C. The valve shaft shall be T304L material 1” in diameter. Float arms shall securely fasten to shaft using T316SS nuts with washers to provide adjustability. Arms shall be ½” diameter all thread rod T316SS with length as required. Valve sizes 14” – 20” shall have ¾” square tubing for arms.

D. Ball floats shall be constructed of T304L stainless steel and be 7” in diameter with internal weighting. Floats shall also be adjustable using T316SS nuts with washers as previously described. Provide one (1)/two (2) float arms as shown on the drawings. Valve sizes 14” – 20” shall have 12” diameter cylindrical floats.

E. The float arms shall be hinged to allow for vertical operation. A 12 gauge T304L bracket shall be provided as a guide to maintain the vertical float positions.

2.08 SUBMERGED SERVICE OPERATORS
A. Use only approved service operators for the valve requiring underwater operation in the surge tank or in manhole used for pool draining.

2.09 VALVE OPERATOR EXTENSION
A. Extensions shall be stainless steel and by same manufacturer as the valve manufacturer.

2.10 DRAINAGE VALVES
A. Provide min. 3/4” True Union Ball valve on all piping at such a location to allow complete drainage of system.

2.11 REDUCERS
A. Use Eccentric reducers on pump suction lines only and concentric reducers on pump discharge lines only.
B. Stainless steel body and flanges, T304 materials, ANSI 125# rated flanges.
C. Use Neptune Benson, 15-CNS/15ECS series "or equal”.
D. Provide valves of same manufacturer throughout where possible and practical.
E. Provide valves with manufacturer's name and pressure rating clearly marked on outside of body.

2.12 VALVE LABELS
A. Provide and install 2” round, 1/16” thick, multi-layered valve tags with contrasting lettering with non-corrosive beaded tie on all valves. All labels shall be me labeled in accordance with the valve chart per Section 13 11 14.

PART 3 EXECUTION

3.01 VALVE CONNECTIONS
A. Provide valves suitable for connection to adjoining piping.
B. Valve size shall be the same as the pipe size.

3.02 VALVE USE
A. Pipe sizes 3” - 14” – Butterfly
B. Miscellaneous valves 1/2” – 2-1/2” - PVC True Union Ball Valves
C. All chemical lines and equipment - PVC True Union Ball Valves
3.03 VALVE OPERATORS

A. All butterfly valves shall have gear operators and chain operators as required unless drawings indicate otherwise. Chain operators shall be required on all gear operators located 7'-0" or higher above finished floor.

B. Provide extension lengths as necessary to operate submerged or below surface valves and the appropriate valve box access cover.

END OF SECTION
SECTION 13 1125
POOL CENTRIFUGAL PUMPS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pumps
   1. Flooded Suction
   2. Self-Priming Thermoplastic

B. Pump Accessories
   1. Pump Strainers
   2. Gauges
   3. Flow meters

1.02 RELATED DOCUMENTS

A. Drawings and Contracting Requirements, including General and Supplementary Conditions and Division 01 - General Requirements, apply to this Section.

1.03 REFERENCES

A. The following latest edition reference specifications, guides and standards shall become part of this Specification as if herein written. If provisions conflict, the more stringent provisions shall apply.
   1. Hydraulic Institute Standards
   2. Institute of Electrical and Electronics Engineers Standards (IEEE)
   3. National Electrical Manufacturers Association Standards (NEMA)
   4. Occupational Safety and Health Administration Rules and Regulations (OSHA)
   5. National Sanitary Foundation (NSF)
   6. American Society for Testing and Materials Standards (ASTM)
   7. American Iron and Steel Institute (AISI)
   8. American National Standards Institute (ANSI)
   11. AISI 1045
   12. ASTM B62 – Standard Specification for Composition Bronze or Ounce Metal Castings

1.04 DESCRIPTION OF WORK

A. The pumping units shall be installed in accordance with the instructions of the manufacturer and as shown on the drawings by the Architect/Engineer.

B. Pump capacity, horsepower, TDH (Total Dynamic Head), speed, suction and discharge diameters, type, and other requirements shall be as shown on the drawings and shall comply with the requirements as specified herein.

C. The General Conditions shall apply to this Section as fully as if repeated herein.

1.05 QUALITY ASSURANCE

A. To assure a properly integrated and compatible system, the Equipment Manufacturer shall assume full responsibility for the warranty and proper operation of the pumps and/or accessory equipment.

B. Acceptable Products and Manufacturer: As listed on the contract documents or included herein or, an Engineer approved equal product and manufacturer.

C. All pumps and strainers shall be NSF50 certified as provided, including required coatings and shall be labeled as such on the serial number identification tag.

1.06 SUBMITTALS

A. Refer to General Requirements and Division 01.
B. Submit complete motor and pump data together with shop drawings for the driven machine. All material is to be collated in a card stock binder, with pockets for large drawings, and with index. This data shall be prepared by the motor and/or pump manufacturer and shall include:

1. Pump manufacturer and model number, name of motor manufacturer, type of pump and motor with dimensioned drawings.
2. Characteristic curves at full load motor speed showing flow, TDH, efficiency, horsepower, and NPSH required. For all VFD applications include a family of performance curves, separate of the full load motor speed curve, for speeds of 105%, 100%, 89%, 83%, 66%, and 50% of the scheduled RPM.
3. Nominal motor horsepower, speed at full load, frame size, enclosure construction, winding insulation class and treatment, temperature rise at nominal horsepower, service factor, voltage rating (indicate if dual voltage), number of phases, frequency rating, full-load amperes at nominal horsepower for application voltage, starting code letter, or locked rotor KVA or amperes.
4. Complete pump description plus material list including casings, impellers, seals, shaft, bearing frame, motor mounts, guards, base plate, exterior coating type and mill thickness.
5. Installation Instruction and Operation and Maintenance Manuals shall include recommended protection and maintenance required for storage prior to putting pumps in service and may be submitted any time before shipment of the pumps.

1.07 SUBSTITUTIONS
A. Refer to General Requirements and Division 01.

1.08 DELIVERY, STORAGE, AND HANDLING
A. Refer to General Requirements and Division 01.

1.09 WARRANTIES
A. Manufacturer's standard pump warranty. Warranty on mechanical seals covering 100% of the cost on all parts and labor extending over the same time period as the standard pump warranty.
B. Flooded Suction Pumps.
   1. The manufacturer warranty period shall be for a period of five years from date of shipment. Warranty shall cover against defective material and/or faulty workmanship Including seal guard mechanical seals from manufacturer.
   2. Bearings - 12 months warranty
C. All pump strainers shall be provided with a minimum one-year warranty covering failure of any pump/motor/strainer component directly attributable to materials and/or workmanship.

PART 2 PRODUCTS
2.01 END SUCTION, CENTRIFUGAL PUMPS
A. General
   1. Pumps to be provided with the seal guard system and additional spare wearable parts for each size of pump including: 2 gaskets, copper rings for screwed plug 903, copper ring for screw 900, mechanical seal 433.1, mechanical seal 433.2, and o-ring for seal guard system.
   2. Pump performance shall be optimized with provision of variable speed drives where designated in the drawings.
   3. Operational Pump Characteristics
      a. Engineer has the right to reject any pump with a pump curve having a design point operating efficiency more than 5% below the operating efficiency of the scheduled pump provided on the drawings.
   4. Furnish and install horizontal close-coupled end suction centrifugal pumps as specified on the Contract Drawings or as pre-approved by the Architect/Engineer.
B. Materials of Construction:
   1. Pump materials shall be as follows:
      a. Casing – close-grained cast iron ASTM A48 Class 30B
      b. Impeller – Copper-aluminum cast alloy ASTM B148 UNS C95800
      c. Case Wear Ring - Herborner Pumpen Polyoxymethylen Impeller Protector
d. Shaft – 316 Stainless Steel

e. Shaft Sleeve – A shaft sleeve shall not be provided or required due to optimal balanced connections of mechanical sealing and shaft material while manufacturing.

f. Coating: Volute, intermediate casing and all rotating parts, suction and discharge connections shall be entirely coated from medium-contacting areas as well as external sections with HPC (Herborner Pump Coating) system thickness of 20 up to 24 mils providing a 100% corrosion protection. Coating of cast iron materials shall be in equal endurace to bronze construction. Coating of only wetted cast iron surfaces of volute and bracket as well as fusion bonded epoxy shall not be acceptable. Coating must be proven to provide extremely smooth surface for optimal efficiency savings and cavitation prevention damage. HPC coated sections shall be black.

g. The casing will be of the end suction design with tangential discharge outlet. For suction piping diameters of 2" or greater, the suction and discharge shall be bolt through flanged connections. Flange connections shall be ANSI 125# rated with NPT gauge tapings.

h. Pump shall be of back pull out design to allow servicing without disturbing piping.

i. Variable flange positions in 45° increments offering optimum design possibilities.

j. The pump casing, intermediate casing as well as casing cover material shall be close-grained cast iron ASTM A48 Class 30B with a minimum tensile strength of 30,000 P.S.I. Volute shall have integrally cast suction and discharge connections, gauge ports at nozzles, and vent and drain ports.

k. Impeller: Closed multi-vane, copper-aluminum alloy impeller with minimum of 95,000 PSI tensile strength against cavitation, corrosion and abrasion resistance. Impeller both hydraulically and dynamically balanced to ISO 1940-1:2003 balance grade G6.3 and keyed to the shaft. The impeller may be trimmed to meet the specific hydraulic requirements when not used with a Variable Frequency Drive.

l. Mechanical Seal: Silicon Carbide with FKM Rubber with by-pass channel and flushing device for lubrication and cooling medium.

m. Mechanical Seal: Carbon with Nitrile Rubber (NBR)

n. Seal Guard System

o. Media Reservoir shall be provided to protect mechanical seal from dry running.

p. Mechanical Seal shall be further protected with a nitrile rubber O-ring. Mechanical seal seat is 100% protected against corrosion.

q. Shaft: The impeller shall be direct coupled to the 316SS motor shaft. The motor shaft shall be machined to provide a key-way and drilled and tapped to accept the impeller fastener. Stub shafts are not acceptable.

r. Shaft Sleeve: A shaft sleeve shall not be provided or required due to optimal balanced connections of mechanical sealing and shaft material while manufacturing. The use of adhesive compounds to fasten the sleeve to the shaft shall not be accepted.

s. Pump shall have an HPC coated casing baseplate as support. The base shall be sufficiently rigid to support the pump and the motor without the use of additional supports or members. Pump shall be of a maintainable design for ease of maintenance and should use machine fit parts that are easily disassembled.

t. Each pump shall be factory tested and name-plated before shipment. Each pump shall be painted blue with one coat of high-quality factory approved paint and name-plated before shipment from the factory. Color specific paint may be provided upon request.

u. Pump electric motor shall be factory provided and assembled at manufacturer’s approved representative’s facility. The pump manufacturer shall have complete unit responsibility. No field- assemblies shall be accepted.

v. Motors shall meet scheduled horsepower, speed, voltage, and enclosure design.

w. Shaft seal ring and anti-friction bearings on both non-drive and drive sides. Drives sides shall be equipped with double row bearings.

x. The motor shall be close coupled type and non-overloading at any point on the pump curve and shall meet NEMA specifications. The motor shall be TEFC Super-E® Pump Motors (IE3) with AEGIS® Bearing Protection Ring, a Permanent Magnet Motor (IE5) or a Heat Exchanger Motor.

y. Motor shall meet or exceed the minimum full load efficiencies as per Super-Efficient NEMA Premium motors. The motor ball bearings shall be selected to withstand thrust loads and have a minimum life of L-10 25,000 life hours.

z. Class F insulation.
2.02 PUMP ACCESSORIES

A. Pump Strainers
   1. All Pumps
      a. Unless the pump has an integral hair and lint strainer, supply and install strainers equal to those indicated on the Contract Documents.
      b. Provide each strainer with two strainer baskets.

B. Gauges
   1. Provide compound gauges where called for on Drawings and as required by Code.
   2. Compound gauges shall be Liquid Filled, 30 Hg to 60 PSI with gauge cock and snubber as manufactured by Weksler, Marsh, Winters or equal.

C. Flowmeters
   1. Provide flow meters where called for on the Drawings and as required by Code on main lines and on branch lines of flow ranges indicated.
   2. Flowmeters shall be as specified on the contract documents or approved equal.

D. Pump Labels
   1. Provide corrosion-resistant, permanent pump labels with contrasting lettering.
   2. Label shall include pump ID from contract drawings and a description. (e.g. "P1A Lap Pool Filtration Pump")

PART 3 EXECUTION

3.01 PUMP INSTALLATION

A. The pumping units shall be installed in accordance with the instructions of the manufacturer and as shown on the drawings by the Pool Engineer.

B. Ensure that the pumps and motors are properly supported and aligned with no pipe strain transmitted to the pump casing.

C. Installation shall include furnishing the required oil and grease for initial operation. The grades of oil and grease shall be in accordance with the manufacturer's recommendations.

D. Permanently affix pump label to the pump.

3.02 ACCESSORY INSTALLATION

A. Install accessories as shown on the contract documents and in accordance with manufacturer’s instructions.

B. Strainers shall be supported on a concrete housekeeping pad and provided with sufficient space for maintenance.

C. Gauges shall be positioned to be read adjacent to the pump or from above, where pumps are in a pump pit.

D. Permanently affix pump label to the pump in an easily visible location.

3.03 FACTORY TRAINED REPRESENTATIVE

A. Provide a factory-trained representative for the purpose of supervising installation, start-up, final field acceptance testing, and providing instruction to the owner’s operating personnel in the proper operation and maintenance of the equipment in this section.

B. Contractor and factory-trained representative shall verify pump flow aligns with the pump curve and calibrate flowmeter as required

END OF SECTION
PART 1 GENERAL

1.01 DESCRIPTION

A. Work Includes:
   1. Furnish all labor, materials, tools, and equipment, as indicated, in accord with provisions of Contract Documents.
   2. Completely coordinate with work of all other trades.
   3. Although such work is not specifically shown or specified, all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation shall be furnished and installed as part of this work.
   4. See Section 26 0001 for General Electrical Requirements.
   5. See Division 1 for General Requirements.
   6. Coordinate all requirements with Contractor providing equipment including but not limited to contacts bypass and controls.

1.02 RELATED WORK

A. Section 26 0526 – Grounding and Bonding
B. Section 26 0553 – Electrical Identification
C. Section 26 2813 - Fuses
D. Section 26 2816 – Enclosed Switches

1.03 REFERENCE STANDARDS


1.04 SUBMITTALS

A. Submit shop drawings and product data under provisions of Division 01, General Conditions of the Contract, and Section 26 0001.

B. Include physical, electrical, and performance characteristics of each variable frequency drive and associated components, including dimensions; weight; input and output performance; voltage, phase, current and overcurrent characteristics; installation instructions; protective features; wiring and block diagrams indicating specified options; electrical noise attenuation equipment where required to meet the criteria specified; line side voltage notch wave form and line side current harmonics; certified efficiency versus load and speed curves; and required operating environment.

1.05 OPERATING AND MAINTENANCE INSTRUCTIONS

A. Submit operation and maintenance data under provisions of Section 26 0001 and Division 01.

B. Instructions to include recommended maintenance procedures, maintenance schedules, recommended spare parts list, and vendor name for those parts.

1.06 EQUIPMENT STARTUP AND AGENCY TRAINING

A. Provide the services of a factory trained and certified technician to approve the installation; start-up, test, and adjust for proper operation; and instruct and train the Agency's representative in the operation and maintenance of the unit(s). Upon completion of the equipment startup, submit a complete manufacturer's field report, including startup and test log, signed by the factory trained technician. Coordinate with other Contractors as required. The startup shall be completed within ten (10) working days from the startup date.

1.07 WARRANTY

A. The warranty shall be for a period of 36 months applied from the date of project Substantial Completion, but not to exceed 42 months from shipment. Further, the warranty shall include all parts, labor, travel time,
administrative costs, overhead, travel expenses, technical support and any and all other costs to provide the warranty service.

1.08 COORDINATION

A. All line voltage power wiring to equipment, factory mounted control panels, to motor control centers, to and from disconnect switches, and to individually mounted starters, and from starter to motors, shall be provided by the Electrical Contractor.

B. Vendor/Contractor that specifies "starters by Electrical Contractor" shall furnish project specific wiring diagrams to Electrical Contractor for all equipment and devices furnished by this Contractor and indicated to be wired by the Electrical Contractor. In addition, furnish complete sets of wiring diagrams for Owner's bound maintenance manual.

C. All line, or low voltage, wiring which is not indicated on the drawings, or specified, but necessary to complete the installation, shall be provided by this Division.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. ABB or Eaton.

2.02 DESIGN AND CONSTRUCTION

A. The unit shall be variable torque, modular design for control of the motors as specified by others, to be furnished by Electrical Contractor and rated at the motor full load nameplate amps.

B. The unit shall be U.L. listed, solid state, micro processor-based with a pulse width modulated (PWM) output wave form (none others are acceptable).

C. The VFD shall employ a full wave bridge rectifier, to prevent line notching, with DC output bus choke, capacitors to minimize the ripple of the rectified voltage to maintain near constant DC voltage. Insulated gate bipolar transistors (IGBT’s) shall be employed as the output switching device.

D. Control circuitry shall be plug-in, plug-out modular basis with a corrosion resistant coating on printed circuit boards.

E. Units to be suitable for an operating environment from 0°C to 40°C temperature and humidity up to 90% non-condensing.

F. Electrically and physically isolate control circuitry and conductors from power circuitry and power conductors. Control conductors and power conductors shall not be run in the same conduit.

G. The unit enclosure shall be UL Type 12 enclosure for the application minimum and all components shall be fully factory assembled and tested prior to leaving the manufacturing facility.

H. Include the following operating and monitoring devices mounted on the front cover:
   1. Fused disconnect switch with door interlocked handle and lock-open padlocking provisions (VFDs with no bypass).
   2. Operating mode selector switch marked “hand-off-auto”. Manual speed adjustment via keypad, mounted on the door.
   3. Manual bypass selector switch to select power through drive or bypass where indicated on drawings.
   4. Pilot light marked "RUN".

I. Provide a manual bypass circuit and bypass starter to transfer from variable frequency drive operation to bypass operation where indicated on drawings.

J. Provide partitioning within drive enclosure to separate and isolate bypass section from variable frequency drive section and to house bypass wiring, contactors, relays, and manual bypass circuit so that devices within the converter/inverter compartment are able to be serviced without electrical danger to the service technician.

K. Starters shall have provisions for additional control requirements such as, but not limited to inputs and outputs for connection to external relays and equipment where required.
2.03 PERFORMANCE REQUIREMENTS

A. Units shall be suitable for input power of electrical system as scheduled on the drawings ±10%, 3 phase, 60 Hertz nominal.

B. Provide minimum 5% line reactor in each AC phase on the input side or 5% dual DC bus reactors to reduce harmonic voltage distortion. Limit line noise, as measured at the point of common coupling, to a voltage factor of 5% or less as defined in IEEE-519, latest edition. If the distortion is greater than that allowed by IEEE-519, latest edition, the line reactor shall be changed in size to ensure compliance. The supplier of the VFD shall provide distortion calculations to be used for setup and analysis.

C. Use a current limiting control device to limit output current to 110% continuous for one minute; also refer to Protection Features in this section. Full load output current available from drive shall not be less than motor nameplate amperage. The full load amp rating of the VFD shall not be less than the values indicated in the NEC Table 430-150.

D. Output power shall be suitable for driving standard NEMA B design, three phase alternating current induction motors at full rated speed with capability of 6:1 turndown.

E. Additional performance capabilities to include the following:
   1. Ride through a momentary power outage of 15 cycles.
   2. Start into a rotating load without damage to drive components or motor.
   3. Capable of automatic restart into a rotating load after a preset, adjustable time delay following a power outage.
   4. Input power factor: Min 0.95 throughout the speed range.
   5. Minimum efficiency: 95% at 100% speed, 85% at 50% speed.

2.04 CONTROL FEATURES

A. Use control circuits compatible with input signal from control system in the automatic mode and from manual speed control in the manual mode. Vary motor speed in response to the input control signal. Include components necessary to accept the signal from the control system in the form that it is sent. Coordinate with Vendor/Contractor supplying control system and motor.

B. Include the following additional control features:
   1. Hand-Off-Automatic (HOA) selector switch to select local or remote start/stop and speed control.
   2. Analog input, selectable 0-10v or 4-20 mA, for automatic control from the temperature control system. Include a RS485 Port with BACnet protocol.
   3. Local speed control at the VFD.
   4. Adjustable acceleration and deceleration rate so that the time period from start to full speed and from full speed to stop can be field adjusted.
   5. Adjustable minimum and maximum speed settings for both automatic and manual modes of operation.
   7. Field adjustment of minimum and maximum output frequency.
   8. Three (3) sets of programmable form “C” contacts for remote indication of variable frequency drive condition. Note: default programming to be set for “Drive, Run & Fault”.
   9. Illuminated display keypad.
   10. External Fault indicator.
   11. One (1) input for a N.O. dry contact type input for a 2-wire remote start/stop.
   12. One (1) input for a N.C. dry contact type input for external faults: (freezestats, fire alarm, smokes, etc). This input shall be factory wired to prevent both the VFD and bypass starter operation when external fault is present.

2.05 PROTECTION FEATURES

A. Use electronic protection circuitry in the power circuits to provide an orderly shutdown of the drive without blowing fuses or tripping circuit breakers and prevent component loss under the following abnormal conditions:
   1. Activation of any safety device.
   2. Instantaneous overcurrent and/or over voltage of output.
   3. Power line overvoltage and undervoltage protection.
   4. Phase loss.
   5. Single and three phase short circuiting.
7. Control circuit malfunction.
8. Over temperature.

B. Provide the following additional protective features:
1. Input transient overvoltage protection up to 3000 volts per ANSI 37.90A;
2. DC bus fusing or other electronic controls which limit the rate of rise of the DC bus current and de-
energizes the drive at a predetermined current level;
3. Fusing for the control circuit transformer;
4. Grounded control chassis; and
5. Devices and/or control circuitry to ensure that the
6. variable frequency drive and bypass starter are not both energized and driving motor simultaneously.

2.06 DIAGNOSTICS

A. Provide an English character display (no error codes) with indicators for the following:
   1. Phase Loss
   2. Ground Fault
   3. Over Current
   4. Over Voltage
   5. Under Voltage
   6. Over Temperature
   7. Overload
   8. DC Buss Status

2.07 QUALITY ASSURANCE TESTS

A. Use a factory heat stress test to verify proper operation of all functions and components under full load.

B. Field performance test of variable frequency drives to determine compliance with this specification will be
   performed at the owner’s discretion and may include any specified feature, including operation of protective
devices through a simulated fault. Contractor will pay for initial testing. Should drive be found deficient by
this testing, drive manufacturer will be required to make any and all changes necessary to bring unit(s) into
compliance with the specified performance and demonstrate this performance by retesting. Cost of
changes and retest will be by this contractor.

C. Variable frequency drive manufacturer or designated representative to perform a field test of each drive, in
   the presence of the owner’s representative, for the following items:
   1. Provide general inspection to verify proper installation;
   2. Demonstrate drive reaction to simulated power interruptions of two seconds and sixty seconds;
   3. Demonstrate adequate protection during switching from variable frequency drive operation to bypass
      starter operation and back again;
   4. Measure and record voltage distortion factor and line notch depth at the point of common coupling.
      Provide the recorded value as part of the startup report.

2.08 BYPASS EQUIPMENT

A. Bypass Starters:
   1. The bypass starters shall be across-the-line magnetic starter type.

B. Bypass Configuration:
   1. Provide one main fused disconnect switch or circuit breaker to isolate both the drive and bypass
circuit. Bypass configuration shall consist of one input drive contactor or disconnect, one output drive
contactor and one output bypass contactor. The two output contactors shall be mechanically and
electrically interlocked.

C. Provide motor overload protection in the bypass circuit.

D. Provide bypass equipment inside the main VFD panel enclosure.

2.09 LINE REACTORS

A. Furnish and factory install line reactors to comply with the specified limits on electrical line noise.
B. Line reactors shall be designed for operation on the input side of the VFD.

C. Line reactors shall be installed in each phase of the AC input side of the VFD and mounted within a common enclosure with the VFD.

D. Line reactor shall be suitable for the voltage of the system ± 10%, 3 phase, 60 Hertz.

E. Line reactor ampere rating shall be sized in accordance with the variable frequency drive manufacturer’s recommendations with the minimum size equal to the NEC Table 430-150 full load ampere rating of the connected motor.

F. Line reactor shall be a three-phase inductor, 3% impedance, iron core, 600V, Class H insulation, 115 degree C rise, copper windings with screw type terminal blocks.

PART 3 EXECUTION

3.01 VARIABLE FREQUENCY DRIVES

A. Install where indicated on drawings and in accordance with approved submittals and manufacturer’s published recommendations. Installation to be by the Division 26 contractor.

B. Input wiring shall be installed in a separate conduit system, output wiring shall be installed in a separate conduit system and control wiring shall be installed in a separate conduit system. Do not mix input power, output power, or control wiring in a common conduit.

C. Control signal for drive will be provided as indicated on drawings.

D. VFD manufacturer to perform a field test of each drive and provide Owner operational and maintenance training.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES
A. Pool Regenerative Media Filter and all filter related components required for the proper operation of the filter system.

1.02 RELATED DOCUMENTS
A. Drawings and Contracting Requirements, including General and Supplementary Conditions and Division 01 - General Requirements, apply to this Section.

1.03 QUALITY ASSURANCE
A. The equipment described herein shall be products of a manufacturer regularly engaged in the fabrication of filtration and recirculating systems for at least fifteen (15) years and shall be a professional engineering corporation.
B. The owner requires that filters bear the National Sanitation Foundation (NSF) seal for Standard #50. This NSF listing is required by the owner regardless of local health department regulations.
C. The "EQUIPMENT SUPPLIER" shall be Neptune Benson.

1.04 SUBMITTALS
A. Refer to General Requirements and Division 01.
B. Provide detailed shop drawings of the items of equipment being provided, indicating the dimensions, material of the filter tanks, valves, actuators, RMF programmer & accessory components.
C. Provide a complete set of operating instructions, embracing the operational functions and recurring maintenance processes involved in connection with the complete filtration system.

1.05 SUBSTITUTIONS
A. Refer to General Requirements and Division 01.
B. All substitutions shall be submitted using the appropriate substitution request forms as provided under the substitution section in the project manual.
C. Voluntary Alternates for Filtration System
   1. Purpose of the bid is to purchase and have installed a complete operating filtration and recirculation system for the swimming pool. It is intended to limit the bidding to a style of product and company that has a proven history and record of performance.
   2. Due to the specialized nature of certain components required for this project, these specifications, in some instances, refer to various components by trade or manufacturers name.
   3. Whenever a proprietary (trade) name is used within this Specification Section, it is used for informational purposes to describe a standard of required function, dimension, appearance and quality. References to materials by trade name, make or model number shall not be construed as limiting competition. All bidders are required to bid on the named manufacturer in the BASE BID.
   4. Other treatment systems will be considered only if a complete set of drawings and specifications detailing such equipment as it pertains to this project are submitted for evaluation fourteen (14) days prior to the bidding. The submission should include a list of five (5) operating installations within a reasonable distance of the jobsite. List should include the names and telephone numbers of the operating personnel. The technical contents of the submittal shall include hydraulic calculations, equipment fabrication details, filter room layout in plan and elevation views specific to the project, warranties, installation and operating instructions.
   5. Alternates meeting the terms and conditions of the bidding documents will be acknowledged prior to bidding by addendum. No alternates will be considered after the bid.
6. For any and all alternates approved in accordance with the above conditions, state the amount to be DEDUCTED from the BASE BID if an alternate filtration system is being offered.

1.06 DELIVERY, STORAGE, AND HANDLING
   A. Refer to General Conditions, Division 01, and Section 13 1101.

1.07 WARRANTIES
   A. The “EQUIPMENT SUPPLIER” shall guarantee that the equipment to be furnished is of the correct capacity, that the various parts are designed to operate correctly and in conjunction with each other, that if the installation is made in accordance with the project drawings and operated in accordance with the suppliers instructions, the system will perform the prescribed functions correctly, the water entering the pool will be clear, bright, free from suspended matter visible to the unaided eye, and will be sanitary to the satisfaction of all authorities having jurisdiction.
   B. Defender filter tanks with Flexsol 3000 shall carry a 10-year limited fully rated warranty as regularly offered by the tank manufacturer.
   C. Bump tire shall carry a fully rated 1-year warranty.
   D. Valve bodies shall carry a 5-year fully rated warranty.
   E. Valve operators and system accessories including the RMF controller, quick exhaust valve and solenoid valve shall carry a 1-year warranty as provided by the product manufacturer.
   F. Unless otherwise specified, workmanship is to be guaranteed first class and carry a 1-year warranty.
   G. Internal filter tube elements shall carry a fully rated 10-year warranty.

PART 2 PRODUCTS

2.01 FILTER SYSTEM
   A. The filter system under this section shall be as detailed on the drawings.
   B. It is the intent of these specifications to describe a filter system complete with all accessory items supplied and warranted by one manufacturer.
   C. The primary components of the system consist of the main filter tank, flex tube filter elements, element assembly, bump mechanism, vacuum transfer system, sight glass, pressure gauge panel, inspection (viewing) window, valves, automatic filter controller, air compressor.
   D. All components and related subassemblies shall be factory assembled and tested prior to shipment.

2.02 FILTER TANKS
   A. The filter tank(s) shall not be less than the diameter shown on the drawings, suitable for 50 psi working pressure and hydrostatically tested to 75 psi. Tank shell shall be not less than ¼” thick. Bottom dished head shall be not less than ¼” thick. Top flat head shall be not less than 1 1/4” thick. All material to be Type A-36, carbon steel.
   B. All welding shall be performed by qualified operators. Joints shall be butt or fillet welded inside and out by manual or automatic process. Welded joints shall have complete penetration and fusion with little or no reduction of the thickness of the base metal. Welds shall be free of coarse ripples, grooves, overlaps, abrupt ridges or valleys. All welded surfaces shall be chipped and brushed clean, when necessary, leaving no slag or splatter.
   C. Tank legs shall be type A-36 carbon steel. Bearing plates shall be type 304L stainless steel. Each bearing plate shall have (2) 5/8” drilled holes to secure to the floor with the ½” x 4 ½” stainless steel concrete anchors provided. The legs shall be designed with bolted connections to minimize overall tank height for shipping and access into the mechanical room.
   D. The tank head shall be bolted to the shell with T304 stainless steel threaded rods and nuts, around the tank perimeter.
   E. Tank(s) shall be equipped with a UL listed grounding lug.
F. Tank shall incorporate connections for filter influent, effluent, drain; vacuum transfer piping, viewing window, and lift shaft gland.

G. Tank shall include brackets for mounting of automatic controller, gauge panel, filter / regulator, vacuum transfer blower and vacuum hose rack.

H. Tank shall include an integrally mounted hydraulic lifting device (davit). The davit assembly shall be designed to lift the filter head and include a pivot mechanism allowing the head to rotate 180°, for access to the tube sheet. (Model SP-18-48-176 excludes davit requirement.)

I. Tanks larger than 18” diameter shall include an integrally mounted hydraulic lifting device (davit). The davit assembly shall be designed to fit the filter head and include a pivot mechanism allowing the head to rotate 180°, for access to the tube sheet. Systems requiring additional devices for filter head removal will not be considered.

2.03 INTERIOR LINING

A. All interior surfaces shall be grit blasted to white metal condition with a 2-3 mil profile. Blasted surfaces shall be cleaned of all dust or blast residue. Lining shall be applied as soon as is practical on the same day blasting is done.

B. Flexsol 3000® shall be a urethane, 100% solid plural component lining. Hardness shall be 75 durometer on the shore D scale. Break tensile strength shall be 4000 psi with elongation of less than 10%. Adhesion shall be greater than 2500 psi.

C. Application of Flexsol 3000® lining shall be done by experienced applicators using a high pressure, high temperature plural component system. All wetted surfaces including flange faces, manway rings and manway covers shall be lined to 100 mils +/- 10 mils DFT.

D. Hardness shall be verified after curing to ASTM D 2240 standard.

E. Flexsol 3000® lining shall meet the NSF toxicity standard unconditionally and shall be approved for use with the NSF approved filter.

F. Flexsol 3000® lined vessels shall carry a ten (10) year limited non-prorated warranty.

G. The filter manufacturer shall bear the responsibility for suitability of lining and shall be the sole source for the specified warranty.

2.04 EXTERIOR COATINGS

A. All exterior surfaces shall be grit blasted to white metal condition with a 2-3 mil profile. Blasted surfaces shall be cleaned of all dust or blast residue and primed as soon as is practical on the same day blasting is done.

B. When priming has dried the coating process will begin. If prime has sat for over twenty-four hours, a refresher coat will be applied.

C. Two coats of high solids enamel shall be applied for a total developed film thickness of 5-8 mils.

D. Manufacturer is to supply min.16 oz of high solids enamel touch-up paint.

2.05 INTERNAL COMPONENTS

A. The filter shall consist of flex tube elements, filter tube sheet, stainless steel lift shaft and internal flow diversion assembly.

B. The filter elements shall be flexible tubes that provide the support structure for the media. The outer wall of each element shall be fabricated of multi-filament high strength polyester braid. Each element shall have an internal T304 (optional T316) stainless steel spring, which acts a support structure for the braided filament.

C. The filter element tube sheet shall be fabricated of T304 (optional T316) stainless steel and provide both support for the top of the element assembly as well as water tight seal to prevent media from escaping the filter tank.
D. The lift shaft shall be fabricated from T304 (optional T316) stainless steel and provide the internal connection between the filter element tube sheet and the external bump mechanism.

E. The filter influent connection shall be fitted with a T304 (optional T316) stainless steel flow diversion assembly to eliminate disturbance to the filter elements during operation.

F. All stainless steel wetted fasteners shall be Type 304 (optional T316).

2.06 BUMP MECHANISM

A. The bump mechanism shall include a pneumatically operated tire mounted externally on the filter tank head. The tire is alternately pressurized then depressurized causing the connected filter element assembly to move in an upward then downward fashion. This movement shall provide the means of dislodging the media and accumulated solids, which then recoat the filter element.

NOTE: Systems that do not incorporate a pneumatic bump mechanism shall not be considered.

2.07 VACUUM TRANSFER SYSTEM

A. The vacuum transfer system shall be provided to allow the recharging of media into the filter for either bag or bulk media.

B. The vacuum shall include a 5 peak HP 115V single phase motor 60 Hz, cULus listed.

C. A GFI protected receptacle shall be provided for field installation on the vacuum mounting bracket and field wired to the RMF controller.

D. Provide three (3) 1-1/2" SCH 80 PVC ball valves: for the vacuum drain line, the blower inlet and the vacuum hose.

E. The Manufacturer shall provide all necessary pipe, fittings and hardware for field plumbing of the vacuum transfer system.

F. Provide a minimum 5 feet of vacuum hose with required fittings.

2.08 AUTOMATIC CONTROLLER

A. The automatic controller shall provide total control of the system’s filtration and regeneration cycles, and provide all necessary equipment interlocks and timing mechanisms to execute the filter program.

B. The controller shall include an adjustable pressure switch, factory set to 50 psi. The switch shall stop the filtration pump and close the pneumatic valves if air pressure falls to 50 psi.

C. The controller shall control the operation of the following functions:
   1. Bump cycle-manual or automatic; with or without security interlock for data logging
   2. Pre-coating of the filter elements
   3. Stopping and starting of the man recirculation pump
   4. Opening and closing of pneumatically operated valves
   5. Vacuum transfer system
   6. Heather cool down delay
   7. Auxiliary contacts to interlock UV Lamps, chemical control, or other equipment
   8. 7-inch Hi-Res LCD Screen with Tactile Feedback Membrane
   9. Step-by-Step animated graphics
   10. Last Bump TM and Bump-n-Go TM Features
   11. Remote Operation via browser or phone
   12. Off Site Real-Time Status
   13. Email on change of condition
   14. Data logging of process
   15. Differential Pressure Monitoring and Bump Control
   16. Automatic maintenance reminders
   17. Exporting of process data logs to .csv Excel TM Files
   18. Modbus Communications for PLC connectivity
   19. Nema 4x/IP66 approved/UL Listed
   20. Electrical Requirements: 120VAC-10-60Hz, 15-amp Circuit Protection (CP)/240VAC-10-50Hz, 10-amp CP
D. The controller panel shall display the following functions:
   1. Filter status
   2. Pre-coat status
   3. Filtration pump status
   4. Vacuum transfer pump status
   5. System power
   6. Last Bump
   7. Low Pressure Alarm
   8. Recirculation Pump off Alarm
   9. Pressure Differential

E. The controller enclosure shall be NEMA 4X/IP66 Approved/4L Listed.

F. The RMF automatic controller will provide signal power to the main filtration pump motor starter. The unit is required to be a device or variable frequency drive (VFD) and is to be installed with control wiring by the electrical contractor.

G. The RMF shall be 120 V, 1 phase, 15-amp rated, and shall be UL labeled.

H. NOTE: Systems without programmable, automatic bump/regeneration/filter modes shall not be considered.

2.09 FILTER REGULATOR

A. Each filter shall include a combination filter / regulator. The regulator shall be adjustable from 0 – 120 p.s.i. 1/2" F.P.T. connections shall be provided for field installation of air lines.

2.10 WATER SEPARATOR

A. One water separator with automatic drain shall be included for each air compressor supplied. 1/2" F.P.T. connections shall be provided for field installation of air lines.

2.11 AIR COMPRESSOR

A. Provide (1) air compressor per mechanical room with the following minimum requirements: 20-gallon tank, 2 HP, 115V, 1 phase, 15 amp, 5.2 CFM @ 90 psi, air pressure gauge, pressure relief valve, belt guard, pressure switch, air filter, and tank drain.

2.12 PNEUMATIC ACTUATORS

A. Each filter shall include pneumatic actuators for (1) influent valve, (1) effluent valve and (1) pre-coat valve.

B. The actuators shall be double acting with valve mounted drilling to ISO 5211.

C. The actuators shall include (2) 1/4" FPT ports for open / close connections. Flow control valves with quick connect fittings shall be provided at each port to allow speed control adjustment for the open / close function of the actuators.

D. Materials of Construction
   1. Body: aluminum alloy, extruded acc. to ASTM 6063, anodized acc. To UNI 4522
   2. Ends: Die-cast in aluminum alloy acc. To ASTM B179, epoxy-polyester coated
   4. Pinion: Nickel-plated steel
   5. Slideways: Acetal resin (LAT LUB 731320T)
   6. Fasteners: AISI 304 Stainless steel
   7. Springs: Epoxy coated steel, pre-compressed
   8. Seals: NBR Nitrile rubber
   9. Lubricant: MoS2

E. The actuators shall be factory lubricated to allow for 1,000,000 maneuvers.

F. The actuators shall have adjustable travel stops for both directions.

G. Working temperature limits: 4°F to 186°F. NOTE: Systems utilizing manually operated valves shall not be considered.
2.13 SOLENOID VALVES
A. Each filter shall include three (3) single solenoid 4-way valves mounted on a multi-station manifold for operation of the pneumatic actuators and bump mechanism.
B. The solenoids valves shall include lighted DIN connectors.
C. The solenoid valves shall be factory lubricated and shall not require any field lubrication.
D. The solenoid valves with multi-station manifold shall be located on the bottom of the automatic controller, factory wired and include quick connect fittings for attachment to the pneumatic actuators and bump mechanism.
E. The solenoid valves shall be SMC Series SY 7000, or equal.

2.14 VALVES
A. All valves 3” – 12” shall be constructed with cast aluminum ASTM S12A housing and fully coated with Rilsan on all interior and exterior surfaces. Internal components include EPDM resilient lining, Rilsan coated ductile iron disc and T304 stainless steel shaft. Valves 14” and larger shall be constructed with cast iron housing fully coated with nylon and with nylon coated ductile iron disc.
B. Valves shall be butterfly valves and shall be provided for the effluent and pre-coat lines.

2.15 CHECK VALVES
A. Shall have epoxy coated body.

2.16 SYSTEM VALVES
A. Each defender filter shall include Five (5) system valves to facilitate system fill after media recharge, pre-coat/regeneration, influent & effluent for filtering and media dump/drain valve.
B. The pre-coat/regeneration and effluent valves shall be butterfly type with pneumatic actuators per 2.12 & 2.14A.
C. The system fill valve shall be butterfly type with gear operator and shall be the same size as the pre-coat/regeneration valve.
D. The influent valve shall be wafer type check valve, ductile iron body w/double disc, SS type 304.
E. The dump/rinse valve shall be butterfly type, lever operated with stainless steel type 304 extension to facilitate operation.
F. Automated Dilution Valve shall be supplied and programmed by the RMF Controller to purge water from the system automatically to reduce pool water TDS levels.
G. Automated purge valve shall be supplied and programmed by the RMF Controller to purge water from the filter drain on a regular timed basis.

2.17 MEDIA
A. Media shall be expanded perlite with a median particle size of 37 microns. Percentage retained on a +150 Tyler Mesh shall not be less than 8% or more than 25%. Darcy permeability shall be between 1.2-1.85.
B. The media shall contain no more than 1 tenth of one percent (.001) of crystalline silicate.
C. The media shall be certified by the Manufacturer for use in the filter. The media shall be NSF listed in and Std. 50.
D. The media shall be as approved by filter manufacturer. The media shall be Aquaperl/Harborlite.
E. Provide tank loaded with the manufacturer’s recommended media. Provide six (6) additional refills of media to the Owner.

2.18 FILTER ELEMENT CLEANING AGENT
A. The flexible filter elements should be cleaned (degreased/descaled) annually and possibly more often depending on water quality, bather load and exposure to oils and other contaminants. The filtration system
shall never be operated in the recirculation mode without a proper media coating of the filter elements. The contractor shall provide the Owner a system with clean filter elements. If the Engineer or Filter Manufacturer determines that the elements require cleaning prior to project completion, the contractor shall clean the elements in accordance with the filter manufacturer’s recommendations and instructions.

B. The filter manufacturer shall include in the Filter O&M Manual, and in the System Operator Training, all information required for filter element cleaning, including but not necessarily limited to the following: recommended cleaning frequency, cleaning instructions, and recommended cleaning agent.

C. The contractor shall provide to the Owner a supply of filter element degreaser/descaler cleaning agent with a copy of the material safety data sheet (MSDS). Quantity shall be 110% of the filter manufacturer’s suggested quantity required to clean all filters one time. Include a copy of the MSDS sheet.

D. Filter element degreaser/descaler cleaning agent product:
   1. “Filter Cleanse” by Great Lakes Bio Chemical Co., Inc., or as recommended by the filter manufacturer.
   2. Provide one-year supply of cleaning agent necessary to clean internal tube elements.

PART 3 EXECUTION

3.01 FILTER SYSTEM

A. Provide installation complete with factory representative training and equipment start.

B. Pool Contractor shall deliver four complete sets of operating and maintenance instructions for operation, maintenance and cleaning of Filter system.

C. Training and Start-Up
   1. Filter installation shall include a filter system “start-up” and “system operator training (SOT)”. Start-up shall include the first-time use of the filter in recirculation mode and all system adjustments as needed for proper operation of all filter modes. SOT shall include written and verbal instructions and demonstrations required for the system operator to properly operate and maintain the filter system in all filter operating modes.
   2. Start-Up and SOT shall be completed by a fully trained and authorized filter manufacturer representative.
   3. Prior to initiating the Start-Up procedures, the contractor shall complete all equipment installation and tests as required for proper filter operations. Contractor shall obtain the “Pre-Start-Up” requirements/checklist directly from the filter manufacturer.
   4. Contractor shall coordinate and schedule the system start-up and training directly with the filter manufacturer and Owner.
   5. SOT session shall be a minimum of one (1) day duration. Obtain written documentation with a dated signature from the system operator that training was provided to their satisfaction.

END OF SECTION
SECTION 13 1134
POOL VERTICAL FIBERGLASS FILTERS

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Pool Vertical Fiberglass Filters

1.02 RELATED DOCUMENTS
A. Drawings and Contracting Requirements, including General and Supplementary Conditions and Division 01 - General Requirements, apply to this Section.

1.03 REFERENCES
A. The following latest edition reference specifications, guides and standards shall become part of this Specification as if herein written. If provisions conflict, the more stringent provisions shall apply.
1. National Sanitary Foundation (NSF)

1.04 DESIGN REQUIREMENTS
A. As assurance that each item of apparatus is properly sized to perform in conjunction with each other, the Owner requires bidders to use the filter manufacturer as a single source of supply for the items of equipment as listed and described herewith.

1.05 SUBMITTALS
A. Provide detailed Shop Drawings of the items of equipment being provided, indicating the dimensions, material and characteristics of the filter shells, interior and exterior filter manifolds, nozzle system and filter media.
B. Provide a typed sheet of Operating Instructions, embracing the operation functions and recurring maintenance processes involved in connection with the complete filtration system.

1.06 CERTIFICATIONS
A. Shall bear the NSF Seal of Approval, Standard #50 for sand type filters.

1.07 QUALIFICATION STATEMENTS
A. The equipment described herein shall be a product of a manufacturer regularly engaged in the fabrication of fiberglass pressure vessels for at least fifteen (15) years.

1.08 WARRANTY
A. The equipment supplier shall guarantee that the equipment to be furnished is of the correct capacity, that the various parts are designed to operate correctly and in conjunction with each other, that if the installation is made in accordance with his drawings and operated in accordance with his instructions, the system will perform the prescribed functions correctly, the water entering the pool will be clear, bright, free from suspended matter visible to the unaided eye, will not produce any toxic effect or impart undesirable taste, odors or colors, and will be sanitary to the satisfaction of all authorities having jurisdiction.
B. Provide a standard one (1) year non-prorated warranty.

1.09 SYSTEM STARTUP
A. An authorized representative of the equipment supplier shall provide the supervisory services of an Installation Engineer for at least 4 hours to fully instruct designated personnel in the operation, care and maintenance of the filter system.
PART 2 PRODUCTS

2.01 FILTERS

A. Fiberglass Filter Tank
   1. The filter tank shall be no less diameter and length than shown on plan. It shall be suitable for 50 psi working pressure.
   2. The vessel(s) shall be constructed of multi-layer fiberglass. Layers shall consist of a combination of chopped glass and woven roving in an isophthalic-polyester matrix. The vessel shall be assembled from one side shell and two domed ends which shall be joined with an adhesive and reinforced with FRP layup. Alternate construction methods shall not be acceptable.
   3. Vessels shall be provided with ABS support bases. The tanks will be secured to these bases with adhesive.
   4. The wetted surface shall be a standard gel coat (GC). The gel coat shall be a modified polyester gel coat equivalent to a Cook gel coat 943-AN-023 with a thickness of no less than 10 mils.
   5. The external surface shall be smooth in appearance and be free of cracks or other defects. The exterior surface shall be supplied with an all-weather coating. The tank coating shall be water based acrylic emulsion paint with UV inhibitors.
   6. Each filter tank shall be equipped with a bottom mounted drain out system that shall completely empty the vessel.
   7. Each tank shall have an automatic and manual air release system and shall be of non-corrosive materials.
   8. Each filter tank shall be equipped with the necessary flanges and connections for the internal and external piping and valves.
   9. Each tank shall have one influent header fitted with sufficient distributors to properly distribute incoming flow evenly across the sand bed surface and one hub with sufficient laterals equally distributed not less than 12 inches below the filtering sand bed with a total effective slot area such that the average velocity through the slots will not exceed 6 feet per second at the design flow rate. The hub shall be fabricated of ABS and all distributors and laterals shall be replaceable. The laterals shall have “cam and ramp” ¼ turn connections and be constructed of ABS plastic with molded ‘V’-groove slots. Laterals with machined or cut slots shall not be accepted. Laterals shall be threaded at right angles into the header pipe.
   10. Exterior influent and effluent pipe connections shall be 2” PVC.
   11. Each tank shall have an 8.5-inch diameter access manhole with molded cover, o-ring, and pressure gauge.
   12. The system shall be designed for installation against a back or side wall with all servicing accessible without moving tank(s). When the system is off, the tank(s) must remain full of water and not allow water to gravity drain back to the source to prevent disturbance of the sand bed.
   13. Each filter tank shall be equipped with the necessary flanges and connections for the internal and external piping and valves.

B. Multi-port and Hi Flow Valve Control Assembly (Unless Otherwise Noted in Drawings).
   1. Valve assembly shall be pre-plumbed and constructed of PVC.
   2. Valve shall include a six-position positive lock operation system.
   3. Shall be side mounted.
   4. Valve mechanism shall be designed so that the filter, drain, rinse and backwash cycles can be accomplished by repositioning one valve handle that will provide accurate positioning for tight shut off.

2.02 FILTER MEDIA

A. A sufficient quantity of #20 US sieve grade clean crystal silica sand to cover filter elements with a minimum 12-inch sand bed shall be furnished and installed into each tank and shall be free of limestone or clay and shall be free from minerals that may precipitate onto pool surfaces. The following is an acceptable gradation for this media:
   1. #20 SILICA SAND
      Effective size: 0.45 mm (0.018 in.)
      Uniformity coefficient: 1.5
      Mean diameter: 0.616 mm (0.0243 in.)
      Standard deviation: 0.110 mm (0.00432 in.)
      Grain Sphericity: GRTR 0.7
B. Each filter tank shall be provided with media as required per manufacturer’s recommendations.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES
A. Pool Ultraviolet Disinfection Equipment

1.02 RELATED DOCUMENTS
A. Drawings and Contracting Requirements, including General and Supplementary Conditions and Division 01 - General Requirements, apply to this Section.

1.03 REFERENCES
A. The following latest edition reference specifications, guides and standards shall become part of this Specification as if herein written. If provisions conflict, the more stringent provisions shall apply.
1. NSF – National Sanitary Foundation
2. MET – Met Laboratories, Inc.
3. CSA – Canadian Standards Association
4. UL – Underwriters Laboratory
5. NEMA – National Electrical Manufacturers’ Association
6. ANSI – American National Standards Institute
7. USEPA UVDGM- U.S. Environmental Protection Agency Ultraviolet Guidance Manual
8. Din- German Institute of Standardization
9. IP- International Electrotechnical Commission

1.04 SUBMITTALS
A. Drawings and Instructions
1. Provide detailed Shop Drawings of the items of equipment being provided, indicating the dimensions, material and characteristics.

1.05 SUBSTITUTIONS
A. Refer to General Requirements and Division 01.

1.06 DELIVERY, STORAGE, AND HANDLING
A. Refer to General Requirements and Division 01.

1.07 WARRANTY
A. A factory trained representative of the manufacturer shall perform all warranty work. Manufacturer to warranty Ultraviolet chamber and Spectra Touch Control panel for a period of 5 years (see requirements) excluding lamps, quartz and seals. Medium pressure Ultraviolet bulbs shall be warranted for a period of 8,000 hours. Intermittently operated lamps (≥ 1 on/off cycles per day) will be replaced free of charge should failure occur prior to 4,000 hours and replacement will be prorated between 4,000 and 8,000 hours.
B. Manufacturer must maintain spare or replacement parts in the USA for same day or no longer than next day delivery in North America, other areas based on expedited delivery available.
C. A Service Agreement (twice per year maintenance) from a qualified factory certified distributor shall be provided to initiate the service to maintain the five-year warranty.

PART 2 PRODUCTS

2.01 GENERAL
A. Ultraviolet Disinfection Equipment: Shall operate within the UVC electromagnetic spectrum emitting wavelengths in the range of 200nm to 400nm. This required wavelength will provide constant
disinfection/inactivation of bacteria, algae, molds, viruses and destruction of Monochloramines, Trichloramines, and Dichloramines. Ultraviolet Lamp/Chamber and Spectra Touch Control Panel by ETS UV by Neptune Benson (Telephone 920-885-4628, Fax 920-885-4386) or Architect/Engineer approved equal. Any deviation/exception must be provided in writing to and approved by the designer prior to the bid date.

B. The UV System shall have a MET or equivalent (ETL, CSA, or UL) listing, be NSF-50 2016 certified including Section 14.18 (crypto inactivation) and 3rd party validated to the USEPA UVDGM 2006 Guidelines.
   1. Equipment General Description
      a. The Ultraviolet System shall be provided in a complete package to include: 316L Schedule 10 Stainless Steel Chamber, Spectra Touch Control System located in a NEMA 12 (IP52) rated panel, Medium Pressure Bulb(s) designed to emit wavelengths within the UVC electromagnetic spectrum, UV EZ Clean strainer, automatic wiper system, and Project Commissioning by a Certified ETS Ultraviolet Technician.

2.02 UNIT TYPES –

A. ECP Units: Ultraviolet manufacturer to offer unit capability of a horizontal OR vertical installation application using state of art design and direct flow through characteristics. Direct flow will be required in order to reduce total head loss through the system. Unit shall be a Single Lamp medium pressure system with a bulb of 1.3 kW power range. ANSI/DIN (as specified) flange of 3”/80mm and flow pattern of up to 260 GPM/1145 m3/hr @ 94% UVT. Any systems validated or designed for flows based on 98% UVT are not acceptable. Chamber and Control Cabinet shall be as indicated on the drawings. The electrical requirements include either 208/220/230 volt single-phase 50/60 Hz power (as specified) with a 20-amp external breaker. All required electrical work to be performed by licensed electrician.

B. ECF Units: Ultraviolet manufacturer to offer unit capability of a horizontal OR vertical installation application using state of art design and direct flow through characteristics. Direct flow will be required in order to reduce total head loss through the system. Unit shall be a Multiple Lamp medium pressure system with a bulb range of (2) 1.0 kW – (4) 3.0 kW power range. Multiple lamp system is required in order to maintain quality disinfection in the event of a single bulb failure. ANSI or PN (as specified) flange range of 4”/100MM – 12”/300MM and flow pattern of 350 to 3700 GPM (79 m3/hr to 840 m3/hr) @ 94% UVT. Any systems validated or designed for flows based on 98% UVT are not acceptable. Chamber and Control Cabinet shall be as indicated on the drawings. Electrical requirements to include either of the following 208, 240, 315, 400, 415, 480 or 575 volt 3-phase 50/60 HZ (as specified) with a (XX) amp external breaker recommended by ETS based on the appropriate supply voltage. The electrical contractor is to take into account plus/minus 3% for external breaker. All required electrical work to be performed by licensed electrician.

2.03 ULTRAVIOLET CHAMBER

A. Pressure rated for 100 psi/8 Bar (tested to 150 psi/11 Bar), and pressure drop across the unit will be minimal. The unit shall be constructed of 316L stainless steel, schedule 10 pipe, passivated to prevent corrosion within the harsh pool environment. The Ultraviolet chamber shall come complete with the following equipment:

B. Ultraviolet intensity monitor factory calibrated to provide intensity in mw/cm2, monitors providing percentage of lamp output not acceptable. It must include a built-in alarm system to notify operator when output level drops below required level of 60 mj/cm2 for indoor pools or 40mj/cm2 for outdoor pools (or operator set dosing levels).

C. Ultraviolet temperature control system shall be provided to maintain system integrity in the event of flow interruptions to the chamber.

D. Ultraviolet chamber shall come complete with annealed quartz sleeve with “O” ring seals for water tightness.

E. Chambers shall be complete with ANSI or DN flanges (as specified) and all ports or vents shall be threaded NPT. The Ultraviolet chamber must be capable of installation in the system so that it remains full under all conditions.
F. The ultraviolet unit must be complete with integrated brackets or feet for ease of installation in either vertical or horizontal mounting.

G. The Chamber shall have a sacrificial anode attached to the chamber, extending inside the chamber and be bonded to the installation bond loop.

2.04 ULTRAVIOLET LAMP

A. Ultraviolet lamp shall be medium pressure high intensity. Lamp shall be designed to emit continuous Ultraviolet wavelengths in the range of 200nm to 400nm. This will provide optimal disinfection benefits and destruction of the Monochloramine, Dichloramine, and Trichloramine compounds. Lamp must remain unaffected by temperature variance of 0 degrees Fahrenheit (-17 degrees Celsius) to 200 degrees Fahrenheit (93 degrees Celsius).

B. The lamp system must provide a constant dose of not less than 60 mj/cm2 until the end of the lamp life for indoor applications and not less than 40 mj/cm2 for outdoor disinfection and this must be based on constantly monitoring the full recirculating flow rate, not on a side stream treatment. The system must be equipped with variable power control to control the intensity & dose of the lamp in 1% increments. Power stepping not acceptable.

C. The lamp(s) must be powered by chokes. Electronic ballasts are not acceptable since they limit the distance between the chamber and the power supply to 13 feet (4M) to operate effectively and must be replaced every two to three years.

2.05 AUTOMATIC WIPER SYSTEM

A. An automatic cleaning system shall be provided for cleaning of quartz sleeve and Ultraviolet monitor probe. The system shall travel the entire length of the quartz sleeve twice per desired cleaning cycle. Precision molded wiper rings shall be provided to ensure thorough quartz tube cleaning and quartz tube protection. Wiper cycle shall be user selectable and adjustable within a range of 5 minutes to 24 hours depending on anticipated application and deposit build-up. At a minimum, the Automatic Wiper system shall have the following characteristics:
1. System shall utilize direct Belt Drive with square machined pulleys and acme threaded shaft to prevent slippage and pin shearing. Systems utilizing shear pins or complicated gear boxes will be unacceptable.
2. Wiper power supply shall be 24-volt DC for improved safety. Higher voltage not acceptable.
3. System shall incorporate Direct Shaft Encoding for positional location. Systems relying on external limit switches or internally located magnets will be unacceptable.
4. Wiper interval shall be operator selectable with optional override switch.
5. Wiper faults are to be indicated on the control system display.
6. Wiper System to utilize “Intelligent Operation” for automatic start-up commissioning.
   a. Records wiper position at chamber ends. Position must be fixed and not dependent on a timed interval or component striking end of chamber.
   b. Establish a travel run without setting limit adjustments to ensure system integrity and longevity.

2.06 UV STRAINER

A. The UV system must be provided with a downstream strainer to protect against the remote possibility of lamp/quartz breakage traveling downstream.

B. The strainer must be cleanable without removal from the piping system.

C. The strainer must be operable either manually, electrically or pneumatically to clean it.

D. The electrical or pneumatic operation must be able to be integrated with the filtration control system and/or the UV control system.

2.07 ULTRAVIOLET CONTROL SYSTEM

A. Control cabinet shall be an ETS SPECTRA Touch control unit and or pre-approved equal. The cabinet shall be an epoxy coated NEMA 12 / IP52 rated cabinet. If mounted outdoors it must be a NEMA4X /IP56 rated cabinet with an integral A/C unit to protect the components from the environment. The power must be controllable to provide full power, half power and infinite variable power based on real time interface with changes in UVT, Flow Rate or Combined Chloramines. The power panel must house the chokes required
to ignite the lamps. Three levels of operation shall be provided to meet the needs of the operator and pool environment: Simple Control (start, stop and reset), Full Parameter Display, and Customized Operator Configuration. Modes of operation shall be password protected to secure system critical setup functions. Touch Control system shall have clearly identifiable start, stop, and reset icons (suitable for gloved operation) with Running and Fault LCD indicators.

1. The main Touch screen shall display a minimum of the following: Ultraviolet calculated dose (derived from flow and intensity inputs), Ultraviolet intensity (as a % and mw/cm2), Lamp Current, Flow rate (accepts signal from optional flow meter – displayed as gallons per minute or m3/hour), Chamber temperature (displayed as deg. F or deg. C), Operation hour meter, and fault indicators to include Lamp fault, low Ultraviolet & temperature alarm, Ground fault trip, Wiper fault. All alarm functions shall have simple text message display to assist in fault finding.

2. Touch Control system shall have a minimum of the following system interface control: Remote operation, Process interrupt features (from valves, flow meters), Low UV dose (configurable to shutdown or alarm only), Flow meter input, Auto-Restrike, Half to full power Ultraviolet setting with 24-hour/7-day settable timer. Variable power/Dose pacing interface.

3. Touch Control system shall have built in data-logging capabilities to record the following information: Ultraviolet intensity required, Ultraviolet intensity measured, Lamp current, Chamber temperature, Flow rate (if flow meter is connected), Time and date stamp, All alarms generated.

4. Touch Control system must be able to be interfaced with a Chemistry Controller that can measure Total or Combined Chloramines in order to maintain the proper dosage required during the life of the lamp.

5. Touch Control System must be able to interface with the Defender filtration controller.

6. Touch Control System must be capable of operating through Ethernet or Wi Fi.

7. Touch Control System must be capable of interfacing with a SCADA system including both Profibus and Modbus.

PART 3 EXECUTION

3.01 SYSTEM STARTUP

A. Install in accordance with contract documents and manufacturer’s instructions.

B. Commissioning

1. Ultraviolet Chamber and Control Panel shall be commissioned by a qualified factory trained technician to institute the warranty.

2. Final electrical and control cabling will be connected from the Touch control cabinet to the Ultraviolet disinfection chamber during the commissioning process.

3. Daily operation and simple maintenance instructions shall be provided during the commissioning process.

4. SOT shall be conducted only by a factory trained technician.

END OF SECTION
SECTION 13 1137
POOL CHEMICAL SYSTEMS AND CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Chemical Controller with the following sensors:
      1. pH Sensor
      2. ORP Sensor
      3. Temperature Sensor
      4. Flow Sensor
   B. Free Chlorine Sensor
   C. Total Chlorine Sensor
   D. Surge Tank Level Sensor
   E. Chemical Tank Level Sensor
   F. Liquid Chlorine (Sodium Hypochlorite) Feed Pumps
   G. Acid (Hydrochloric or Sulfuric) Feed Pumps
   H. Liquid Chlorine (Sodium Hypochlorite) Storage Tanks
   I. Acid (Hydrochloric or Sulfuric) Storage Tanks

1.02 RELATED DOCUMENTS
   A. Drawings and Contracting Requirements, including General and Supplementary Conditions and Division 01 - General Requirements, apply to this Section.

1.03 QUALITY ASSURANCE
   A. The controller shall carry the following product certifications:
      1. NSF Standard 50
      2. UL 61010-1

1.04 SUBMITTALS
   A. Refer to General Requirements and Division 01.
   B. Submittals required: For each type of manufactured material and product indicated. Provide Submittals indicating equipment provided, dimensions, material specifications, wiring diagrams and all accessory components including sensors.

1.05 SUBSTITUTIONS
   A. Refer to General Conditions, Division 01.

1.06 DELIVERY, STORAGE, AND HANDLING
   A. Refer to General Conditions, Division 01.

1.07 WARRANTIES
   A. Controller shall be covered by manufacturer’s 5-year warranty.
   B. ORP and pH sensors shall be covered by manufacturer’s 2-year warranty.
   C. Other sensors and flow cell components shall be covered by manufacturer’s 1-year warranty.
   D. Chemical feed pumps shall be covered by manufacturer’s 2-year warranty.
E. A factory trained/authorized representative shall provide training to the owner. The control system shall be provided with on-site start-up, on-site operator training, and 1-year on-site warranty service performed by a representative trained and authorized by the controller manufacturer.

PART 2 PRODUCTS

2.01 All products listed as basis of design are acceptable, as are approved equivalents by Project Manager.

2.02 CHEMICAL CONTROLLER

A. The water chemistry control system shall provide continuous monitoring and control of the water chemistry and related disinfection equipment.
   1. The controller shall continuously monitor and control pH. Chemical feed shall be configurable for manual, automatic, proportional, and on/off modes.
   2. The controller shall continuously monitor and control sanitizer based upon the ORP reading, the free chlorine sensor, or both. Chemical feed shall be configurable for either on/off or time-based proportional feed.
   3. The controller shall have a programmable superchlorination function, based upon ORP or ppm superchlorination setpoint, which is triggered manually.
   4. The controller shall have a programmable dechlorination function, based upon ORP or ppm dechlor setpoint, which is triggered either manually or by the completion of the superchlorination function.
   5. The controller shall compute the Langelier Saturation Index and the Ryznar Saturation Index based upon sensor data and/or manual entered by the operator.
   6. The controller shall continuously monitor, display, and datalog system flow, maintaining a total flow volume. A Low Flow Alarm shall be operator settable, which can be programmed to disable chemical feeds.
   7. The controller shall control the boost function for a UV dosing based on real-time combined chlorine as calculated by the readings from an amperometric free chlorine and total chlorine sensor.
   8. The controller shall also have a Minimum Flow Rate setting to turn off heater whenever system flow is less than this programmed minimum level. The controller shall also manage the heater on/off status based on real-time water temperature reading.
   9. The controller shall continuously monitor, display, and data log liquid pH adjuster and chlorine inventory levels. The controller shall include low chemical level alarm points for each chemical being monitored.
  10. The controller shall continuously monitor, display, and data log pool or surge tank level. The controller shall automatically control a water makeup relay to add makeup water to maintain pool level set point based on pool or surge tank level.

B. The standard display shall be a backlit transflective LCD that will continuously display information related to the following:
   1. All installed sensor readings
   2. Set points, with current control status
   3. All active alarms, including time activated

C. The flow sensor shall be used to prove flow to the chemical controller to prevent dosing of chemicals during a system low flow/no flow condition.

D. The controller shall automatically abort a Manual or Scheduled Turndown upon declining water chemistry and return to the standard programmed circulation rate to maintain optimal water quality. Declining water chemistry is signaled by any of the alarm conditions.

E. The controller shall signal all alarm conditions with the following indicators:
   1. A bright flashing LED on the front of the controller.
   2. Each active alarm listed on the LCD display along with time activated.
   3. Email and text alarm notifications.

F. The controller inputs are as follows:
   1. The controller shall have inputs available for pH, ORP, Temperature, free chlorine, and flow sensors.
   2. The controller shall come with a minimum of (3) fully assignable digital inputs available for items other than those listed above.

G. The controller outputs are as follows:
1. The controller shall have integral line or dry contact 5A solid-state relay outputs capable of switching 3A under all normal operating conditions available for Acid or CO2 feed and sanitizer feed pumps.
2. The controller shall come with a minimum of (2) fully assignable integral line or dry contact 5A solid-state relay outputs capable of switching 3A under all normal operating conditions available for items other than those listed above.
3. All relays must account for the effects of the temperature gradient inside the IP66 or NEMA 4X enclosure. Systems that utilize relays that are not de-rated must submit an engineering evaluation justifying the use of relays at their full, optimal-condition capacity. All solid-state relays shall have a provision for an electrical interlock with the circulation pump motor starter.
4. The controller shall come with a minimum of (8) separately isolated 4-20mA output signals.
5. The controller shall be capable of expanded capabilities with optional expansion package.

H. Required controller safety features:
1. The controller shall have built-in limits to the amount of time any relay control output may be forced on (i.e. in “Manual On” mode).
2. The controller shall have programmable high and low alarm settings for pH, ORP, PPM, temperature, low flow & no flow and chemical overfeed, turbidity, surge tank levels, chemical inventory. The controller shall have a programmable lockout of sanitizer feed upon pH high or low alarm.
3. The controller shall activate a No Flow alarm when the dedicated sample stream flow switch indicates there is insufficient flow through the sample stream. This No Flow alarm shall lockout all chemical feed control operations.
4. The controller shall have a dedicated Emergency Off button on the front panel of the system, which immediately halts all chemical feeds and control outputs when pressed. This feature shall require entry of a security access code.

I. Required controller remote communication and access features:
1. The controller shall have the ability to allow field upgrades and updates and programming as needed. Controller must be capable of being accessed via remote communication.
2. The controller shall have a means to preserve data logs during power outages, for input level recording and events. All input levels shall be recorded and maintained for 365 days on the controller, with a sample taken every minute. The controller shall record and maintain the events over the last 365 days recording all alarms, parameter changes, user logins, and operational cycles related to all control features.
3. The controller shall also support the following types of connection to 3rd party applications such as EMS, BMS, BAC and SCADA systems:
   a. MODBUS TCP/IP
   b. MS/TP (RS485)
   c. TCP/IP (Ethernet) BACnet connection
      The connection shall support access to Inputs (current readings), System Information, Set Points, Alarm Points, Control Status and Alarms. Set Points and Alarm Points shall be modifiable from the 3rd party application via the selected interface.
4. The controller shall come with an integral Wi-Fi module.
5. The controller shall be compatible or include the necessary software and apps to allow for the real-time monitor/ of the following via personal computer, smartphone, or tablet device:
   a. Auto-Polling – to allow automatic download of data logs.
   b. Graphical Operator’s Console – to display current readings, setpoints, alarm points and control status mode.
   c. Data Logging
   d. Email and text alarms notifications.
6. The controller shall require security access codes.

J. The controller shall be housed in an IP66 or NEMA 4X polycarbonate enclosure. All high-voltage wiring shall be performed in a separate IP66 OR NEMA 4X enclosure that precludes access to the controller electronics.

2.03 pH SENSOR

A. The controller shall provide a measurement of pH by utilizing a sensor with the following characteristics:
1. 2 – 12 sensing range
2. operating temperature range of 32-140 °F (0-60°C)
3. operating pressure range of 0 - 60 psi (0 TO 4.1 bar)
The controller shall continuously monitor, display and data log pH with minimum 0.1 resolution.

2.04 ORP SENSOR
A. The controller shall provide a measurement of ORP by utilizing a sensor with the following characteristics:
   1. 0 to 999 mV sensing range;
   2. operating temperature range of 32-140°F (0-60°C)
   3. operating pressure range of 0-60 psi (0 TO 4.1 bar)

   The controller shall continuously monitor, display and data log ORP with minimum 6mV resolution.

2.05 TEMPERATURE SENSOR
A. The controller shall provide a measurement of water temperature by utilizing a sensor with the following characteristics:
   1. 32 – 212°F (0 – 100°C) sensing range
   2. Operating temperature range of 32 – 212°F (0 – 100°C)
   3. Operating pressure range of 0-145 psi (0-10 bar)

   The controller shall continuously monitor, display and data log temperature with 5/9 °C (1°F) resolution.

2.06 CIRCULATION FLOW SENSOR
A. The controller shall provide a measurement of pool circulation flow rate and volume by utilizing a flow sensor with the following characteristics:
   1. paddle wheel flow sensor
   2. O-ring seal

   The controller shall continuously monitor, display and data log flow rate with 0.45 lpm (0.1 gpm) resolution.

2.07 FREE CHLORINE SENSOR
A. The controller shall provide a measurement of free chlorine by utilizing an amperometric sensor with the following characteristics:
   1. 0.0 to 10.0 mg/l (ppm) measuring range
   2. 41° - 113°F (5 to 45° C) operating temperature range,
   3. Operating pressure range 0-14.5 psi (0-1 bar)
   4. replaceable membrane and electrolyte

   The controller shall continuously monitor, display and data log free chlorine with 0.1 mg/l resolution.

2.08 TOTAL CHLORINE SENSOR (WITH COMBINED CHLORINE READING)
A. The controller shall provide measurement of total chlorine utilizing a sensor with the following characteristics:
   1. 0.0 to 10.0 mg/l (ppm) measuring range
   2. (41° - 113°F) 5°-45°C operating temperature range,
   3. Operating pressure range 0-44 psi (0-3 bar)
   4. replaceable membrane and electrolyte

   The controller shall continuously monitor, display and data log total chlorine with 0.1 mg/l resolution.

   The controller shall also continuously monitor, display and data log combined chlorine (from the total chlorine and free chlorine sensors) with 0.1 mg/l resolution.

2.09 AUTO-FILL WATER LEVEL SENSOR
A. The controller shall provide a measurement of the water level by utilizing a continuous level sensor with the following characteristics:
   1. Field configurable sensor length,
   2. Installation options for wall mount and stand pipe glass configurations.
   3. 4 to 20 mA output

   The controller shall continuously monitor, display and data log the water level with 10 mm (0.4”) resolution or better. The controller shall use the sensor to control a water makeup valve to maintain water level (Autofill) and/or control a main drain modulating valve.
2.10 CHEMICAL TANK LEVEL SENSOR
A. The Chemical tank level controller system provides a measurement of the tank liquid level by utilizing a continuous level sensor with the following characteristics:
1. Field configurable sensor length
2. Installation options for wall mount and stand pipe glass configurations.
3. 4 to 20 mA output

2.11 LIQUID CHLORINE (SODIUM HYPOCHLORITE) FEED PUMPS
A. All liquid chlorine feed pumps shall be of the size and meet the output requirements indicated on the construction documents, meet all state and local code requirements, and shall meet the following criteria:
1. Self-priming adjustable peristaltic pump.
2. 32-125°F (0-52°C) operating temperature range
3. Operating pressure range: 0-25 psi (0-1.7 Bar)
4. Required suction lift: 25' (7.6 M) at sea level.
6. Tubing: Norprene®, Norprene Chemical®, or Santoprene® tubes.
7. Chemical compatibility: All components of feed pump must be resistant to Sodium Hypochlorite at 16% Maximum Strength.

2.12 ACID (HYDROCHLORIC/SULFURIC) FEED PUMPS
A. All acid feed pumps shall be of the size and meet the output requirements indicated on the construction documents, meet all state and local code requirements, and shall meet the following criteria:
1. Self-priming adjustable peristaltic pump
2. 32-125°F (0-52°C) operating temperature range
3. Operating pressure range: 0-25 psi (0-1.7 Bar)
4. Required suction lift: 25’ (7.6 M) at sea level
5. Motor: Variable Speed
6. Tubing: Norprene®, Norprene Chemical®, or Santoprene® tubes. Feed pump shall provide a mechanism to detect chemical spills from worn-out tubing and provide alarm notification.
7. Chemical compatibility: All components of feed pump must be resistant to Hydrochloric and Sulfuric Acid at 50% maximum strength.

2.13 LIQUID CHLORINE (SODIUM HYPOCHLORITE) STORAGE TANKS
A. All liquid chlorine storage tanks shall be of the size indicated on the construction documents and shall be vertical flat bottom tanks with fume-tight manway covers. Tanks shall be dual wall type (unless specified on drawings to include a separate secondary containment system), recommended for sodium hypochlorite storage by the tank manufacturer, and shall meet the following criteria:
1. The LMDPE or HDLPE Resin, natural in color, 1.9 specific gravity, and 41.4 bar (600 psi), which meets ASTM D 1998.
2. XLPE Resins shall not be considered suitable for sodium hypochlorite storage.
3. The finished surface of the tank shall be free as commercially practicable from visual defect such as foreign inclusions, air bubbles, pine holes, craters, crazing, and cracking that will impair the serviceability of the tank.
4. The tank shall be marked with the identity of producer, date (month/year of manufacturer, capacity, and serial numbers.
5. All fittings and flange faces shall be protected from damage during handling by covering with suitable material. Pipe, tubing, fittings, and miscellaneous small parts shall be packaged separately and not placed inside tank as they may scratch interior surface.

2.14 ACID (HYDROCHLORIC OR SULFURIC) STORAGE TANKS
A. All acid storage tanks shall be of the size indicated on the construction documents and shall be vertical flat bottom tanks with fume-tight manway covers. Tanks shall be dual wall type (unless specified on drawings to include a separate secondary containment system), recommended for hydrochloric and sulfuric acid storage by the tank manufacturer, and shall meet the following criteria:
1. The LMDPE, HDPE, XLPE Resin, natural in color, 1.9 specific gravity, and 41.4 bar (600 psi, which meets ASTM D 1998.
2. All plumbing to the tank shall be hose type flexible connections resistant to hydrochloric acid capable of accommodating 4% lateral and vertical expansion and contraction of tank.
3. The finished surface of the tank shall be free as commercially practicable from visual defect such as foreign inclusions, air bubbles, pine holes, craters, crazing, and cracking that will impair the serviceability of the tank.
4. The tank shall be marked with the identity of producer, date (month/year of manufacturer, capacity, and serial numbers.
5. All fittings and flange faces shall be protected from damage during handling by covering with suitable material. Pipe, tubing, fittings, and miscellaneous small parts shall be packaged separately and not placed inside tank as they may scratch interior surface.

PART 3 EXECUTION

3.01 CHEMICAL CONTROLLER INSTALLATION
   A. Installation of the system shall be per the manufacturer's specification and no exceptions shall be allowed. A factory trained/authorized representative shall provide training to the owner. The control system shall be provided with on-site start-up, on-site operator training, and 1-year on-site warranty service performed by a representative trained and authorized by the controller manufacturer.
   B. Calibration of chemical controller shall be executed only after the monitored pool temperature has been established to within 4 degrees of the design temp, or as required by the manufacturers installation instructions, if more stringent.

3.02 CHEMICAL STORAGE INSTALLATION
   A. Tank shall be hydrostatically tested at time of installation.

3.03 MANUALS
   A. Manufacturer shall supply an Installation, Operation and Maintenance Manual describing features, operating instructions, maintenance procedures and replacement parts.

END OF SECTION
SECTION 13 1140
POOL HEATING SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Gas-fired Pool Heaters

1.02 RELATED DOCUMENTS
A. Drawings and Contracting Requirements, including General and Supplementary Conditions and Division 01 - General Requirements, apply to this Section.

1.03 DESCRIPTION OF WORK
A. Heating system for swimming pool. Coordinate all venting, interlocking and control wiring for pool heaters with HVAC Contractor.

1.04 SUBMITTALS
A. Refer to General Requirements and Division 01.
B. Submittals required:
   1. Heaters
   2. Thermometers
   3. Printed and bound operating, installation, and service manuals

1.05 SUBSTITUTIONS
A. Refer to General Requirements and Division 01.

1.06 DELIVERY, STORAGE AND HANDLING
A. Refer to General Requirements and Division 01.

1.07 WARRANTIES
A. Standard Manufacturer’s Warranty

PART 2 PRODUCTS

2.01 POOL HEATERS
A. Provide gas fired heaters for pools, as scheduled on Contract Drawings, complete with controls.
B. Heaters must be A.S.M.E. Coded and labeled by manufacturer.
C. Provide and install per State and Local Codes, including State Boiler Code required control and safety device packages.

2.02 THERMOMETERS
A. Thermometers shall have an adjustable angle and separable brass socket thermowell. The insertion length shall accommodate pipe size as required by the manufacturer.
B. Thermometers shall be liquid filled with a 9" scale, glass window, and dual face to display both Fahrenheit and Celsius temperatures, manufactured by Weksler, Marsh, Winters or approved equal; or thermometers shall be solar powered with digital display, glass passivated thermistor and aluminum stem as manufactured by Wika or approved equal.
PART 3 EXECUTION

3.01 POOL HEATERS

B. Install per manufacturer’s installation instructions and recommendations, and in accordance with all applicable State and Local Codes.

C. Furnish and install thermometers in inlet and outlet piping to heater and downstream in the blended water stream.

D. Furnish and install a pressure relief valve for each heater and pipe to within 6” of floor.

E. Furnish and install a flow switch per heater manufacturer’s requirements.

F. Factory authorized start-up required. Start-up form shall be included in the Operating and Maintenance Manuals and submitted separately to the Architect/Engineer.

END OF SECTION
SECTION 13 1143
POOL STAINLESS STEEL GUTTERS

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Pool Stainless Steel Gutters

1.02 RELATED DOCUMENTS
A. Drawings and Contracting Requirements, including General and Supplementary Conditions and Division 01 - General Requirements, apply to this Section.

1.03 REFERENCES
A. The following latest edition reference specifications, guides and standards shall become part of this Specification as if herein written. If provisions conflict, the more stringent provisions shall apply.
1. NSF/ANSI 50 – NSF International Standard/American National Standard
2. NEC – National Electric Code
3. ANSI A137.1-2012

1.04 SUBSTITUTIONS
A. For alternate manufacturer system to be pre-qualified, the alternate Supplier shall have a minimum of 5 years of continuous experience in the manufacture and installation of continuous stainless steel gutter systems, and shall have no less than five other pools of similar scope utilizing recirculation systems manufactured by that Supplier and installed by their own personnel. Any request for approval of an alternate must be in the form of a complete set of engineering drawings, hydraulic calculations, and specifications, prepared specifically for this project and submitted to the Architect/Engineer for review. Systems that do not provide overflow skimming over the entire perimeter when the pool is in quiescence, and during all levels of bather use, are not acceptable.

1.05 DESIGN REQUIREMENTS
A. Provide a continuous stainless-steel gutter system for recirculation of pool water. The gutter system shall extend around the perimeter of the pool, as shown on the Contract Drawings, providing surface skimming and incorporating a filtered water return line.
B. The recirculating gutter system proposed for the swimming pool shall be designed specifically for this project and shall be fabricated and installed by an established manufacturer specializing in gutter overflow systems. All hydraulic calculations shall be provided in the shop drawings, as part of the gutter submittal.

1.06 SUBMITTALS
A. Shop Drawings: Five copies of shop drawings and hydraulic calculations signed and sealed by an Engineer registered in the project State shall be submitted for the Architect/Engineer’s approval and the State Department of Public Health approval 120 days prior to manufacture/installation of gutter.
B. Stainless steel gutter manufacturer must provide stainless steel certificate showing type of stainless, chemical composition and finish type. Stainless certificate will show stainless steel used for manufacturing of this gutter to be purchased from a U.S. owned and U.S. located mill.

1.07 QUALIFICATION STATEMENTS
A. The system shall be the product of a manufacturer regularly engaged in the engineering, construction and installation of swimming pool overflow gutter systems.

1.08 DELIVERY, STORAGE AND HANDLING
A. The fabricated gutter components shall be delivered to the jobsite, unloaded by the pool construction contractor and stored in the shallow end of the pool.
1.09  WARRANTY

A.  The Recirculating Gutter System shall be guaranteed by the manufacturer for workmanship, materials, and performance for a period of five years from date of installation. The guarantee shall include all labor and materials for replacement of any defective materials.

PART 2  PRODUCTS

2.01  STAINLESS STEEL GUTTER

A.  Manufacturers
1.  The following are approved manufacturers:
   a.  Whitten Products Division of Hydrotech System, Cohoes, NY
   b.  Paddock Pool Equipment Co. Inc., P.O. Box 11676, Rock, SC
   c.  Neptune Benson Inc., One Bridal Avenue, West Warwick, RI 02893

B.  Materials
1.  The major components of the perimeter gutter system shall be fabricated of low maintenance, 12-gauge Type 316L (Type 304L) stainless steel with a finish equivalent to No.3 or 4., as standard to the manufacturer. Materials and methods of installation shall provide a durable and rigid installation. Exposed surface of the gutter shall be cleaned and polished to a smooth, uniform, non-corrosive finish.
2.  Gutter grating shall be NSF 50 compliant with integral slip-resistant surface.
3.  The gutter and gutter grating shall have a slip-resistant surface on all horizontal faces, with a minimum dynamic coefficient of friction at least equal to the requirements of ANSI A137.1-2012 of 0.42 as measured by the DCOF AcuTest.

C.  Components
1.  The gutter system shall consist of a stainless-steel drainage trough, slip-resistant overflow lip, deflector plate and pipe converter.
2.  The system shall be provided a stainless-steel filtered water return tube, sized to meet flow velocities requirements in the health code.
3.  A grating system will be included to enclose/cover the gutter trough.
4.  The gutter drainage channel and supply system shall be fitted with movable joints at locations to match expansion joints installed into the concrete structure. The joints shall be designed to accommodate expansion and contraction of the recirculation system without causing distortion of the channel, stress on the mounting anchors, or broken welds.
5.  Recessed Steps
6.  Vinyl Markings for Depth and Lanes
7.  Dive Agitators

D.  Overflow Skimming
1.  The gutter drainage trough must be capable of continuous overflow skimming and delivery to the filter of 125% of the total recirculation flow rate. The cross sectional area and depth of the gutter trough shall provide adequate hydraulic gradient considering the size of the pool.

E.  Overflow Lip
1.  The overflow lip of the gutter shall provide a handhold not exceeding 2-1/2 inches wide and not less than 1 inch deep as required by Code.
2.  The overflow lip shall be level to a tolerance of 1/8 inch (+/- 1/16”) around the entire pool perimeter to provide uniform skimming of the entire pool surface.

F.  Deflector Plate
1.  For pools with freeboard greater than 1”, the upper periphery of the pool gutter shall be formed as a wave deflector plate with angle of deflection providing a splash plate extending above the overflow level. The horizontal surface of this plate shall be slip-resistant at the deck.

G.  Depth Markers, Target Markings
1.  Pool gutter shall be complete with vinyl depth markers and target markings applied to the vertical face as required on the Drawings.

H.  Converters
1. Gutter manufacturer shall provide gutter supply and drainage converters as required. The converters shall be incorporated into the gutter and fabricated of Type 316L (Type 304L) stainless steel and provide all necessary pipe stub connections for interconnection of circulation piping.
   a. Field connections to flanged converters shall be made by means of non-corrosive hardware.

I. Grates
1. Gutter systems not incorporating a grate will not be acceptable.
2. Grates shall provide a means of 100% access for trough inspection. Grating shall have a minimum 32% open area around the entire pool perimeter for fast reception of pool overflow and turbulence.
3. Grating shall be held in place by non-corrosive tamper-proof fasteners.
4. The grating system shall not restrict the required hydraulic flow from pool to primary channel.
5. Grates shall be unbreakable and capable of supporting at least 450 lbs. per square foot structural bearing load when in place in gutter.

J. Accessibility and Expansion
1. All return tubes, fittings, inlets and rope anchors shall be 100% accessible for inspection, repair or replacement. Allowance for lineal expansion and contraction of the gutter shall be provided.

K. Filtered Water Return Tube
1. The filtered water return tube shall be fabricated from 12-gauge type 316L (304L) stainless steel and fitted with variable sized nylon jet inlet nozzles not over 42" on center around the entire pool perimeter except in swimming lane and stair locations. Nozzles shall be grouped under floating swimming lane lines and provided in stairwells parallel to stair treads. Inlet jets shall be installed as to provide a steady and consistent stream of filtered chlorinated water on a fixed 45-degree angle directed toward the bottom of the pool. The inlet openings shall not be larger than 1/2" in diameter and the system shall provide uniform flow around the entire pool perimeter. Provide calculations indicating the rate of flow through each inlet.

L. Racing Lane and Safety Line Anchors
1. Anchors shall be integral to the gutter system and recessed such that no part of the anchor protrudes above any finish face of the gutter.

M. Grouting
1. Grout mixture shall non-shrink, non-metallic be as designed and recommended by the manufacturer and approved by the Architect/Engineer.

N. Grounding
1. Complete stainless-steel recirculating gutter system including all appurtenances (i.e. gutter components, converters, etc.) shall be provided with grounding lugs in accordance with N.E.C., Article 680 for bonding to ground system by others.

PART 3 EXECUTION

3.01 GUTTER INSTALLATION

A. Anchoring and Installation
1. The recirculation gutter system shall be installed with corrosion resistant anchorage spaced at a maximum of 4 feet on center around the entire pool perimeter.
2. Accurate horizontal and vertical alignment not to exceed plus or minus 1/16 inch around the entire pool perimeter.
3. All joints between stainless steel sections shall be welded. Bolted or caulked joints not accepted.
4. After the stainless-steel gutter system is installed and leveled on the pool walls, the gutter system installer shall complete the installation by grouting under and behind the gutters around the entire perimeter of the pool to insure a watertight seal around the entire pool perimeter.

B. Welds
1. All seams shall be welded by the TIG process and shall result in a uniform appearance. Welds shall not be ground. All welds shall be brushed after appropriate cooling. Seams shall have a flush appearance.
2. All horizontal welds shall be fully accessible for inspection.
C. At the completion of the gutter system installation, the gutter installer shall clean and passivate all accessible gutter and welds, including below the grating, per manufacturer’s cleaning instructions.

END OF SECTION
SECTION 13 1145
POOL RAIL GOODS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Rail Goods
   1. Hand rails
   2. Grab rails
   3. Ladders
   4. Stanchions

B. Accessories
   1. Wedge Anchors
   2. Compression Anchors
   3. Escutcheons

1.02 RELATED DOCUMENTS

A. Drawings and Contracting Requirements, including General and Supplementary Conditions and Division 01 - General Requirements, apply to this Section.

1.03 REFERENCES

1.04 DESCRIPTION OF WORK

A. Fabrication and installation of hand rails, grab rails ladders, stanchions and accessories required for installations.

1.05 QUALITY ASSURANCE

A. Refer to General Requirements and Division 01 of the Specifications for additional requirements.

1.06 SUBMITTALS

A. Refer to General Requirements and Division 01.

B. Submittals required:
   1. Hand Rails
   2. Grab Rails
   3. Ladders
   4. Therapy Rails
   5. Anchors
   6. Escutcheon Plates
   7. Stanchions
   8. Stanchion Sockets

C. Provide care and maintenance instructions, embracing the operation functions and maintenance processes involved in connection with the complete system, including routine maintenance and cleaning. Provide information regarding maintenance practices and products which may be detrimental to the products.

D. Printed and bound operating, installation, and service manuals.

1.07 SUBSTITUTIONS

A. Refer to General Requirements and Division 01.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Refer to General Requirements and Division 01.

1.09 WARRANTIES

A. Pool Equipment
1. Manufacturer’s Standard Warranty

PART 2 PRODUCTS

2.01 GENERAL

A. Provide the equipment scheduled, and any necessary fittings, anchors, and connectors as required and not provided by the manufacturer. The equipment shall be the manufacturer and model number listed or a pre-approved equal. Although unit quantities are shown, it is the installing contractor’s responsibility to verify and provide actual quantities required.

B. The following manufacturers have been pre-approved as capable of providing products meeting this specification. Note that custom material/size/finish may be required from some of the manufacturer’s listed to meet these specifications.
   1. Spectrum Aquatic, 800-791-8056
   2. SR Smith LLC, 800-824-4387
   3. Paragon Aquatics, 888-KDI-SWIM

2.02 MATERIALS OF CONSTRUCTION

A. Rails
   1. All rail products specified in this section shall be 316L stainless steel.
   2. All rail goods with a grip surface (handrails, grab rails, therapy bars, ladders) shall be 1.50” OD.
   3. Provide rail material with 0.120 wall thickness.
   4. The surface of the rails shall be polished to a minimum 500 grit mirror finish and passivated according to ASTM A967.
   5. Final coating of steel shall be per manufacturer’s standard treatment procedure. All welds shall be finished, polished, and passivated to blend and match the rail finish.

B. Stanchions (Backstroke and activity)
   1. All rail products specified in this section shall be 316L stainless steel.
   2. Shall be 1.90” OD, 0.145” wall thickness
   3. The surface of the stanchions shall be polished to a minimum 500 grit mirror finish and passivated according to ASTM A967.
   4. Final coating of steel shall be per manufacturer’s standard treatment procedure.
   5. Stanchions shall be 4’-6” or 8’-0” tall and provided with a 2” ring on the top surface and a 2” ring on sliding collar.

C. Wedge Anchors
   1. Rail Anchors shall be corrosion resistant, sized to accept the rail dimensions specified and a minimum of 4” deep. For anchors greater than 4” deep, contractor shall verify adequate concrete thickness at the anchor points.
   2. Stanchion Sockets shall be corrosion resistant, minimum 6” deep and designed to accept a 1.90” OD stanchion.

D. Escutcheon Plates
   1. Provide escutcheon plates for each anchor location, sized to match rail diameter.
   2. Shall be rail manufacturer’s round, stamped 316L Stainless Steel escutcheon.

PART 3 EXECUTION

3.01 INSTALLATION

A. Manufacturer’s Installation Instructions
   1. All equipment of this section shall be installed in accordance with industry standards and comply with manufacturer’s installation instructions/recommendation. The contractor shall notify the engineer in writing of any discrepancies between the contract documents and the manufacturer’s instruction. This notification shall include a request for clarification prior to installation.

B. Install equipment true and level.

C. Equipment shall be installed secure, with no “play” or movement when shaken.
D. Rails shall be clean, free of dirt and contamination, and polished prior to turnover to owner.

E. Protect Equipment from damage during installation and up to substantial completion. Repair or replace damaged parts.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES
A. Pool Equipment
   1. Pool fittings, deck, maintenance, and safety equipment.
B. Pool Specialty Equipment
   1. Spray and play equipment manufactured for use in swimming pools and/or spray pads.

1.02 RELATED DOCUMENTS
A. Drawings and Contracting Requirements, including General and Supplementary Conditions and Division 01 - General Requirements, apply to this Section.

1.03 REFERENCES
A. Specialty Equipment
   1. Equipment submitted shall be designed by manufacturer to meet all federal, state, and local requirements.
   2. Equipment manufacturer shall meet applicable requirements of Consumer Product Safety Commission, ASTM, UL, and other applicable standards.
   3. Comply with ASTM F2461-09, standard practice for manufacture, construction, operation, and maintenance of aquatic play equipment.

1.04 DESCRIPTION OF WORK
A. Refer to General Requirements and Division 01 of the Specifications for additional requirements.

1.05 QUALITY ASSURANCE
A. Refer to General Requirements and Division 01 of the Specifications for additional requirements.

1.06 SUBMITTALS
A. Refer to General Requirements and Division 01.
B. Submittals required:
   1. Pool Fittings and Equipment
   2. Deck Equipment
   3. Safety Equipment
   4. Maintenance Equipment
   5. Pool Specialty Equipment
      a. Provide detailed Shop Drawings of equipment being installed, including but not limited to:
         1) Location
         2) Flow rates
         3) Safety equipment
   C. Provide a typed sheet of Operating Instructions, embracing the operation functions and maintenance processes involved in connection with the complete system, including routine maintenance, and start-up requirements.
   D. Printed and bound operating, installation, and service manuals.

1.07 SUBSTITUTIONS
A. Refer to General Requirements and Division 01.

1.08 DELIVERY, STORAGE, AND HANDLING
A. Refer to General Requirements and Division 01.
1.09 Warranties

A. Pool Equipment
   1. Manufacturer’s Standard Warranty

B. Pool Specialty Equipment
   1. Manufacturer’s Standard Warranty – 2-year minimum

PART 2 PRODUCTS

2.01 GENERAL

A. Provide the equipment scheduled on the drawings, and any necessary fittings, anchors, and connectors as required and not provided by the manufacturer. The equipment shall be the manufacturer and model number listed or a pre-approved equal. Although unit quantities are shown for value engineering purpose, it is the installing contractor’s responsibility to verify actual quantities required.

PART 3 EXECUTION

3.01 INSTALLATION

A. Manufacturer’s Installation Instructions
   1. All equipment of this section shall be installed in accordance with industry standards and comply with manufacturer’s installation instructions/recommendation. The contractor shall notify the engineer in writing of any discrepancies between the contract documents and the manufacturer’s instruction. This notification shall include a request for clarification prior to installation.

B. Install equipment true and level.

C. Protect Equipment from damage during installation and up to substantial completion. Repair or replace damaged parts.

END OF SECTION
SECTION 13 1160
POOL QUARTZ AGGREGATE FINISH

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Includes but is not limited to the complete installation of a quartz aggregate finish as designated in the plans and specifications within strict accordance to manufacturer instructions and listed references.

1.02 RELATED DOCUMENTS

A. Drawings and Contracting Requirements, including General and Supplementary Conditions and Division 01 - General Requirements, apply to this Section.

1.03 REFERENCES

A. The following latest edition reference specifications, guides and standards shall become part of this Specification as if herein written. If provisions conflict, the more stringent provisions shall apply.

1.04 QUALITY ASSURANCE

A. The installer shall provide documentation providing a minimum of five (5) successful installations of similar scope and complexity with current contact information and phone number.

B. The installer shall be a member of the National Plasterer’s Council in good standing.

C. The installer shall provide documentation/certification that the laborer’s performing the work on site have been factory trained by the pool finish manufacturer.

D. The installer shall provide a letter of reference from the pool finish manufacturer.

1.05 SUBMITTALS

A. Refer to General Requirements and Division 01.

B. Submit product literature and sample colors for Quartz Aggregate Finish and manufacturer approved bond coat forty (40) days prior to use. Quartz Aggregate material shall be listed in the material submitted.

C. Submit all documents required above for experience and qualification.

D. Provide three (3) 3’x3’ onsite mock-ups of varying grades of coarseness for Owner’s approval. The pool contractor is responsible to coordinate approval of mock ups prior to the quartz aggregate pool finish installation.

1.06 SUBSTITUTIONS

A. Refer to General Requirements and Division 01.

1.07 DELIVERY, STORAGE, AND HANDLING

A. If material is stored, it must be in a cool, dry area, protected from the elements.

1.08 WARRANTIES

A. It shall be noted that the pools may be subject to be drained for prolonged periods of time for normal maintenance and cleaning.

B. Provide Manufacturer’s Product Warranty on the Quartz Aggregate Pool Finish Product. The pool finish manufacturer shall acknowledge that the pool(s) are subject to be drained completely for winterization and periods during normal maintenance and shall guarantee the pool finish for five (5) years covering any defects caused by product failure.
C. Provide Special Project Application Warranty on the Quartz Aggregate Finish Application. The pool finish installer shall acknowledge that the pool(s) are subject to be drained completely for winterization and periods during normal maintenance and shall guarantee the pool finish application for two (2) years covering any defects caused by the application of the product not limited to: abnormal cracks (other than closed shrinkage cracks that may appear), discoloration, hollow spots and de-lamination.

D. Special Project Warranty on Concrete Structure and Special Aggregate Finish: The Pool Contractor shall guarantee for two (2) years repair of the special aggregate finish covering any defects, cracks and/or leaking in the pool shell.

PART 2 PRODUCTS

2.01 ACCEPTABLE PRODUCTS AND MANUFACTURERS

A. Sun Stone by:
CLI Industries, Inc.
P.O. Box 593704
Orlando, FL 32859,
(407) 851-2660.
www.clindustries.com

B. Approved Equal

2.02 INSPECTION/MEETINGS AND PREPARATION

A. Schedule a pool finish pre-installation conference before applying the pool finish.
1. Attendees: Manufacturer’s representative, Pool Finish Installer, Contractor and its superintendent and other concerned parties shall attend the conference. All participants at the conference shall be familiar with the Project and authorized to conclude matters relating to the work.
2. Agenda: Review the manufacturer’s application instructions and discuss items of significance that could affect progress and installation, including but not limited to the following:
   a. Construction schedule
   b. Critical work sequencing
   c. Accessibility
   d. Designation of responsible personnel qualified to do the work
   e. Concrete surface preparation requirements
   f. Bond coat curing and application
   g. Pool Finish application and surface preparation
   h. Finishing methods as recommended by the manufacturer to include exposing the aggregate
   i. Verify and discuss proposed work force is adequate to complete the installation as recommended by the manufacturer
   j. Verify pool mechanical and chemical system is prepared for immediate start up after filling the pool
3. Record significant discussions and agreements and disagreements of the conference, and the approved schedule. Promptly publish and distribute any issues or discrepancies to the Architect/Engineer prior to installing the pool finish.

PART 3 EXECUTION

3.01 PREPARATION

A. All pool finish work must strictly follow manufacturer installation guidelines, references and recommendations.

B. Environmental conditions must comply with manufacturer’s requirements and may not be applied to frozen or frost laden surfaces or when the temperature is 40 degrees F or due to fall to 40 degrees within 24 hours.

C. The filtration and chemical system must be ready for startup and operating immediately after the pool is filled for pool finish curing per manufacture instruction.

D. The pool finish applicator shall coordinate with the pool shell concrete contractor, specific concrete finish requirements for the pool finish application.
E. It is the applicator’s responsibility to ensure that the concrete substrate is adequate for proper bonding of pool finish in accordance with manufacturer recommendations.

F. Prepare all pool surfaces to receive the quartz aggregate finish per manufacturer recommendation.

G. A brush or roll on bonding coat produced and approved by the pool finish manufacturer is required to be applied to the entire pool structure where the pool finish is to be applied. The manufacturer’s approved bond coat must be installed and cured in accordance with manufacturer instructions prior to applying the quartz aggregate finish. No exceptions.

H. Adding any supplements to the manufacturer’s pre-bag mix is strictly prohibited unless manufacturer’s approved written documentation is submitted and is pre-approved by the pool Architect/Engineer.

3.02 APPLICATION

A. All pool finish work must strictly follow manufacturer installation guidelines, references and recommendations.

B. Apply the quartz aggregate finish so that it is flush with the pool gutter, tiles and other embedded items as detailed in the plans and specifications.

C. The pool finish must be installed to a thickness and tolerance between 3/8” to 1/2” or as recommended by the manufacturer.

D. Finish quartz aggregate in a workmanlike fashion. Trowel surface smooth. Proceed with application to natural breaks.

E. No hollow areas, discolored or delaminated areas will be acceptable, any and all hollow areas must be chipped out and repaired, patching shall be done in a quality workmen’s like fashion. If hollow spots are detected where individual patching required will reduce the overall aesthetic value, it will be the Architect/Engineers discretion to have an entire area between breaks removed and replaced.

F. All pool floors and horizontal surfaces shall have a slip resistant finish. Slip resistance shall meet Dynamic Coefficient of Friction (DCOF) value of WET: > 0.42. Abrasive resistance shall meet a DCOF value of WET: > 0.60.

G. The contractor is responsible for all brushing/cleaning, chemical monitoring and other requirements set forth by the manufacturer installation and curing instructions. This shall not be the responsibility of the owner.

H. The installing contractor shall guaranty the finish to be free of sharp edges and splatter that may cause cuts on swimmers’ feet.

END OF SECTION
SECTION 13 1161
POOL CERAMIC TILE

PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Ceramic Pool Tile

1.02 RELATED DOCUMENTS
   A. Drawings and Contracting Requirements, including General and Supplementary Conditions and Division 01 - General Requirements, apply to this Section.

1.03 REFERENCES
   A. The following latest edition reference specifications, guides and standards shall become part of this Section as if herein written. If provisions conflict, the more stringent provisions shall apply.
   1. ANSI A108 – Specifications for Installation of Ceramic Tile
   2. ANSI A137.1 – Tile Grade Requirements
   3. ASTM C-150, Type 1 – Portland Cement
   4. ASTM C-206, 7 Type S – Hydrated Lime
   5. ASTM C-144 - Sand
   6. ANSI A118.1 – Dry Set Mortar
   7. TCA 759 – Dry Set Mortar
   8. ANSI A118.3 – Epoxy Adhesive
   10. ISO 13007 – International Standards Organization; Classification for Grouts and Adhesives.

1.04 SUBMITTALS
   A. Refer to General Requirements and Division 01.
   B. Submit product data and samples for each tile product indicated.
   C. Submit shop drawings for approval before ordering tile. Include the following:
      1. Plan, elevations, and sections of pool tank and deck.
      2. Indicate tile layout, patterns, color, expansion joints, junctions with dissimilar materials and setting details.
   D. Plans of all tile marking showing exact locations and positions of individual tiles.
   E. Maintenance data: Include routine maintenance and stain removal methods.
   F. Provide five copies of submittals.

1.05 SUBSTITUTIONS
   A. Refer to General Requirements and Division 01.

1.06 DELIVERY, STORAGE AND HANDLING
   A. Refer to General Requirements and Division 01.
   B. Deliver all products to job in manufacturer's unopened containers with grade seals unbroken and labels intact.
   C. Keep tile cartons dry.

1.07 QUALITY ASSURANCE
   A. Single source responsibility:
      1. Obtain each type and color tile material from single source.
      2. Obtain setting and grouting materials from one manufacture to ensure compatibility.
3. Obtain membrane from same manufacturer as setting material or from manufacturer approved by setting material manufacturer to ensure compatibility.

4. Furnish fifteen (15) year guarantee from installation material manufacturer. This guarantee is inclusive of installation materials, finish product, and labor.

B. Manufacturer Qualifications:
   1. Tile: Minimum five (5) years’ experience in manufacture of tile products.
   2. Setting Materials: Minimum ten (10) years’ experience in manufacture of setting and grout materials specified.

C. Installer Qualifications: Specializing in tile work having a minimum of 5 years successful documented experience with work comparable to that required for this project.

D. Certifications:
   1. Submit “Master Grade Certificate” for each shipment, type, and composition of tile, signed by tile manufacturer and installer with requirements of ANSI A137.1.
   2. Submit manufacturers certifications that mortars, adhesives, and grouts are suitable for intended use.

E. Field Samples:
   1. Sample Installation:
      a. For final review of each type of installation, construct sample panel of approximately 100 square feet.
      b. Install in location as directed by Architect and approved by Owner’s Representative.
      c. Show workmanship of finished work and construction techniques including installation and incorporation of waterproofing membrane. Where a particularly difficult detail or technique is required, or where special sizes or shapes of product are needed, they shall be included in sample panel.
      d. Approved field samples will serve as project standard and may remain as part of the work.

F. Pre-Installation Conference:
   1. Require attendance of General Contractor, Pool Contractor, Tile Installer and Installers of related work. Review installation procedures and coordination required with related and adjacent work. Hold meeting one week prior to commencing work of this section. Publish meeting minutes within 5 days of meeting, distribute minutes to participants, copy Architect.
   2. Meeting agenda shall include, but is not limited to:
      a. Surface preparation
      b. Tile and installation material compatibility
      c. Edge protection, transition and pre-fabricated movement joint profiles
      d. Waterproofing techniques
      e. Crack Isolation techniques
      f. Environmental requirements
      g. Finish protection

1.08 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in manufacturer’s unopened containers, fully identified with brand, name, type and grade. Comply with requirements in ANSI A137.1 for labeling sealed tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location. Protect materials from contamination, dampness, freezing or overheating in accordance with manufacturer’s instructions.

C. Broken, chipped, warped, stained or damaged tile will be rejected.

D. Store liquid latexes in unopened containers and protect from freezing.

1.09 ENVIRONMENTAL REQUIREMENTS

A. Comply with requirements of referenced standards and recommendations of material manufacturers for environmental conditions before, during, and after installation.

B. Do not begin installation until construction in spaces is complete and ambient temperature and humidity conditions are consistent with standards and manufacturers written instructions.
C. Ventilate spaces receiving tile with manufacturer’s instructions.

1.10 WARRANTIES

A. Contractor shall provide written materials and installation warranty, executed by the contractor, Installer and Manufacturer, agreeing to repair or replace tile that fails in material or workmanship within the specified warranty period to Architect/Engineer prior to filling pool with water.

1. Warranty Period: Fifteen (15) years after Substantial Completion, or manufacturer’s system warranty, if longer.

PART 2 MATERIALS

2.01 GENERAL

A. ANSI Standard for Ceramic Tile: Provide tile that complies with ANSI 137.1 for types, compositions, and grades of tile indicated.

B. ANISI Standard for Tile Installation Materials: Provide materials that comply with ANSI standards referenced in “American Standard Specifications for the Installation of Ceramic Tile” with products and materials indicated for setting and grouting.

C. Furnish ceramic tile required as follows. Colors shall be as selected by Owner and Architect.

D. Furnish all tiles required for special markings and lettering in conformance with the drawings and applicable Codes, including depth markings and no diving markers.

E. Racing lane tile edges shall be installed flush with finish pool floor.

F. Target tile shall be installed flush with finish pool wall.

G. Use surface bullnose on pool edge where required for proper trim and as directed on the drawings.

2.02 POOL CERAMIC TILE

A. Indoor Pool Ceramic Tile

1. Agrob Buchtal, Dal-Tile - Keystone or equal as scheduled.
   a. Sizes, types, and slip resistance as scheduled, see end of this section [Drawings].
   b. Color as selected by Owner/Architect (see Architect’s tile selection schedule).
   c. Increase the slip resistance of all end wall target tile with the addition of 7.5% by weight abrasive grains.
   d. Provide special shapes, bullnose and other tile as required.

2.03 MORTAR, GROUT AND ADHESIVE MANUFACTURERS

A. Acceptable Manufacturers: Subject to compliance with requirements herein, provide products from one of the following manufacturers or an approved equal:

1. MAPEI Corporation, Deerfield Beach, FL.
2. Laticrete International, Inc., Bethany, CT.

2.04 MORTAR MATERIALS: THICK SET

A. Latex – Portland Cement Mortar: Thick Set (ANSI A118.4)

B. Description: Two component system; latex additive water emulsion added to Portland cement mortar in place of water or replacing part of the water. The dry-set mortar must be pre-blended and must be specified by the latex manufacturer for use with the particular latex additive. Use amount of liquid latex recommended by latex additive manufacturer.

C. Acceptable Products:

1. Laticrete 226 thick bed mortar mixed with Laticrete 3701 Mortar Admix, by Laticrete International.
2. MAPEI, 4 to 1 Mud Bed Mix mixed with MAPEI, Planicrete AC, by MAPEI Corporation.

2.05 MORTAR MATERIALS: THIN SET AND SLURRY BOND COAT

A. Improved Modified Dry-Set Cement Mortar: Thin Set (ANSI A118.15)
B. Description: Two component system; latex additive water emulsion added to Portland cement mortar in place of water or replacing part of the water. The dry-set mortar must be pre-blended and must be specified by the latex manufacturer for use with the particular latex additive. Use amount of liquid latex recommended by latex additive manufacturer.

C. Acceptable Products:
   1. Laticrete 254 Platinum thin set mortar by Laticrete International.
   2. Kerasonic System consisting of Kerasonic polymer additive and Kerabond dry-set mortar by MAPEI Corporation.

2.06 EPOXY GROUT
A. Multi-component, factory prepared, 100 percent epoxy resin and hardener with sand or mineral filler material. (ANSI A118.3)
B. Acceptable Products:
   2. Kerapoxy CQ by MAPEI Corporation.

2.07 ANTI-FRACTURE/ WATERPROOFING MEMBRANE
A. Multi-component, factory prepared, anti-fracture/ waterproofing membrane system comprised of a self-curing liquid rubber polymer
B. Acceptable Products:
   1. Laticrete Hydroban by Laticrete International.

2.08 WALL PATCH & RENDER MORTAR
A. Quick-Setting, Fiber-Reinforced, Cementitious Patch and Render Mortar.
B. Acceptable Products:
   1. Laticrete 3701 Fortified Mortar Bed by Laticrete International

2.09 MISCELLANEOUS MATERIALS
A. Temporary protective coating: Provide product that is formulated to protect exposed surfaces of tile against adherence of mortar and grout, is compatible with tile and mortar/grout products, and is easily removable after grouting is completed without damaging grout or tile.
   1. Grout release in form of manufacturers standard propriety liquid coating that is specially formulated and recommended for use as a temporary protective coating for tile.
B. Acceptable Products:
   2. UltraCare Grout Release by MAPEI Corporation.
C. Epoxy Grout Haze Remover.
   1. Stonetech Epoxy Grout Haze & Coating Stripper by Laticrete International
   2. UltraCare Epoxy Grout Haze Remover by MAPEI Corporation

2.10 MIXING MORTAR AND GROUT
A. Mix mortars and grouts in accordance with manufacturer's instructions.

2.11 EXTRA MATERIALS
A. Supply extra 5% of each color of flat and trim in clean marked cartons for Owner's use.

PART 3 EXECUTION
3.01 ACCEPTABILITY OF SURFACES
A. Before tiling, check area to be tiled for acceptability as follows:
   1. Surface medium-rough texture.
2. All surfaces to be tiled shall be free of dust, rust, paint, from oil or other release coatings.
3. Provision for ladders and other embedments at proper locations.
4. Concrete true to line, level, plumb and curvature.
5. Width, depth and length will permit finished accuracy of markings and dimensions.
6. Verify surfaces for compatibility with tile setting material manufacturer’s requirements prior to installation.

3.02 ENVIRONMENTAL CONDITIONS
A. Protect all newly tiled areas.
B. Maintain temperature at 50 degrees F minimum during tile work and for seven days after completion or furnish protection as approved by the Architect/Engineer.

3.03 PREPARATION
A. Clean substrates.
B. Wet down or wash dry, dusty surfaces and remove excess water immediately prior to tile applications.
C. Install waterproofing membrane at pools A & B.
D. Install slurry bond coat.
E. Do not seal substrate unless required by manufacturer.
F. Prime substrate if required by manufacturer.

3.04 INSTALLATION
A. Tile installation, General
   1. Install tile materials in accordance with ANSI A137.1, other reference ANSI or TCNA specifications, and TCNA “Handbook For Ceramic, Glass, and Stone Tile Installation”, except for more stringent requirements of manufacturer or these specifications.
   2. Cut and fit tight to protrusions and vertical interruptions.
   3. Work tile joints uniform in width, subject to variance in tolerance in tile size. Make joints watertight, without voids, cracks, excess mortar or grout.
   4. Prepare surface, fit, set, bond, grout and clean in accordance with applicable requirements of ANSI standards and Tile Council of North America.
   5. Floors and walls: dry set: TCNA F113, F115, and W202E.
   6. Comply with tile setting material manufacturer’s installation requirements.
B. Thin set method
   1. Apply mortar or adhesive with notched trowel using scraping motion to work material into good contact with surface to be covered. Back bed tiles with mortar. Maintain 95 percent coverage on back of tile and fully bed all corners.
   2. Apply only as much mortar or adhesive as can be covered within allowable windows as recommended by mortar or adhesive manufacturer or while surface is still tacky.
   3. Set tile in place and rub or beat with small beating block.
   4. Beat or rap tile to ensure proper bond and to level surface of tile.
   5. Align tile to show uniform joints and allow to set until firm.
   6. Clean excess mortar or adhesive from surface of tile with wet cheesecloth while mortar is fresh.
   7. Sound tile after setting. Replace hollow sounding tiles.
C. Thick Set Method
   1. Apply slurry bond coat.
   2. While the slurry bond coat is wet, spread the mortar and compact well.
   3. While slurry bond coat is wet and sticky, set tile in place and beat in well.
   4. Beat or rap tile to ensure proper bond and also to level surface of tile.
   5. Align tile to show uniform joints and allow to set until firm.
   6. Clean excess mortar or adhesive from surface of tile with wet cheesecloth while mortar is fresh.
   7. Sound tile after setting. Replace hollow sounding tiles.
D. Grouting
   1. Allow tile to set a minimum of 48 hours before grouting.
2. If bonding materials are rapid setting, follow manufacturer’s recommendations.
3. Install in accordance with grout manufacturer’s recommendations and ANSI A108.10.
4. Pack joints full and free before mortar takes initial set.
5. Clean excess grout from surfaces per manufacturer recommendations, as work progresses.

3.05 LAYOUT
A. Align all joints to give straight uniform grout lines.
B. Observe exact minimum length per dimensions shown on Contract Drawings.
C. Observe exact minimum width per dimensions shown in Contract Drawings.
D. Observe +/- 1/16” maximum finish elevation tolerance on all gutter edges.
E. Provide expansion joints per TCNA EJ171.

3.06 WORKMANSHIP
A. Supply first-class workmanship in all tile work.
B. Use all products in strict accordance with recommendations and directions of manufacturer.
C. Proportion all mixes in accordance with latest ANSI Standard Specifications.
D. Smooth all exposed cut edges.
E. Gutter edges shall not vary from level or true plane more than 1/8” of pool static water level.

3.07 CLEANING
A. Clean excess mortar from surface with water as work progresses.
B. Clean tile surface as thoroughly as possible on completion of grouting, preform cleaning while mortar is fresh and before it hardens on surfaces.
C. Before acid cleaning, saturate with clean water all grout joints in areas to be cleaned.
D. Use manufacturers suggested products for cleaning off grout film.
E. Remove temporary protective coating by method recommended by coating manufacturer. Trap and removing coating to prevent it from clogging drains.

3.08 PROTECTION
A. Prohibit traffic from tile finish for 72 hours after installation.
B. Protect work so that it will be without any evidence of damage or use at time of acceptance.

3.09 TILE SCHEDULE
A. See Tile schedule, following PL101, for tile information.

END OF SECTION
SECTION 13 1163
MARCITE PLASTER POOL FINISH

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Includes but is not limited to the complete installation of a Marcite plaster pool finish as designated in the plans and specifications within strict accordance to manufacturer instructions and listed references.

1.02 RELATED DOCUMENTS
A. Drawings and Contracting Requirements, including General and Supplementary Conditions and Division 01 - General Requirements, apply to this Section.

1.03 REFERENCES
A. The following latest edition reference specifications, guides and standards shall become part of this Specification as if herein written. If provisions conflict, the more stringent provisions shall apply.

1.04 QUALITY ASSURANCE
A. The installer shall provide documentation providing a minimum of five (5) successful installations of similar scope and complexity with current contact information and phone number.
B. The installer shall be a member of the National Plasterer’s Council in good standing.
C. The installer shall provide documentation/certification that the laborer’s performing the work on site have been factory trained by the pool finish manufacturer.
D. The installer shall provide a letter of reference from the pool finish manufacturer.

1.05 SUBMITTALS
A. Refer to General Requirements and Division 01.
B. Submit product literature and sample colors for Marcite plaster pool finish and manufacturer forty (40) days prior to use. Include manufacturer-approved “bond coat” or sub-plaster coating material as required by manufacturer.
C. Submit all documents required above for experience and qualification.
D. Provide three (3) 3’x3’ onsite mock-ups of varying grades of coarseness for Owner’s approval. The pool contractor is responsible to coordinate approval of mock ups prior to the Marcite plaster pool finish installation.

1.06 SUBSTITUTIONS
A. Refer to General Requirements and Division 01.

1.07 DELIVERY, STORAGE, AND HANDLING
A. If material is stored, it must be in a cool, dry area, protected from the elements.

1.08 WARRANTIES
A. It shall be noted that the pools may be subject to be drained for prolonged periods of time for normal maintenance and cleaning.
B. Provide Manufacturer’s Product Warranty on the Marcite plaster pool finish product. The pool finish manufacturer shall acknowledge that the pool(s) are subject to be drained completely for winterization and
periods during normal maintenance and shall guarantee the pool finish for five (5) years covering any defects caused by product failure.

C. Provide Special Project Application Warranty on the Marcite plaster pool finish application. The pool finish installer shall acknowledge that the pool(s) are subject to be drained completely for winterization and periods during normal maintenance and shall guarantee the pool finish application for two (2) years covering any defects caused by the application of the product not limited to: abnormal cracks (other than closed shrinkage cracks that may appear), discoloration, hollow spots and de-lamination.

D. Special Project Warranty on Concrete Structure and Marcite plaster pool finish: The Pool Contractor shall guarantee for two (2) years repair of the plaster finish covering any defects, cracks and/or leaking in the pool shell.

PART 2 PRODUCTS

2.01 PLASTER FINISH (UNLESS OTHERWISE NOTED)

A. Materials
1. Portland Cement: ASTM C150, Type I white Portland cement
2. Aggregates for Pool Plaster Finish Coat: White marble dust uniformly graded within following limits, all passing the No. 30 sieve.
3. Percentage Retained (by Weight Plus or Minus 2%) on Each Sieve

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Minimum</th>
<th>Maximum</th>
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<tr>
<td>No. 30</td>
<td>0</td>
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<tr>
<td>No. 50</td>
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<td>No. 100</td>
<td>75</td>
<td>90</td>
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<tr>
<td>No. 200</td>
<td>90</td>
<td>100</td>
</tr>
</tbody>
</table>

Water: Clean, fresh, from domestic potable source proportions and mixing
4. Materials are specified on a volume basis and shall be measured in approved containers that will insure that the specified proportions will be controlled and accurately maintained during the progress of the work. Measuring materials with shovels ("shovel count") is not permitted.
5. White marble pool plaster finish coat: Mix finish in proportion of one part by volume of white Portland cement to not more than two parts by volume of aggregates (specified white marble dust).

B. Schedule a pool finish pre-installation conference before applying the pool finish.
1. Attendees: Manufacturer’s representative, Pool Finish Installer, Contractor and its superintendent and other concerned parties shall attend the conference. All participants at the conference shall be familiar with the Project and authorized to conclude matters relating to the work.
2. Agenda: Review the manufacturer’s application instructions and discuss items of significance that could affect progress and installation, including but not limited to the following:
   a. Construction schedule
   b. Critical work sequencing
   c. Accessibility
   d. Designation of responsible personnel qualified to do the work
   e. Concrete surface preparation requirements
   f. Bond coat curing and application
   g. Pool Finish application and surface preparation
   h. Finishing methods as recommended by the manufacturer to include exposing the aggregate
   i. Verify and discuss proposed work force is adequate to complete the installation as recommended by the manufacturer
   j. Verify pool mechanical and chemical system is prepared for immediate start up after filling the pool
3. Record significant discussions and agreements and disagreements of the conference, and the approved schedule. Promptly publish and distribute any issues or discrepancies to the Architect/Engineer prior to installing the pool finish.

PART 3 EXECUTION

3.01 PREPARATION OF SURFACES

A. Prepare pool surface per manufacturer’s requirements.
1. Clean base surfaces of projections, dust, loose particles, grease, bond breakers, and foreign matter.
2. Make sufficiently rough to provide a strong mechanical bond.
3. Wash entire concrete pool shell with acidic solution within twenty-four (24) hours of plastering.
4. Do not apply plaster directly to the surfaces of masonry or concrete that are coated with any acidic solution compound or similar agent until compound or agent is completely removed by water blasting.
5. Thoroughly wash entire surface with 2,000 psi high pressure water immediately prior to plastering.
6. Wet cementitious base surfaces with a fine fog water spray, or manufacturer’s required bond coat, to produce a uniformly moist condition and check screeds, pool equipment, and accessories for correct alignment before plastering is started.
7. Do not apply plaster to base surfaces containing frost.
8. Install temporary coverings as required to protect adjoining surfaces from staining or damage by plastering operations.

3.02 APPLICATION

A. General: Apply finish plaster to minimum ½-inch thickness at any location. Apply finish plaster by hand or machine. If plastering machine is used, control fluidity of plaster to have a slump not exceeding 2-1/2 inches when tested using a 2” by 4” by 6” high slump cone. Do not add additional water to the mix subsequent to determining water content to meet this slump. Perform slump test according to following procedure:
   1. Place cone on level, dry non-absorptive base plate.
   2. While holding cone firmly against base plate, fill cone with plaster taken directly from hose or nozzle of plastering machine, tamping with a metal rod during filling to release all air bubbles.
   3. Screed off plaster level with top of cone. Remove cone by lifting it straight up with a slow and smooth motion.
   4. Place cone in a vertical position adjacent to freed plaster sample using care not to jiggle base plate.
   5. Lay straightedge across top of cone being careful not to vibrate cone; measure slump in inches from bottom edge of straightedge to the top of slumped plaster sample.

B. Workmanship: Apply finish plaster in two (2) coats by “double-back” method with second coat applied as soon as first coat is tamped and initially floated. Apply plaster with sufficient pressure to provide a good bond on bases. Work plaster to screeds at intervals of from 5 feet to 8 feet on straight surfaces. Apply smooth trowel finish without waves, cracks, trowel marks, ridges, pits, crazing, discoloration, projections, or other imperfections. Form plaster carefully around curves and angles, well up to screeds. Take special care to prevent sagging and consequent drooping of applications. Produce surfaces free of visible junction marks in finish coat where one (1) day's work adjoins another.

C. Curing: Curing plaster with fine fog water spray applied to finish coat as frequently as required to prevent dry-out of plaster. Keep plaster damp until pool is filled. Prevent damage or staining of plaster by troweling or curing.

D. Patching, pointing, and cleaning up: Upon completion, cut out and patch loose, cracked, damaged, or defective plaster; patches matching existing plaster in texture, color, and finish, flush with adjoining plaster. Perform pointing and patching of surfaces and plaster work abutting or adjoining any other finish work in a neat and workmanlike manner. If 10 percent or more of the pools plaster finish is found to be defective, the plaster shall be removed and replaced complete from all surfaces. Remove plaster droppings or spatterings from all surfaces. Leave plaster surfaces in clean, unblemished condition ready for pool filling. Remove protective coverings from adjoining surfaces. Remove rubbish and debris from the site.

END OF SECTION
PART 1 GENERAL

1.01 DESCRIPTION

A. Scope of Work: Work shall include the furnishing of all labor, materials, equipment, engineering expertise and other incidentals to the construction of:
   1. One (1) indoor body flume ride.
   2. One (1) outdoor inner tube flume ride designed for use with tubes and an outside shoulder width not less than 84" and an inside depth of 36".
   3. One (1) outdoor body flume ride all to include but not be limited to:
      a. Fiberglass flume components.
      b. Flume support system.
      c. Starting platform, all stairways and railings and steps as necessary to enter ride.
      d. Concrete footings and foundations.

B. Work Provided Elsewhere in the Specifications or on the Drawings:
   1. Furnish and install pumps for water supply to the slide and all necessary piping as specified by the successful water flume ride bidder.
   2. Cut-outs in pool wall to accept slides.
   3. Patch in and waterproofing of entry sections into the pool after installation of the slide.
   4. Pool and deck structure around slide foundation and columns.
   5. Refer to Division:
      b. Concrete - 03.
   6. Refer to General & Supplementary Conditions - This contractor shall be bound by the General and Supplementary Conditions.

1.02 REGULATIONS

A. The Water Flume Ride starting platform, stairways and railings shall be designed and installed to conform to all requirements of:
   1. The Department of Public Health, and all other state and local health and building codes.
   5. Applicable local, provincial or state building codes.

1.03 SITE CONDITIONS

A. Topography - The drawings indicate the location and building information pertaining to the site for Water Flume.

B. Soils - Refer to Division 02.

1.04 USE OF SITE

A. General
   1. The contractor will restrict his construction to the general area shown on the drawings.
   2. Access and egress shall be coordinated with the general contractor and controlled so as not to conflict with the normal operations of the project.

B. Design
   1. The design, shown on the drawings show the intended use and desired locations of the elements in relation to the adjacent deck uses.
2. The slide manufacturer, in providing its bid, warrants that it is licensed to do work in the project’s state and municipality and holds appropriate professional registrations, permits and/or meets other requirements by authorities having jurisdiction.

3. The slide manufacturer shall indemnify and hold harmless the architect and the owner from any and all actions caused by or related to the design, fabrication and installation of the work of this specification section.

1.05 PERMITS & FEES

A. The manufacturer and/or the contractor shall provide sufficiently detailed information on all items furnished to secure all necessary permits, including but not limited to:
   1. Building permit.
   2. State Department of Public Health construction and operating permits.

B. All applicable fees and permits for construction will be paid for by the contractor(s) and shall be included in the bid price. The Department of Public Health construction permit for the swimming pools will be paid for by owner.

1.06 JOB CONDITIONS

A. Protection:
   1. Use all means necessary to protect existing work and, in the event of damage, immediately make all repairs and replacements necessary, subject to approval of the architect/engineer and at no additional cost to the owner.

B. Store Products:
   1. Contractor shall assume full responsibility for the protection and safe keeping of products under this contract stored on the site.

C. Lines, Levels and Layout of Work:
   1. The contractor shall establish and guarantee all lines, levels, etc. called for on the drawings.
   2. The contractor shall be responsible for the lines, levels, etc. of all his subcontractors.

1.07 SUBMITTALS

A. Submit in accordance with Division 0.

B. Construction Schedule:
   1. The contractor will cooperate with scheduling determined for the complete job so as not to create any delays or slowdown of other contractors.

C. Shop Drawings:
   1. Promptly after award of the contract, the contractor shall submit complete shop drawings to include, but not be limited to:
      a. Course layout with dimensions.
      b. Flume detail.
      c. Flume support details, including footings and foundations.
      d. Tower and stair details, including foundations, structural support, bracing, and starting chute as indicated on the plans.
      e. Modifications to plunge area, if any, required for the safety of the contractor’s slide path design.
      f. Modifications to the slide pumps, if any, required for the contractor’s slide path design.
   2. All shop drawings shall be certified and sealed by a structural engineer, registered and licensed in the project state.

1.08 GUARANTEE/WARRANTY

A. Labor and Material Payments Bonds: The contractor may be required to furnish bonds equal to the total contract amount guaranteeing the payment of all labor and materials. See General Project Requirements.

B. Special Project Requirements: Manufacturer agrees to provide evidence of product liability insurance naming the owner, architect and Water Technology, Inc. as additional insured. This insurance will be maintained for a minimum of five (5) years or as required by statue, whichever is greater. In addition, the manufacturer agrees to indemnify, hold harmless, and defend the owner, the architect and Water Technology, Inc. including their agents and employees for any and all claims, damages, losses and
expenses of whatsoever nature, including but not limited to claims for property damage, personal injury (including death), attorneys fees, litigation expenses, court costs and all other damages arising out of or incidental to, resulting from or in connection with performance of this manufacturer’s work.

C. Qualification of Workmen: At least one (1) person who is thoroughly familiar with the materials, methods and equipment being utilized shall be present at all times during the construction to direct the work where required.

D. Approved Manufacturers - The following manufacturers have submitted sufficient information to be pre-qualified as sources of water flume equipment:
   1. PROSLIDE TECHNOLOGY, INC., 2650 Queensview Dr. Suite 150, Ottawa, Ontario, CANADA K2B 8H6, (613) 526-5522.
   2. SPLASHTACULAR Operations Facility Kansas: 102 W. Kaskaskia, Suite 201 Paola, KS 66071 (800) 844-5334; Corporate Office – California 78-670 Hwy 111, PMB 225 La Quinta, CA 99253.
   3. WHITEWATER, 6700 McMillan Way, Richmond, BC V6W 1J7, (604) 273-1068.

PART 2 PRODUCTS

2.01 FIBERGLASS FLUME COMPONENTS

A. General: The fiberglass flume components are those various elements that compose the water flume and include:
   1. Starting Section.
   2. Curved Sections.
   3. Straight Sections.
   4. Drop or Accelerating Sections and Deceleration Sections.
   5. Built-up Sections Including Lead-ins and Lead-outs.
   6. Exit Section or End Section.
   7. All other incidental fiberglass components necessary for a complete system.
   8. All sections shall be bolted and caulked. No fiberglass joints allowed.

B. Fiberglass Laminate Materials:
   1. Gelcoat: Interior gel coat shall be “crystal clear” high quality isophthalic polyester with U.V. inhibitors. 20 mils thickness. Exterior coat 18 mils wet clear gloss U.V. protective coating.
   2. Resins: Thixotropic promoted low profile polyester resin with alternate layers of continuous roving chop and 18 oz. woven roving.
   3. Structure: Fiberglass lamination with sandwich panel center line reinforcement. Standard flume section shall be 3/16” thick, minimum weight 14 oz. per square foot. Flanges shall be minimum 1/4” thick and extend at least 4-3/4” from the slide surface, “L” type.

C. Joints, Connections and Seams:
   1. Flume to flume joints shall be fastened with 3/8” stainless steel bolts, washers (2 per bolt), and self-locking nuts.
   2. Flume to support system connections shall be made with stainless steel hardware and shall be connected separately form water slide section connections.
   3. Fiberglass joint connections shall be made using waterproof non-shrink caulking with suitable adhesion to fiberglass. Silicone sealants will not be permitted.
   4. Fiberglassing over seams within the riding surface is not permitted. Sanding within the slide surface should be minimized to maintain adequate gel coat thickness and gloss. Any sanded areas shall be polished to a high gloss until undetectable.

D. Color:
   1. Shall be as standard to the manufacturer, and approved by architect/engineer, integral to the fiberglass and the same top and bottom (inside and outside). Verify color selection with architect and owner.

E. Ride Configuration:
   1. The body slide length and configuration shall be as indicated in the drawings.
   2. Alternate configurations will be considered if rides commence and terminate at the same location/elevation, are of the same length and configuration, and all other features of the specifications are met.
F. Required Components: All slides shall be furnished with the following components:
   1. Entry tray shall be pre-plumbed for water injection down-stream of the rider entry point.
      Rider entry area shall be a non-skid surface, no steps are permitted.
   2. Factory pre-drilling of all sections.
   3. Waterproof joint sealant as specified in Article 2.01.C.
   4. Stainless steel assembly hardware as specified in Article 2.01.C

2.02 FLUME SUPPORT, TOWER AND STAIR SYSTEM

A. General: The flume support tower and stair system shall consist of all elements necessary to
   safely and securely support the fiberglass water flume from the starting platform to the plunge
   pool and consists of:
   1. Concrete footings and foundations, including excavation, backfill and compaction.
   2. Concrete supports.
   3. Factory painted galvanized steel tower and stair system. Follow paint manufacturer’s
      specifications for surface preparation of galvanized steel.
   4. All connecting hardware.

B. Design: The supports and footings shall be certified by a licensed structural engineer in the
   project state for the soil conditions as indicated, and the stresses generated by the water flume
   ride during use.

C. Concrete
   1. Cast-in-place: Minimum compressive strength shall be 3,000 psi at 28 days. Maximum size
      aggregate shall be 3/4 inch. Slump shall not be more than 3 inches. Concrete shall be
      vibrated but not to excess so as to cause segregation of materials. Check all applicable
      drawings for locations of blockouts, anchors, inserts, etc. before concrete is placed.
   2. Reinforcing Steel:
      a. Fy = 60,000 psi min., for: ASTM A615 (deformed bar) or equivalent. ASTM A82
         (welded wire fabric) or equivalent.
   3. Unless otherwise noted, concrete cover of reinforcing shall be as follows: Footing 3 inches
      and walls, pedestals, and columns 1 ½ inch minimums.
   4. All concrete procedures to conform to latest ACI Building Code.
   5. Steel reinforcing lap splices for concrete slab shall be a minimum of 36 bar diameter.

D. Structural Steel
   1. Shall consist of radial arms with end yoke type fastening assembly for each support point.
      (NOTE: A central column support with radial arms may be used to support circular sections
      of 180 degrees or greater.)
   2. Structural steel shall be new material of sizes and shapes listed in current AISC handbooks
      and as indicated on drawings.
   3. Shapes and plates: ASTM A36 or equivalent minimum Fy = 36,000 psi (248.2 MpA).
   4. Square structural section: ASTM A500 minimum Fy = 46,000 psi (317 MpA).
   5. Round steel pipes: ASTM A53 grade B minimum Fy = 35,000 psi (241.3 MpA).
   6. Cast steel: ASTM A27 minimum Fy = 36,000 psi or equivalent.
   7. Tension rods, bolts, and anchor bolts: ASTM A36 minimum allowable tensile stress Ft
      =19,100 psi (131.7 MpA).
   8. Structural bolts: ASTM A325, friction type or equivalent minimum allowable shear stress, Fv
      = 21,000 psi (144.8 MpA). Minimum allowable tensile stress, Ft = 44,000 psi (303.4 MpA).
   9. Welding electrodes: E480XX electrode (E70XX). Minimum allowable shear stress,
      Fv=21,000 psi (144.8 MpA).
   10. Grout: Masterflow 713 or approved equal non-shirk, non-metallic grout. Use as
       recommended by manufacturer.
   11. All plates, shapes and tubes in contact are to be welded with ¼-inch minimum fillet welds all
       around unless otherwise indicated.
   12. Unless otherwise noted all steel structure shall be galvanized.
   13. Contractor shall supply temporary bracing to take care of all loads on the structure during
       erection to ensure the safety of the structure, leave as long as is required, remove when
       safety is assured.
14. All flumes and support arms shall be properly set and installed prior to installation of permanent column bracing. Additional column bracing as required by engineer, in addition to those noted on the drawing, shall be provided upon site inspection.

15. All hollow structural sections shall be closed airtight with end plates sealed with welds.

16. All steel shall be thoroughly cleaned of all loose mill scale, loose rust, oil and dirt.

17. Surface to be welded shall be free from loose scale, rust, paint or other foreign matter. Care shall be taken to minimize stresses due to heat expansion, contraction and distortion by using proper sequence in welding and by other approved methods.

18. Fabrication and erection shall conform to the latest editions of the ASTM Specifications and Code of Practice: Welding shall be done by welders certified with AWS D-1.1.

19. Equivalent structural steel sizes listed in current AISC or CISC Handbook may be used upon approval of the architect/engineer.

20. Definitions:
   b. AISC - American Institute of Steel Construction
   c. CISC - Canadian Institute of Steel Construction

E. Column System
   1. A single or multiple concrete post system shall be used.

F. Starting Tower/Stairway/Railing
   1. General - The starting tower/stairway shall consist of:
      a. A factory painted galvanized tower and stair support system with Duradek T-1800 or fiberglass grating. Risers shall be closed.
      b. All stair treads shall have a step edge of a contrasting color.
      c. Powder Coated Type 304 Stainless Steel. Color Selection by Owner/Architect.
      d. Bracing and structural support (non-corrosive).
      e. Hand rails on both sides of entire stair tower.
   2. Design
      a. The structured design shall be certified by an engineer licensed in the project state. Structure shall be sized to handle the user volumes, the height required by the flume length, and the location on the existing topography.
      b. Stair design shall follow current State building codes.
      c. Coordinate with slide manufacturer.
   3. Concrete Footings & Piers
      a. Shall be designed and constructed to support the design loads.
      b. All concrete shall have a minimum twenty-eight (28) day compressive strength of 4,000 psi.
      c. All footings shall be on undisturbed soil.
      d. Vertical members shall be on concrete footings, above grade and be secured with flange plates and anchor bolts.
   4. Hardware
      a. Steel Hardware, ASTM A-7 or A-36 (hot dipped galvanized).
   5. Starting Tower
      a. Shall be factory painted hot dipped galvanized steel structure and shall be supported by their own hot dipped galvanized steel columns. Coordinate design with building structural engineer and slide manufacturer.
      b. Shall have Duradek T-1800 or Fibredek fiberglass grate, decking, treads, and closed risers.
   6. Stairs and Railings
      a. Stairs shall have factory painted hot dipped galvanized steel stringers with fiberglass grating treads and closed panels. Stairs shall have four foot minimum width.
      b. Rail system shall be a minimum of 42" high at any point, non-climbable and designed to prevent accidental exit. Handrails shall be located at 34" above stair riser. Color selection by architect and owner.
      c. The stair entry shall be provided with a 42" high lockable gate of similar construction as the rail system.
   7. Finish
      a. All galvanized metal:
1) Wash all galvanized to be painted with a simple green soap, rinse thoroughly.
2) Clean galvanized surfaces with Xylene, which will leave a whitish film - do not remove film.
3) Prime galvanized with Devoe Tru-Glaze Epoxy Primer #12735/12702, following manufacturer's instructions.
4) Finish coat to be Devoe Deythane 369 Aliphatic Urethane Gloss Enamel #369-K-XXXX, following manufacturer's instructions - color by owner.
5) Second coat may be necessary, depending on appearance of first finish coat; second coat to be Devoe Deythane 369 Aliphatic Urethane Gloss Enamel #369-K-XXXX.

b. All ferrous metal parts:
1) Surface Preparation: Blast all surfaces to be coated to the extent of an SSPC-SP6 commercial-grade level of cleanliness. Create a 1.5 - 2.0 mil profile and prime before any rust bloom forms on the surface.
2) Primer: Spray apply, in the shop, one full coat of Tnemec Series 90-97 Aromatic Urethane Zinc-Rich or Amercoat 68 HS primer to a DFT of 4.0 mils. Allow to cure as per data sheet (4 hours @ 75°F) before applying topcoat.
3) Topcoat: Spray apply in the shop one even finish coat of Tnemec Series 74-Color Endura-Shield. Acrylic Polyurethane or Ameron PSX-700 finish to a minimum DFT of 5.0 mils. Allow to cure as per data sheet (6 hours @ 75°F) before handling/loading in the shop.
4) Field Touchup: If the broken area of the shop applied film is rough from scaring, disc-abrade that area smooth and then solvent clean it as per an SSPC-SP1, level of cleanliness. Brush or roller apply one coat of Tnemec Series 135 Chembuild or Ameron epoxy primer. Allow to cure as per data sheet. Brush or roller apply one coat of Tnemec Series 74 or Ameron PSX-700 shop applied color to bring the film up to specification thickness.

c. Fiberglass handrail posts:
1) Finish: Tnemec Series 74 or Ameron PSX-700 shop applied at 5.0 mils DFT.
2) Field Touchup: Tnemec Series 74 or Ameron PSX-700 shop applied at 5.0 mils DFT.
3) Manufacturer: Tnemec 816/483-3400 or Amercoat 800/244-0025 or pre-approved equal.

d. Top deck and landing shall have a non-slip finish.
e. Treads non-slip shall have a non-slip finish.
f. All exposed concrete vertical surface shall have a sack rubbed finish.
g. Seal all concrete with a minimum of two (2) coats of slip resistant Concrete Sealer.
h. Colors shall be as selected by the architect and owner.

PART 3 EXECUTION

3.01 GENERAL

A. The installation of this work shall comply with the following governing and regulatory authorities.
   1. Department of Labor (OSHA).
   2. State Department of Public Health.
   3. All State and Local Building Codes.
   4. Any other agency that has legal jurisdiction.

3.02 FLUME CONSTRUCTION

A. All construction shall conform to the recommendations of the approved manufacturer selected through this bidding process.
B. The manufacturer shall be responsible for the quality of the flume material and equipment.
C. The slide manufacturer shall be responsible for the layout, assembly and erection of the flume products in a workmanlike manner.
D. Flume joints shall be properly connected so as to avoid abrupt edges that may cause irritation.
E. Flume flanges shall be bolted together with 3/8 inch diameter bolts. All connectors shall be stainless steel.
F. Polyurethane sealant or any other approved sealant shall be provided on each flange connection.

G. All flumes shall be properly cleaned and surfaces smooth finished, and complete with all the necessary sections prior to use of the slide.

H. All flumes underground shall be carefully backfilled to prevent the flumes from getting damaged. All fill in contact with flume shall be of good quality and free of boulders.

I. Flumes shall be inspected by the representative of the slide manufacturer to ensure a smooth finish prior to acceptance of work.

3.03 OWNER INSTRUCTION

A. In addition to Section 13150 requirements for operation/maintenance instructions, the slide manufacturer shall deliver four complete sets of operating and maintenance instructions bound together in a complete manual for the slide(s) to the Architect/Engineer. Including, but not limited to the following:

1. Narrative on the slide operation including recommended loading procedures and operation through all sequences.

2. Recommended user requirements including recommended signage and height and weight restrictions.

3. Written slide warranty and contact information.

4. Maintenance information and recommended maintenance program.

END OF SECTION
SECTION 13 3419
PRE-ENGINEERED METAL BUILDING SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Manufacturer-engineered, shop-fabricated structural steel building frame.
B. Insulated metal wall panels and metal roof panels including soffits and gutters and downspouts.
C. Openings for exterior doors, windows, and other indicated fenestration elements.
D. Design engineering for pre-engineered metal building systems.

1.02 REFERENCE STANDARDS
A. AISC 360 - Specification for Structural Steel Buildings.
D. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
G. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
L. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions.
M. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination.
N. AWS D1.1/D1.1M - Structural Welding Code - Steel.
P. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic").

1.03 SUBMITTALS
A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide data on profiles, component dimensions, fasteners and all exterior cladding and roofing products.
C. Shop Drawings: Indicate assembly dimensions, locations of structural members, connections; wall and roof system dimensions, panel layout, general construction details, anchorages and method of anchorage, installation; framing anchor bolt settings, sizes, and locations from datum, foundation loads for most severe loading combination for allowable stress design in accordance with IBC Section 1605.3.1; indicate welded connections with AWS A2.4 welding symbols; indicate net weld lengths; provide professional seal and signature.

D. Samples: Submit two samples of precoated metal panels for each color selected, 12 by 12 inch in size illustrating color and texture of finish.

E. Manufacturer’s Instructions: Indicate preparation requirements, anchor bolt placement, and other pertinent information.

F. Erection Drawings: Indicate members by label, assembly sequence, and temporary erection bracing.

1.04 QUALITY ASSURANCE

A. Designer Qualifications: Design structural components, develop shop drawings, and perform shop and site work under direct supervision of a Professional Structural Engineer experienced in design of this Work.
   1. Design Engineer: Licensed in Colorado.
   2. Comply with applicable code for submission of design calculations as required for acquiring permits.
   3. Cooperate with regulatory agency or authorities having jurisdiction (AHJ), and provide data as requested.

B. Perform work in accordance with AISC 360 and MBMA (MBSM).

C. Perform welding in accordance with AWS D1.1/D1.1M.

D. Manufacturer Qualifications: Company specializing in the manufacture of products similar to those required for this project.
   1. Not less than three years of documented experience.

E. Erector Qualifications: Company specializing in performing the work of this Section with minimum five years experience.

1.05 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

C. Provide five year manufacturer warranty for entire installation.
   1. Include coverage for exterior pre-finished surfaces to cover pre-finished color coat against chipping, cracking or crazing, blistering, peeling, chalking, or fading. Include coverage for weather tightness of building enclosure elements after installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturer:
   2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 ASSEMBLIES

A. Single span rigid frames as indicated on Drawings.

B. Primary Framing: Rigid frame of rafter beams and columns, braced end frames and end wall columns, and wind bracing.

C. Secondary Framing: Purlins, and other items as indicated.
D. Wall System: Preformed insulated metal panels of vertical seam profile, with sub-girt framing/anchorage assembly, and accessory components.
   1. Liner Panels: Specified manufacturer’s "Multi Rib" panel system.
   2. Wall Panels: Specified manufacturer's "Long Span III" panel system.

E. Roof System: Preformed metal panels oriented parallel to slope, with sub-girt framing/anchorage assembly, and accessory components.
   1. Specified manufacturer's "Standing Seam 360" panel system.

2.03 PERFORMANCE REQUIREMENTS

A. Design structural members to withstand dead load, wind uplift, and other design loads due to pressure and suction of wind calculated in accordance with design load schedule on Structural Drawings.

B. Exterior wall and roof system shall withstand imposed loads with maximum allowable deflection of 1/90 of span.

C. All columns shall withstand imposed loads with maximum allowable horizontal drift of H/100 (building height divided by 100).

D. Provide drainage to exterior for water entering or condensation occurring within wall or roof system.

E. Permit movement of components without buckling, failure of joint seals, undue stress on fasteners or other detrimental effects, when subject to temperature range of 50 degrees F.

F. Size and fabricate wall and roof systems free of distortion or defects detrimental to appearance or performance.

2.04 MATERIALS - FRAMING

A. Structural Steel Members: ASTM A36/A36M.

B. Structural Tubing: ASTM A500/A500M, Grade B cold-formed.

C. Plate or Bar Stock: ASTM A529/A529M, Grade 50.

D. Anchor Bolts: ASTM F1554, Grade 36, Class 1A, with no preference for protective coating.

E. Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1; galvanized to comply with requirements of ASTM A153/A153M.

F. Welding Materials: Type required for materials being welded.

G. Primer: SSPC-Paint 20, zinc rich.

H. Grout: ASTM C1107/C1107M; Non-shrink; premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.
   1. Minimum Compressive Strength at 48 Hours: 2,000 pounds per square inch.
   2. Minimum Compressive Strength at 28 Days: 10,000 pounds per square inch.
   3. Height Change, Plastic State: When tested in accordance with ASTM C827/C827M:
      b. Minimum: Plus 1 percent.

2.05 MATERIALS - WALLS AND ROOF

A. Steel Sheet: Hot-dipped galvanized steel sheet, ASTM A653/A653M, Designation SS (structural steel), Grade 33 (230), with G90/Z275 coating.

B. Insulation: Type as specified in Section 07 2100.

C. Joint Seal Gaskets: Manufacturer's standard type.

D. Fasteners: Manufacturer’s standard type, galvanized to comply with requirements of ASTM A153/A153M, finish to match adjacent surfaces when exterior exposed.

E. Bituminous Paint: Asphaltic type.

F. Sealant: ASTM C920, elastomeric sealant with movement capability of at least plus/minus 50 percent; 100 percent silicone; for exposed applications, match adjacent colors as closely as possible.
2.06 OTHER COMPONENTS
   A. Metal Doors and Frames: Specified in Section 08 1113.
   B. Gutters and Downspouts: Specified in Section 07 6200.
   C. Storefronts and Windows: Specified in Section 08 4313.

2.07 FABRICATION - FRAMING
   A. Fabricate members in accordance with AISC 360 for plate, bar, tube, or rolled structural shapes.
   B. Anchor Bolts: Formed with bent shank, assembled with template for casting into concrete.
   C. Provide wall opening framing for doors, windows, and other accessory components.

2.08 FINISHES
   A. Framing Members: Clean, prepare, and shop prime. Do not prime surfaces to be field welded.

PART 3 EXECUTION

3.01 EXAMINATION
   A. Verify that foundation, floor slab, mechanical and electrical utilities, and placed anchors are in correct position.

3.02 ERECTION - FRAMING
   A. Erect framing in accordance with AISC 360.
   B. Provide for erection and wind loads. Provide temporary bracing to maintain structure plumb and in alignment until completion of erection and installation of permanent bracing.
   C. Set column base plates with non-shrink grout to achieve full plate bearing.
   D. Do not field cut or alter structural members without approval.
   E. After erection, prime welds, abrasions, and surfaces not shop primed.

3.03 ERECTION - WALL AND ROOF PANELS
   A. Install in accordance with manufacturer's instructions and as specified in applicable related Sections.
   B. Exercise care when cutting prefinished material to ensure cuttings do not remain on finish surface.
   C. Fasten cladding system to structural supports, aligned level and plumb.
   D. Locate end laps over supports. End laps minimum 2 inches. Place side laps over bearing.
   E. Provide expansion joints where indicated.
   F. Install all required sealants, flashings, and gaskets, providing weather tight installation.

3.04 ERECTION - GUTTERS AND DOWNSPOUTS
   A. Install in accordance with manufacturer's instructions and as specified in applicable related Sections.
   B. Rigidly support and secure components. Join lengths with formed seams sealed watertight. Flash and seal gutters to downspouts.

3.05 TOLERANCES
   A. Framing Members: 1/4 inch from level; 1/8 inch from plumb.
B. Siding and Roofing: 1/8 inch from true position.

END OF SECTION
SECTION 13 3423
PRE-ENGINEERED RESTROOM BUILDING

PART 1 GENERAL

1.1 SUMMARY
A. The work shall include furnishing the sealed architectural, structural, mechanical, and electrical plan sets as well as the structural, mechanical, and electrical building components as a complete, pre-designed packaged restroom building as shown on drawings and as specified herein.

1.2 SCOPE
A. Packaged restroom building and all associated design and engineering, with all listed components supplied by Romtec, Inc., hereafter designated as the building supplier. The building supplier shall be a single source design, engineering, and manufacturer who shall supply the packaged restroom building and meet all the following scope requirements.
B. The contractor is responsible for building installation, hereafter designated as the building installer. Building installer work will generally include: site preparation and grading, excavations for structures, backfill and/or structural backfill, foundation and pad construction, and building construction. Note: Romtec Inc. does not serve as the building installer. Romtec Inc. is only the packaged restroom building supplier.
C. The packaged restroom building should be the latest standard product of a building supplier regularly engaged and having at least ten (10) years of experience in packaged restroom building engineering, design, supply, and construction.
D. The building supplier must meet or exceed the product specification which was prepared using the Romtec Inc. building as a guide and example.
E. Alternate building suppliers shall demonstrate that they have designed, engineered, produced, delivered, and constructed at minimum ten (10) other functioning site built restroom buildings of similar type. Project completion date and a reference contact from the owner of each project must be provided.
F. Alternate building suppliers must also disclose all instances of any prior municipal or landscape architect’s rejection of the same or similar product as an “or equal” to the specified basis of design building package.
G. Contractors wanting to propose an “or equal” building supplier other than Romtec Inc. are required to submit a complete submittal package with full sealed plan sets, calculations, and all pre-engineered structural items, ten (10) calendar days prior to the bid opening date. Any products proposed as “or equal” that are not as specified must be specifically listed and accompanied by the manufacturer’s data sheets for review. This will be approved or denied prior to the bid opening. Incomplete submittals will be rejected and returned to the bidder.
H. The building and its concrete footings, foundation, and slab are to be engineered by the building supplier to meet site specific conditions including wind and snow loading, local frost depth, and ground conditions.
I. Footings are to be dug by the building installer and poured on site to meet local code for permanent structures. A prefabricated, modular mat placed on compacted base is not an accepted equal to a site specific, site poured, engineered foundation.
J. Typical fasteners such as nails, staples, and screws shall be supplied by building installer. Atypical fasteners shall be supplied by building supplier.
K. Building is to be designed and constructed on site to meet local codes and approvals for permanent structures. Any building that is temporary, permanently relocatable, prefabricated modular, an offsite constructed product, or pre-cast is not an accepted equal to permanent, on site, conventional construction.
L. No outside entity approval will override the local building authority’s codes and inspections. Seals meant for modular homes and production plant certifications will not be allowed in lieu of sealed plans from a licensed engineer and conventional inspection during construction.
M. The Romtec building package has been quoted with the specific product colors noted below. Changes to these color selections may result in a price increase.
N. Building sidings, treatments, and roofing are to be as specified. Precast buildings with painted textures are not to be considered architecturally equivalent.

O. Within one (1) week of contract award, the building supplier shall submit the packaged restroom building preliminary Scope of Supply and Design Submittal (SSDS), including the building plan view and elevation drawings.

P. The SSDS is reviewed by the necessary parties and returned to the building supplier with any revisions to the contractual language, product data sheets, and/or building plan view and elevation drawings. Once the design is approved, the building supplier will provide a sealed plan set stamped by an engineer licensed in the state that the building is located for building department review.

Q. One full round of sealed plan revisions are to be provided by the building supplier in the design and engineering services before additional fees apply.

R. The building supplier shall submit complete, code compliant building plans including plans, elevations, sections, and details, under seal of a National Kitchen and Bathroom Association (NKBA) certified technical designer.

S. The building supplier shall submit complete structural calculations meeting code loads, design loads, and seismic design under seal of a professional Engineer with current license in the state of Colorado.

T. Once submittal approval is received, three (3) wet stamped sets of plans and structural calculations shall be issued. Any additional plan sets and structural calculations can be obtained for a fee.

U. The building supplier does not provide a final site plan.

V. The reviewing authority reserves the right to review or reject all submittals at their sole discretion.

W. All work and materials shall comply with the latest industry building codes and regulations for the state of Colorado.

X. Americans with Disabilities Act Accessibility Guidelines (ADAAG) will be followed in design, manufacture, and construction.

Y. The specific supplier is indicated for each item. Building supplier, building installer, and owner supplied components are listed as such. Products not listed as building supplier or building installer supplied, are to be owner supplied.

1.3 DESIGN & SUBMITTAL DOCUMENTATION

A. The building supplier work shall include the design of the architectural, mechanical, structural, and electrical components that will be required for this building.

B. The building will be designed as a complete, packaged building to be delivered to the job site to be constructed on site by the contractor.

C. The building supplier will provide complete submittal documentation in the pre-engineered building suppliers standard submittal format for review.

D. The following sections shall be included in the building supplier’s Scope of Supply and Design Submittal. Incomplete submittals will be rejected and returned to the bidder.

1. INTRODUCTION
2. BUILDING SUPPLIER PRODUCTS & SERVICES
3. PRODUCTS & SERVICES NOT SUPPLIED BY BUILDING SUPPLIER
4. WARRANTY & LIMITATIONS
5. PROJECT DESIGN
6. PRODUCT DATA SHEETS

E. The building supplier will provide the building plan view and elevation with the Scope of Supply and Design Submittal (SSDIS) electronically for review and approval.

1. The building supplier will revise the SSDS per the review comments.
2. Once the design is approved, the building supplier will provide a sealed plan set stamped by an Engineer licensed in Colorado for building department review.
3. The building supplier will provide (2) sealed plan sets.

Note: Pricing allows for one revision in response to comments. Should additional revisions be requested, Romtec will provide a change order for the additional design work.

4. The plan set standard size is 11” x 17”.

Note: If a larger plan set size is required it will result in a price increase.

F. The building supplier to supply O&M manuals if requested.

1.4 WARRANTY
A. The building and all its associated components will be warranted against defects in materials and workmanship for a period of not less than one (1) year from date of final acceptance. Acceptance is defined as the date of the delivery of the building and all its associated components or the date that the building and all its associated components are ready to deliver whichever comes first.

1.5 MAINTENANCE
A. The building supplier does not supply maintenance for the packaged restroom building.

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS
A. Romtec, Inc.,
18240 North Bank Rd. Roseburg, OR. 97470
Tel: 541-496-3541; Fax: 541-496-0803; Email: travis.olson@romtec.com
Web: www.Romtec.com
B. Requests for substitutions will be considered in accordance with provisions of Section 1.

2.2 BUILDING DESCRIPTION
A. Refer to plans for quantities, dimensions, locations, and installation methods for the materials and items described in this section. The building supplier reserves the right to make substitutions of equivalent materials and items without notice.
B. Building dimensions shall match what is indicated on drawings.

2.3 WALLS
A. Concrete Masonry Units (CMU) shall be supplied by building supplier.
1. Walls shall be constructed of 8"W x 16"L x 8"H smooth-face mortar joint concrete masonry units (concrete blocks).
2. Blocks shall be manufactured to ASTM C90 designation for load bearing concrete masonry units. Note: The Building installer may be required to notch CMU block for bond beams, cut blocks to make the required shapes and/or grind block for fixture mounting.
3. Block color shall be Gray.
B. Exterior finish to be fiber cement lap siding with insulation between block and siding supplied by building supplier.
C. Privacy walls in front of restroom entrance shall be steel framed with fiber cement shiplap siding supplied by building supplier.
1. Steel to be powder coated black.
D. Polycarbonate gable windows shall be supplied by building supplier.
1. Windows shall include pre-assembled steel frame with 1/8" thick polycarbonate with translucent pebble finish.
2. Steel frames are powder coated black.
E. Sanitary tile cove base on interior walls shall be supplied by building supplier.
F. Door system components shall be supplied by building supplier.
1. Doors shall be Steelcraft® SL18 standard laminated honeycomb core and 18-gauge galvanized steel.
2. Door frame shall be pre-welded Steelcraft® 3-Sided flush frame, 16-gauge galvannealed steel.
3. Doors and frames to be powder coated black.
4. Masonry door clips (3/16" dia.) for door frame shall be fitted between the doorframe and concrete blocks to bond frame to wall. Door clips allow full internal grouting of the frame during installation.
5. Hinges shall meet ANSI A5112 with non-removable pin and two ball bearings.
6. Door closer shall have double heat treated steel tempered springs, a triple heat treated steel spindle and hold open arm.
7. Doors to have pull handles with deadbolt locks.
G. Bradley phenolic restroom partitions shall be shall be supplied by building supplier.
   1. Solid Phenolic core is composed of compressed cellulose fibers impregnated with resins. The
      surface laminate is fused to the resin-impregnated core. All edges are machined and finished
      smooth with a 15-degree beveled edge. Material will not delaminate even under extreme
      conditions. Materials are non-absorbent, impact and graffiti resistant. Materials are impervious to
      steam, soaps and detergents and will not mildew.
   2. Partition color shall be Graphite Grafix (006F).

2.4 ROOFING
   A. Roof shall be supplied by building supplier.
      1. Trussed roof system with insulation.
   B. Roofing shall be Fabral, 26-gauge, Horizon 16, standing seam panels, with 16 in. coverage width.
      1. Roofing package shall include inside and outside foam closures, matching trim (eaves, gables and
         ridge) and fasteners, sheet metal flashing (all sides), and 30# felt (under metal).
      2. Roofing color to be selected by the owner from the manufacturers standard color chart.
   C. Steel truss, beams and posts, 36’ roof extension.
      1. Tongue & groove decking shall be 2x6 V-edge deck boards, select deck Douglas fir.
      2. Steel to be powder coated black.

2.5 PLUMBING FIXTURES & ACCESSORIES
   A. The following restroom fixtures and accessories shall be supplied by building supplier.
   B. Toilets shall be floor mount, top supply, white vitreous china.
      1. Flush valve shall be a chrome, manual lever with ADA compliant metal oscillating non-hold-open
         handle.
   C. Urinals shall be wall mount, top supply, back discharge, white vitreous china.
      1. Flush valve shall be a chrome, manual lever with ADA compliant metal oscillating non-hold-open
         handle.
   D. Lavatory shall be 19 in. x 17 in. white vitreous china and wall hung with anti-splash rim and concealed
      front overflow.
      1. Faucets shall be a 2.2gpm, pivot action lever style faucet.
   E. Grab bars shall be stainless steel.
   F. Toilet paper dispenser shall be white, wall mount with two roll capacity.
   G. Surface-mounted liquid soap dispenser shall be fabricated of 20-gauge satin finish stainless steel.
      Dispenser shall have completely concealed mounting, vandal resistant filler hole cover and sight
   H. Drinking fountain shall be vandal-resistant EZH20 bottle filling station with bi-level vandal-resistant
      cooler, with freeze protection.

2.6 ELECTRICAL
   A. The following electrical fixtures shall be supplied by building supplier.
   B. Light fixtures shall be supplied by building supplier.
      1. Exterior lights to be LED downlights with cast-aluminum housing with corrosion-resistant paint in
         dark bronze. Polycarbonate lens protects the LED from moisture, dirt and other contaminants.
      2. Interior surface mount, 48” LED light fixtures.
      3. Lights controlled by motion sensor.
   C. Mini split cooling-heating, multi-indoor unit supplied by building supplier.
   D. Electric, ventilation package with energy recover ventilator supplied by building supplier.
   E. Restroom doors to have magnetic locking system supplied by building supplier.
   F. Bradley, surface mount, white hand dryers with 15 second dry time shall be supplied by building
      supplier.
   G. Main breaker panel shall be supplied by building supplier.
      1. Breaker Panel shall be 100 Amp, single-phase, indoor.

Note: This panel has been sized to accept only the loads of the building supplier electrical
fixture package. The building supplier has the right to modify the main breaker panel to be
most efficient based on any changes.
2.7 DELIVERY, STORAGE, AND HANDLING
   A. The building supplier freight shall be based on delivering the product on a 48’ to 53’ flatbed or van truck and trailers, or as close as they can legally get to the site. Overall dimensions of the truck and trailers shall be the following: 70’ overall length, 102” wide and 168” high.
   B. The building package to arrive on organized pallets that are shrink wrapped and separated into stages for ease of installation. Bill of material stating stages of components to be included.
      1. Stage 1 pallets to include components such as block, frames, vents, beams, connectors, trusses, etc.
      2. Stage 2 pallets to include filler wall material, windows, skylights, roofing, etc.
      3. Stage 3 pallets to include siding material, tile, doors etc.
      4. Stage 4 pallets to include toilets, sinks, drinking fountains, electrical fixtures, accessories, etc.

PART 3 EXECUTION

3.1 CAST IN-PLACE CONCRETE
   A. All equipment, labor, trades and materials shall be supplied by building installer.
      1. Includes all materials and labor for foundations/footings, interior slabs, exterior/entry slabs, and sidewalks.
   B. Engineered fill shall be ¾” minus crushed aggregate around footings, foundations, and slabs as required.
   C. Slab vapor barrier shall be 6-mil continuous plastic under the concrete slab.
   D. The foundation shall be installed as designed with all cast in-place concrete poured to dimensions specified in final plans.
      1. Footings will be built to 24” depth.
      2. Minimum compressive strength of 3000 psi at 28 days, 4+/-1” slump, with max ¾” aggregate, cured in accordance with ACI 308.
      3. Slabs shall have a fine broom finish with joints required in flat work as shown on plans.
      4. Steel rebar shall be installed as specified in final plans.
   E. Concrete slab sealer shall be a water-based transparent curing, sealing and dust proofing compound with two (2) coats to be applied per manufacturer’s instructions.
   F. Refer to drawings for sidewalks and entry slabs.
      1. Minimum concrete compressive strength of 2500 psi at 28 days.
      2. Remesh or rebar reinforcement shall be used in sidewalks.
      3. All sidewalks shall be finished with a fine broom with control joints installed per engineer’s specification.

3.2 STRUCTURE
   A. Masonry (concrete) grout shall be supplied by building installer.
      1. Grout shall have a minimum compressive strength of 2500 psi at 28 days, 9+/-1” slump, with max ½” aggregate.
      2. Fine or coarse grout may be used in accordance with 2009 UBC.
      3. All CMU must be fully grouted and may not be wetted.
   B. Rebar in walls shall be supplied by building installer.
      1. All walls have # 4 and # 5 rebar, see plans for spacing.
      2. All rebar used in building must meet ASTM A615 manufacturing standards and is to be placed per plans.
   C. Ceiling finish to be supplied by building installer.
   D. Interior block wall finish to be latex epoxy paint supplied by building installer.
   E. Interior floors to be sealed concrete finish supplied by building installer.
   F. Sealant for all exposed wood shall be supplied by building installer.
   G. Fiber cement siding is primed to be painted on-site by building installer.

3.3 PLUMBING
   A. Plumbing rough-in, installation and trim shall be supplied by building installer.
1. All underground water service and sewer drain(s) from building to be as specified in final site plan.
2. All floor drains shall be as shown on final building plans.
3. Building water shutoff valve, drain, and all rough piping shall be as shown on final building plans. Final location to be set onsite.
4. Minimum water pressure at toilet and urinal flush valves shall be 40 psi. with minimum pipe sizing as per 2009 Uniform Plumbing Code Section 610.
5. Install the supplied fixtures and all other plumbing supplies as specified in final plans.

B. Floor drains shall be supplied by **building installer**.
C. Water line drain valve shall be supplied by **building installer**.
D. Sewer line backflow check valve shall be supplied by **building installer**.

### 3.4 ELECTRICAL
A. Electrical rough-in, installation and trim shall be supplied by **building installer**.
   1. All underground and/or overhead service to building shall be as specified in the final site plan.
   2. Electric meter base and all rough wiring, switches, plugs and circuit breakers shall be as shown on final plans. The **building supplier** does not supply the meter base and meter.
   3. **Building installer** is responsible for all necessary wire, connectors, grounding, conduit etc. to install the components and meet national and local code. The installation of these components shall comply with all state and/or local codes.

### 3.5 OTHER MATERIALS & EQUIPMENT
A. Unless otherwise specified, the following products and materials are NOT supplied by Romtec.
   1. All items not listed in Romtec Products.
   2. Any item listed as supplied by “installer”, “contractor”, “owner”, or “others”.
B. Unless specified in the plans or submittals, Romtec does not supply the following:
   1. Building installation
   2. Asphalt paving
   3. Masonry pavers
   4. Sidewalks
   5. Landscaping
   6. Site grading
   7. Cast-in-place concrete foundations, footings, interior slabs and exterior/entry slabs
   8. Concrete slab sealer
   9. Mortar
   10. Concrete grout
   11. Rebar
   12. Latex epoxy paint
   13. Caulk for siding
   14. Plumbing rough in, installation and trim
   15. Electrical rough in, installation and trim
   16. Drain valves and backflow check valves
   17. Branch circuit breakers
   18. Switches & outlets
   19. Typical fasteners; for example: roofing nails, staples, etc.
   20. Fasteners not included in product packaging
   21. Irrigation Equipment
   22. Gutters and downspouts
   23. Fire alarm and fire suppression equipment
   24. Lighting equipment not attached to the building
   25. Clear coat finish for all decking, glulam beams, posts, and extensions
   26. All other items indicated on final plans or required by building codes which are not specifically stated as supplied by Romtec.

### 3.6 DELIVERY, STORAGE, AND HANDLING
A. The **building installer** will be responsible for all equipment and labor required for off-loading of the building onsite.
B. The building installer will assume responsibility for adequate protection of materials from weather, damage, and pilferage or all warranties, expressed or implied may be voided.

PART 4: EXECUTION

4.2 SPECIAL INSPECTION
   A. If required, special inspection shall be owner supplied.
   B. If special inspection is required per the building department or other regulatory agencies, then the building supplier can assist but NOT provide this service.

4.3 INSTALLATION
   A. All components to be installed according to the plan sets and/or manufacturer’s instructions.

4.4 OPERATION & MAINTENANCE MANUALS
   A. Upon installation, do not throw away the Operations & Maintenance manuals that are provided by some manufacturers in their packaging. Requests for additional copies from the building supplier will result in subsequent charges.

END OF SECTION