

**Engineering Exhibit B
Specifications – Volume 1
Bid Documents**

**City of Madison
Metro Transit
Service Lane Addition**

Mead & Hunt, Inc.
4503500-170148.02

**Contract No. 8238
Munis No. 11228**

Prepared for:

**City of Madison
Metro Transit
Madison, Wisconsin**

Prepared by:



January 17, 2019

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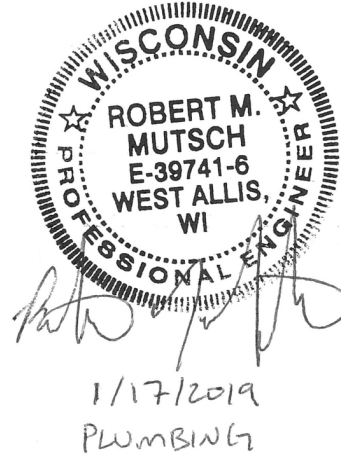
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LIST OF DRAWING SHEETS

PART 1 - GENERAL

1.1 LIST OF DRAWINGS

- A. Drawings: Drawings consist of the Contract Drawings and other drawings listed on the Table of Contents page of the separately bound drawing set titled City of Madison Metro Transit – Service Lane Addition – Phase 1, dated January 17, 2019, as modified by subsequent Addenda and Contract modifications.
- B. List of Drawings: Drawings consist of the following Contract Drawings and other drawings of type indicated:
1. G-001 COVER SHEET
 2. G-010 LIFE SAFETY SITE PLAN AND EXISTING PLANS
 3. G-011 LIFE SAFETY WORK AREA PLANS
 4. G-101 PHASING PLANS
 5. C-021 EXISTING SITE PLAN
 6. C-041 SITE REMOVALS PLAN
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53. F-102 FIRST FLOOR FIRE SPRINKLER PLANS - AREAS C & D
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80. E-001 NOTES, SYMBOLS & ABBREVIATIONS
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- 109. E-701 ONE-LINE DIAGRAM

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

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**DOCUMENT 003132
GEOTECHNICAL DATA**

PART 1 - GENERAL

1.1 GEOTECHNICAL DATA

- A. This Document with its referenced attachments is part of the Procurement and Contracting Requirements for Project. They provide Owner's information for Bidders' convenience and are intended to supplement rather than serve in lieu of Bidders' own investigations. They are made available for Bidders' convenience and information but are not a warranty of existing conditions. This Document and its attachments are not part of the Contract Documents.

- B. A geotechnical exploration investigation report and soil boring information was prepared for this project by CGC, Inc., dated June 12, 2018, is available for viewing as appended to this Document.

END OF DOCUMENT 00 31 32

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Construction • Geotechnical
Consulting Engineering/Testing

June 12, 2018
C18051-8

Mr. Jon Evans, P.E., LEED AP-BD&C
Building Design Project Manager
Department of Public Works
Engineering Division
City-County Building, Room 115
210 Martin Luther King, Jr. Blvd.
Madison, WI 53703

Re: Geotechnical Exploration Report
Proposed Madison Metro Building Addition
1101 East Washington Avenue
City of Madison, Dane County, Wisconsin

Dear Mr. Evans:

Construction • Geotechnical Consultants, Inc. (CGC) has completed the subsurface exploration program for the above-referenced project. The purpose of this program was to evaluate the subsurface conditions within the proposed construction area and to provide geotechnical recommendations regarding site preparation, foundation and floor slab design/construction. A determination of the site class for seismic design is also included. We are sending you an electronic copy of this report, and we can provide a paper copy upon request.

PROJECT DESCRIPTION AND SITE CONDITIONS

We understand that a building addition for bus fueling and washing is planned southeast of the existing Madison Metro facility at 1101 East Washington Avenue in Madison, Wisconsin. The addition is anticipated to be a single-story, slab-on-grade structure within an area that is currently paved with asphalt. Finish floor elevation of the addition is expected to match the existing building (approximately at existing site grades). Based on publicly-available topographic data (DCiMap; 2-ft contour lines), site grades within the project area gently slope from the northeast down to the southwest, with grades also sloping to a storm sewer inlet within western areas of the addition. Existing ground surface elevations range between about EL 850 and 852 ft.

According to historic aerial images (DCiMap), a previous structure (former Grisholt Foundry) in northeastern parts of the construction area was demolished at some point between 1976 and 1995. We understand a foundation wall of the demolished building was left in-place. This wall may be pile-supported although the depth of the wall/grade beam is unknown. The old foundation wall is located in portions of the southeastern exterior wall of the envisioned building addition.

Mr. Jon Evans, P.E., LEED AP-BD&C
Department of Public Works
June 12, 2018
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SUBSURFACE CONDITIONS

Subsurface conditions on-site were explored by drilling three Standard Penetration Test (SPT) soil borings to 40 ft below current site grades. Note that shallower (25 ft deep) borings were initially planned, but borings were drilled deeper to obtain more subsurface information with regard to deep foundation design, since we understand the existing building is supported on driven piles. The boring locations were jointly selected by the city and CGC and field-located by CGC. Ground surface elevations at the boring locations were surveyed using the slab of the existing building at bay door #18 as a benchmark at EL 100.0 ft (assumed datum). The borings were performed on May 15 and 16, 2018 by Badger State Drilling (under subcontract to CGC) using a truck-mounted D-120 rotary drill rig equipped with hollow-stem augers, mud-rotary tooling and an automatic SPT hammer. The specific procedures used for drilling and sampling are described in Appendix A, and the boring locations are shown in plan on the Soil Boring Location Exhibit attached in Appendix B.

The subsurface profiles at the boring locations were fairly similar, and the following strata were typically encountered (in descending order):

- About 4 in. of **asphalt pavement**; followed by
- About 4.5 to 9 ft of **granular fill** (including asphalt base course), comprised generally of very loose to medium dense sand soils with variable silt and gravel contents. Note that the sand fill was intermixed with apparent *foundry sand* and *cinders* in Borings 2 and 3; over
- About 3 to 11.5 ft of loose to dense **silty fine sand, sandy silt and silt (to clayey silt)**; underlain by
- About 5 ft of stiff **lean clay** that was laminated with silt (and silty fine sand) seams; over
- About 6 to 10 ft of loose to very dense **silty fine sand** with little to some gravel and occasional thin silt and clay seams; followed by
- Medium dense to dense apparent **glacial till**, consisting of sand with significant amounts of silt and gravel as well as scattered cobbles/boulders, to the maximum depth explored in Boring 3; or
- Medium dense to very dense **possible/probable highly weathered to weathered sandstone bedrock** to the maximum depths explored in Borings 1 and 2.

Note that the silt soils between the granular fill and the natural clays in Boring 1 were classified as *possible fill* due to somewhat inconsistent composition. As an exception to the above generalized soil profile, an approximately 5-ft thick, medium stiff natural clay layer was encountered below the fill in Boring 3, underlain by medium dense to dense sands and silts, which were followed by the deeper, stiff clays that were also encountered in the other borings.

Mr. Jon Evans, P.E., LEED AP-BD&C
Department of Public Works
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Page 3

As mentioned above, the existing fill soils contained apparent foundry sand and cinders in Borings 2 and 3, and these soils (potentially along with fill containing other debris) will likely require landfill disposal if excavated and removed from the site. An environmental consultant should be contacted to advise on this issue.

Representative clay and silt samples were analyzed for their natural moisture contents which ranged from 19.7% to 25.4%. Based on natural moisture contents, some of the on-site cohesive and fine-grained soils should be considered slightly to moderately compressible.

Subsurface conditions within the area of the existing Madison Metro facility were also previously explored by Soils & Engineering Services, Inc. (1978). The exploration program included 16 soil borings that were drilled to depths between about 10 and 64 ft below site grades. The findings in the recent soil borings are in general agreement with nearby previous borings (e.g., B-2, B-8 and B-15). Note, however, that a buried topsoil layer was noted in the previous B-2 and B-8 that was not encountered in the recent borings.

Groundwater was encountered in the borings during drilling at depths between about 8 and 10 ft below the ground surface (corresponding to approximately EL 89.6 to 92 ft assumed site datum, or roughly EL 840 to 843 ft USGS datum based on DCiMap contour lines). It must be noted that the cohesive and finer-grained on-site soils are typically considered to have a very to fairly low hydraulic conductivity, which may delay inflow of groundwater into the boreholes. Groundwater readings during the fairly short period of drilling should therefore be considered approximate. However, in order to stabilize the boreholes, the drillers switched from hollow-stem auger to mud-rotary drilling at depths between about 10 and 20 ft, with the use of the rotary drilling slurry obscuring longer-term groundwater level readings in the boreholes (i.e., after the completion of drilling). A more detailed description of the site soil and groundwater conditions is presented on the soil boring logs attached in Appendix B, which also contain the laboratory test results.

The site is located about half-way between Lakes Mendota and Monona (slightly closer to Lake Monona), and groundwater levels below the site are generally expected to be between water levels in the two lakes. The water level in Lake Mendota is typically between about EL 848 and 850 ft, and the water level in Lake Monona between approximately EL 842 and 845 ft. For reference, lake levels on May 15 and 16 (the days the soil borings were drilled) were about EL 850.9 and 846.3 ft in Lakes Mendota and Monona, respectively. In addition to the influence from the water levels in Lakes Mendota and Monona, groundwater levels are expected to fluctuate with pumping rates in nearby wells (which may also be responsible for relative low short-term groundwater levels compared to lake levels at the time of drilling) and seasonal variations in precipitation, infiltration, evapotranspiration, as well as other factors.

DISCUSSION AND RECOMMENDATIONS

1. Overview

As discussed above, shallow variable fill was encountered in the soil borings, underlain by various cohesive and fine-grained soils, sands, glacial till and eventually sandstone bedrock. Based on the soil borings, it is our opinion that the proposed building addition in southwestern to central portions can likely be supported on conventional spread footing foundations, provided that existing fill and potentially some lower-strength natural soils are undercut and replaced below footings. Remnants of a former building (i.e., the old foundation wall, etc.) in northeastern parts of the planned addition represent a special case for foundation design, as highly variable subgrade stiffness is expected between portions of new footings bearing on the old wall and adjacent undocumented (and apparently non-engineered) wall backfill. Our recommendations for foundation and floor slab design/construction, which will be further discussed in the following subsections, can be outlined as follows:

- As noted above, we generally anticipate that conventional reinforced concrete spread footing foundations can be used in southwestern to central parts of the building. Existing fill soils are considered unsuitable for foundation support due to the risk that unacceptable settlement may occur and should be undercut and replaced below footings. Some undercutting of lower-strength natural soils may also be required. Provided the soils at the bottom of undercut excavations are stable and grade is subsequently restored with engineered granular backfill, it is our opinion that conventional spread footings can be designed for a fairly low to moderate allowable bearing pressure (which we anticipate to be sufficient since structural loads are generally expected to be fairly light).
- As mentioned earlier, the highly variable subgrade conditions (between old foundation wall and existing wall backfill) may be problematic for foundation support in the northeast. Intermediate or deep foundation could be used for new footing support in this area. However, if differential settlement between portions of the building addition supported on conventional shallow spread footing foundations and portions supported on intermediate or deep foundations is a concern, intermediate or deep foundation support could also be considered for the entire building addition.
- Floor slab support is somewhat complicated due to the widespread presence of apparent non-engineered fill and a possible thin buried topsoil layer, and several alternatives for slab support exist. In our opinion, appropriate alternatives would be (from lowest to highest risk of unacceptable long-term floor slab performance, but likely highest to lowest cost): undercut the existing fill soils in their entirety below floor slab areas; partially undercut the fill below floor slab subgrades (about 1 to 2

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ft); or leave the fill in-place, recompact subgrades and locally undercut/stabilize loose or soft zones. Ground improvement techniques, such as aggregate piers or stone columns, could also be considered to improve the soils for slab support with minimal undercutting/replacement.

Our recommendations for site preparation, foundation and floor slab design/construction, along with our assessment of the site class for seismic design are presented in the following paragraphs. Additional information regarding the conclusions and recommendations presented in this report is discussed in Appendix C.

2. Site Preparation

We recommend that the existing pavement be removed within the footprint of the proposed building addition. In areas requiring fill beyond the footprint of the addition (if any), we recommend the existing pavement be broken up (pulverized) to promote drainage, or be removed as well.

Existing walls (and pile caps/foundations) of former structures that coincide with the building addition footprint will likely require at least partial removal to not interfere with new construction, but complete removal and engineered granular backfill replacement may not be possible if the structural components are very deep. Abandoned utilities should also be removed and properly backfilled within the addition area.

After pavement removal, the exposed soils are expected to consist primarily of undocumented and apparently non-engineered, mostly granular fill that is mixed with cinders and foundry sand. The earthwork sequence following pavement removal will depend upon the floor slab support alternative that is chosen, which is discussed in more detail in the Floor Slab section of this report. However, if mass or partial undercutting are not the chosen alternatives for slab support, we recommend the existing granular soils be thoroughly recompact with a vibratory smooth-drum roller in areas remaining at grade or requiring additional fill. Zones that remain loose after recompaction should be undercut and replaced with granular backfill compacted to at least 95% compaction based on modified Proctor methods (ASTM D1557) in accordance with our Recommended Compacted Fill Specifications presented in Appendix D. Alternatively, 3-in. dense graded base (DGB) that is placed in loose 10-in. lifts and compacted until deflection ceases can be used to restore grades in undercut areas. Note that cohesive and fine-grained soils (where encountered at subgrade elevations) will require static recompaction (i.e., without vibration) and subsequent proof-rolling with a piece of heavy rubber-tire construction equipment, such as a loaded tri-axle dump truck, to check for soft/yielding areas. If soft/yielding areas develop, these soils should be undercut and replaced or stabilized as described above. Areas subsequently receiving fill should be checked for their floor slab and footing support suitability prior to fill placement.

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Note that due to the presence of potentially impacted soils at the site, we recommend that excavated soils either be kept on site and appropriately capped (if impacted soils are determined to be within regulatory limits for this approach) or screened for environmental contaminants before being hauled off site. A materials management plan should be developed, and impacted soils removed from the site should be properly disposed of in a licensed landfill. We recommend that an environmental consultant provide guidance on the need for special handling and disposal of impacted soils, as well as other environmental-related questions.

Fill placement to establish site and floor slab grades, where required, can then proceed. To the extent possible, we recommend using granular soils (i.e., sands/gravels, including natural sand soils excavated on-site) as structural fill within the building envelope and upper 2 to 3 ft in pavement areas because these soils are relatively easy to place and compact in most weather conditions compared to clay/silt soils. To the extent possible, clay and silt soils excavated on-site are generally not recommended as structural fill because moisture conditioning by discing and drying (aeration) will likely be required to achieve desired compaction levels, which is highly weather-dependent (i.e., dry, warm and windy conditions) and could delay construction progress. In our opinion, clay/silt soils are best used as fill in landscaping or potentially as lower lifts in pavement areas provided the moisture contents can be sufficiently lowered from the natural states to facilitate compaction efforts. We recommend that structural fill be compacted to at least 95% compaction based on modified Proctor methods (ASTM D1557) following Appendix D guidelines. Periodic field density tests should be taken by CGC staff within the fill to document the adequacy of compactive effort.

3. Foundation Design

We expect finish floor elevation of the addition to match the existing building near current site grades. Footings are generally anticipated to extend on the order of 2 to 5 ft below finish floor elevation, and foundation loads of the single-story, slab-on-grade addition are expected to be fairly light (assuming metal-framing). In Borings 2 and 3, performed in southern to central portions of the construction area, existing fill was found to extend about 0 to 4 ft below anticipated foundation grades, and these soils should be undercut and replaced below footings due to the risk of total and differential settlement exceeding typically tolerable levels. In Boring 1, existing fill or possible extended about 7 to 10 ft below anticipated footing grades (about 12 ft below the existing ground surface). However, non-engineered wall backfill next to the remaining foundation wall/grade beam of the former building may potentially extend deeper below existing site grades, depending on the depth of the wall. As discussed above, conventional shallow spread footing foundations can likely be utilized in southwestern and central parts of the building addition, with intermediate or deep foundation support potentially required in the northeast.

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A. *Shallow Foundations*

As noted above, existing fill should be undercut and replaced below footings, resulting in undercut depths on the order of 0 to 4 ft (potentially more) in southwestern to central portions of the building (see Borings 2 and 3). The natural loose (to medium dense) silty sands, silts, and medium stiff clays anticipated below the existing fill should be checked for their footing support suitability prior to backfilling, and some of the natural soils exposed at the bottom of undercut excavations may potentially require stabilization or partial undercutting in order to develop suitable subgrades. Stabilization could occur with a fairly thin (i.e., about 6 to 12 in. thick) layer of clear stone that is compacted into the subgrade until deflection ceases. If stabilization is unsuccessful and subgrades continue to yield, undercut excavations may have to be extended slightly deeper.

We recommend the following parameters be used for foundation design:

- Maximum net allowable bearing pressure: 1,500 psf
- Minimum foundation widths:
 - Continuous wall footings: 18 in.
 - Column pad footings: 30 in.
- Minimum footing depths below finish site grades:
 - Exterior/perimeter footings: 4 ft
 - Interior footings: no minimum requirement

Note that the allowable bearing pressure for foundation design is controlled by medium stiff clays and looser sand/silt soils encountered in the soil borings below anticipated footing grades. If a higher bearing pressure should be desired, these soils would have to be undercut and replaced below footings, resulting in total undercut depths of about 3 to 10 ft (potentially more) below the bottom of footings. Note that deeper undercuts may potentially extend below the groundwater table. Alternatively, the entire building could be supported on intermediate foundation in order to implement a higher bearing pressure for foundation design while reducing the potential for undercutting, or deep foundations could be utilized. Intermediate and deep foundations are further discussed in the following subsections.

Footing subgrades should be checked by a CGC field representative to document that the subgrade soils are suitable for footing support and advise on corrective measures, if necessary. We recommend using a smooth-edged backhoe bucket for footing and undercut excavations. The base of undercut excavations should be widened beyond the footing edges at least 0.5 ft in each direction for each foot of undercut depth for stress distribution purposes. OSHA slope guidelines should be followed if workers need to enter footing excavations. Granular soils exposed at footing grade or the bottom of undercut excavations above the water table should be thoroughly recompacted with a large vibratory plate compactor or an excavator-mounted hoe-pack prior to backfilling or formwork/concrete

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placement to densify soils loosened during the excavation process. Soils potentially susceptible to disturbance from vibratory compaction (e.g., cohesive/fine-grained soils or sands near or below the water table) should be hand-trimmed. Subgrades that are fairly wet should be stabilized with a thin (approximately 6 in. thick) layer of crushed clear stone that is compacted into the subgrade until deflection ceases.

In order to re-establish footing grade in undercut areas above the water table, we generally recommend using granular backfill compacted to at least 95% compaction based on modified Proctor methods (ASTM D1557), in accordance with the Recommended Compacted Fill Specifications presented in Appendix D. Alternatively, 3-in. DGB that is placed in loose 10-in. lifts and compacted until deflection ceases can also be used to restore grades above the water table in undercut areas. Below the water table, undercut excavations should be backfilled with crushed clear stone that is placed in loose lifts of 12 in. or less, which are subsequently compacted with a large vibratory plate compactor or excavator-mounted hoe-pack until deflection ceases. Where total clear stone layer thickness exceeds 12 in., the clear stone should be wrapped in non-woven geotextile fabric (e.g. Mirafi 160N or equivalent) to prevent migration of fines into the void spaces of the clear stone. Alternatively, foundation grade below the water table can be restored with lean mix concrete that is capable of developing a minimum 28-day strength of 1,000 psi. Note that with the use of lean mix concrete as backfill, undercut excavations should be laterally oversized 0.5 ft from the edges of the foundation and geotextile fabric is not required at the bottom of the excavation. (Appropriate OSHA sloping should occur if workers need to enter the excavation.)

Where footing or undercut excavations extend near or below the water table, dewatering should occur in advance of final excavation to lower groundwater at least 2 ft below the bottom of the excavation. In general, it has been our experience that groundwater drawdowns of about 1 to 2 ft can typically be achieved with submersible pumps in filtered sump pits, and greater drawdowns typically require well-points or deep wells. Dewatering means and methods are the responsibility of the contractor.

Provided the foundation design/construction recommendations discussed above are followed, we estimate that total and differential settlements should be on the order of 1.0 and 0.5 in., respectively.

B. Intermediate Foundations

Due to remnant foundations in northeast parts of the building addition that could potentially extend fairly deep below footing grade, likely rendering removal and replacement with engineered granular backfill infeasible, it is our opinion that intermediate foundation systems, such as aggregate piers, stone columns, etc. could be used for foundation support of the building addition. Aggregate piers (or similar) could also be used in other parts of the building in order to implement a higher allowable bearing pressure for foundation design while reducing the potential for undercutting below footings.

Aggregate piers, stone columns, etc. are not deep (pile) foundations, but are considered intermediate foundation systems that instead essentially stiffen the existing fill and marginal natural soils to a

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sufficient depth below grade such that conventional spread footings at a moderate to high bearing pressure are feasible without the need for deep undercutting. For foundation support, relatively closely-spaced holes are drilled into the ground to a sufficient depth to limit total settlement to less than 1 in. For floor slab support, spacing is generally expected to be wider than below footings but would depend on slab loading. However, it is our opinion that other alternatives for floor slab support may be economically favorable for this project compared to aggregate piers (or similar). We anticipate that the holes for this project would generally terminate within the at least medium dense sand/silt soils, although the exact termination depth would be determined by the contractor/designer of the aggregate piers (or similar). The holes are then filled with crushed stone/dense graded base and compacted with a specially designed hydraulic tamper.

The intermediate foundation contractor should be aware of the potential presence of miscellaneous debris within the existing fill soils and possible buried remnants of the former building (other than the known foundation wall) which will likely impact aggregate pier (or similar) installation and may require removal prior to installation. The intermediate foundation contractor should have provisions to deal with the presence of potential obstructions, such as removing obstructions with an excavator.

Several proprietary systems exist, and aggregate piers (or similar) can be bid as an alternative to undercutting/replacing unsuitable soils below the buildings or using deep foundations, with foundation design typically included in the package. Aggregate piers (or similar) have been used successfully on many projects in Wisconsin with similar soil conditions, including several projects along East Washington Avenue in Madison. Full-time inspection is recommended during aggregate pier installation to document their construction according to design requirements, and this cost is typically included in the installation cost by the contractor, who generally conduct one or more load or modulus tests to check that the installed piers satisfy design assumptions. Footing subgrade preparation where aggregate piers (or similar) are installed generally includes recompaction of the tops, recompaction or hand-trimming of the soils between the piers, as well as other site-specific guidelines determined by the contractor.

Note that the aggregate pier (or similar) installation process does generate vibrations, and care is required where piers will be installed near existing structures because the vibrations may result in settlement of nearby structures supported on shallow foundations. The completion of a pre-condition survey of the existing building and possibly vibration monitoring during construction to determine if vibrations may potentially damage nearby structures is recommended. If only parts of the addition are to be supported on intermediate foundations (e.g., northeastern parts of the addition with intermediate foundation support and southwestern to central parts on conventional spread footings) control joints may be necessary between parts of the building supported by a conventional spread footing foundation system and parts supported on aggregate piers (or similar) in order to accommodate potential differential settlement above typically tolerable levels. The potential for differential settlement should be discussed between the intermediate foundation designer/installer and the structural engineer.

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C. Deep Foundations

As an alternative to intermediate foundations, deep foundations (helical piers, auger-cast grout piles, micropiles, driven piles, etc.) could also be considered. Although we understand the existing building is supported on driven piles, alternative deep foundation systems may prove more economical, especially if only a small area of the building addition will be supported on deep foundations. In our opinion, auger-cast grout piles, micropiles and helical piers would likely be suitable deep foundation alternatives for this project, especially since these foundation systems can generally be installed without generating significant vibrations that are generated during pile driving and could affect nearby structures supported on shallow foundations. Between auger-cast grout piles, micropiles and helical piers, we generally expect helical piers to be economically favorable compared to the other alternatives, as structural loads for this project are generally anticipated to be fairly light. Therefore, the following paragraphs focus on helical pier foundations. If desired, we can provide additional information and recommendation regarding other deep foundation systems upon request. Note that additional, deeper soil borings could potentially be required for the evaluation of driven piles, micropiles and auger-cast grout piles, depending on the required foundation capacity.

Helical piers are generally expected to extend through the existing fill and marginal natural soils, and bear within at least medium dense silt and sand strata. However, in order to develop higher capacities, the piers would likely extend slightly deeper into dense glacial till or weathered sandstone bedrock. Helical pier capacity will vary depending on the number and size of helices, depth of installation and bearing stratum. Soil parameters for the design of helical piers near Boring 1 are included in Table 1. Using these parameters, we used the commercially available software, HeliCAP® 2.5.1, produced by Hubbell Power Systems, to estimate helical pier capacities for a three-helix configuration (10 in., 12 in. and 14 in.). Using the subsurface profile encountered in Boring 1 (northeast portion of the building area), we have estimated that helical pier lengths on the order of 27 to 29 ft (below current site grades) will likely be required to develop ultimate capacities (i.e., with a factor of safety $FS = 1$) of about 80 to 100 kips (in compression). Note that helical pier capacities at the upper end of this range appear to be governed by the structural capacities of the helices, rather than the geotechnical capacities of the bearing strata. Heavy-duty helical piers or piers designed to penetrate into bedrock may be required where the piers extend into weathered sandstone bedrock (or dense till with significant gravel content and cobbles/boulders) to take advantage of higher capacities. *Since helical piers are proprietary, the helical pier capacities should be considered approximate, and the helical pier installer should determine the helix configuration and depth necessary to satisfy project requirements. Soil stratigraphy and properties should be expected to vary across the site, as shown in the borings, which will affect helical pier installation depths to achieve given capacity. Actual design depths should be determined by a separate, independent analysis using specific helix configurations proposed on the project.*

The installation torque is correlated with capacity, although static load tests can also be completed to confirm the ultimate and allowable capacities. A minimum factor of safety of 2.0 to 3.0 is generally used for helical pier design. If a factor of safety of 2.0 is used to determine the allowable helical pier

TABLE 1

Recommended Soil Parameters for Helical Pier Foundations ⁽¹⁾

*Proposed Madison Metro Building Addition - 1101 East Washington Avenue
City of Madison, Dane County, Wisconsin*

Boring	Description	Approximate Depth below Existing Ground Surface (ft)	Moist Unit Weight (pcf)	Saturated Unit Weight (pcf)	Buoyant Unit Weight (pcf)	Angle of Internal Friction (deg)	Cohesion (psf)
1	Medium Dense Sandy Fill	0.3 to 9.0	120	130	68	31	0
	Loose Silt to Clayey Silt (Possible Fill)	9.0 to 12	115	125	63	26	0
	Stiff Lean Clay with Silt/Silty Fine Sand Seams	12 to 17	120	125	63	0 ⁽³⁾ / 25 ⁽⁴⁾	1,500 ⁽³⁾ / 30 ⁽⁴⁾
	Loose Silty Sand	17 to 23	115	125	63	28	0
	Medium Dense Silty Sand (Possible Highly Weathered Sandstone Bedrock)	23 to 27	120	130	68	34	0
	Medium Dense to Very Dense Sand (Probable Weathered Sandstone Bedrock)	27 to 40+ ⁽²⁾	125	135	73	36	0

Notes: ⁽¹⁾ Generalized to some degree; refer to boring logs for more detailed soil descriptions. Not including factor of safety (i.e., FS = 1).

⁽²⁾ Soil boring termination depth.

⁽³⁾ Short-term loading conditions.

⁽⁴⁾ Long-term loading conditions.

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capacity, we recommend that a minimum of one static load test be performed to confirm the helical pier design satisfies the project requirements. The static load test should be performed on a pier installed to similar installation depth and torque as production piers. Additionally, the torque of each pier should be monitored during installation to document that each pier is torqued to the minimum torque established by the static load test or empirical correlations to ultimate capacity. If a static load test is not performed, we recommend using a minimum factor of safety of 2.5 to 3.0 in determining the allowable capacity, and the installation torque of each pier should be monitored, which is empirically correlated to the ultimate capacity. *Since there are multiple proprietary helical pier systems, as well as different methods for estimating helical pier capacities, it is the responsibility of the contractor to determine that their selected helical pier configuration, installation procedures and termination criteria satisfy the project requirements.*

Other helical pier considerations include the following:

- Prospective helical pier contractors should be aware of the potential presence of miscellaneous debris within the existing fill soils and possible buried remnants of the former building (other than the known foundation wall) that may require removal prior to helical pier installation. The presence of weathered sandstone bedrock as well as elevated gravel contents and cobbles/boulders in some of the deeper till strata could also impact helical pier installation. The helical pier installer should have provisions to deal with the presence of potential obstructions. If obstructions are encountered at shallow depths, removing obstructions with an excavator would be one method to deal with the obstructions. Under some circumstances, using smaller diameter helix configuration may also assist in the installation process but may require deeper piers to develop capacity. Specially-designed lead sections may be required where piers will extend into bedrock to prevent “spin-off” of the piers. If “spin-off” does occur, full scale load testing should be performed to better determine pier capacity, as torque-based estimates may not be accurate in “spin-off” situations.
- The existing fill may potentially be corrosive, so the helical pier shafts should include corrosion protection, which can include hot-dip galvanizing, anti-corrosion coatings or increased steel shaft thickness. Alternatively, helical pier cap excavations could be extended deeper to remove fill soils around the helical piers.
- Loose fill and marginal natural cohesive and fine-grained soils may have relatively low lateral capacity, so *round helical pier shafts*, which have higher resistance to buckling, are recommended over square shafts. A buckling analysis should be completed to check that the pier shaft has adequate buckling resistance.
- If lateral loads are high enough such that vertical helical piers do not provide sufficient lateral resistance, battered helical piers can be considered. It is also

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possible that battered micropiles may be needed in the event that high lateral loads need to be resisted.

- Pile caps below exterior walls of the building additions should be located a minimum of 4 ft below finish grade for frost protection.
- Pile cap excavations should be sloped in accordance with OSHA slope guidelines if workers need to enter the excavations, and the excavation should be monitored by a competent person to determine the appropriate excavation slopes.

As with the use of intermediate foundations for partial building support, control joints between parts of the building addition supported on helical piers and parts supported on conventional shallow spread footings may be required.

4. Floor Slab

The existing fill soils are considered to be undocumented (and likely non-engineered) and therefore marginal for direct floor slab support due to the likelihood that unacceptable total and differential settlement may occur over time. The floor slab settlement risk is the responsibility of the client. Among the conventional floor slab alternatives that could be considered are a complete undercut of the existing fill below floor slab areas, a partial undercut of the existing fill below the floor slab, or a slab constructed on a thoroughly recompacted existing fill subgrade (without widespread undercutting). A conventional floor slab supported on aggregate piers (or similar), or a structural slab on helical piers could also be considered, but these alternatives may be economically unfavorable compared to the other three, previously-mentioned scenarios.

The first two alternatives (conventional slab over completely or partially undercut/replaced existing fill soils and a possible buried topsoil) involve the least amount of risk of unacceptable floor slab performance (settlement, cracking, etc.), but the highest up-front costs, with the complete undercut obviously more expensive than the partial undercut. Note that the costs for the undercutting/replacement alternatives will likely increase rapidly with undercut depth, as excavated fill soils may require landfill disposal. The conventional floor slab alternative with thoroughly recompacted existing fill subgrade likely involves the lowest up-front cost, but also carries the highest long-term risk of unacceptable floor slab performance, including slab settlement and/or cracking, as well as the potential for slab jacking if slab settlement becomes intolerable. The risk is the owner's responsibility. If the owner is willing to accept the risk that floor slab settlement and/or cracking may occur and a conventional floor slab will be constructed without widespread undercutting, the owner's risk of undesirable slab performance can be reduced (though not eliminated) by careful slab preparation practices. The practices would involve thoroughly recompacting the subgrades with a large vibratory compactor and then proof-rolling the subgrades with a loaded tri-axle dump truck to check for loose/soft zones. If loose or soft zones are encountered, these areas should be undercut, with

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grade re-established with granular soil compacted to a minimum of 95% compaction (ASTM D 1557) or well-compacted 3-in. dense graded base. Undercutting can likely be reduced where site grades are raised with high-quality granular fill. If the risk of unacceptable slab performance is not acceptable, complete undercut/replacement of the non-engineered fill (and possible buried topsoil noted in the earlier borings) should be performed.

To act as a capillary break below the slab, we recommend including a minimum 4 to 6-in. thick layer of well-graded sand/gravel with less than 5% passing the No. 200 U.S. standard sieve. Note, however, that some structural engineers require a layer of DGB, such as 1¼-in. DGB, rather than sand/gravel below the floor slab to increase the subgrade modulus immediately below the slab. To further minimize the potential for moisture migration through the slab, a plastic vapor barrier can also be utilized. Fill and base layer material below the floor slab should be placed as described in the Site Preparation section of this report. Slabs constructed on a minimum 6-in. thick dense graded base layer *over at least 2 ft of engineered granular fill or backfill (i.e., where site grades are raised or the existing fill are at least partially undercut)* may be designed utilizing a subgrade modulus of 150 pci. A subgrade modulus of 100 pci should be used for the design of slabs that are constructed on a sand/gravel layer *over at least 2 ft of engineered granular fill/backfill*. If widespread undercutting of existing fill should not be performed below the floor slab, we recommend subgrade moduli of 100 pci and 75 pci be used for floor slabs constructed on at least 6 in. of DGB and sand/gravel, respectively. The design subgrade moduli are based on a firm or adequately stabilized, recompacted subgrade such that non-yielding conditions are developed. The slab should be structurally separated from the footings with a compressible filler and have construction joints and reinforcement for crack control.

Note that due to apparently environmentally impacted soils at this site a sub-floor venting system may be required to remove harmful vapors that may accumulate below the slab in the event that at least some fill soils remain below the floor slab. We recommend that an environmental consultant evaluate the need for and design of a sub-floor venting system.

4. Seismic Site Class

In our opinion, the average soil/bedrock properties in the upper 100 ft of the site (based on SPT blow counts “N-values” between 15 and 50 blows/ft, on average, in the fine-grained and granular soils, as well as highly weathered to weathered sandstone bedrock underlying the site) can be characterized as a stiff soil profile. This characterization would place the site in Class D for seismic design according to International Building Code (see Table 1613.5.2).

CONSTRUCTION CONSIDERATIONS

Due to variations in weather, construction methods and other factors, specific construction problems are difficult to predict. Soil related difficulties which could be encountered on the site are discussed below:

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- Due to the potentially sensitive nature of some of the on-site soils, we recommend that final site grading activities be completed during dry weather, if possible. Construction traffic should be avoided on prepared subgrades to minimize potential disturbance.
- Contingencies in the project budget for subgrade stabilization with coarse aggregate in pavement and floor slab areas should be increased if the project schedule requires that work proceed during adverse weather conditions.
- Earthwork construction during the late fall through early spring could be complicated as a result of wet weather and freezing temperatures. During cold weather, exposed subgrades should be protected from freezing before and after footing construction. Fill should never be placed while frozen or on frozen ground.
- Excavations extending greater than 4 ft in depth below the existing ground surface should be sloped or braced in accordance with current OSHA standards.
- Based on observations made during the field exploration and anticipated building elevations, we generally do not expect groundwater infiltration into footing excavations, but groundwater could be encountered in some undercut excavations that may be required to remove deeper fill and/or marginal natural soils below footings. It has been our experience that groundwater drawdowns on the order of 1 to 2 ft can typically be achieved with submersible pumps that operate from filtered sump pits. Groundwater drawdowns exceeding about 2 ft will likely require alternative dewatering systems, such as vacuum-well point or deep well systems. Dewatering means and methods are the contractor's responsibility. Water accumulating at the base of excavations as a result of precipitation or seepage should be controlled and quickly removed in a similar manner.

RECOMMENDED CONSTRUCTION MONITORING

The quality of the foundation and floor slab subgrades will be largely determined by the level of care exercised during site development. To check that earthwork and foundation construction proceeds in accordance with our recommendations, the following operations should be monitored by CGC:

- Subgrade recompaction/proof-rolling;
- Fill/backfill placement and compaction;
- Aggregate pier (or similar) or helical pier installation;
- Foundation excavation/subgrade preparation; and
- Concrete placement.



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It has been a pleasure to serve you on this project. If you have any questions or need additional consultation, please contact us.

Sincerely,

CGC, Inc.

Tim F. Gassenheimer, E.I.T.
Staff Engineer

David A. Staab, P.E., LEED AP
Senior Consulting Professional

- Encl: Appendix A - Field Exploration
Appendix B - Soil Boring Location Exhibit
Logs of Test Borings (3)
Log of Test Boring-General Notes
Unified Soil Classification System
Appendix C - Document Qualifications
Appendix D - Recommended Compacted Fill Specifications

APPENDIX A
FIELD EXPLORATION

APPENDIX A

FIELD EXPLORATION

Subsurface conditions on-site were explored by drilling three Standard Penetration Test (SPT) soil borings to 40 ft below current site grades. Note that shallower (25 ft deep) borings were initially planned, but borings were drilled deeper to obtain more subsurface information with regard to deep foundation design, since we understand the existing building is supported on driven piles. The boring locations were jointly selected by the client and CGC and field-located by CGC. Ground surface elevations at the boring locations were surveyed using the slab of the existing building at bay door #18 as a benchmark at EL 100.0 ft (assumed datum). The borings were performed on May 15 and 16, 2018 by Badger State Drilling (under subcontract to CGC) using a truck-mounted D-120 rotary drill rig equipped with hollow-stem augers, mud-rotary tooling and an automatic SPT hammer.

The soil borings were generally sampled at 2.5-ft intervals to a depth of 15 ft, and at 5-ft intervals thereafter. The soil samples were obtained in general accordance with specifications for standard penetration testing, ASTM D 1586. The specific procedures used for drilling and sampling are described below.

1. Boring Procedures between Samples

The boring is extended downward, between samples, by a hollow-stem auger, or by a roller bit in combination with drilling slurry.

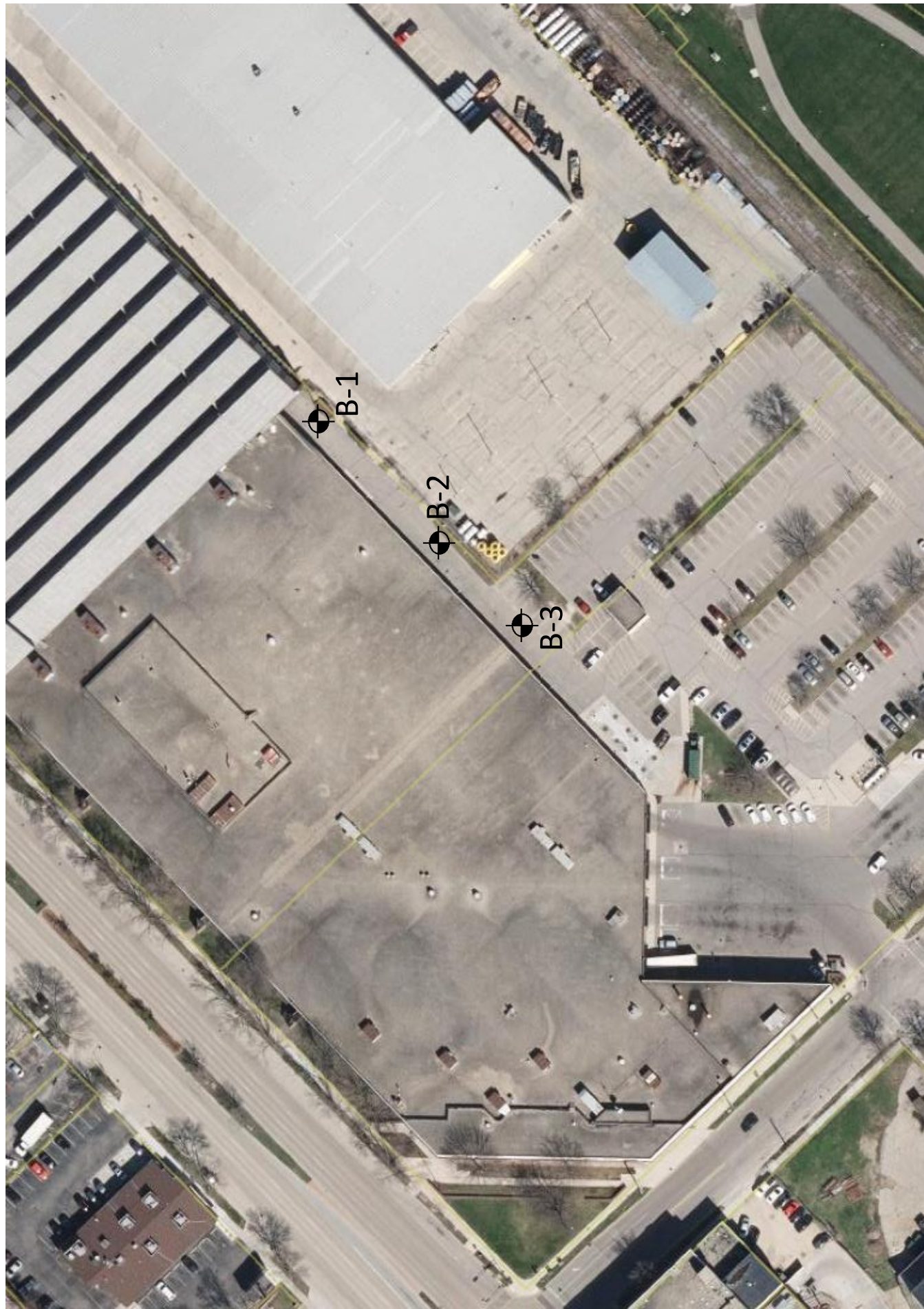
2. Standard Penetration Test and Split-Barrel Sampling of Soils
(ASTM Designation: D 1586)

This method consists of driving a 2-inch outside diameter split-barrel sampler using a 140-pound weight falling freely through a distance of 30 inches. The sampler is first seated 6 inches into the material to be sampled and then driven 12 inches. The number of blows required to drive the sampler the final 12 inches is recorded on the log of borings and is known as the Standard Penetration Resistance.

During the field exploration, the driller visually classified the soil and prepared a field log. *Field screening of the soil samples for possible environmental contaminants was not conducted by the drillers as these services were not part of CGC's work scope.* Water level observations were made in each boring during and after drilling and are shown at the bottom of each boring log. Upon completion of drilling, the borings were backfilled to satisfy WDNR regulations and the soil samples were delivered to our laboratory for visual classification and laboratory testing. The soils were visually classified by a geotechnical engineer using the Unified Soil Classification System. The Soil Boring Location Exhibit, the final logs prepared by the engineer including the laboratory test results, and a description of the Unified Soil Classification System are presented in Appendix B.

APPENDIX B

**SOIL BORING LOCATION EXHIBIT
LOGS OF TEST BORINGS (3)
LOG OF TEST BORING-GENERAL NOTES
UNIFIED SOIL CLASSIFICATION SYSTEM**



Legend

- ⊕ Denotes Boring Location and Number

Notes

1. Borings performed by Badger State Drilling on May 15 and 16, 2018.
2. Boring locations are approximate.
3. Base map from Dane County DCiMap.

Scale: Reduced



SOIL BORING LOCATION EXHIBIT
 Proposed Madison Metro Building Addition
 1101 East Washington Avenue
 City of Madison, Dane Co., WI



Date: 05/2018	Job No.: C18051-8
-------------------------	-----------------------------



LOG OF TEST BORING

Project **Proposed Madison Metro Building Addition**
 1101 East Washington Avenue
 Location **City of Madison, Dane Co., WI**

Boring No. **B-1**
 Surface Elevation (ft) **100.8**
 Job No. **C18051-8**
 Sheet **1** of **1**

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

SAMPLE					VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES				
No.	Rec (in.)	Moist	N	Depth (ft)		qu (qa) (tsf)	W	LL	PL	LI
1	10	M	22	4±	4± in. Asphalt Pavement					
2	10	M/W	11	5	FILL: Medium Dense, Brown Fine to Medium Sand, Little Silt and Gravel, Scattered Silt Pockets					
3	14	M	24		Increasing to Some Silt and Gravel with Depth					
4	12	M/W	5	10	Loose, Dark Gray/Brown (Mottled) SILT to Clayey SILT, Trace to Little Sand (ML - Possible Fill) Top of Sample was Gray/Brown (Mottled) Silty Clay	(1.5)	25.4			
5	18	M/W	9	15	Stiff, Gray Lean CLAY, Laminated with Silt and Silty Fine Sand Seams (CL)	(1.5)	20.7			
6	18	W	5	20	Loose, Light Gray Silty Fine SAND, Little Gravel (SM)					
7	12	W	28	25	Medium Dense, Light Greenish Gray Silty Fine SAND, Little to Some Gravel (SM - Possible Highly Weathered Sandstone Bedrock)					
8	10	W	57	30	Medium Dense to Very Dense, Brown/Yellow Brown Fine to Coarse SAND, Some Gravel, Little to Some Silt (SP-SM/SM - Probable Weathered Sandstone Bedrock)					
9	12	W	27	35						
10	16	W	37	40	Color Grades to Light Gray to Brown Near 40 ft					
				40	End of Boring at 40 ft					
				45	Borehole backfilled with bentonite slurry, chips and asphalt patch					

WATER LEVEL OBSERVATIONS

GENERAL NOTES

While Drilling ∇ **8.8'** Upon Completion of Drilling _____
 Time After Drilling _____
 Depth to Water _____
 Depth to Cave in _____

Start **5/15/18** End **5/15/18**
 Driller **BSD** Chief **KD** Rig **D-120**
 Logger **CV** Editor **DAS**
 Drill Method **4-1/4" HSA (0-20'), 3-7/8" RB/DM (20-40'); Autohammer**

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.



LOG OF TEST BORING

Project **Proposed Madison Metro Building Addition**
1101 East Washington Avenue
 Location **City of Madison, Dane Co., WI**

Boring No. **B-2**
 Surface Elevation (ft) **100.1**
 Job No. **C18051-8**
 Sheet **1** of **1**

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

SAMPLE					VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES				
No.	Rec (in.)	Moist	N	Depth (ft)		qu (qa) (tsf)	W	LL	PL	LI
1	14	M	8	4± in.	Asphalt					
2	12	M	8		FILL: Dark Gray/Black Sand, Some Silt, Intermixed with Apparent Foundry Sand and Cinders					
3	16	M/W	8		Loose, Light Gray Silty Fine SAND (SM)					
4	14	W	11		Medium Dense, Yellow-Brown (Lightly Mottled) Sandy SILT, Trace Organics/Fine Roots (ML)					
5	12	W	29		Medium Dense to Dense, Brown to Gray Silty Fine SAND to Sandy SILT, Laminated with Thin Silt, Clay and Fine Sand Seams (SM/ML)					
6	10	W	36							
7	18	W	11		Stiff, Gray Lean CLAY, Laminated with Silt Seams (CL)	(1.75-2.0)	23.8			
8	12	W	7		Loose, Light Gray Silty Fine SAND, Little Gravel (SM)					
9	14	W	66		Very Dense, Brown Silty Fine SAND, Little to Some Gravel, Trace Clay (SM)					
10	10	W	88/10'		Very Dense, Light Gray Fine SAND, Some Gravel, Little to Some Silt (SP-SM/SM - Probable Weathered Sandstone Bedrock)					
11	12	W	62		Grades to Light Brown and Finer with Less Gravel Near 40 ft					
					End of Boring at 40 ft					
					Borehole backfilled with bentonite slurry, chips and asphalt patch					

WATER LEVEL OBSERVATIONS					GENERAL NOTES				
While Drilling	▽	8.0'	Upon Completion of Drilling		Start	5/15/18	End	5/15/18	
Time After Drilling					Driller	BSD	Chief	KD	Rig D-120
Depth to Water					Logger	CV	Editor	DAS	
Depth to Cave in					Drill Method	4-1/4" HSA (0-10'), 3-7/8" RB/DM (10-40'); Autohammer			

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.



LOG OF TEST BORING

Project **Proposed Madison Metro Building Addition**
1101 East Washington Avenue
 Location **City of Madison, Dane Co., WI**

Boring No. **B-3**
 Surface Elevation (ft) **99.6**
 Job No. **C18051-8**
 Sheet **1** of **1**

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

SAMPLE					VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES				
No.	Rec (in.)	Moist	N	Depth (ft)		qu (qa) (tsf)	W	LL	PL	LI
1	12	M	13	4± in.	Asphalt					
2	10	W	2		FILL: Very Loose to Medium Dense, Dark Gray/Dark Brown/Black Sand, Some Silt, Intermixed with Apparent Foundry Sand and Cinders					
3	10	M	4		Medium Stiff, Gray/Brown (Mottled) Lean CLAY, Trace to Little Gravel (CL)	(0.75-1.0)	22.9			
4	4	M	5		Grades to Brown (Mottled) Near 10 ft	(1.0)	19.7			
5	8	W	24		Medium Dense, Brown Fine SAND, Little to Some Silt, Trace Gravel (SP-SM/SM)					
6	6	W	30		Medium Dense to Dense, Tan Silty Fine SAND to Sandy SILT (SM/ML)					
7	16	W	7		Stiff, Gray Lean CLAY, Laminated with Silt Seams (CL)	(1.0-1.25)	24.5			
8	12	W	22		Medium Dense, Gray Silty Fine SAND, Laminated with Thin Silt and Clay Seams (SM)					
9	10	W	24		Medium Dense, Olive Brown/Gray Fine SAND, Some Silt, Trace Gravel (SM)					
10	12	W	36		Medium Dense to Dense, Gray Fine to Medium SAND, Some Silt and Gravel, Scattered Cobbles/Boulders (SM)					
11	8	W	24		End of Boring at 40 ft					
					Borehole backfilled with bentonite slurry, chips and asphalt patch					

WATER LEVEL OBSERVATIONS					GENERAL NOTES				
While Drilling	∇	10.0'	Upon Completion of Drilling		Start	5/16/18	End	5/16/18	
Time After Drilling					Driller	BSD	Chief	KD	Rig D-120
Depth to Water				∇	Logger	CV	Editor	DAS	
Depth to Cave in					Drill Method	4-1/4" HSA (0-10'), 3-7/8" RB/DM (10-40'); Autohammer			
<small>The stratification lines represent the approximate boundary between soil types and the transition may be gradual.</small>									

CGC, Inc.

Madison - Milwaukee

Unified Soil Classification System

UNIFIED SOIL CLASSIFICATION AND SYMBOL CHART

COARSE-GRAINED SOILS

(more than 50% of material is larger than No. 200 sieve size)

Clean Gravels (Less than 5% fines)



GW

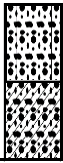
Well-graded gravels, gravel-sand mixtures, little or no fines



GP

Poorly-graded gravels, gravel-sand mixtures, little or no fines

Gravels with fines (More than 12% fines)



GM

Silty gravels, gravel-sand-silt mixtures



GC

Clayey gravels, gravel-sand-clay mixtures

Clean Sands (Less than 5% fines)



SW

Well-graded sands, gravelly sands, little or no fines



SP

Poorly graded sands, gravelly sands, little or no fines

Sands with fines (More than 12% fines)



SM

Silty sands, sand-silt mixtures



SC

Clayey sands, sand-clay mixtures

FINE-GRAINED SOILS

(50% or more of material is smaller than No. 200 sieve size.)



ML

Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity



CL

Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays



OL

Organic silts and organic silty clays of low plasticity



MH

Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts



CH

Inorganic clays of high plasticity, fat clays



OH

Organic clays of medium to high plasticity, organic silts



PT

Peat and other highly organic soils

LABORATORY CLASSIFICATION CRITERIA

GW $C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{D_{30}}{D_{10} \times D_{60}}$ between 1 and 3

GP Not meeting all gradation requirements for GW

GM Atterberg limits below "A" line or P.I. less than 4

GC Atterberg limits above "A" line or P.I. greater than 7

Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols

SW $C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{D_{30}}{D_{10} \times D_{60}}$ between 1 and 3

SP Not meeting all gradation requirements for GW

SM Atterberg limits below "A" line or P.I. less than 4

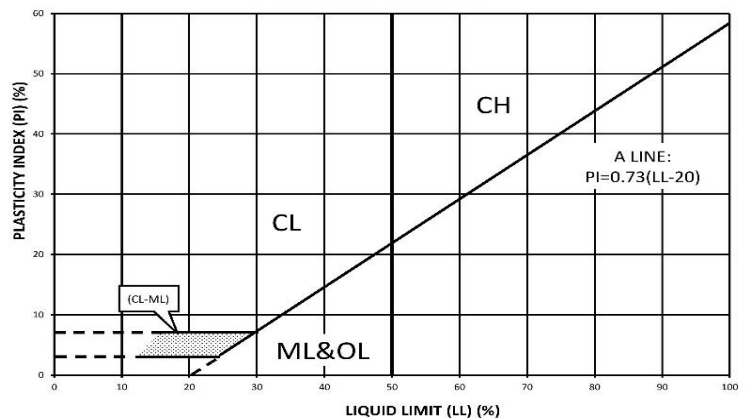
SC Atterberg limits above "A" line with P.I. greater than 7

Limits plotting in shaded zone with P.I. between 4 and 7 are borderline cases requiring use of dual symbols

Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows:

Less than 5 percent GW, GP, SW, SP
 More than 12 percent GM, GC, SM, SC
 5 to 12 percent Borderline cases requiring dual symbols

PLASTICITY CHART



LOG OF TEST BORING
General Notes

DESCRIPTIVE SOIL CLASSIFICATION

Grain Size Terminology

Soil Fraction	Particle Size	U.S. Standard Sieve Size
Boulders	Larger than 12"	Larger than 12"
Cobbles	3" to 12"	3" to 12"
Gravel: Coarse.....	¾" to 3"	¾" to 3"
Fine	4.76 mm to ¾"	#4 to ¾"
Sand: Coarse.....	2.00 mm to 4.76 mm.....	#10 to #4
Medium	0.42 to mm to 2.00 mm	#40 to #10
Fine	0.074 mm to 0.42 mm.....	#200 to #40
Silt.....	0.005 mm to 0.074 mm.....	Smaller than #200
Clay.....	Smaller than 0.005 mm.....	Smaller than #200

Plasticity characteristics differentiate between silt and clay.

General Terminology

Physical Characteristics
 Color, moisture, grain shape, fineness, etc.
Major Constituents
 Clay, silt, sand, gravel
Structure
 Laminated, varved, fibrous, stratified, cemented, fissured, etc.
Geologic Origin
 Glacial, alluvial, eolian, residual, etc.

Relative Density

Term "N" Value
 Very Loose..... . 0 - 4
 Loose..... 4 - 10
 Medium Dense.....10 - 30
 Dense.....30 - 50
 Very Dense.....Over 50

Relative Proportions Of Cohesionless Soils

Proportional Term	Defining Range by Percentage of Weight
Trace.....	0% - 5%
Little.....	5% - 12%
Some.....	12% - 35%
And	35% - 50%

Consistency

Term	q _u -tons/sq. ft
Very Soft.....	0.0 to 0.25
Soft.....	0.25 to 0.50
Medium.....	0.50 to 1.0
Stiff.....	1.0 to 2.0
Very Stiff.....	2.0 to 4.0
Hard.....	Over 4.0

Organic Content by Combustion Method

Soil Description	Loss on Ignition
Non Organic.....	Less than 4%
Organic Silt/Clay.....	4 - 12%
Sedimentary Peat.....	12% - 50%
Fibrous and Woody Peat...	More than 50%

Plasticity

Term	Plastic Index
None to Slight.....	0 - 4
Slight.....	5 - 7
Medium.....	8 - 22
High to Very High ..	Over 22

The penetration resistance, N, is the summation of the number of blows required to effect two successive 6" penetrations of the 2" split-barrel sampler. The sampler is driven with a 140 lb. weight falling 30" and is seated to a depth of 6" before commencing the standard penetration test.

SYMBOLS

Drilling and Sampling

- CS – Continuous Sampling
- RC – Rock Coring: Size AW, BW, NW, 2"W
- RQD – Rock Quality Designation
- RB – Rock Bit/Roller Bit
- FT – Fish Tail
- DC – Drove Casing
- C – Casing: Size 2 ½", NW, 4", HW
- CW – Clear Water
- DM – Drilling Mud
- HSA – Hollow Stem Auger
- FA – Flight Auger
- HA – Hand Auger
- COA – Clean-Out Auger
- SS - 2" Dia. Split-Barrel Sample
- 2ST – 2" Dia. Thin-Walled Tube Sample
- 3ST – 3" Dia. Thin-Walled Tube Sample
- PT – 3" Dia. Piston Tube Sample
- AS – Auger Sample
- WS – Wash Sample
- PTS – Peat Sample
- PS – Pitcher Sample
- NR – No Recovery
- S – Sounding
- PMT – Borehole Pressuremeter Test
- VS – Vane Shear Test
- WPT – Water Pressure Test

Laboratory Tests

- q_a – Penetrometer Reading, tons/sq ft
- q_u – Unconfined Strength, tons/sq ft
- W – Moisture Content, %
- LL – Liquid Limit, %
- PL – Plastic Limit, %
- SL – Shrinkage Limit, %
- LI – Loss on Ignition
- D – Dry Unit Weight, lbs/cu ft
- pH – Measure of Soil Alkalinity or Acidity
- FS – Free Swell, %

Water Level Measurement

- ▽ - Water Level at Time Shown
- NW – No Water Encountered
- WD – While Drilling
- BCR – Before Casing Removal
- ACR – After Casing Removal
- CW – Cave and Wet
- CM – Caved and Moist

Note: Water level measurements shown on the boring logs represent conditions at the time indicated and may not reflect static levels, especially in cohesive soils.

APPENDIX C
DOCUMENT QUALIFICATIONS

APPENDIX C

DOCUMENT QUALIFICATIONS

I. GENERAL RECOMMENDATIONS/LIMITATIONS

CGC, Inc. should be provided the opportunity for a general review of the final design and specifications to confirm that earthwork and foundation requirements have been properly interpreted in the design and specifications. CGC should be retained to provide soil engineering services during excavation and subgrade preparation. This will allow us to observe that construction proceeds in compliance with the design concepts, specifications and recommendations, and also will allow design changes to be made in the event that subsurface conditions differ from those anticipated prior to the start of construction. CGC does not assume responsibility for compliance with the recommendations in this report unless we are retained to provide construction testing and observation services.

This report has been prepared in accordance with generally accepted soil and foundation engineering practices and no other warranties are expressed or implied. The opinions and recommendations submitted in this report are based on interpretation of the subsurface information revealed by the test borings indicated on the location plan. The report does not reflect potential variations in subsurface conditions between or beyond these borings. Therefore, variations in soil conditions can be expected between the boring locations and fluctuations of groundwater levels may occur with time. The nature and extent of the variations may not become evident until construction.

II. IMPORTANT INFORMATION ABOUT YOUR GEOTECHNICAL ENGINEERING REPORT

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes. While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. *No one except you* should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one - not even you* - should apply the report for any purpose or project except the one originally contemplated.

READ THE FULL REPORT

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

A GEOTECHNICAL ENGINEERING REPORT IS BASED ON A UNIQUE SET OF PROJECT-SPECIFIC FACTORS

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, *do not rely on a geotechnical engineering report* that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes - even minor ones - and request an assessment of their impact. *CGC cannot accept responsibility or liability for problems that occur because our reports do not consider developments of which we were not informed.*

SUBSURFACE CONDITIONS CAN CHANGE

A geotechnical engineering report is based on conditions that existed at the time the geotechnical engineer performed the study. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

MOST GEOTECHNICAL FINDINGS ARE PROFESSIONAL OPINION

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgement to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ - sometimes significantly - from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most

effective method of managing the risks associated with unanticipated conditions.

A REPORT'S RECOMMENDATIONS ARE NOT FINAL

Do not over-rely on the confirmation-dependent recommendations included in your report. *Those confirmation-dependent recommendations are not final*, because geotechnical engineers develop them principally from judgement and opinion. Geotechnical engineers can finalize their recommendations *only* by observing actual subsurface conditions revealed during construction. *CGC cannot assume responsibility or liability for the report's confirmation-dependent recommendations if we do not perform the geotechnical-construction observation required to confirm the recommendations' applicability.*

A GEOTECHNICAL ENGINEERING REPORT IS SUBJECT TO MISINTERPRETATION

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Constructors can also misinterpret a geotechnical engineering report. Confront that risk by having CGC participate in prebid and preconstruction conferences, and by providing geotechnical construction observation.

DO NOT REDRAW THE ENGINEER'S LOGS

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

GIVE CONSTRUCTORS A COMPLETE REPORT AND GUIDANCE

Some owners and design professionals mistakenly believe they can make constructors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give constructors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise constructors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure constructors have sufficient time* to perform additional study. Only then might you be in a position to give constructors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

READ RESPONSIBILITY PROVISIONS CLOSELY

Some clients, design professionals, and constructors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic

expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineer's responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

ENVIRONMENTAL CONCERNS ARE NOT COVERED

The equipment, techniques, and personnel used to perform an *environmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

OBTAIN PROFESSIONAL ASSISTANCE TO DEAL WITH MOLD

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, many mold prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; *none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention.* *Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.*

RELY ON YOUR GEOTECHNICAL ENGINEER FOR ADDITIONAL ASSISTANCE

Membership in the Geotechnical Business Council (GBC) of Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk confrontation techniques that can be of genuine benefit for everyone involved with a construction project. Confer with CGC, a member of GBC, for more information.

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Geotechnical Business Council
of the Geoprofessional Business Association
8811 Colesville Road, Suite G 106
Silver Spring, MD 20910

APPENDIX D

RECOMMENDED COMPACTED FILL SPECIFICATIONS

APPENDIX D

CGC, INC.

RECOMMENDED COMPACTED FILL SPECIFICATIONS

General Fill Materials

Proposed fill shall contain no vegetation, roots, topsoil, peat, ash, wood or any other non-soil material which by decomposition might cause settlement. Also, fill shall never be placed while frozen or on frozen surfaces. Rock, stone or broken concrete greater than 6 in. in the largest dimension shall not be placed within 10 ft of the building area. Fill used greater than 10 ft beyond the building limits shall not contain rock, boulders or concrete pieces greater than a 2 sq ft area and shall not be placed within the final 2 ft of finish subgrade or in designated utility construction areas. Fill containing rock, boulders or concrete pieces should include sufficient finer material to fill voids among the larger fragments.

Special Fill Materials

In certain cases, special fill materials may be required for specific purposes, such as stabilizing subgrades, backfilling undercut excavations or filling behind retaining walls. For reference, WisDOT gradation specifications for various types of granular fill are attached in Table 1.

Placement Method

The approved fill shall be placed, spread and leveled in layers generally not exceeding 10 in. in thickness before compaction. The fill shall be placed at moisture content capable of achieving the desired compaction level. For clay soils or granular soils containing an appreciable amount of cohesive fines, moisture conditioning will likely be required.

It is the Contractor's responsibility to provide all necessary compaction equipment and other grading equipment that may be required to attain the specified compaction. Hand-guided vibratory or tamping compactors will be required whenever fill is placed adjacent to walls, footings, columns or in confined areas.

Compaction Specifications

Maximum dry density and optimum moisture content of the fill soil shall be determined in accordance with modified Proctor methods (ASTM D1557). The recommended field compaction as a percentage of the maximum dry density is shown in Table 2. Note that these compaction guidelines would generally not apply to coarse gravel/stone fill. Instead, a method specification would apply (e.g., compact in thin lifts with a vibratory compactor until no further consolidation is evident).

Testing Procedures

Representative samples of proposed fill shall be submitted to CGC, Inc. for optimum moisture-maximum density determination (ASTM D1557) prior to the start of fill placement. The sample size should be approximately 50 lb.

CGC, Inc. shall be retained to perform field density tests to determine the level of compaction being achieved in the fill. The tests shall generally be conducted on each lift at the beginning of fill placement and at a frequency mutually agreed upon by the project team for the remainder of the project.

**Table 1
Gradation of Special Fill Materials**

Material	WisDOT Section 311	WisDOT Section 312	WisDOT Section 305			WisDOT Section 209		WisDOT Section 210
	Breaker Run	Select Crushed Material	3-in. Dense Graded Base	1 1/4-in. Dense Graded Base	3/4-in. Dense Graded Base	Grade 1 Granular Backfill	Grade 2 Granular Backfill	Structure Backfill
Sieve Size	Percent Passing by Weight							
6 in.	100							
5 in.		90-100						
3 in.			90-100					100
1 1/2 in.		20-50	60-85					
1 1/4 in.				95-100				
1 in.					100			
3/4 in.			40-65	70-93	95-100			
3/8 in.				42-80	50-90			
No. 4			15-40	25-63	35-70	100 (2)	100 (2)	25-100
No. 10		0-10	10-30	16-48	15-55			
No. 40			5-20	8-28	10-35	75 (2)		
No. 100						15 (2)	30 (2)	
No. 200			2-12	2-12	5-15	8 (2)	15 (2)	15 (2)

Notes:

1. Reference: Wisconsin Department of Transportation *Standard Specifications for Highway and Structure Construction*.
2. Percentage applies to the material passing the No. 4 sieve, not the entire sample.
3. Per WisDOT specifications, both breaker run and select crushed material can include concrete that is 'substantially free of steel, building materials and other deleterious material'.

**Table 2
Compaction Guidelines**

Area	Percent Compaction (1)	
	Clay/Silt	Sand/Gravel
<u>Within 10 ft of building lines</u>		
Footing bearing soils	93 - 95	95
Under floors, steps and walks		
- Lightly loaded floor slab	90	90
- Heavily loaded floor slab and thicker fill zones	92	95
<u>Beyond 10 ft of building lines</u>		
Under walks and pavements		
- Less than 2 ft below subgrade	92	95
- Greater than 2 ft below subgrade	90	90
Landscaping	85	90

Notes:

1. Based on Modified Proctor Dry Density (ASTM D 1557)

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**SECTION 00 31 46
PERMITS**

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PART 1 – GENERAL

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1.1. SUMMARY

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1.2. REFERENCES

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1.3. GENERAL CONTRACTORS REQUIREMENTS

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PART 2 – PRODUCTS – THIS SECTION NOT USED

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PART 3 – EXECUTION – THIS SECTION NOT USED

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END OF SECTION

SECTION 00 43 25
SUBSTITUTION REQUEST FORM (DURING BIDDING)

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8 PART 3 - EXECUTION 1
9 3.1. REQUESTING A SUBSTITUTION DURING BIDDING 1
10 3.2. SUBMISSION REVIEW 2
11 3.3. SUBSTITUTION APPROVAL 2
12 3.4. SUBSTITUTION REQUEST FORM 3

13
14 **PART 1 – GENERAL**

15
16 **1.1. SUMMARY**

- 17 A. The City of Madison uses a specific list of preferred products for various specification items to establish
18 standards of quality, utility, and appearance required.
19 B. The City of Madison will not allow substitutions for specified Products except as follows:
20 1. The Product is no longer produced or the product manufacturer is no longer in business.
21 2. The manufacturer has significantly changed performance data, product dimensions, or other such design
22 criteria for the specified Product(s).
23 3. Products specified by naming one or more Products or manufacturer’s and “or approved equal” or
24 “approved equivalent.”
25 C. The procedures in this specification shall apply to all proposals by Contractors, Suppliers, Vendors, and
26 Manufacturers when the conditions in item 1.1.B. above have been met during the bidding phase.
27

28 **1.2. RELATED SPECIFICATIONS**

- 29 A. 01 25 13 Product Substitution Procedures
30

31 **PART 2 – PRODUCTS – THIS SECTION NOT USED**

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33 **PART 3 - EXECUTION**

34
35 **3.1. REQUESTING A SUBSTITUTION DURING BIDDING**

- 36 A. In the event that a substitution is requested during the bidding phase the Contractor, Supplier, Vendor, or
37 Manufacturer shall do all of the following:
38 1. Submit a Substitution Request Form for each different product. Use a printed/scanned copy of the form
39 at the end of this specification as a cover sheet.
40 2. Support your request with complete data, drawings, specifications, performance data and samples as
41 appropriate. A complete submission shall include the following:
42 a. Substitution Request Form as a cover sheet
43 b. Comparison of qualities of the proposed substitutions with that specified.
44 c. Changes required in other elements of the Work because of the substitution.
45 d. Effect on the construction schedule.
46 e. Cost data comparing the proposed substitution with the Product specified.
47 f. Any required license fees or royalties.
48 g. Availability of maintenance service and source of replacement materials.
49 3. Submit the Substitution Request Form and all required supporting documentation to the City Project
50 Manager and Project Architect.
51 a. Submissions to be done as complete PDF files for each product, appropriately titled
52 b. Email submissions to the Project Architect and City Project Manager at the email addresses
53 provided on the last page of Section D of the contract documents.
54 i. The subject line shall include the contract number and “Request for Substitution”.
55 Example: Contract 1234 – Request for Substitution
56 4. Submissions must be received by the substitution request deadline specified in Section A of the Contract
57 Documents.
58

1 **3.2. SUBMISSION REVIEW**

2 A. The Project Architect, City Project Manager, members of the design team, and the Owners staff shall review all
3 submissions for substitutions during the bidding phase.
4

5 **3.3. SUBSTITUTION APPROVAL**

6 A. All requests for substitutions that have been approved shall be published by Addenda to the bid documents.
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9 **NOTE SEE NEXT PAGE FOR SAMPLE SUBSTITUTION REQUEST FORM.**
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1 3.4. SUBSTITUTION REQUEST FORM
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For Pre-bid Substitution Requests all text boxes on this form are required information for a complete request.

		<h1>Substitution Request</h1>	
Today's Date:	<input type="text"/>		
Project Title:	<input type="text"/>		
Project Number:	<input type="text"/>	Contract Number:	<input type="text"/>
<p><i>By completing and submitting this form for review the General Contractor affirms that all of the following statements are correct:</i></p> <ol style="list-style-type: none">1 The General Contractor affirms that this request is in compliance with the requirements described in <i>Specification 01 25 13 Product Substitution Procedures</i>.2 The function, appearance, and quality of the proposed substitution are equal or superior to the specified item.3 The proposed substitution does not affect dimensions shown on the drawings.4 The proposed substitution will have no adverse affects on other trades, the construction schedule, or any specified warranty requirements.5 Maintenance and service parts will be locally available for the proposed substitution. (GC shall provide supporting documentation in the attachments section below.)6 The General Contractor shall be responsible for any and all costs associated with this substitution request if approved. This includes but is not to limited to fees for building design, engineering design fees, detailing fees, plan review fees, construction costs, and inspection fees.			
<u>GC Substitution Request:</u>			
General Title:	<input type="text"/>		
Related Specification:	<input type="text"/>	<input type="text"/>	<input type="text"/>
Reason for Substitution:	<input type="text"/>		
Proposed Substitution: (include Name, Model, etc.)	<input type="text"/>		
Submitted By:	<input type="text"/>	Phone:	<input type="text"/>
Company:	<input type="text"/>	Email:	<input type="text"/>

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**SECTION 00 43 43
WAGE RATES FORM**

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6 1.2. RELATED SPECIFICATIONS 1
7 PART 2 – PRODUCTS – NOT USED 1
8 PART 3 - EXECUTION 1
9 3.1. GENERAL REQUIREMENTS..... 1
10 3.2. GENERAL CONTRACTORS RESPONSIBILITIES 1
11

PART 1 – GENERAL

1.1. SUMMARY

- A. The Reimbursable Hourly Worksheet is a contractor provided document that indicates the basic rate of pay, fringe benefits, and each companies cost of required insurance for all Trades and Classifications that will be performing productive labor during the execution of this contract.
1. Rates shall be similar to recognized rates published by the Bureau of Labor Statistics, Associated General Contractors (AGC), Associated Builders and Contractors (ABC), appropriate union contracts, and other similar organizations or documents.
- B. The Reimbursable Labor Rate Worksheet shall provide the basis for labor rates being used on Change Order Request forms.

1.2. RELATED SPECIFICATIONS

- A. Section 01 26 57 Change Order Request
B. Section 01 29 76 Progress Payment Procedures
C. Section 01 31 23 Project Management Web Site (SharePoint)
D. Section 01 32 19 Submittals Schedule

PART 2 – PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1. GENERAL REQUIREMENTS

- A. Prior to the Pre-Construction Meeting the City Project Manager (CPM) or the City Construction Manager (CCM) shall provide the GC a copy of the *Reimbursable Labor Rate Worksheet.xls*.
1. See the last page of this specification for an example of the worksheet.
- B. The GC shall provide all subcontractors that will be performing productive labor during the execution of this contract with additional copies of the worksheet as needed.
- C. All contractors shall be required to fill out and submit completed worksheets for all Trades and Classifications of labor that will be performing productive labor during the execution of this contract.

3.2. GENERAL CONTRACTORS RESPONSIBILITIES

- A. The GC shall consolidate all Trades and Classifications into one master Excel Workbook of all trades.
- B. The GC shall provide the combined workbook as required by Section 1.6 of Specification 01 32 19 Submittals Schedule for review and approval by the Owners Representatives.
1. Submittal shall be an Exported PDF of the completed Excel Workbook.
- a. As an Exported PDF the individual worksheets will be bookmarked and the document will be word searchable for easy reference.
- C. The GC shall only use the rates posted in the approved submittal throughout the execution of this contract.

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 2

Reimbursable Hourly Rate Worksheet

(see bottom of page for instructions)

Project Name: _____
 Project Location: _____
 Project Number: _____
 Contractor: _____
 Rates are based on the following documentation: _____

Enter TRADE Here:

Carpenter

<u>Classification:</u>		<u>Foreman</u>	<u>Journeyman</u>	<u>Laborer</u>	<u>Apprt 1</u>	<u>Other</u>	<u>Other</u>	<u>Other</u>
Base Rate (BR)		\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Vacation		\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Health Insurance		\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Pension		\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Apprenticeship		\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
<i>Sub-total</i>		\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
BR Sub-total		\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Work. Comp	% of BR	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Gen Liability	% of BR	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
WI Unemploy	% of BR	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Fed Unemploy	% of BR	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
FICA	% of BR	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
<i>Sub-total</i>		\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
TOTAL COST		\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00

Enter YOUR percentage of base rate in the column below.

% of BR	
0	- Work. Comp
0	- Gen Liability
0	- WI Unemploy
0.6	- Fed Unemploy
7.65	- FICA

Form Instructions:

1. Provide a work sheet for ALL Trade Classifications that will be performing on site productive labor during the execution of this project.
2. Responsible contractor to complete only boxes that are shaded, all non-shaded boxes are formula driven.
3. Contractor shall provide the name of the source used for these rates. (union contract, Bureau of Labor and Statistics, AGC, ABC, etc.) and be prepared to provide copies if so requested.

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END OF SECTION

**SECTION 00 62 76.13
SALES TAX FORM**

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4 PART 1 – GENERAL 1
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6 1.2. RELATED SPECIFICATION SECTIONS 1
7 1.2. TAX EXEMPT FORM 1
8 PART 2 – PRODUCTS – THIS SECTION NOT USED 1
9 PART 3 – EXECUTION – THIS SECTION NOT USED 1

10

11 **PART 1 – GENERAL**

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13 **1.1. SUMMARY**

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- A. The City of Madison is a qualifying tax exempt entity in the State of Wisconsin.
- B. The Contractor shall refer to *Section 102.9 – Bidders Understanding of the City of Madison Standard Specifications for Public Works Construction* for more information on Tax Exempt Status.
- C. This project constructs or remodels facilities owned by the City of Madison in Madison, Wisconsin.

18

19 **1.2. RELATED SPECIFICATION SECTIONS**

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- A. Parts of this specification will reference articles within “The City of Madison Standard Specifications for Public Works Construction”.
 - 1. Use the following link to access the Standard Specifications web page:
<http://www.cityofmadison.com/business/pw/specs.cfm>
 - a. Click on the “Part” chapter identified in the specification text. For example if the specification says “Refer to City of Madison Standard Specification 210.2” click the link for Part II, the Part II PDF will open.
 - b. Scroll through the index of Part II for specification 210.2 and click the text link which will take you to the referenced text.

29

30 **1.3. TAX EXEMPT FORM**

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- A. The Contractor can access Wisconsin Sales and Use Tax Exemption Certificates (form S-211, Wisconsin Department of Revenue) from the City of Madison Finance website.
 - 1. City of Madison tax exempt information and signature by Purchasing Supervisor is already completed.
 - 2. Website: <http://www.cityofmadison.com/employeeenet/finance/purchasing>
 - a. Under the title *Purchasing Forms*, scroll down to the form link titled *Sales Tax Exempt Form S-211*.

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37 **PART 2 – PRODUCTS – THIS SECTION NOT USED**

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39 **PART 3 – EXECUTION – THIS SECTION NOT USED**

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END OF SECTION

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SECTION 01 10 00 SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Phased construction.
4. Work under separate contracts.
5. Purchase contracts.
6. Owner-furnished products.
7. Access to site.
8. Coordination with occupants.
9. Work restrictions.
10. Specification and drawing conventions.
11. Miscellaneous provisions.

- B. Related Requirements:

1. Section 01 50 00 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.
2. Section 01 76 00 "Protecting Installed Construction" for procedures and responsibilities for protecting existing and new construction.

1.3 PROJECT INFORMATION

- A. Project Identification: Metro Transit – Phase 1 - Service Lane Addition, Contract No. 8238.

1. Project Location: 1101 East Washington Avenue, Madison, WI

- B. Owner: City of Madison - Engineering, City County Building, 210 Martin Luther King Jr. Blvd., Madison, WI 53703

1. Owner's Representative: Jonathan Evans and James Whitney

- C. Architect: Mead & Hunt, Inc.

- D. Civil, Structural, Plumbing, Mechanical, Electrical, and Technology Infrastructure: Mead & Hunt, Inc.

- E. Architect's Consultants: The Architect has retained the following design professional who have prepared designated portions of the Contract Documents:
1. Maintenance Equipment: Kueny Architects, LLC, Jon Wallenkamp, 1505 Corporate Drive, Suite 100, Pleasant Prairie, WI. 53158, Telephone: 262-857-8101.
- F. Project Web Site: A project Web Site administered by the City of Madison will be used for purposes of managing communication and documents during the construction stage.
1. See Section 01 31 23, "Project Management Web Site." for requirements for establishing, administering and using the Project Web site.

1.4 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Work of Project is defined by the Contract Documents and consists of the following:
1. An addition (approx..10,300 sf) to the existing Bus Maintenance and Storage Building for new bus Service Lanes and interior remodeling of existing areas, (approx..13,255 sf) along with all associated site work, utility work, and limited offsite work as identified in Drawings. Work includes phasing to allow for continuous Owner occupancy in existing business and maintenance garage occupancies with 24-hour operations. New construction includes load-bearing precast concrete wall panels and precast concrete roof superstructure. Exterior walls are clad with metal panels or the exposed precast panels. Low-slope EPDM roofing as identified on drawings. New or renovated interior construction is of concrete masonry units. Interior finishes include high performance wall and ceiling coatings, painted masonry, and sealed concrete and resinous flooring finishes. New openings include coiling overhead doors, FRP doors with aluminum frames, hollow metal doors and frames, and fiberglass-sandwich-panel exterior windows and skylights. Work includes renovation and/or replacement and new heating, ventilation, air conditioning, electrical, plumbing, fire protection and technology systems. Equipment is also included: vehicle lifts, fueling and lubrication systems, vacuuming systems, and vehicle washing.
- B. Type of Contract:
1. Project will be constructed under a single prime contract.

1.5 PHASED CONSTRUCTION

- A. The Work shall be conducted in 3 Phases, with each Phase substantially complete as indicated:
1. Phase 1: Service Lane Addition and Remodeled Areas. Work of this phase shall commence within 7 days after the Notice to Proceed and be substantially complete within 263 calendar days after the Notice to Proceed.
 2. Phase 2: Operational testing of new Service Lane. Work of this phase shall commence after substantial completion of Phase 1 construction and be substantially complete and ready for occupancy within days 12 calendar days

- after the Notice to Proceed. Under no circumstance can the existing Service Lane be demolished until the new Service Lane is operational.
3. Phase 3: Deconstruction of existing Service Lane. Work of this phase shall commence after substantial completion of Phase 2 construction and be substantially complete and ready for occupancy within 78 calendar days after the Notice to Proceed. Under no circumstance can the existing Service Lane be demolished until the new Service Lane is operational
- B. Before commencing Work of each phase, submit an updated copy of Contractor's construction schedule showing the sequence, commencement and completion dates, and move-out and -in dates of Owner's personnel for all phases of the Work.

C. Liquidated damages will apply to this project.

1.6 WORK UNDER SEPARATE CONTRACTS

- A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract or other contracts. Coordinate the Work of this Contract with work performed under separate contracts.
- B. Preceding Work: Owner has awarded separate contract(s) for the following construction operations at Project site. Those operations are scheduled to be substantially complete before work under this Contract begins.
1. Hazardous Material Abatement: A&A Environmental Services, P.O. Box 708, Poynette, WI. 53955.
 2. Site Survey: Burse Surveying and Engineering, Inc., 2801 International Lane, Suite 101, Madison WI. 53704.
 3. Geotechnical Report: CGC, Inc., 2931 Perry Street, Madison WI. 53713.
- C. Concurrent Work: Owner will award a separate contract for the following construction operations at Project site. Those operations may be conducted simultaneously with work under this Contract.
1. Electric Bus Integration: A separate contractor will provide wiring and control integration for electric bus charging and maintenance troubleshooting.

1.7 OWNER-FURNISHED PRODUCTS

- A. Owner will furnish products indicated. The Work includes receiving, unloading, handling, storing, protecting, and installing Owner-furnished products and making building services connections.
- B. Owner-Furnished Products:
1. Base Bid: Equipment as indicated on Drawings, including but not limited to, fueling station monitoring and cash vaults and existing door access control and camera monitoring system to new Cash room.

2. Electric Bus Charging Stations and Dispensers. Contractor will provide conduit infrastructure for concurrent project as indicated on the drawings and specifications.

1.8 ACCESS TO SITE

- A. General: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.
- B. Use of Site: Limit use of Project site to work in areas indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.
 1. Limits: Confine construction operations to areas identified on drawings.
 2. Driveways, Walkways and Entrances: Keep driveways loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
 - a. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
 - b. Offsite parking for contractor employees will be required.
 3. A construction easement has been facilitated at the southeast interior corner to allow access to the site. Contractor shall be responsible for securing the site on both sides.
- C. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.
 1. Protect existing underground and above ground fueling tanks and dispensing stations during construction and provide access to tanks for re-fueling.

1.9 COORDINATION WITH OCCUPANTS

- A. Partial Owner Occupancy: Owner will occupy the premises during entire construction period, with the exception of areas under construction. The owner operates the building 24 hours a day, 7 days a week. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's operations. Maintain existing exits unless otherwise indicated.
 1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and authorities having jurisdiction.
 2. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.
- B. Owner Limited Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed portions of the Work,

prior to Substantial Completion of the Work, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and limited occupancy shall not constitute acceptance of the total Work.

1. Architect will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied prior to Owner acceptance of the completed Work.
2. Obtain a Certificate of Occupancy from authorities having jurisdiction before limited Owner occupancy.
3. Before limited Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy, Owner will operate and maintain mechanical and electrical systems serving occupied portions of Work.
4. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of Work.

1.10 WORK RESTRICTIONS

- A. Work Restrictions, General: Comply with restrictions on construction operations.
1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.
- B. On-Site Work Hours: Limit work in the existing building to normal business working hours of 7 a.m. to 7 p.m., Monday through Friday, unless otherwise indicated.
1. Weekend Hours: Obtain Owner's written permission for weekend hour work.
 2. Early Morning Hours: Comply with City of Madison requirements on noise.
 3. Hours for Utility Shutdowns: Obtain Owner's written consent for all utility shutdowns.
- C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:
1. Notify Owner not less than two days in advance of proposed utility interruptions.
 2. Obtain Owner's written permission before proceeding with utility interruptions.
- D. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.
1. Notify Owner not less than two (2) days in advance of proposed disruptive operations.
 2. Obtain Owner's written permission before proceeding with disruptive operations.
- E. Nonsmoking Building: Smoking is not permitted within the building or within 25 feet of entrances, operable windows, or outdoor-air intakes.
- F. Controlled Substances: Use of tobacco products and other controlled substances on Project site is not permitted.

1.11 SPECIFICATION AND DRAWING CONVENTIONS

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 10 00

SECTION 01 22 00 UNIT PRICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for unit prices.
- B. Related Documents:
 - 1. Drawing and General provisions of the contract, including General and Supplementary conditions and other Division 01, specifications sections, apply to this section.

1.3 DEFINITIONS

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

1.4 PROCEDURES

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF UNIT PRICES

- A. General: Unsuitable Soil Disposal shall consist of excavation, transportation, and disposal of unsuitable soil at an approved landfill according, and specification section 31 20 00 "Earth Moving." It shall include excavation, hauling, all material, labor, equipment, taxes, and fees from the landfill for acceptance of the material, record keeping of the quantity, contractor acting as the manifest and providing the delivery tickets to the Architect/Owner for review prior to payment. Payment shall be made based on the actual tonnage accepted and recorded by the landfill. The base bid will be adjusted for the actual quantities over or under the 3550 tons of disposed material and engineered backfill.
1. Unit Price 1: Unsuitable Soil, cost per ton based on 3550 tons. (3550 tons is based on an estimated quantity of 2,841 tons with an additional 25% contingency included)
 2. Unit Price 2: Backfill of over-excavated areas beyond base bid excavations. Backfill shall consist of drainage course and unit price be based on 3550 tons.
- B. General, Helical Piles totaling 194 piles at 28 feet depth are the base bid for the project, totaling 5,432 linear feet.
1. Unit price 3: Provide a unit cost for additions/deductions from all work required under the contract for the actual installed quantity above or below the estimated quantity of 5,432 linear feet.

END OF SECTION 01 22 00

SECTION 01 23 00 ALTERNATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1.3 DEFINITIONS

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

1.4 PROCEDURES

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

- A. Alternate No. 1: Contractor-furnished Equipment.
1. Base Bid: Contractor to install fire alarm system equipment as indicated on Drawings, and specified in Section 28 46 21.11, Addressable Fire Alarm Systems
 2. Alternate: Contractor to furnish and install fire alarm equipment as indicated on Drawings ED-141, ED-142, ED-143, ED-144, E-140, E-141, E-142, E-143 and E-144 and specified in Section 28 46 21.11, addressable Fire Alarm Systems.

END OF SECTION 01 23 00

SECTION 01 25 13
PRODUCT SUBSTITUTION PROCEDURES

1
2
3
4 PART 1 – GENERAL 1
5 1.1. SUMMARY 1
6 1.2. RELATED SPECIFICATIONS 1
7 PART 2 – PRODUCTS 1
8 2.1. SUBSTITUTION REQUEST FORM 1
9 PART 3 - EXECUTION 1
10 3.1. REQUESTING A SUBSTITUTION DURING BIDDING 1
11 3.2. REQUESTING A SUBSTITUTION AFTER AWARD OF CONTRACT 2
12 3.3. UNAUTHORIZED SUBSTITUTIONS 2
13

14 **PART 1 – GENERAL**

15
16 **1.1. SUMMARY**

- 17 A. The City of Madison uses a specific list of preferred products for various specification items to establish
18 standards of quality, utility, and appearance required.
19 B. The City of Madison will not allow substitutions for specified Products except as follows:
20 1. The Product is no longer produced or the product manufacturer is no longer in business.
21 2. The manufacturer has significantly changed performance data, product dimensions, or other such design
22 criteria for the specified Product(s).
23 3. Products specified by naming one or more Products or manufacturer’s and “or approved equal” or
24 “approved equivalent.”
25 C. The City of Madison will not allow substitutions for specified Products as follows:
26 1. For Products specified by naming only one Product and manufacturer, no substitute product will be
27 considered.
28 2. For Products specified by naming several Products or manufacturers select any one of the products or
29 manufacturers named, which complies with the specifications. No substitute product will be considered.
30 D. Request for substitutions from any party other than the General Contractor (GC) will not be accepted.
31

32 **1.2. RELATED SPECIFICATIONS**

- 33 A. Section 01 26 13 Request for Information (RFI)
34 B. Section 01 31 23 Project Management Web Site
35 C. Section 01 33 23 Submittals
36

37 **PART 2 – PRODUCTS**

38
39 **2.1. SUBSTITUTION REQUEST FORM**

- 40 A. During bidding all contractors (General and Sub-contractors) and suppliers of materials or products shall provide
41 hard copy of the Substitution Request form and all required attachments directly to the Project Architect.
42 1. Contractors and suppliers shall use the screen shot of the form located at the end of this specification to
43 print a hard copy for all pre-bid substitution requests.
44 B. After bidding only the GC shall submit a request and shall use the form located on the Project Management Web
45 Site.
46

47 **PART 3 - EXECUTION**

48
49 **3.1. REQUESTING A SUBSTITUTION DURING BIDDING**

- 50 A. In the event that a substitution is requested during the bidding phase the Contractor or Supplier shall meet the
51 substitution request deadline listed in the bidding documents. No substitution request will be considered during
52 the bidding period after the stated substitution request deadline. In general this procedure shall be as follows:
53 1. Submit a Substitution Request Form for each different product
54 2. Support your request with complete data, drawings, specifications, performance data and samples as
55 appropriate. A complete submission shall include the following:
56 i. Substitution Request Form as a cover sheet
57 ii. Comparison of qualities of the proposed substitutions with that specified.
58 iii. Changes required in other elements of the Work because of the substitution.

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- iv. Effect on the construction schedule.
 - v. Cost data comparing the proposed substitution with the Product specified.
 - vi. Any required license fees or royalties.
 - vii. Availability of maintenance service and source of replacement materials.
 - 3. Submit the Substitution Request Form and all required supporting documentation to the City Project Manager and Project Architect.
 - i. Submissions to be done as complete PDF files for each product, appropriately titled
 - ii. Email submissions to the Project Architect and City Project Manager at the email addresses provided on the last page of Section D of the contract documents.
 - iii. Submissions must be received by the substitution request deadline specified in Section A of the Contract Documents.
 - B. Substitutions submitted and approved during the bidding phase shall be announced by the City of Madison by addenda prior to the bid due date.
 - C. The Owner and Architect may reject any substitution request without providing specific reasons.

3.2. REQUESTING A SUBSTITUTION AFTER AWARD OF CONTRACT

- A. A substitution request will only be considered after award of contract if it meets the qualifying provisions as described in 1.1.B.1 and .2 above.
- B. The GC shall submit a substitution request using the digital form on the Project Management Web Site located in the Construction Administration-Substitution Request library.
 - 1. Click on *Add document* to open a new digital form, fill out form, provide required attachments, then click the Submit button.
 - 2. Consulting Staff, Owner and Owners Representatives will review the request and provide the appropriate approvals and feed back to the GC.

3.3. UNAUTHORIZED SUBSTITUTIONS

- A. Any Contractor who substitutes products without proper authorization by the Owner and Architect will be required to immediately remove and replace the product and all costs required to conform to the Contract Documents shall be borne by the General Prime Contractor.

NOTE SEE NEXT PAGE FOR SAMPLE SUBSTITUTION REQUEST FORM.

1

For Pre-bid Substitution Requests all text boxes on this form are required information for a complete request.

	<h1>Substitution Request</h1>
Today's Date:	<input type="text"/>
Project Title:	<input type="text"/>
Project Number:	<input type="text"/>
Contract Number:	<input type="text"/>
<p>By completing and submitting this form for review the General Contractor affirms that all of the following statements are correct:</p> <ol style="list-style-type: none">1 The General Contractor affirms that this request is in compliance with the requirements described in <i>Specification 01 25 13 Product Substitution Procedures</i>.2 The function, appearance, and quality of the proposed substitution are equal or superior to the specified item.3 The proposed substitution does not affect dimensions shown on the drawings.4 The proposed substitution will have no adverse affects on other trades, the construction schedule, or any specified warranty requirements.5 Maintenance and service parts will be locally available for the proposed substitution. (GC shall provide supporting documentation in the attachments section below.)6 The General Contractor shall be responsible for any and all costs associated with this substitution request if approved. This includes but is not to limited to fees for building design, engineering design fees, detailing fees, plan review fees, construction costs, and inspection fees.	
GC Substitution Request:	
General Title:	<input type="text"/>
Related Specification:	<input type="text"/> <input type="text"/> <input type="text"/>
Reason for Substitution:	<input type="text"/>
Proposed Substitution: (include Name, Model, etc.)	<input type="text"/>
Submitted By:	<input type="text"/>
Company:	<input type="text"/>
Phone:	<input type="text"/>
Email:	<input type="text"/>

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END OF SECTION

SECTION 01 26 13
REQUEST FOR INFORMATION (RFI)

1
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4 PART 1 – GENERAL 1
5 1.1. SUMMARY 1
6 1.2. RELATED SPECIFICATIONS 1
7 1.3. PERFORMANCE REQUIREMENTS..... 1
8 1.4. QUALITY ASSURANCE 1
9 PART 2 – PRODUCTS..... 1
10 2.1. REQUEST FOR INFORMATION FORM 1
11 PART 3 - EXECUTION 1
12 3.1. CONTRACTOR INITIATED RFI 2
13 3.3. RFI RESPONSES 2
14 3.4. COMMENCEMENT OF WORK RELATED TO AN RFI 2
15

16 **PART 1 – GENERAL**

17
18 **1.1. SUMMARY**

- 19 A. Contractors shall use the RFI form/process to request additional information or clarification regarding the
20 construction documents.
21 B. All RFI documentation will be processed through the through the Construction Administration-Request for
22 Information Library on the Project Management Web Site (PMWS).
23

24 **1.2. RELATED SPECIFICATIONS**

- 25 A. Section 01 26 46 Construction Bulletin (CB)
26 B. Section 01 26 57 Change Order Request (COR)
27 C. Section 01 26 63 Change Order (CO)
28 D. Section 01 31 23 Project Management Web Site (PMWS)
29 E. Section 01 91 00 Commissioning
30

31 **1.3. PERFORMANCE REQUIREMENTS**

- 32 A. RFI issues initiated by any contractor shall be done through the General Contractor (GC).
33 1. RFIs submitted by any Sub-contractor under the GCs control shall be returned with no response.
34 B. Submit a new RFI for each issue. Only multiple questions that are of a similar nature may be combined into one
35 RFI shall be allowed and responded to.
36

37 **1.4. QUALITY ASSURANCE**

- 38 A. The GC shall be responsible for all of the following:
39 1. Ensure that any request for additional information is valid and the information being requested is not
40 addressed in the construction documents.
41 2. Ensure that all requests are clearly stated and the RFI form is completely filled out.
42 3. Ensure that all Work associated an RFI response is carried out as intended.
43 B. The PA shall be responsible for the following:
44 1. Ensure that all responses to contractor initiated RFIs are properly responded to in a timely fashion.
45 a. The CPM, Owner, consulting staff, and other City staff shall be responsible for the initial review of
46 the RFI. The PA shall be responsible for codifying all consultant and Owner/City staff comments
47 into a unified RFI response.
48

49 **PART 2 – PRODUCTS**

50
51 **2.1. REQUEST FOR INFORMATION FORM**

- 52 A. The RFI form is located on the Project Management Web Site. The GC, PA, or CPM as appropriate shall click the
53 link in the left margin of the project web site opening a new form. Project information is pre-loaded, provide
54 additional information as indicated below in the execution to complete the form.
55

56 **PART 3 - EXECUTION**

57

1 **3.1. CONTRACTOR INITIATED RFI**

- 2 A. Immediately on discovery of the need for additional information or interpretation of the Contract Documents
3 any contractor may initiate an RFI for additional information or clarification through the GC.
4 B. The GC shall select the "Submit an RFI" link on the Project Management Web Site and completely fill out the
5 form as follows:
6 1. Contract related information will be automatically populated on the form.
7 2. Thoroughly explain the issue at hand, provide backup information (photographs, sketches, drawings,
8 data, etc) as necessary, and clearly state the question or problem that requires a resolution. Combine
9 like or related issues but do not include multiple issues on one form.
10 a. Example. If a duct interferes with other critical piping and electrical work include all issues into
11 one RFI.
12 b. Example. If you have a question regarding the chiller and another regarding toilet partitions
13 create separate RFIs.
14 3. Check all relevant boxes for trades affected. This will assist the design team in determining who should
15 be reviewing the RFI.
16 C. Upon completing the RFI click the "Submit" button. The PMWS software will automatically route the RFI to the
17 appropriate reviewers.
18

19 **3.3. RFI RESPONSES**

- 20 A. Responses to simple RFI issues shall use the response section of the RFI form and shall be completed within five
21 (5) working days of the RFI form being submitted.
22 B. Responses to more complex issues may require additional time or may require a Construction Bulletin to be
23 published. The initial RFI shall be responded to within five (5) working days stating that the RFI is being
24 reviewed and provide an estimated date for the response.
25 C. The following GC generated RFIs will be returned without action:
26 1. Requests for approval of submittals
27 2. Requests for approval of substitutions
28 3. Requests for approval of Contractor's means and methods.
29 4. Requests for coordination information already indicated in the Contract Documents.
30 5. Requests for adjustments in the Contract Time or the Contract Sum.
31 6. Requests for interpretation of A/E's actions on submittals.
32 7. Incomplete RFI or inaccurately prepared RFI.
33

34 **3.4. COMMENCEMENT OF WORK RELATED TO AN RFI**

- 35 A. The GC shall only proceed with the Work of an RFI when additional information is not required.
36 B. The GC shall not proceed with any Work associated with an RFI while it is under review.
37 C. The GC shall not proceed with any Work associated with an RFI that clearly states a CB will be issued in response
38 to the RFI.
39 D. The GC will be required to immediately remove and replace unauthorized Work and all costs required to
40 conform to the Contract Documents shall be borne by the GC.
41
42
43

44 **END OF SECTION**
45
46

**SECTION 01 26 46
CONSTRUCTION BULLETIN (CB)**

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4 PART 1 – GENERAL 1
5 1.1. SUMMARY 1
6 1.2. RELATED SPECIFICATIONS 1
7 1.3. PERFORMANCE REQUIREMENTS..... 1
8 1.4. QUALITY ASSURANCE 1
9 PART 2 – PRODUCTS..... 2
10 2.1. CONSTRUCTION BULLETIN FORM 2
11 PART 3 - EXECUTION 2
12 3.1. WRITING THE CONSTRUCTION BULLETIN 2
13 3.2. EXECUTING THE CONSTRUCTION BULLETIN 2
14

PART 1 – GENERAL

1.1. SUMMARY

- 18 A. Construction Bulletins (CB) are formal published construction documents that modify the original contract bid
19 documents after construction has commenced. CBs may be published for many reasons, including but not
20 limited to the following:
21 1. Clarification of existing construction documents including specifications, plans, and details
22 2. Change in product or equipment
23 3. A response to a Request for Information
24 4. Change in scope of the contract as either an add or a deduct of work
25 B. CBs provide a higher degree of detail in response to a Request for Information (RFI) through directives, revised
26 plans/details, and specifications as necessary.
27 C. The CB may change the original contract documents through additions or deletions to the Work.
28 D. Where the directives of a CB are significant enough to warrant a Change Order Request (COR) the GC shall use all
29 information provided in the CB to assemble all required back-up documentation for additions and deletions of
30 materials, labor and other related contract costs for the COR.
31 E. All CB documentation will be processed through the Construction Administration-Construction Bulletin Library
32 on the Project Management Web Site (PMWS).
33

1.2. RELATED SPECIFICATIONS

- 34 A. Section 01 26 13 Request for Information (RFI)
35 B. Section 01 26 57 Change Order Request (COR)
36 C. Section 01 26 63 Change Order (CO)
37 D. Section 01 31 23 Project Management Web Site
38 E. Section 01 91 00 Commissioning
39
40

1.3. PERFORMANCE REQUIREMENTS

- 41 A. Project Architect (PA): The PA shall be the only person authorized to publish a CB as needed for any reason
42 indicated in section 1.1.A above. The PA shall consult as necessary with any of the following while drafting the
43 CB and shall confirm final direction with the CPM prior to issuing a CB:
44 1. City Project manager (CPM)
45 2. Owner
46 3. Members of the consulting staff
47 4. Members of city staff
48 5. The General Contractor
49 6. Sub-contractors
50 7. Commissioning Agent (CxA)
51 B. General Contractor: The GC shall be responsible for the following as needed:
52 1. Executing the directives of the CB when he/she believes that no changes in labor, materials, equipment,
53 or contract duration will be required for additions or deletions.
54 2. Submit a COR when he/she believes that a change in labor, materials, equipment or contract duration
55 will be required for additions or deletions.
56
57

1 **1.4. QUALITY ASSURANCE**

- 2 A. The PA shall be responsible for ensuring the final CB sufficiently provides direction, details, specifications and
3 other information as necessary for the GC to perform the intended Work.
4 B. The PA shall be responsible for ensuring the final CB is published as expeditiously as practical based on the
5 complexity of the CB being written. CBs that may affect the GC critical path shall be given priority.
6

7 **PART 2 – PRODUCTS**

8
9 **2.1. CONSTRUCTION BULLETIN FORM**

- 10 A. The CB form is located on the Project Management Web Site. The PA shall click the link in the left margin of the
11 project web site opening a new form. Project information is pre-loaded, the PA only needs to enter information
12 and make attachments as needed to complete the form.
13

14 **PART 3 - EXECUTION**

15
16 **3.1. WRITING THE CONSTRUCTION BULLETIN**

- 17 A. The PA shall draft a CB as needed using the Construction Bulletin form on the Project Management Web Site.
18 1. The PA and/or consulting staff as necessary shall provide specifications, model numbers and performance
19 data, details and other such information necessary to clearly state the intentions of the CB.
20 2. The consulting staff, CPM, Owner, CxA and other City Staff shall review the draft and recommend
21 changes as needed.
22 3. The PA shall amend the draft as necessary into a final CB for review
23 B. Once the final CB has been approved the PA shall “Submit” the CB through the Project Management Web Site to
24 the GC.
25

26 **3.2. EXECUTING THE CONSTRUCTION BULLETIN**

- 27 A. The GC shall acknowledge receipt of the CB on the Project Management Web Site as instructed in the Tutorial
28 Manual provided to the awarded contractor.
29 B. The GC shall notify all Sub-contractors of the CB and publish the CB to all field sets of drawings and specifications
30 as appropriate.
31 C. The GC shall execute the directives of the CB or submit COR documentation as necessary during the execution
32 and implementation of the CB.
33 1. See Specification 01 26 57 Change Order Request (COR)
34
35
36

37 **END OF SECTION**
38

**SECTION 01 26 57
CHANGE ORDER REQUESTS (COR)**

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3
4 PART 1 – GENERAL 1
5 1.1. SUMMARY 1
6 1.2. RELATED SPECIFICATION SECTIONS 2
7 1.3. DEFINITIONS AND STANDARDS 2
8 1.4. CONTRACT EXTENSION 3
9 1.5. OVERHEAD AND PROFIT MARKUP 3
10 1.6. PERFORMANCE REQUIREMENTS 3
11 1.7. QUALITY ASSURANCE 4
12 PART 2 – PRODUCTS 4
13 2.1. CHANGE ORDER REQUEST FORM 4
14 PART 3 - EXECUTION 4
15 3.1. ESTABLISHING A CHANGE ORDER REQUEST 4
16 3.2. SUBMIT A CHANGE ORDER REQUEST FORM 4
17 3.3. CHANGE ORDER REQUEST REVIEW, APPROVAL, AND PROCESSING 5
18 3.4. EMERGENCY CHANGE ORDER REQUEST 5

PART 1 – GENERAL

1.1. SUMMARY

- 23 A. Except in cases of emergency, no changes in the Work required by the Contract Documents may be made
24 by the General Contractor (GC) without having prior approval of the City Engineer or his representative.
25 B. The City may at any time, without invalidating the Contract and without Notice to Sureties, order changes in
26 the Work by written Change Order (CO). Such changes may include additions and/or deletions.
27 C. Where the City desires to make changes in the Work through use of written Change Order Request (COR), the
28 following procedures apply:
29 1. If requested by the City, the GC shall prepare and submit a detailed proposal, including all cost and time
30 adjustments to which the GC believes it will be entitled if the change proposed is incorporated into the
31 Contract. The City shall be under no legal obligation to issue a Change Order for such proposal.
32 2. The parties shall attempt in good faith to reach agreement on the adjustments needed to the Contract to
33 properly incorporate the proposed change(s) into the Work. In the event that the parties agree on such
34 adjustments, the City may issue a Change Order and incorporate such changes and agreed to
35 adjustments, if any.
36 3. In some instances, it may be necessary for the City to authorize Work or direct changes in Work for which
37 no final and binding agreement has been reached and for which unit prices are not applicable. In such
38 cases the following shall apply.
39 a. Upon written request by the City, the GC shall perform proposed Work
40 b. The cost of such change may be determined in accordance with this specification.
41 c. In the event agreement cannot be accomplished as contemplated herein, the City may authorize
42 the Work to be performed by City forces or to hire others to complete the Work. Such action on
43 the part of the City shall not be the basis of a claim by the GC for failure to allow it to perform the
44 changed Work.
45 D. Where changes in the Work are made by the City through use of a force account basis, the GC shall as soon as
46 practicable, and in no case later than ten (10) working days from the receipt of such order, unless another time
47 period has been agreed to by both parties, give the City written Notice, stating:
48 1. The date, circumstances and source of the extra work; and,
49 2. The cost of performing extra work described by such Order, if any; and,
50 3. Effect of the order on the required completion date of the Project, if any.
51 E. The giving of each Notice by the GC as prescribed by this specification, shall be a requirement to liability of the
52 City for payment of any additional costs incurred by the GC in implementing changes in the Work. Under this
53 specification, no order or statement of the City shall be treated as a Change Order, or shall entitle the GC to an
54 equitable adjustment of the terms of this Contract or damages for costs incurred by the GC on any activity for
55 which the Notice was not given.
56 F. In the event Work is required due to an emergency as described in this specification the GC must request an
57 equitable adjustment as soon as practicable, and in no case later than ten (10) working days of the
58 commencement of such emergency.

- 1 G. All GC requests for equitable adjustment shall be submitted to the CPM per the specifications below. Such
2 requests shall set forth with specificity the amount of and reason(s) for the proposed adjustment and shall be
3 accompanied by supporting information and documents.
4 H. No adjustment of any kind shall be made to this Contract, if asserted by the GC for the first time, after the date
5 of final payment.
6 I. This specification shall be used by the GC when preparing documentation for any COR to ensure each has been
7 properly and completely filled out as required by the City of Madison.
8 J. All COR documentation will be processed through the Construction Administration-Change Order Request
9 Library on the Project Management Web Site (PMWS).
10

11 **1.2. RELATED SPECIFICATION SECTIONS**

- 12 A. Section 01 26 13 Request for Information (RFI)
13 B. Section 01 26 46 Construction Bulletins (CB)
14 C. Section 01 26 63 Change Order (CO)
15 D. Section 01 31 23 Project Management Web Site
16 E. Section 01 91 00 Commissioning
17 F. Parts of this specification will reference articles within "The City of Madison Standard Specifications for Public
18 Works Construction".
19 1. Use the following link to access the Standard Specifications web page:
20 <http://www.cityofmadison.com/business/pw/specs.cfm>
21 a. Click on the "Part" chapter identified in the specification text. For example if the specification
22 says "Refer to City of Madison Standard Specification 210.2" click the link for Part II, the Part II
23 PDF will open.
24 b. Scroll through the index of Part II for specification 210.2 and click the text link which will take you
25 to the referenced text.
26

27 **1.3. DEFINITIONS AND STANDARDS**

- 28 A. LABOR: The amount of time and cost associated with the performance of human effort for a defined scope of
29 Work. Labor is further defined as follows:
30 1. Labor rate is the total hourly rate which includes the basic rate of pay, fringe benefits plus each
31 company's cost of required insurance, also referred to as a reimbursable labor rate.
32 2. Unit labor is the labor hours anticipated to install the corresponding unit of material.
33 3. Labor cost is the labor hours multiplied by the hourly labor rates.
34 B. MATERIAL: Actual material cost is the amount paid, or to be paid, by the GC for materials, supplies and
35 equipment entering permanently into the Work, including cost of transportation and applicable taxes. The cost
36 shall not exceed the usual and customary cost for such items available in the geographical area of the project
37 C. LARGE TOOLS AND MAJOR EQUIPMENT: Large tools and major equipment are those with an initial cost greater
38 than \$1,500, whether from the GC or other sources.
39 1. Tool and equipment use and time allowed is only for extra work associated with change orders.
40 a. Rental Rate is the machine cost associated with operating a piece of equipment for a defined
41 length of time (hour, day, week, or month) and shall not exceed the usual and customary amount
42 for such items available in the geographical area of the project.
43 b. Rental cost is the rental rate multiplied by the anticipated duration the equipment shall be
44 required.
45 2. The GC shall provide a breakdown of all rental rates to indicate what items and costs are associated with
46 the rate. Examples of items to include in the breakdown would be fuel consumption, lubrication,
47 maintenance and other similar expenses but not including profit and overhead.
48 3. When large tools and equipment needed for Change Order work are not already at the job site, the
49 actual cost to get the item there is also reimbursable.
50 D. BOND COST: The cost shall be calculated at 1% of the total proposed change order.
51 E. SUB-CONTRACTOR COSTS: Sub-contractor costs are for those labor, material, and equipment costs required by
52 subcontracted specialties to complete the Change Order work.
53 F. OVERHEAD AND PROFIT Markup: The allowable markup percentage to a COR by the GC and Sub-contractors for
54 overhead and profit. All of the following are expenses associated with overhead and profit and shall not be
55 reimbursable as individual items on any COR:
56 1. CHANGE ORDER PREPARATION: All costs associated with the preparing and processing of the change
57 order.

- 1 2. DESIGN, ESTIMATING, AND SUPERVISION: All such efforts, unless specifically requested by Owner as
2 additional Work to be documented as a COR or portion thereof.
3 3. INSTALLATION LAYOUT: The layout required for the installation of material and equipment, and the
4 installation design, is the responsibility of the GC.
5 4. SMALL TOOLS AND SUPPLIES: The cost of small hand tools with an initial cost of \$1,500 or less, along
6 with consumable supplies and expendable items such as drill bits, saw blades, gasoline, lubricating or
7 cutting oil, and similar items.
8 5. GENERAL EXPENSE: The general expense, which is those items that are a specific job cost not associated
9 with direct labor and material such as job trailers, foreman truck, and similar items.
10 6. RECORD DRAWINGS: The preparation of record or as-built drawings.
11 7. OTHER COSTS: Any miscellaneous cost not directly assessable to the execution of the Change Order
12 including but not limited to the following:
13 a. All association dues, assessments, and similar items.
14 b. All education, training, and similar items.
15 c. All drafting and/or engineering, unless specifically requested by Owner as additional Work to be
16 documented as a Change Order proposal or portion thereof.
17 d. All other items including but not limited to review, coordination, estimating and expediting, field
18 and office supervision, administrative work, etc.
19 G. Contract Extension: The necessary amount of time to be added to the contract deadlines for the completion of a
20 change order.
21
22 **1.4. CONTRACT EXTENSION**
23 A. The GC shall not assume that every COR will require a Contract Extension. If the GC feels a contract extension is
24 warranted he/she shall provide sufficient scheduling information that shows how the COR being requested
25 impacts the critical path of the project.
26 B. The City of Madison strongly encourages the GC to explore alternative methods and practices prior to submitting
27 a COR with a request for contract extension.
28
29 **1.5. OVERHEAD AND PROFIT MARKUP**
30 A. Pursuant to the City of Madison Standard Specifications for Public Works Construction, Section 104.7, Extra
31 Work, the following maximum allowable markups shall be strictly enforced on all change orders associated with
32 the execution of this contract.
33 1. The total maximum overhead and profit shall not exceed fifteen percent (15%) of the total costs.
34 2. The total maximum overhead and profit shall be distributed as follows:
35 a. For work performed and materials provided solely by the General Contractor, fifteen percent
36 (15%) of the total costs.
37 b. For work performed and materials provided solely by Sub-contractors and supervised by the
38 General Contractor:
39 i. Supervision of the GC, five percent (5%) of the total Sub-contractor cost.
40 ii. Sub-contractors work and materials ten percent (10%) of the total Sub-contractor cost.
41
42 **1.6. PERFORMANCE REQUIREMENTS**
43 A. The GC shall become thoroughly familiar with this specification as it will identify procedures and expenses that
44 are or are not allowed under the Change Order and Change Order Request process.
45 B. The GC shall be responsible for all of the following:
46 1. Carefully reviewing the CB that is associated with the COR.
47 2. Collecting required supporting documentation from all contractors that quantify the need for a COR.
48 a. Labor hours and wage rates
49 b. Material costs
50 c. Equipment costs
51 C. The following shall apply to establishing prices for labor, materials, and equipment costs:
52 1. Where Work to be completed has previously been established by individual bid items in the contract bid
53 proposal the GC shall use the unit bid prices previously established.
54 2. Where Work to be completed was bid as a Lump Sum without individual bid items the GC shall provide a
55 breakdown of all labor, materials, equipment including unit rates and quantities required.
56 D. The completion date is determined by Owner. The schedule, however, is the responsibility of the GC. Time
57 extensions for extra Work will be considered when a schedule analysis of the critical path shows that the Change
58 Order Request places the Work beyond the completion date stated in the Contract.

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1.7. QUALITY ASSURANCE

- A. The GC shall be responsible for ensuring that all COR supporting documentation meets the following requirements prior to completing the COR form on the Project Management Web Site:
 - 1. Sufficiently indicates labor, material, and other expenses related to completing the intent of the CB.
 - 2. No costs exceed the usual and customary amount for such items available in the geographical area of the project, and no costs exceed those established under the contract.
- B. The Project Architect (PA), Commissioning Agent (CxA), City Project Manager (CPM), other members of the consulting staff, and city staff shall review all COR requests to ensure that the intent of the CB will be met under the proposal of the COR or request additional information as necessary.

PART 2 – PRODUCTS

2.1. CHANGE ORDER REQUEST FORM

- A. The COR form is located on the Project Management Web Site. The GC shall click the link in the left margin of the project web site opening a new form. Follow additional instructions below in the execution section for filling out the form.

PART 3 - EXECUTION

3.1. ESTABLISHING A CHANGE ORDER REQUEST

- A. Upon receipt of a Construction Bulletin (CB) where the GC believes a significant change in contract scope warrants the submittal of a COR the GC shall do all of the following within ten (10) working days after receipt of the CB:
 - 1. Review the CB with all necessary trades and sub-contractors required by the change in scope.
 - a. Additions or deletions to the contract scope shall be as directed within the CB.
 - b. Additions or deletions of labor and materials shall be determined by the GC based on the directives of the CB.
 - 2. Assemble all required back-up documentation for additions and deletions of materials, labor and other related contract costs as previously outlined in this specification.
 - 3. Submit a COR request form on the Project Management Web Site.
- B. Submitting a COR does not obligate the GC to complete the work associated with the COR nor does it obligate the Owner to approve the COR as a change to the contract.

3.2. SUBMIT A CHANGE ORDER REQUEST FORM

- A. This specification shall provide a subject overview only. In depth instructions shall be provided to the awarded Contractor in a PDF Instructional Manual.
- B. The GC shall select the “Submit a COR” link on the Project Management Web Site.
- C. The software will open a new COR form and the GC shall provide all of the following information:
 - 1. DO NOT perform any calculations on this worksheet, only provide the raw data as requested below. All calculations, totals, and markups shall be computed as described within this specification.
 - 2. Provide a summary description of the COR request, and justification for any requested time extension to the contract, indicate the number of calendar days being requested for the extension and add any attachments to the form as needed.
 - 3. Provide all GC self performance data including all of the following:
 - a. Materials description, quantities, and unit costs.
 - b. Labor hours and rates for all Foremen, Journeymen, and Apprentices by trade.
 - c. Equipment descriptions, quantities, unit costs and rates.
 - 4. Provide all Sub-contractor data including all of the following:
 - a. Materials description, quantities, and unit costs.
 - b. Labor hours and rates for all Foremen, Journeymen, and Apprentices by trade.
 - c. Equipment descriptions, quantities, unit costs and rates.
 - 5. Ensure all calculations performed by the form have been completed correctly. Contact the CPM directly if you suspect an error before hitting the save button.
- C. At any time after creating a COR you must at a minimum click “Save as Draft” to save your work.
- D. When all data has been entered and verified click on the “Submit COR” button. This will kick off the COR Review and Approval process.

- 1 **3.3. CHANGE ORDER REQUEST REVIEW, APPROVAL, AND PROCESSING**
2 A. The PA and CPM shall review all CORs submitted by the GC.
3 1. Additional consulting staff and city staff having knowledge of the components of the COR shall review
4 and advise the PA and CPM as to the accuracy of the items, quantities, and associated costs of the COR as
5 directed by the CB.
6 2. The CPM shall review the COR with the Owner.
7 B. If required the PA and CPM, shall in good faith, further negotiate the COR with the GC as necessary. All
8 amendments to any COR shall be documented within the Project Management Web Site software.
9 C. After final review of the COR the CPM and Owner may accept the COR.
10 D. The CPM shall prepare the COR in the form of an official Board of Public Works Change Order for final review and
11 approval as outlined in Section 01 26 63 Change Order (CO).
12 E. The GC shall not act upon any accepted COR until it has received final approval through the Public Works process
13 as an official CO to the Work unless instructed to do so by the CPM. Proceeding without the final approval of a
14 fully authorized Change Order is at the GC's own risk.
15

16 **3.4. EMERGENCY CHANGE ORDER REQUEST**

- 17 A. In the event Work is required due to an emergency as described in the Contract Documents, the GC must
18 request an equitable adjustment as soon as practicable, and in no case later than ten (10) working days of the
19 commencement of such emergency.
20 B. The GC shall provide full documentation of all labor, materials and equipment used during the period of
21 emergency as part of the COR submittal.
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END OF SECTION

**SECTION 01 26 63
CHANGE ORDER (CO)**

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4 PART 1 – GENERAL 1
5 1.1. SUMMARY 1
6 1.2. RELATED SPECIFICATION SECTIONS 1
7 1.3. BOARD OF PUBLIC WORKS PROCEDURE 1
8 PART 2 – PRODUCTS..... 1
9 2.1. CHANGE ORDER FORM..... 1
10 PART 3 - EXECUTION 2
11 3.1. PREPARATION OF THE CHANGE ORDER 2
12 3.2. EXECUTION OF THE CHANGE ORDER 2

13
14 **PART 1 – GENERAL**

15
16 **1.1. SUMMARY**

- 17 A. Except in cases of emergency, no changes in the Work required by the Contract Documents may be made
18 by the General Contractor (GC) without having prior approval of the City Project Manager (CPM).
19 B. The City may at any time, without invalidating the Contract and without Notice to Sureties, order changes in
20 the Work by written Change Order. Such changes may include additions and/or deletions.
21 C. The Change Order (CO) is a Board of Public Works (BPW) form that is reviewed and approved by a specific
22 process.
23 D. The CO form is typically made up of multiple Change Order Requests (CORs) and/or Bid Items as appropriate
24 depending on the type of project and how the contract was bid.
25 E. All CO documentation shall be processed through the Construction Administration-Change Order Library and
26 digital workflow on the Project Management Web Site (PMWS).
27

28 **1.2. RELATED SPECIFICATION SECTIONS**

- 29 A. Section 01 26 13 Request for Information (RFI)
30 B. Section 01 26 46 Construction Bulletin (CB)
31 C. Section 01 26 63 Change Order Request (COR)
32 D. Section 01 31 23 Project Management Web Site
33 E. Section 01 91 00 Commissioning
34

35 **1.3. BOARD OF PUBLIC WORKS PROCEDURE**

- 36 A. The Board of Public Works has a very explicit procedure for the review and approval of all change orders
37 associated with any Public Works Contract as follows:
38 1. The Supervisory Chain of the CPM shall review and approve any CO under \$10,000 provided it does not
39 include either of the following:
40 a. The CO does not request a time extension to the contract.
41 b. The CO does not cause the contract contingency sum to be exceeded.
42 2. The Board of Public Works shall review and approve any CO that requires any of the following:
43 a. Any CO over \$10,000.
44 b. Any CO requesting a time extension to the contract regardless of the monetary value of the CO.
45 c. Any CO that that causes the contract contingency sum to be exceeded.
46 B. The Board of Public Works generally meets every other week and only once in August and December. The GC is
47 cautioned that, under normal scheduling, a CO requiring a BPW review will take a minimum of two (2) weeks to
48 achieve final approval.
49 1. The City shall not be responsible for additional delays to the Work caused by the scheduling constraints
50 of the Board of Public Works.
51 C. **SPECIAL NOTE:** The GC is cautioned to never proceed unless told to do so by the CPM. Only in rare instances
52 may the CPM give a written notice to proceed on a COR without an approved CO. Proceeding without the
53 written notice of the CPM or an approved CO is at the GC’s own risk.
54

1 **PART 2 – PRODUCTS**

2

3 **2.1. CHANGE ORDER FORM**

4

- A. The CO form is located on the Project Management Web Site. The CPM shall click the link in the left margin of the project web site opening a new form. Project information is pre-loaded, the CPM only needs to enter information and make attachments as needed to complete the form.

5

6 **PART 3 - EXECUTION**

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9 **3.1. PREPARATION OF THE CHANGE ORDER**

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- A. The CPM shall prepare the required CO forms in the Construction Administration-Change Order Library on the Project Management Web Site as follows:
1. Provide information for all contract information.
 2. Provide a general description of the items described within the change order.
 3. Provide detailed information for each Item on the CO form. At the option of the CPM he/she may include multiple Change Order Requests each as their own item.
 4. Provide required pricing and accounting information as needed for the item.
 5. Insert attachments of contractor/architect provided information that clarifies and quantifies the CO. Attachments may include but not be limited to material lists, estimated labor, revised details or specifications, and other documents that may be related to the requested change.
 6. Save the final version of the completed CO.

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3.2. EXECUTION OF THE CHANGE ORDER

- A. Upon saving the CO as described in section 3.1 above the software associated with the Project Management Web Site shall notify the GC that the CO has been drafted and is ready for review. The GC shall do the following:
1. Open the appropriate CO form in the Construction Administration-Change Order Library and review all items on the form.
 2. The GC shall notify the CPM immediately of any errors or discrepancies on the form and shall not sign or save it.
 - a. The CPM shall make any corrections as needed, re-save the form, and notify the GC.
 3. If/when the GC concurs with the CO form as drafted the GC shall digitally sign the form and click SAVE.
- B. After the GC digitally signs/saves the CO it shall be routed through the Project Management Web Site for additional review and/or approvals. The CPM shall do the following:
1. Monitor the review process to ensure the software is working properly at each review step.
 2. Ensure that proper BPW procedures are executed as needed by the CO approval process.
 - a. Schedule the CO on the next available BPW agenda if required.
 - i. Attend the BPW meeting to speak on the CO to board members and answer questions.
 - ii. The GC and/or PA may be required to attend the BPW meeting to address specific information as it relates to the Work and/or materials associated with the CO.
 3. Monitor final approval and distribution of the CO.
 4. Notify the GC that the CO has been completed.
 5. Ensure that the CO is posted to the next Public Works payment schedule.
 6. Verify that the GC's next Progress Payment-Schedule of Values show the CO as part of the contract sum.
- C. Upon final approval of the CO the GC may proceed with executing the Work associated with the CO.

END OF SECTION

**SECTION 01 29 73
SCHEDULE OF VALUES**

1
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4 PART 1 – GENERAL 1
5 1.1. SUMMARY 1
6 1.2. RELATED SPECIFICATIONS 1
7 1.3. RELATED DOCUMENTS 1
8 1.4. BASIS OF VALUES 2
9 PART 2 – PRODUCTS – THIS SECTION NOT USED 2
10 PART 3 - EXECUTION 2
11 3.1. AIA DOCUMENT G702 – APPLICATION AND CERTIFICATE FOR PAYMENT 2
12 3.2. AIA DOCUMENT G703 – CONTINUATION SHEET 2
13 3.3. INITIAL SCHEDULE OF VALUES SUBMITTAL 2
14 3.4. SOV FOR PROGRESS PAYMENT REQUESTS 3
15

PART 1 – GENERAL

1.1. SUMMARY

- 19 A. The Schedule of Values (SOV) is a Contractor provided statement that allocates portions of the total contract
20 sum to various portions of the contracted work and shall be the basis for reviewing the Contractors Progress
21 Payment Requests.
22 B. AIA Document G702 – Application and Certificate for Payment and AIA Document G703 Continuation Sheet shall
23 be filled out in sufficient detail to be used as a guideline in determining work completed and materials stored on
24 site when verifying Progress Payment Requests.
25 C. The General Contractor shall be responsible for filling out, updating, and providing these work sheets with each
26 Progress Payment Request.
27

1.2. RELATED SPECIFICATIONS

- 29 A. Section 01 26 63 Change Order (CO)
30 B. Section 01 29 76 Progress Payment Procedures
31 C. Section 01 31 23 Project Management Web Site
32 D. Section 01 32 26 Construction Progress Reporting
33 E. Section 01 33 23 Submittals
34 F. Parts of this specification will reference articles within “The City of Madison Standard Specifications for Public
35 Works Construction”.
36 1. Use the following link to access the Standard Specifications web page:
37 <http://www.cityofmadison.com/business/pw/specs.cfm>
38 a. Click on the “Part” chapter identified in the specification text. For example if the specification
39 says “Refer to City of Madison Standard Specification 210.2” click the link for Part II, the Part II
40 PDF will open.
41 b. Scroll through the index of Part II for specification 210.2 and click the text link which will take you
42 to the referenced text.
43

1.3. RELATED DOCUMENTS

- 45 A. The following documents shall be used as the basis for initiating and maintaining the SOV worksheets throughout
46 the execution of this contract.
47 1. Drawing documents and specifications (including general provisions) as provided with the bid set
48 documents and any published addendums.
49 2. Documents associated with revisions or clarifications to number 1 above after awarding of the contract,
50 including but not limited to:
51 a. Construction Bulletins
52 b. Request for Information
53 c. Approved Change Orders
54 3. The latest daily/weekly Construction Progress Report
55 4. Other specifications as identified in Section 1.2 above

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1.4. BASIS OF VALUES

- A. The Contractor shall provide a breakdown of the Contract Sum in sufficient detail to assist the Architect and City Project Manager in evaluating Progress Payment Requests. The breakdown detail may require a labor and material breakdown for each division of work or trade or as directed by the CPM.
- B. The total sum of all items shall equal the Contract Sum.

PART 2 – PRODUCTS – THIS SECTION NOT USED

PART 3 - EXECUTION

3.1. AIA DOCUMENT G702 – APPLICATION AND CERTIFICATE FOR PAYMENT

- A. The Contractor shall use AIA Document G-702 Application and Certificate for Payment with each Progress Payment Request.
- B. Completely fill out the Project Information section as follows:
 - 1. TO OWNER; provide all owner related information as provided in the contract documents.
 - 2. PROJECT; provide all contract information including contract number, title and address.
 - 3. FROM CONTRACTOR; provide all contractor related information.
 - 4. VIA ARCHITECT; provide all the architect’s related information including the architect’s project reference number if different from the owners.
 - 5. Indicate the current APPLICATION NO., PERIOD TO date, and CONTRACT DATE.
- C. Completely fill out the Contractors Application for Payment section.
 - 1. Fill out lines 1 through 9 to reflect the current status of the contract through the payment date being requested.
 - 2. The City of Madison calculates retainage on Public Works Contracts as follows:
 - a. In general, across the duration of the contract, 2.5% of the total contract sum, including change orders, is withheld for retainage as referenced from the City of Madison Standard Specification 110.2:
 - i. Beginning with Progress Payment 1, 5% retainage will be withheld until such time that 50% of the total contract sum has been paid out.
 - ii. No additional retainage will be withheld after 50% of the total contract sum has been paid, unless additional change orders have been approved after the 50% milestone has been reached. Per City of Madison Standard Specification 110.2, additional retainage up to 10%, may be held in the event there are holds placed by Affirmative Action or liquidated damages by BPW.
 - iii. Retainage for additional change orders after the 50% milestone will be withheld at the rate of 2.5% of the total cost of the change order.
 - iv. Retainage is based on the change orders posted to the City’s contract worksheet at the time the progress payment is processed.
- D. Completely fill out the Change Order Summary section. Only change orders that have been finalized and posted to the City of Madison’s Application for Partial Payment worksheet may be itemized into the SOV documents.
- E. The Contractor shall sign and date the application and it shall be properly notarized.
- F. The Contractor shall not fill in any information in the Architects Certificate for Payment section.

3.2. AIA DOCUMENT G703 – CONTINUATION SHEET

- A. The Contractor shall use AIA Document G-703 Continuation Sheet to itemize his/her SOV for this contract. Provide additional sheets as necessary.
- B. Provide information in Column A (Item No.), Column B (Description of Work), and Column C (Scheduled Value) by any method that allocates portions of the total contract sum to various portions of the contracted work. Possible methods include combinations of the following:
 - 1. By division of work
 - 2. By contractor, sub-contractor, sub sub-contractor
 - 3. By specialty item or group
 - 4. Other methods of breakdown as may be requested by the City Project Manager or City Construction Manager at the pre-construction meeting.
- C. Provide total cost of the item/description of work including proportionate shares of profit and overhead related to the item.

1 **3.3. INITIAL SCHEDULE OF VALUES SUBMITTAL**

- 2 A. The Contractor shall upload his/her initial SOV to the Project Management Web Site, Submittals Library, no later
3 than five (5) working days after the Pre-construction Meeting.
4 1. The initial SOV shall provide information in Column A (Item No.), Column B (Description of Work), and
5 Column C (Scheduled Value) only.
6 2. The level of detail shall be as described in section 3.2 above.
7 B. The Project Architect (PA) and the City Project Manager (CPM) shall review the SOV as any other submittal and
8 may require modifications to reflect additional detail as necessary.
9 C. The Contractor shall resubmit the SOV as necessary until such time as the PPA and CPM have sufficient detail for
10 assessing and approving future Progress Payment Applications.
11 D. Progress Payment Application 1 will not be processed until such time as the Contractor has met this requirement
12 regardless of the amount of work completed per the application.
13

14 **3.4. SOV FOR PROGRESS PAYMENT REQUESTS**

- 15 A. The Contractor shall update the initial SOV with each Progress Payment Application as follows:
16 1. Initial items and values as part of Section 3.3 above will not be adjusted once the original Schedule of
17 Values submittal has been approved.
18 2. Change orders shall be added as additional items and values at the bottom of the SOV as they become
19 approved and posted to the City's contract worksheet. The value for each change order shall be the
20 value indicated on the SOV and shall stand alone. Values shall not be split out or combined with other
21 existing items with similar work descriptions on the original SOV.
22 3. Fill out Columns D, E, F and G to properly reflect the work completed and materials received since the last
23 Progress Payment Application.
24 4. Only materials delivered and stored on the project site may be reflected on SOV progress updates.
25 B. Provide updated G702 and G703 sheets with each Progress Payment application.
26 C. See Specification 01 29 76 Progress Payment Procedures for additional information on submitting Progress
27 Payment Applications.
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END OF SECTION

SECTION 01 29 76
PROGRESS PAYMENT PROCEDURES

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4 PART 1 – GENERAL 1
5 1.1. SUMMARY 1
6 1.2. RELATED SPECIFICATIONS 1
7 1.3. RELATED DOCUMENTS 1
8 1.4. PROGRESS PAYMENT MILESTONES 1
9 1.5. PROGRESS PAYMENT SUBMITTAL 4
10 PART 2 - PRODUCTS - THIS SECTION NOT USED 4
11 PART 3 - EXECUTION 4
12 3.1. GENERAL CONTRACTOR PROCEDURE 4
13 3.2. PROJECT ARCHITECT PROCEDURE 5
14 3.3. CITY PROJECT MANAGER PROCEDURE 5
15

16 **PART 1 – GENERAL**

17
18 **1.1. SUMMARY**

- 19 A. The General Contractor (GC) shall review this and all related specifications prior to submitting progress payment
20 requests.
21 B. Progress payment requests (Partial Payment-PP) for this contract shall be uploaded digitally by the GC to the
22 Project Management Web Site
23 C. The Project Architect (PA) and City Project Manager (CPM) shall review and amend or approve the PP on the
24 Project Management Web Site.
25 D. After approval of the PP by the CPM, he/she shall forward the PP to the appropriate agencies for BPW
26 contractual review and payment processing.
27

28 **1.2. RELATED SPECIFICATIONS**

- 29 A. Section 01 26 63 Change Order (CO)
30 B. Section 01 29 73 Schedule of Values
31 C. Section 01 31 19 Progress Meetings
32 D. Section 01 31 23 Project Management Web Site
33 E. Section 01 32 16 Construction Progress Schedules
34 F. Section 01 32 26 Construction Progress Reporting
35 G. Section 01 33 23 Submittals
36 H. Section 01 45 16 Field Quality Control Procedures
37 I. Section 01 77 00 Closeout Procedures
38 J. Section 01 78 13 Completion and Correction List
39 K. Section 01 78 23 Operation and Maintenance Data
40 L. Section 01 78 36 Warranties
41 M. Section 01 78 39 As-Built Drawings
42 N. Section 01 78 43 Spare Parts and Extra Materials
43 O. Section 01 79 00 Demonstration and Training
44

45 **1.3. RELATED DOCUMENTS**

- 46 A. The following documents shall be used when evaluating PP requests.
47 1. Daily and weekly construction progress reports filed since the last payment request.
48 2. Contractors Schedule of Values as updated from the last payment request. See Specification 01 29 73.
49 3. Any document that may be required to be submitted for review and approval, as noted by the
50 specifications listed in Section 1.2 above, or the Progress Payment Milestone Schedule in Section 1.4
51 below, to achieve a required bench mark of contract progression or contract requirement.
52

53 **1.4. PROGRESS PAYMENT MILESTONES**

- 54 A. City Engineering-Facility Management has developed the Project Payment Milestone Schedule (Section 1.4
55 below) to assist the GC in providing required construction specific documentation and general contractual
56 documentation in a timely manner.
57 B. The Progress Payment Milestone Schedule is not an all inclusive list. Multiple agencies review progress payment
58 requests and contract closeout requests. Missing, incomplete, or incorrect documentation for any agency may

- 1 be a cause for not processing progress payments. It shall be the sole responsibility of the Contractor for
2 providing documentation as required or requested to the appropriate agencies.
3 C. The milestone schedule is based on the contract total sum and shall be valid for most contracts. Milestone
4 submittals will be required with whatever progress payment hits the percentage of contract total indicated in
5 the schedule.
6 D. The CPM shall review the milestone schedule with each progress payment request and at his/her option may
7 elect to hold processing the progress payment until such time as the contractor has met the requirements for
8 providing construction specific documentation.
9 E. It shall be the General Contractors responsibility to comply with all BPW Contract Administration requirements
10 and related deadlines as outlined in the Award Letter, Award Checklist, and Start Work Letter.
11

Progress Payment (PP) Milestone Schedule		
Milestone Description	Due Before	Remarks
BPW Contract Administration Documentation <ul style="list-style-type: none"> • Workforce profiles • Best Value Contracting Documentation • Sub-contractors prequalification approval & Affirmative Action plans • Other as may be required 	PP-1, or start work as applicable	<ul style="list-style-type: none"> • For GC and Sub-contractors before PP-1 regardless of scheduling • Sub-contractors (if applicable), due 10 days before they may start work • Sub-contractors (if applicable), due 10 days before they may start work
Required Construction Submittals/Administrative Documents <ul style="list-style-type: none"> • Contractors Project Directory • Schedule of Values • Submittals Schedule • Waste Management Plan • Closeout Requirement Checklist • Warranty Checklist 	PP-1	References <ul style="list-style-type: none"> • Specification 01 31 23 • Specification 01 29 73 • Specification 01 32 19 • Specification 01 74 19 • Specification 01 77 00 • Specification 01 78 36 • Various specifications.
Construction Progress Milestones <ul style="list-style-type: none"> • Early submittals, per submittal schedule • Detailed Contract Schedules 	PP-1	See specifications for specific requirements <ul style="list-style-type: none"> • Specification 01 32 19, Examples: concrete mix, structural steel, products with long lead times • See Specification 01 32 16
General Construction Progress Requirements are all up to date <ul style="list-style-type: none"> • Progress Schedules • Submittals/Re-submittals (ongoing) • Schedule of Values • Progress Reporting • LEED Documentation • Waste Management documentation • QMOs are being addressed and closed • Progress Cleaning • As-Built Drawings 	Each future PP	Verified with each Progress Payment Request <ul style="list-style-type: none"> • Specification 01 32 16 • Specification 01 33 23 • Specification 01 29 73 • Specification 01 32 26 • All specifications with LEED documentation requirements • Specification 01 74 19 • Specification 01 45 16 • Specification 01 74 13 • Specification 01 78 39
* All of the above are being updated on the Project Management Web Site as required		
BPW Contract Administration Documentation <ul style="list-style-type: none"> • Weekly payroll reports • Best Value Contracting Reports • SBE Reports 	25% CT or PP 2	See 1.4.E above. <i>This progress payment will be with held by BPW for any missing contractual documentation.</i>

Progress Payment (PP) Milestone Schedule		
Milestone Description	Due Before	Remarks
Construction Progress Milestones <ul style="list-style-type: none"> Construction/Contract Closeout Meeting #1 Submittals/Re-submittals complete 	50% CT	<ul style="list-style-type: none"> Specification 01 31 19 Specification 01 33 23
Operation and Maintenance (O & M) drafts	60% CT	<ul style="list-style-type: none"> Specification 01 78 23
Construction/Contract Closeout Meeting #2 <ul style="list-style-type: none"> Construction closeout checklist 	70% CT	<ul style="list-style-type: none"> Specification 01 31 19 Specification 01 77 00
BPW Contract Administration Documentation <ul style="list-style-type: none"> Request Finalization Review from BPW 	80% CT	<p>This is a recommendation to the GC and is not a requirement of this PP.</p> <ul style="list-style-type: none"> Specification 01 77 00
Construction Progress Milestones <ul style="list-style-type: none"> Operation and Maintenance (O & M) finals, accepted All major QMO issues resolved As-Built Drawings, Division Trades ready for GC review 	80% CT	<ul style="list-style-type: none"> Specification 01 78 23 Specification 01 45 16; Items that could prevent occupancy Specification 01 78 39
All of the following shall be completed for this PP: <ul style="list-style-type: none"> Regulatory Inspections completed All QMO reports closed Demonstration and Training completed Attic Stock completed Final Cleaning 	90% CT	<p>Contractor to determine the proper order of completion:</p> <ul style="list-style-type: none"> Governing ordinances and statutes Specification 01 45 16 Specification 01 79 00 Specification 01 78 43 Specification 01 74 13
Construction Closeout Procedures: <ul style="list-style-type: none"> Letter of Substantial Compliance sent to BI and DHS as needed Certificate of Occupancy issued As-Built Drawings, finals, accepted City Letter of Substantial Completion Warranty letters dated and issued 	100% CT	<ul style="list-style-type: none"> Specification 01 77 00 Generated/Signed by the Architect Building Inspection Specification 01 78 39 Signed by the City Engineer Specification 01 78 36
* Completion of this begins the one year warranty.		
BPW Contract Administration Documentation Contract Closeout Procedures <ul style="list-style-type: none"> Construction Closeout has been completed Contractor requests final payment of retainage upon receiving City Letter of Substantial Completion All BPW contractual requirements are verified 	Final	<ul style="list-style-type: none"> Specification 01 77 00 Contractor must provide any missing BPW Contractual Documentation
* Completion of this closes the contract but not the warranty period/bond.		
NOTE: CT = Contract Total less held retainage		

- 1 **1.5. PROGRESS PAYMENT SUBMITTAL**
2 A. Each progress payment submittal shall be:
3 1. Digital in PDF format
4 2. PDF shall be in color
5 3. Uploaded to the appropriate Project Management library and properly named per the tutorial
6 instructions provided to the awarded contractor.
7 B. Submit all required construction progress documentation to the appropriate Project Management Web Site
8 library.
9 C. In general the following shall apply to all PP requests:
10 1. Materials or products:
11 a. On order, being shipped, etc. may not be invoiced.
12 b. Received and stored on the project site may be invoiced.
13 c. Being manufactured off site at any location may not be invoiced (example: cabinetry, ductwork,
14 etc.)
15 d. Completed products stored off site locally waiting for delivery to the project site may be invoiced
16 with prior approval by the CPM. All of the following conditions must be met to be allowed:
17 i. Items must be visually inspected by CPM to verify product is complete.
18 ii. Item must be stored inside a compatible structure and the structure and contents must be
19 insured.
20 iii. Contractor is responsible for condition until installation is completed.
21 2. All labor and equipment, including rental time for the current progress period may be invoiced.
22 3. Only completed installations may be invoiced to 100% based on the Schedule of Values.
23 D. DO NOT submit BPW Contract Administration Documentation for review with Progress Payment Requests,
24 submit them directly to the correct agency and in the correct format as instructed from information in your BPW
25 Contract Award Packet instructions.
26

27 **PART 2 - PRODUCTS - THIS SECTION NOT USED**
28

29 **PART 3 - EXECUTION**
30

- 31 **3.1. GENERAL CONTRACTOR PROCEDURE**
32 A. The GC shall provide an updated version of his/her schedule of values (AIA documents G702 & G 703) with each
33 PP request.
34 1. The AIA - Application and Certificate for Payment (G702) shall be properly filled out and prepared for the
35 Architects review. See specification 01 29 73, Schedule of Values for more information.
36 2. The AIA - Continuation sheets (G703) shall be properly filled out and indicate the dollar value of the
37 completed work to date for each item on the form. See specification 01 29 73, Schedule of Values for
38 more information.
39 a. The GC shall subtotal the work completed to date for all of the original Schedule of Value items.
40 b. Divide the sub total of work completed by the Original Contract Total to obtain a percentage
41 complete of the original Lump Sum Bid. This percentage may be taken out to five (5) decimal
42 places (round fifth place up or down as needed).
43 i. Example: \$5,192.55 of completed work divided by \$10,000 original Contract Total =
44 0.519255, round this to 0.51926
45 c. Write the percentage in Column 10 on the City Tabular Sheet for the original lump sum bid item in
46 RED ink.
47 3. Ensure that any newly posted change orders from the City of Madison provided tabulation sheet have
48 been entered on the G703 continuation sheets. Repeat steps a thru c above for each change order on
49 the schedule of values and the City Tabular Sheet.
50 B. The GC shall fill out the City of Madison Application and Certificate of Payment cover sheet as follows:
51 1. The GC shall not change any pre-printed information and shall not write in the box that indicates previous
52 progress payments.
53 2. The GC shall sign and date the form where indicated.
54 3. The GC shall provide the dates from and to for the PP being requested.
55 4. The GC shall provide the list of all contractors/sub-contractors that were actively working during the
56 dates indicated above.

- 1 a. All contractors/sub-contractors named must be in compliance with all City requirements (Pre-qualified, Affirmative Action Plan on file, etc). The PP will be held and not processed by the City of
2 Madison until all contractors/sub-contractors are in compliance.
3 b. Do not list the names of suppliers or manufacturers, doing so will slow down processing and
4 require a re-submittal of the paperwork.
5
6 C. The General Contractor (GC) shall scan all of the documents listed below in the order shown, save the scan as a
7 single PDF file for each PP request.
8 1. City cover sheet – Application and Certificate for Payment
9 2. City tabulation sheet(s)
10 3. AIA G702 - Application and Certificate for Payment
11 4. AIA G703 - Continuation Sheet(s)
12 5. Any miscellaneous documents that may be requested as backup documentation for the pay request.
13 a. Lien waivers are not required and shall not be submitted.
14 b. Do not provide contractual administrative documents such as pay reports with pay requests.
15 c. Do not supply progress deliverables with pay requests.
16 F. Upload the pay request PDF to the Contract Documents-GC Partial Pay Apps library on the Project Management
17 Web Site.
18

19 **3.2. PROJECT ARCHITECT PROCEDURE**

- 20 A. The PA shall review the AIA-continuation sheets provided by the GC to determine if the Schedule of Values
21 accurately reflects the work completed for the inclusive dates indicated.
22 B. The PA shall advise the CPM of any discrepancies in the schedule of values.
23 C. The PA shall work with the GC and the CPM to resolve any issues prior to signing the AIA - Application and
24 Certificate for Payment.
25 D. When verified, the PA shall digitally sign the original PDF version of the AIA - Application and Certificate for
26 Payment on the Project Management Web Site.
27

28 **3.3. CITY PROJECT MANAGER PROCEDURE**

- 29 A. The CPM shall review all documents submitted by the GC and work with the PA to ensure the schedule of values
30 accurately reflects the work completed to date.
31 B. The CPM may elect to hold processing of any progress payment pending submittal of required progress payment
32 milestones.
33 C. When verified, the CPM shall digitally sign the City Cover Sheet and forward the required documentation to the
34 appropriate City agencies for further processing of the payment request.
35 D. The CPM shall add a scanned copy of any documents indicating the PP request processing was completed to the
36 PMWS.
37

38
39 **END OF SECTION**
40

**SECTION 01 31 13
PROJECT COORDINATION**

1
2
3
4 PART 1 – GENERAL 1
5 1.1. SUMMARY 1
6 1.2. RELATED SPECIFICATIONS 1
7 1.3. GENERAL REQUIREMENTS 1
8 1.4. GENERAL CONTRACTOR PERFORMANCE REQUIREMENTS 2
9 1.5. SUB-CONTRACTOR PERFORMANCE REQUIREMENTS 2
10 PART 2 – PRODUCTS – THIS SECTION NOT USED 3
11 PART 3 – EXECUTION – THIS SECTION NOT USED 3
12

PART 1 – GENERAL

1.1. SUMMARY

- 16 A. Project Coordination covers many areas within the execution of the Contract Documents and the requirements
17 of proper coordination are the applicable to all contractors executing the Work of this contract.
18 B. This specification provides general information regarding project coordination for the General Contractor and all
19 Sub-contractors. All contractors shall be familiar with project coordination requirements and responsibilities
20 that may be defined in other specification within these Contract Documents.
21 C. The General Contractor shall at all times be responsible for the project, project site, and execution of the
22 Contract Documents.
23

1.2. RELATED SPECIFICATIONS

- 24 A. Section 01 29 76 Progress Payment Procedures
25 B. Section 01 31 19 Progress Meetings
26 C. Section 01 31 23 Project Management Web Site
27 D. Section 01 32 16 Construction Progress Schedules
28 E. Section 01 32 19 Submittals Schedule
29 F. Section 01 33 23 Submittals
30 G. Section 01 43 39 Mockups
31 H. Section 01 45 16 Field Quality Control Procedures
32 I. Section 01 60 00 Product Requirements
33 J. Section 01 77 00 Closeout Procedures, including all specifications referenced therein
34 K. Section 01 91 00 Commissioning
35
36

1.3. GENERAL REQUIREMENTS

- 37 A. The following general requirements shall applicable to all contractors:
38 1. Cooperate with the Owner, all authorized Owner Representatives, Project Architect and all consultants of
39 the Owner.
40 2. Materials, products, and equipment shall be new, as specified and to industry standards except where
41 otherwise noted.
42 3. Labor and workmanship shall be of a high quality and to industry standards.
43 B. Existing conditions:
44 1. Verify all existing conditions noted in the contract documents with actual filed locations. Verify
45 dimensions, sizes and locations, of structural, equipment, mechanical and utility components.
46 2. Report any inconsistencies, errors, omissions, or code violations in writing to the General Contractor (GC)
47 immediately.
48 3. Annotate any inconsistencies, errors, omissions on the GC As-Built record drawings immediately for
49 future reference.
50 C. Contract Documents:
51 1. The Contract Documents are intended to include everything necessary to perform the work. Every item
52 required may not be specifically mentioned, shown, or detailed.
53 a. Except where specifically stated all systems and equipment shall be complete, installed, and fully
54 operable.
55 b. If a conflict exists within the contract documents the contractor shall furnish the item, system, or
56 workmanship of the highest quality, largest, largest quantity, or most closely fits the intent of the
57 contract documents.
58

- 1 c. Manufacturers recommended installation details shall be verified and used prior to installation of
2 products and equipment so as to not void warranties.
- 3 D. Errors and Omissions
- 4 1. No Contractor shall take any advantage of any apparent error or omission in the construction documents.
- 5 2. The City of Madison shall be permitted to make such corrections and interpretations as may be deemed
6 necessary for the fulfillment of the intent of the construction documents.
- 7 E. Owners Representatives
- 8 1. All contractors shall be familiar with various Owner Representatives having Quality Management
9 responsibilities for the duration of this project including but not limited to the following:
- 10 a. Project Architect, responsible for all decisions affecting the code compliance and design intent of
11 the construction documents.
- 12 b. Consulting Architects and Engineers, responsible for providing consulting services to the Project
13 Architect, Owner, and City Project Manager, also responsible for Quality Management of the
14 construction documents.
- 15 c. Owner, the designated representative of the City Agency that will occupy the project upon
16 completion.
- 17 d. City Project Manager, responsible for all day to day decisions regarding the execution and
18 performance of this Public Works Contract.
- 19 e. Consulting City Staff, responsible for providing consulting services to the Project Architect, Owner,
20 and City Project Manager, also responsible for Quality Management of the construction
21 documents.
- 22 f. Commissioning Agent (CxA), responsible for ensuring that the project is meeting the Owner's
23 Project Requirements and related quality assurance procedures.
- 24 2. Owner Representatives shall be attending progress meetings, pre-installation meetings, performing or
25 being present for final testing and acceptance and quality management reporting during the execution of
26 the contract documents as outlined in other specifications.
- 27

28 **1.4. GENERAL CONTRACTOR PERFORMANCE REQUIREMENTS**

- 29 A. Assume the responsibility for all Work specified in the Contract Documents except where specifically identified
30 to be performed by the Owner or other contractor separately hired by the Owner.
- 31 1. Coordinate all work by Owner, equipment provided Owner, or contractor hired by the Owner into the
32 project schedule.
- 33 B. Provide all construction management responsibilities as specified in other Division 1 specifications including but
34 not limited to:
- 35 1. Scheduling of work
- 36 2. Coordination of work between other Trades and Sub-contractors
- 37 3. Construction administration and management
- 38 4. Site layout, cleanliness, and protection of completed work/stored materials
- 39 5. Waste Management
- 40 6. Quality Assurance and Quality Control
- 41 C. Use Diggers Hotline and private utility locating companies to accurately locate all public and private utilities on
42 the property as needed. The GC is responsible for any repair or replacement to any public or private utility
43 damaged during the execution of the Work
- 44 D. Report any inconsistencies, errors, omissions, or code violations in writing to the Project Architect immediately.
45 Failure to report inconsistencies prior to beginning work shall indicate that the GC accepted all existing
46 conditions.
- 47 E. The GC shall be responsible for assigning work and related responsibilities where the Contract Documents may
48 not clearly state who is responsible for providing the work, material, or product.
- 49 F. Provide construction management oversight of all items described in Section 1.5 below.
- 50 G. Coordinate and assist CxA as outlined within 01 91 00 and as directed by Owner.
- 51

52 **1.5. SUB-CONTRACTOR PERFORMANCE REQUIREMENTS**

- 53 A. Be familiar with all of the contract documents as they pertain to your Work, adjacent work and the overall
54 progress of the project.
- 55 1. All Sub-contractors shall be familiar with all Division 1 specifications as they may apply to progress,
56 progress payments, quality control construction management, and closeout of the contract.
- 57 B. Coordinate your Work with all adjacent work and existing conditions.

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1. Perform your work in proper sequence according to the GC's project schedule and in relation to the work of other trades.
 2. Notify other sub-contractors and trades whose work may be connected to, combined with, or influenced by your work and allow them reasonable time and access to complete their work.
 3. Join your work to the work of others in accordance with the intent of the Contract Documents.
 4. Order materials and schedule deliveries to facilitate the general progress of the Work.
- C. Cooperate with all other trades to facilitate the general progress of the work. This shall include providing every reasonable opportunity for the installation of work by others and the storage of their materials and equipment.
1. In no case shall any contractor exclude from the premises or work any Sub-contractor or their employees.
 2. In no case shall any contractor interfere with the execution or installation of Work by any other Sub-contractor or their employees.
- D. Arrange your work, equipment, and materials and dispose of your construction waste so as to not interfere with the work or storage of materials of others.
- E. Coordinate all work as indicated during pre-installation meetings with Owner Representatives, the GC and other trades. Any work improperly coordinated shall be relocated as designated by the Owner Representative at no additional cost to the City.
- F. Coordinate and assist CxA as outlined within 01 91 00 and as directed by Owner.

19 **PART 2 – PRODUCTS – THIS SECTION NOT USED**

21 **PART 3 – EXECUTION – THIS SECTION NOT USED**

25 **END OF SECTION**

**SECTION 01 31 19
PROJECT MEETINGS**

1		
2		
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4	PART 1 – GENERAL	1
5	1.1. SUMMARY	1
6	1.2. RELATED SPECIFICATIONS	1
7	1.3. PROJECT MEETING TYPES	1
8	1.4. GENERAL REQUIREMENTS.....	1
9	PART 2 – PRODUCTS – NOT USED IN THIS SECTION.....	1
10	PART 3 - EXECUTION	1
11	3.1. PRECONSTRUCTION MEETING	1
12	3.2. PROJECT MANAGEMENT WEB SITE – TUTORIAL MEETING.....	2
13	3.3. CONSTRUCTION PROGRESS MEETINGS.....	2
14	3.4. PRE-INSTALLATION MEETINGS.....	2
15	3.6. PRE-CONTRACT CLOSEOUT MEETINGS	3
16	3.7. OTHER SPECIAL MEETINGS.....	3

PART 1 – GENERAL

1.1. SUMMARY

- A. The purpose of this specification is to identify various project related meetings and the responsible parties for scheduling, agendas, minutes, and required attendance.
- B. This specification is not intended to be inclusive of all meeting types or a complete list of required meetings.
- C. This specification is not intended to cover planning and execution meetings between the General Contractor (GC) and his/her sub-contractors.

1.2. RELATED SPECIFICATIONS

- A. 01 31 23 Project Management Web Site
- B. 01 32 16 Construction Progress Schedules
- C. 01 43 39 Mockups
- D. 01 91 00 Commissioning

1.3. PROJECT MEETING TYPES

- A. The following project meeting types may be used but not limited to the following
 - 1. Preconstruction Meeting
 - 2. Project Management Web Site – Tutorial Meeting
 - 3. Construction Progress Meetings
 - 4. Pre-installation Meetings (including mock-up review meetings)
 - 5. Weekly Trade Meetings
 - 6. Special Meetings
 - 7. Commissioning Meetings

1.4. GENERAL REQUIREMENTS

- A. Representatives of Contractors, Subcontractors, and suppliers attending meetings shall be qualified and authorized to act on behalf of the entity each represents.

PART 2 – PRODUCTS – NOT USED IN THIS SECTION

PART 3 - EXECUTION

3.1. PRECONSTRUCTION MEETING

- A. After execution of the Contract the City Project Manager (CPM) shall schedule and conduct the Preconstruction Meeting at the Owner’s facilities. The CPM shall coordinate the meeting agenda with the Project Architect and the GC Project Manager.
- B. The CPM shall be responsible for the final agenda.
- C. The CPM and Project Architect shall take notes on the meeting and post completed meeting minutes.
- D. Attendance shall be required by all of the following:
 - 1. Owner Representative(s)

- 1 2. Architect and applicable sub consultant(s)
- 2 3. General Contractor and applicable subcontractors and suppliers
- 3 4. City Quality Management Staff
- 4 5. Commissioning Agent
- 5 6. Others, as may be invited for particular agenda items.
- 6 E. Topics of the Preconstruction Meeting shall include but not be limited to the following:
- 7 1. Staff and contractor introductions
- 8 2. Completion Date
- 9 3. BPW Administrative requirements and due outs
- 10 a. Small Business Enterprise (SBE) (if applicable)
- 11 b. Certified payroll forms
- 12 c. Workforce profiles
- 13 d. Best Value Contracting (BVC)
- 14 4. General Facility Management Division 1 Specifications, including:
- 15 a. Section 01 29 76 Progress Payment Procedures
- 16 b. Section 01 31 23 Project Management Web Site (overview)
- 17 c. Section 01 45 16 Field Quality Control Procedures
- 18 d. Section 01 77 00 Closeout Procedures
- 19 e. Section 01 91 00 Commissioning
- 20 5. Project Meeting scheduling
- 21 a. Section 01 31 19 Project Meetings
- 22 6. Construction Schedule
- 23 7. Commissioning Process
- 24

25 **3.2. PROJECT MANAGEMENT WEB SITE – TUTORIAL MEETING**

- 26 A. The CPM shall schedule and conduct a tutorial presentation of the PMWS prior to the beginning of construction.
- 27 B. The CPM shall be responsible for the final agenda, there will be no minutes.
- 28 C. The required attendance list in 3.1.D. above shall apply except for City Staff in items 1 and 4 who are already familiar with the PMWS system.
- 29
- 30 D. It is recommended that all contractors bring their lap top, tablet or other internet capable device with them including a fully charged battery and internet connection devices as necessary.
- 31
- 32

33 **3.3. CONSTRUCTION PROGRESS MEETINGS**

- 34 A. In general all of the following shall apply:
- 35 1. Representatives of Contractors, Subcontractors, and suppliers attending meetings shall be qualified and authorized to act on behalf of the entity each represents.
- 36 2. The attendance shall be from the required attendance list in 3.1.D. above.
- 37
- 38 B. The General Contractor Project Manager (GCPM) shall:
- 39 1. Schedule and conduct all construction progress meetings biweekly or more frequently as required.
- 40 2. Prepare agenda for meetings including, but not limited to the following:
- 41 a. Safety
- 42 b. Current Schedule, including review of the critical path and 6-week look ahead schedule
- 43 c. Status of project related documentation (Submittals, RFIs, CBs, etc.)
- 44 d. Quality Observation Log and status of correction of deficient items
- 45 e. Project questions and issues from meeting attendees
- 46 f. BPW Administration Check
- 47 g. Other as needed
- 48 h. Status of CORs and COs to be reviewed outside the standard progress meeting time.
- 49 3. Make physical arrangements for meetings.
- 50 4. GCPM to post meeting agendas to the appropriate libraries on the Project Management Web Site (PMWS) no less than two (2) working days prior to the scheduled meeting. Notify all required attendees, applicable parties to the contract, and others affected of the posted meeting agenda.
- 51
- 52
- 53 5. Preside at meetings.
- 54 6. Route a meeting attendance roster for attendees to sign-in on.
- 55 7. GCPM to record the minutes of the meeting; include significant proceedings and decisions. Post meeting minutes to the PMWS no more than two (2) working days after the completed meeting. Meeting minutes shall include a scanned copy of the attendance sign-in sheet. Notify all required meeting attendees, applicable parties to the contract, and others affected by decisions made at the meetings.
- 56
- 57
- 58

- 1 8. The above requirements do not apply to GC/sub-contractor meetings.
2
3 **3.4. PRE-INSTALLATION MEETINGS**
4 A. The GCPM shall schedule and conduct all pre-installation meetings, including mockup reviews, before each
5 construction activity that requires coordination with other trades.
6 B. The GCPM shall be responsible for the final agenda and meeting minutes.
7 C. The GCPM will work with all concerned parties to resolve issues as needed and submit RFI's if necessary.
8 D. Required attendance shall be from the list in 3.1.D. above and shall be personnel having a stake in the outcome
9 of the installation or knowledge of the system being installed.
10 E. In the event the Contractor installs equipment or materials without a pre-installation meeting the Contractor
11 shall be solely responsible for removing, replacing, repositioning materials and equipment as instructed by the
12 Project Architect or City Project Manager at no additional cost to the City.
13
14 **3.6 PRE-CONTRACT CLOSEOUT MEETINGS**
15 A. Two (2) Pre-contract Closeout Meetings shall be held to review the closeout procedures, requirements, and
16 contract deliverables.
17 1. Pre-contract Closeout Meeting #1 shall be scheduled prior to the 50% Progress Payment Request is being
18 requested. This meeting shall discuss items such as closing out QMO reports, providing O&M drafts and
19 finals, payroll and Affirmative Action documentation, and other contract deliverables.
20 2. Pre-contract Closeout Meeting #2 shall be scheduled prior to the 80% Progress Payment Request is being
21 requested. This meeting shall discuss, but not be limited to, the status of scheduling final regulatory
22 inspections, cleaning up outstanding QMO's, demonstration and training, attic stock; and finalization
23 review of payroll and other related documents.
24 B. The GCPM shall schedule, coordinate, and make physical arrangements for both meetings.
25 C. All of the following shall be required to attend both meetings:
26 1. The GCPM and the GC Field superintendent
27 2. All Subcontractor Project Managers regardless of the current status of their work.
28 a. The GCPM may excuse a Subcontractor PM if he is confident that all contractual requirements for
29 closeout by the subcontractor have been completed and/or delivered to the GCPM. The list of
30 attendees shall be reviewed and agreed upon with CPM ahead of the meeting.
31 b. At the option of these project managers the field supervisors may also attend.
32 3. The Project Architect and at least one design consultant from each discipline represented by the plans
33 and specifications to address open QMOs, final tests, reports, etc.
34 4. The Owner
35 5. The CPM
36 6. Quality Management staff as needed to address open QMOs, final tests, reports, etc.
37 7. The Commissioning Agent
38 D. The CPM shall publish an agenda and chair the meeting.
39
40 **3.7 OTHER SPECIAL MEETINGS**
41 A. The Contractor shall schedule special meetings per the requirements of the LEED Specification, the Project
42 Quality Management Plan, the Commissioning Plan and as indicated by other specifications.
43 B. Special meetings include but are not limited to the following:
44 1. Waste Management Conference
45 2. Equipment start up meetings
46 3. Testing and balancing meetings
47 4. Commissioning meetings
48 5. Other meetings as necessitated by the contract documents
49
50

END OF SECTION

**SECTION 01 31 23
PROJECT MANAGEMENT WEB SITE**

1
2
3
4 PART 1 – GENERAL 1
5 1.1. GENERAL DESCRIPTION 1
6 1.2. SHAREPOINT PROCEDURE OVERVIEW 1
7 1.3. RELATED SPECIFICATIONS 2
8 PART 2 - PRODUCTS 2
9 2.1. SHAREPOINT SYSTEM RELATED PRODUCTS 2
10 PART 3 - EXECUTION 2
11 3.1. POST BID-OPENING 2
12 3.2. POST PRE-CONSTRUCTION MEETING 3
13

PART 1 – GENERAL

1.1. GENERAL DESCRIPTION

- 17 A. The City of Madison (CoM) has established a web based Project Management Tool (PMT) using a Microsoft
18 product called SharePoint (SP).
19 B. The software is used throughout the design, construction and warranty process of major remodels and new
20 construction projects executed as a City of Madison, Board of Public Works project.
21 C. Initially deployed in mid-2013, the PMT software has been successfully deployed on several projects, and we
22 continue to modify/update/enhance the PMT on a regular basis.

1.2. SHAREPOINT PROCEDURE OVERVIEW

- 25 A. The CoM PMT is a system of consolidated Document & Form Libraries and Data Lists that assist in performing
26 day to day functions of design/construction management while reducing the use of surface mail, email and email
27 attachments.
28 1. Document libraries store a wide variety of documents in many different formats including but not limited
29 to Word, Excel, PDF, photographs (all popular formats), etc.
30 2. Data Lists contain consolidated data information that can be generated and stored for further use. Punch
31 Lists and Warranty issues will be examples of Data Lists.
32 3. Form Libraries are primarily used when a specific work flow process is needed. The form acts as the
33 cover letter. An example of this would be the Submittal Review Process.
34 4. Libraries are controlled by Permission Groups and Permission Levels.
35 B. The following libraries and sub-libraries on the PMWS are provided for specific workflows and contract
36 documentation. Related specification numbers are in "()" if applicable.
37

Contract Documents	Construction Administration	Construction Progress	LEED Documentation	Quality Control	Construction Closeout
<i>GC Partial Pay Apps (01 29 76)</i>	<i>Change Order Requests (COR Form) (01 26 57)</i>	<i>Schedules (01 32 16)</i>	<i>LEED Documents</i>	<i>Regulatory Inspections</i>	<i>Misc Closeout Documents</i>
<i>Construction Documents</i>	<i>Change Orders (CO Form) (01 26 63)</i>	<i>Progress Meetings (01 31 19)</i>	<i>Waste Management (01 74 19)</i>	<i>Commissioning Checklists</i>	<i>O & M Manuals (01 78 23)</i>
<i>Regulatory Documents</i>	<i>Construction Bulletins (CB Form) (01 26 46)</i>	<i>Daily Journal (DJ Form) (01 32 26)</i>		<i>System Performance Tests</i>	<i>Product Warranties /Guarantees (01 78 36)</i>
<i>Testing Contract</i>	<i>Request for Information (RFI Form) (01 26 13)</i>			<i>Quality Management Observation (QMO Form) (01 45 16)</i>	<i>As-Builts (01 78 39)</i>
	<i>Submittals (SUB Form) (01 33 23)</i>			<i>Safety and Incident Reports</i>	<i>Attic Stock (01 78 23)</i>
	<i>Substitution Request (SR Form) (01 25 13)</i>			<i>Material Testing & Field Reports</i>	<i>Demonstration and Training (01 79 00)</i>

Contract Documents	Construction Administration	Construction Progress	LEED Documentation	Quality Control	Construction Closeout
					Warranty Issues (WI Form) (01 78 23)

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- C. A tutorial document on the web based PMT will be provided to the General Contractor (GC) who is awarded the contract. Additional training will be provided as needed for the GC and Sub-Contractors (SC) by the CoM.
- D. The PMT has predefined work flows that channel automated alerts as documents are uploaded, reviewed, and completed. These workflows are designed for inbound information from the contractor as well as outbound information from the Architectural/Engineer consultant and the Owner.
- E. The GC will be required to receive email notifications, access the internet to review related documentation and be able to upload/download documentation to the various project libraries.
- F. The SC's will be required (at a minimum) to receive email notifications and access the internet to review related documentation. Prior to setting up the final PMT the GC and CPM shall meet to review all SP workflows, the GC will determine to what level over the minimum requirements the SC's will be involved.

1.3. RELATED SPECIFICATIONS

- A. The following specification sections are directly related to the CoM PMT system.
 - 1. 01 25 13 Product Substitution Procedures
 - 2. 01 26 13 Request for Information (RFI)
 - 3. 01 26 46 Construction Bulletins (CB)
 - 4. 01 26 57 Change Order Request (COR)
 - 5. 01 26 63 Change Order (CO)
 - 6. 01 29 76 Progress Payment Procedures
 - 7. 01 31 19 Project Meetings
 - 8. 01 32 16 Construction Progress Schedules
 - 9. 01 32 26 Construction Progress Reporting
 - 10. 01 32 33 Photographic Documentation
 - 11. 01 33 23 Submittals
 - 12. 01 45 16 Field Quality Control Procedures (Owner)

PART 2 - PRODUCTS

2.1. SHAREPOINT SYSTEM RELATED PRODUCTS

- A. SharePoint is a Microsoft Windows based software that requires no additional software installation, hardware or other special requirements/applications for the users. There are no costs associated with the use of this system.
- B. Currently the CoM is using SharePoint 2010.
 - 1. SharePoint works best if the user's computer is running Windows versions 7 through 8.1.
 - 2. SharePoint works best when used with Internet Explorer versions 9 - 11 (32 bit).
 - a. At this time SharePoint is not compatible with other internet browsers such as Fire Fox, Google Chrome, and Safari.

PART 3 - EXECUTION

3.1. POST BID-OPENING

- A. After bids have been opened, a successful bidder has been determined, and bid acceptance procedures have been initiated the City Project Manager (CPM) will contact the GC to provide the following information.
 - 1. Project Management Software Tutorial. This tutorial is in a PDF printable format with screen shots and associated instructions on how to access and use the PMT.
 - a. Tutorial instructions will include but not be limited to the following:
 - i. Descriptions of various libraries, documents, and forms that will be used throughout the construction project.
 - ii. Uploading procedures for various types of documents including standardized naming conventions.

- 1 2. A blank Project Directory in an Excel spread sheet format. The contractor shall provide the following
2 information for GC and SC staffs as indicated on the spreadsheet. This will generally be the Project
3 Manager for the GC as well as the Sub-contractors and the GC Site Supervisor.
4 a. Last Name, First Name
5 b. Company Name
6 c. Email address (valid, work related)
7 d. Work Phone Number (required, include area code)
8 e. Cell Phone Number (not required, include area code)
9 3. The GC shall provide the above information for all SC's where the GC is not self-performing the work.
10 4. The GC may provide project foreperson information for work being self-performed if he/she so desires.
11

12 **3.2. POST PRE-CONSTRUCTION MEETING**

- 13 A. The GCPM will return the completed Project Directory spread sheet to the CPM no later than the Pre-
14 construction meeting.
15 B. The CPM is responsible for uploading all project directory data into SharePoint and coordinating with CoM
16 Information Technology (CoM-IT) for creating the logins and passwords of non-city staff (GC/SC staffs).
17 C. All GC/SC staff will be notified through an automated email from CoM IT that logins and passwords are available.
18 It is the responsibility of each GC/SC to call the CoM-IT number provided in the email to receive his/her
19 login/password over the phone. Logins and passwords will not be released via email.
20 D. Once the GCPM has received his/her login/password uploading of contract related documents can begin. This
21 would include but not be limited to project schedules, submittals, RFI's, and other documents as needed.
22 E. All workflows, review of documentation, and general archiving of construction related documentation will be
23 conducted on the PMWS. These documents will generally not be emailed.
24 F. The following documents related to the execution of the contract will not be part of the PMWS:
25 1. All documentation related to executing the contract, such as:
26 a. Sub Contractors list
27 b. Affirmative Action documentation
28 c. Bonding documentation
29 d. Documentation associated with payroll verification
30 e. Final documentation associated with closing out the contract
31 2. Any documentation required/generated by ordinance, code or statute, such as;
32 a. Erosion Control inspections
33 b. Building Inspection Department inspections
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38

END OF SECTION

SECTION 01 32 16
CONSTRUCTION PROGRESS SCHEDULES

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4 PART 1 – GENERAL 1
5 1.1. SCOPE 1
6 1.2. RELATED SPECIFICATIONS 1
7 PART 2 – PRODUCTS – THIS SECTION NOT USED 1
8 PART 3 - EXECUTION 1
9 3.1. OVERALL PROJECT SCHEDULE (OPS) 1
10 3.2. 6 WEEK LOOK-OUT SCHEDULES (LOS) 1
11 3.3. PROJECT MANAGEMENT WEB SITE (PMWS) 2
12

13 **PART 1 – GENERAL**

14
15 **1.1. SCOPE**

16 A. This specification is to identify various project related schedules associated with indicating construction progress
17 and outlook. The following schedules are the responsibility of the General Contractor (GC).

- 18 1. Overall Project Schedule
19 2. 6 Week Look-out Schedule

20 B. This specification is not intended to include internal schedules generated by the contractors during their
21 planning and execution of the contract.
22

23 **1.2. RELATED SPECIFICATIONS**

- 24 A. Section 01 29 76 Progress Payment Procedures
25 B. Section 01 31 23 Project Management Web Site
26 C. Section 01 31 19 Progress Meetings
27 D. Section 01 74 13 Progress Cleaning
28 E. Section 01 77 00 Closeout Procedures
29 F. Section 01 78 23 Operation and Maintenance Data
30 G. Section 01 78 36 Warranties
31 H. Section 01 78 39 As-Built Drawings
32 I. Section 01 78 43 Spare Parts and Extra Materials
33 J. Section 01 79 00 Demonstration and Training
34 K. Section 01 91 00 Commissioning
35 L. Other specification within the construction documents that may indicate the need for scheduling any event with
36 Owner, Project Architect, Owner Representatives, including any owner provided equipment.
37

38 **PART 2 – PRODUCTS – THIS SECTION NOT USED**

39
40 **PART 3 - EXECUTION**

41
42 **3.1. OVERALL PROJECT SCHEDULE (OPS)**

43 A. The GC shall prepare an OPS that covers the duration of the contract from the pre-construction meeting through
44 the end of construction to final contract closeout.

- 45 1. The GC shall review Specification 01 77 00 Closeout Procedures to become familiar with definitions,
46 differences, and requirements for closing out the construction and contract including the association with
47 progress payments.

48 B. The GC shall provide copies and lead a discussion on the OPS during the pre-construction meeting.

49 C. The OPS shall indicate start and end dates of each task associated with the project.

50 D. The OPS shall clearly indicate the critical path of the project.

51 E. The GC shall update the OPS as often as necessary during the duration of the project. Updates will be briefed as
52 needed during bi-weekly progress meetings.
53

54 **3.2. 6 WEEK LOOK-OUT SCHEDULES (LOS)**

55 A. The GC shall prepare the initial LOS to include detail of daily tasks for the first six (6) weeks of construction in
56 depth for the Pre-construction meeting. The LOS shall be compatible and complimentary to the OPS.

57 B. The GC shall provide copies and lead a discussion on the LOS during the pre-construction meeting.

- 1 C. The LOS shall indicate start and end dates of each major task, associated related sub-tasks, and required parallel
- 2 or pre-requisite tasks required to complete the major task on time.
- 3 D. The LOS shall also include identifying and scheduling such events as:
- 4 1. Pre-installation meetings and mock-up review meetings.
- 5 2. Quality management reviews of installations before they are covered.
- 6 3. Owner provided equipment as designated by the contract documents.
- 7 4. Work by others as designated by the contract documents.
- 8 5. Critical submittal dates.
- 9 E. The GC shall update the LOS prior to each bi-weekly progress meeting to indicate the next 6 weeks of scheduled
- 10 work. Updates will be briefed during each bi-weekly progress meeting.
- 11

12 **3.3. PROJECT MANAGEMENT WEB SITE (PMWS)**

- 13 A. The GC shall upload all project schedules and updates to the PMWS in an original PDF version of the scheduling
- 14 document. Scans will not be permitted.
- 15
- 16

17 **END OF SECTION**

18

SECTION 01 32 19
SUBMITTALS SCHEDULE

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4 PART 1 – GENERAL 1
5 1.1. SUMMARY 1
6 1.2. RELATED SPECIFICATIONS 1
7 1.3. RELATED DOCUMENTS 1
8 1.4. SUBMITTAL DEFINITIONS 1
9 1.5. SUBMITTAL REQUIREMENTS 1
10 1.6. ADMINISTRATIVE SUBMITTALS 2
11 PART 2 – PRODUCTS – THIS SECTION NOT USED 2
12 PART 3 - EXECUTION 2
13 3.1. OVERALL RESPONSIBILITIES OF ALL CONTRACTORS 2
14 3.2. GENERAL CONTRACTORS RESPONSIBILITIES 2
15 3.3. STAFF REVIEW RESPONSIBILITIES 3
16

PART 1 – GENERAL

1.1. SUMMARY

- 20 A. The General Contractor shall submit a complete and comprehensive list of all submittals anticipated during the
21 execution of this contract.
22 B. The GC shall include the Administrative submittals identified in item 1.5 below and shall be required to up load
23 them to the Project Management Web Site.
24 C. The initial Submittals Schedule shall be based on the original contract documents used at the time of bidding and
25 any posted addenda through awarding of the contract.
26 D. The Submittal Schedule may be appended during the execution of the contract based on amendments to the
27 contract in the form of Change Orders, Construction Bulletins, and other related documents that add, or change
28 the scope of the work.
29

1.2. RELATED SPECIFICATIONS

- 30 A. Section 01 29 76 Progress Payment Procedures
31 B. Section 01 31 23 Project Management Web Site
32 C. Section 01 33 23 Submittals
33 D. Section 01 91 00 Commissioning
34
35

1.3. RELATED DOCUMENTS

- 36 A. The following documents shall be used as the basis for initiating the original Submittals Schedule.
37 1. Drawing documents and specifications (including general provisions) as provided with the bid set
38 documents and any published addenda.
39 B. The following documents shall be used to amend the submittals schedule as needed during the execution of this
40 contract.
41 1. Documents associated with revisions or clarifications to number A.1 above after awarding of the
42 contract, including but not limited to:
43 a. Construction Bulletins
44 b. Approved Change Orders
45
46

1.4. SUBMITTAL DEFINITIONS

- 47 A. Administrative Submittal: Any submittal that may be required by a Division 1 Specification and as noted in
48 Section 1.5 below.
49 B. Critical Path Submittal: Any early submittal that needs a priority review due to early construction use or long
50 lead times where a delay could affect the critical path of the construction schedule
51 C. Submittal: Any material, product, equipment, or general requirement as outlined in this and other specifications
52 that require a favorable review or acceptance prior to proceeding with procuring the item or proceeding with
53 the Work.
54
55

1 **1.5. SUBMITTAL REQUIREMENTS**

- 2 A. The GC and all Sub-contractors shall review the construction documents including the specifications of their
3 individual Division or Trade to compile a complete list of all materials, products, or equipment that will require a
4 positively reviewed submittal to be completed prior to procurement and installation.
5 1. Submittals shall include but not be limited to any of the following that may apply:
6 a. Shop Drawings
7 b. Product Data
8 c. Assembly Drawings
9 d. Engineered Drawings
10 e. Product Samples
11 B. The following items will require an approved submittal, verify with specifications for specific needs and
12 requirements:
13 1. Contractor certifications for specialized work such as asbestos removal, well drilling, controls, AV, etc.
14

15 **1.6. ADMINISTRATIVE SUBMITTALS**

- 16 A. The GC shall upload the following submittals within 15 working days of receipt of the City of Madison Start Work
17 Letter. All Administrative Submittals shall be approved prior to requesting Progress Payment Number 1.
18 1. Contractors Project Directory, see specification 01 31 23, discuss requirements with CPM
19 2. Schedule of Values, see Specification 01 29 73
20 3. Submittals Schedule, see Specification 01 32 19
21 4. Waste Management Plan, see Specification 01 74 19
22 5. Closeout Requirement Checklist, see Specification 01 77 00
23 6. Warranty Checklist, see Specification 01 78 36
24

25 **PART 2 – PRODUCTS – THIS SECTION NOT USED**

26
27 **PART 3 - EXECUTION**

28
29 **3.1. OVERALL RESPONSIBILITIES OF ALL CONTRACTORS**

- 30 A. All contractors shall be responsible for reviewing the drawings and specifications within their Divisions of Work
31 to provide a complete and comprehensive list of submittals to the General Contractor.
32 B. Each list shall indicate the title of the submittal, the associated specification of the submittal, whether the
33 submittal can be considered an early/middle/late submittal, the anticipated date the submittal will be provided
34 and the anticipated date the submittal needs to be approved.
35 C. Contractors shall be aware that the goals for submittal review by the Architect staff and City staff will be as
36 follows:
37 1. For items on the Critical Path as identified by the GC, five (5) working days
38 2. For most other submittals ten (10) working days
39 3. Additional time may be needed for complex submittals or if re-submittals are required.
40 D. The general format of the Submittal Schedule shall be tabular as per this example:
41

<u>Title</u>	<u>Specification</u>	<u>Critical Path (Y or N)</u>	<u>Date provided</u>	<u>Date required</u>	<u>Remarks</u>
Concrete Mix Design	03 30 00	Y	Oct 1, 2014	Oct 15, 2014	
Paint Draw Downs	09 90 00	N	Jan 2, 2015	Jan 20, 2015	

42
43 **3.2. GENERAL CONTRACTORS RESPONSIBILITIES**

- 44 A. The General Contractor shall be responsible for all of the following:
45 1. Consolidating all submittal lists from individual contractors into one master list.
46 2. Reviewing all submitted lists for completeness, timing with the overall contract, etc. The GC shall meet
47 with individual contractors to make changes as necessary.
48 3. Upload the completed Submittals Schedule to the Submittal Library on the Project Management Web Site
49 for review as SD 003.0. See Specification 01 33 23 Submittals for more information on this procedure.
50 4. Resubmit the schedule as needed after initial reviews have been completed.
51 B. The GC shall work with other contractors to amend the Submittals Schedule throughout the execution of the
52 project based on changes and modifications as needed.
53 C. The GC and Project Architect shall be responsible for reviewing and briefing the submittal schedule and
54 submittals status at each bi-weekly construction meeting.

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3.3. STAFF REVIEW RESPONSIBILITIES

- A. The Project Architect, consulting staff, Commissioning Agent (CxA), Owner, and city staff will review the Submittal Schedule for completeness per the plans and specifications within their divisions of work. The reviewing staff may provide comments as needed. Some examples might include the following:
 - 1. Submittal not required
 - 2. Provide photos of samples with digital submittal
 - 3. Insure one submittal for complete system
 - 4. Append the schedule to include...
 - 5. See Specification <xyz> for additional requirements
- B. The Project Architect and City Project Manager will finalize review comments regarding the Submittal Schedule. Re-submittal of the submittal schedule may be required.

END OF SECTION

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**SECTION 01 32 23
 SURVEY AND LAYOUT DATA**

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 4 PART 1 – GENERAL 1
 5 1.1. SUMMARY 1
 6 1.2. RELATED SPECIFICATIONS 1
 7 1.3. SURVEYOR QUALIFICATIONS 1
 8 1.4. QUALITY ASSURANCE 1
 9 1.5. SUBMITTALS 2
 10 1.6. EXAMINATION 2
 11 PART 2 – PRODUCTS – NOT USED 2
 12 PART 3 - EXECUTION 2
 13 3.1. PRE-CONSTRUCTION OWNER SUPPORT 2
 14 3.2. UTILITY LOCATING 2
 15 3.3. SURVEY CONTROL AND LAYOUT DATA 2
 16 3.4. TOPOGRAPHIC SURVEYING 2
 17 3.5. SITE SURVEY AS-BUILT 3
 18

PART 1 – GENERAL

1.1. SUMMARY

- A. The purpose of this specification is to set forth the minimal required guide lines to be followed by the General Contractor (GC) and the Land Surveyor (Surveyor) including but not limited to the following:
1. Surveyor Professional Requirements
 2. Horizontal and Vertical Datum Control
 3. Local Control (if any)
 4. Electronic File and Data Requirements
 5. As-Built Documentation Requirements
- B. When working on any City of Madison project, OSHA standards must be complied with. The Surveyor shall provide appropriate traffic control in accordance to the Manual on Uniform Traffic Control Devices (MUTCD).
- C. The Surveyor shall be responsible for notifying Diggers Hotline in advance of beginning the field work for this contract.

1.2. RELATED SPECIFICATIONS

- A. Section 01 29 76 Progress Payment Procedures
- B. Section 01 31 23 Project Management Web Site (SharePoint)
- C. Section 01 33 23 Submittals
- D. Section 01 78 39 As-Built Drawings
- E. Section 105.9, Survey Points and Instructions, of the City of Madison Standard Specifications for Public Works

1.3. SURVEYOR QUALIFICATIONS

- A. The General Contractors, Land Surveyor Sub-Contractor shall meet or exceed the following:
1. The Principal Land Surveyor (PLS) shall be licensed to practice in the State of Wisconsin.
 - a. The PLS's license shall be current at the beginning of the contract and the PLS shall maintain an active license throughout the execution of this contract.
 2. The PLS shall have a minimum of minimum of ten (10) years of field experience on similar projects of scope and size.
 - a. Land Surveyors working under the direction of the PLS shall have a minimum of five (5) years of field experience on similar projects of scope and size.
- B. The PLS shall be responsible for checking and verifying all work being performed under the PLS's direction during the execution of this contract. This shall include but not be limited to periodic field checks of equipment and survey data for accuracy and compliance with the contract documents.

1.4. QUALITY ASSURANCE

- A. The PLS shall do all surveying in City of Madison Datum's as follows:
1. All Horizontal Control shall be in the Dane County Coordinates (WISCRS), NAD 83(1997) datum, US Survey foot).
 2. All Vertical Control shall be in NAVD88(1991).

- 1 3. Information on PLSS Section Corner Monuments and Tie Sheets can be found on the City Engineering
2 Mapping website http://gis.cityofmadison.com/Madison_PLSS/PLSS_TieSheets.html.

3
4 **1.5. SUBMITTALS**

- 5 A. After initial project setup the PLS shall provide the following information as a Survey Data Submittal for review
6 by the CPM/CCM, and Owner. See Specification 01 33 23 – Submittals for more information.
7 1. Copy of the PLS (and any supporting staff) current State of Wisconsin registration certificate/licenses.
8 2. Digital Survey Submittal on a thumb drive delivered to the CPM/CCM. Submittal Survey shall be on a
9 thumb drive or CD in Auto CAD 2017, MicroStation V8i, or DXF format. Digital Submittal shall be of the
10 project site setup showing all of the following:
11 a. Key features not scheduled for demolition, including but not limited to building corners, roof
12 overhangs, and door locations.
13 b. Location of construction limits fencing.
14 c. Locations of PLSS and/or project control points provided by the Owner.
15 d. Locations of project based control points.
16 3. Printed Survey Submittal shall be the same as item 1 above in PDF format. PDF file shall be formatted to
17 print to scale on 24"x36" sheets as required to show all features with text neatly organized for each item
18 identified. When multiple sheets are used a match line and sheet references shall be required.
19 4. PDF file of the complete level/layer scheme. Scheme shall be in tabular form formatted to 8.5 by 11
20 paper and shall include all of the following:
21 a. Level/layer designation (abbreviation).
22 b. Level/layer designation (full title).
23 c. Feature attribute characteristics (line weight, line style, font, etc.).
24 d. Cell attribute information
25 e. Samples of line styles and cells.

26
27 **1.6. EXAMINATION**

- 28 A. The PLS shall be responsible for verifying all site data including the owner provided local control points (see
29 Section 3.1 below) prior to starting the Work.
30 B. Notify the Project Architect and CPM/CCM immediately if any discrepancies are discovered.

31
32 **PART 2 – PRODUCTS – NOT USED**

33
34 **PART 3 - EXECUTION**

35
36 **3.1. PRE-CONSTRUCTION OWNER SUPPORT**

- 37 A. The CPM/CCM shall provide the GC/PLS with a digital CAD seed file on or before the Pre-construction meeting.
38 1. Seed file shall be a MicroStation 3D seed file using the datum indicated above. Seed file shall be
39 delivered as a MicroStation V8i or DXF format as requested by the PLS.
40 a. Seed file shall be used as the PLS's initial base file for all future work on this contract.

41
42 **3.2. UTILITY LOCATING**

- 43 A. The GC and/or PLS shall be responsible for notifying Diggers Hotline for all utility locate requests.
44

45 **3.3. SURVEY CONTROL AND LAYOUT DATA**

- 46 A. The GC and PLS are responsible for all other survey control and layout data required to perform the work in this
47 contract.
48

49 **3.4. TOPOGRAPHIC SURVEYING**

- 50 A. The Surveyor may perform the topographic survey with properly calibrated equipment as follows:
51 1. Total station, achieving minimum accuracy for well-defined features of +/- 0.1 feet horizontal and +/-0.04
52 feet vertical at 95% confidence relative to control. "Well defined features" shall include but not be
53 limited to property irons, pavements, trees, landscaping features, buildings, utility locations, and other
54 permanent features.
55 2. RTK GPS shall be permitted in large open areas, along tree lines, and in brushy areas.
56

1 **3.5. SITE SURVEY AS-BUILT**

- 2 A. See Specification 01 78 39 As-Built Drawings, Section 3.2 for more information on required record site
3 information to be provided prior to contract closeout.
4 B. The GC shall be responsible for scheduling the PLS to capture locations and depths of all buried utilities prior to
5 any contractor back filing trenches. The Owner may require missing information to be located and surveyed at
6 the GC's expense.
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10 **END OF SECTION**
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SECTION 01 32 26
CONSTRUCTION PROGRESS REPORTING

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4 PART 1 – GENERAL 1
5 1.1. SUMMARY 1
6 1.2. RELATED SPECIFICATION SECTIONS 1
7 1.3. PERFORMANCE AND QUALITY ASSURANCE REQUIREMENTS 1
8 PART 2 – PRODUCTS - THIS SECTION NOT USED 1
9 PART 3 - EXECUTION 1
10 3.1. CONTRACTOR JOURNAL 1
11 3.2. CONSTRUCTION PROGRESS MEETINGS 2
12

PART 1 – GENERAL

1.1. SUMMARY

- 16 A. Daily records of project activities, resources used, weather conditions, and other information related to the
17 ongoing progress of the project are extremely important at all levels of Construction Management.
18 B. Daily records provide the base for weekly progress reports and updating progress schedules.

1.2. RELATED SPECIFICATION SECTIONS

- 21 A. Section 01 31 19 Project Meetings
22 B. Section 01 31 23 Project Management Web Site
23 C. Section 01 32 23 Photographic Documentation

1.3. PERFORMANCE AND QUALITY ASSURANCE REQUIREMENTS

- 26 A. The General Contractor (GC) shall be responsible for all Construction Progress Reporting as outlined in this and
27 other specifications as noted.
28 B. The GC shall maintain daily progress journals in a format of his/her choosing provided it is legible and contains
29 the information as outlined in Section 3.1 below.
30 C. The journal shall be located in the job trailer and shall be reviewable by the Project Architect or City Project
31 Manager if so requested.

PART 2 – PRODUCTS - THIS SECTION NOT USED

PART 3 - EXECUTION

3.1. CONTRACTOR JOURNAL

- 38 A. The GC shall maintain a journal of daily progress on which Work is performed by any employee or entity for
39 which the GC is responsible. Such reports shall include all relevant data concerning the progress of Work
40 activities the GC and Subcontractors are responsible for and the effect of that activity on the time of
41 performance of the Contract.
42 1. Some projects may not require weekly journals be kept instead of daily journals. This is at the sole
43 discretion of the City Project Manager. A daily journal will generally be required when the contract has a
44 significant amount of site work. A weekly journal will generally be used when a contract is interior work
45 only.
46 B. Journal entries shall be made on the Contractor Daily/Weekly Report Form located in the Construction Progress-
47 Daily Journal Library on the Project Management Web Site. The form consists of the following areas:
48 1. Weather; include temperature, humidity, precipitation, wind and other related information such as
49 significant storm events, times, and details.
50 2. Work completed by trade
51 3. Delays encountered
52 4. Deliveries received or delayed
53 5. Hot issues that need to be addressed
54 6. Safety issues
55 7. Photograph progress and upload to the Photo Library on the Project Management Web Site.
56 8. Other including inspections, testing, etc.
57 9. Space for attaching documents

- 1 C. Contractor Daily/Weekly Report Forms shall be completed and signed by the GC's Job Superintendent or other
2 on-site representative authorized by the GC confirming each such report is current, accurate and complete.
3 D. If applicable the GC shall include schedules of quantities and costs, progress schedules, wage rates, reports,
4 estimates, invoices, records and other data as requested by the CPM concerning Work performed or to be
5 performed under this Contract if the CPM determines such information is needed to substantiate Change Order
6 proposals, claims, or to resolve disputes.
7

8 **3.2. CONSTRUCTION PROGRESS MEETINGS**

- 9 A. The GC shall provide a verbal summary of the previous two (2) weeks progress reports at each bi-weekly
10 construction progress meeting.
11

12 **END OF SECTION**
13
14

**SECTION 01 32 33
PHOTOGRAPHIC DOCUMENTATION**

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3
4 PART 1 – GENERAL 1
5 1.1. SCOPE 1
6 1.2. RELATED SPECIFICATION SECTIONS 1
7 1.3. SUBMITTALS 1
8 PART 2 – PRODUCTS 1
9 2.1. DIGITAL CAMERA 1
10 2.1. TIME LAPSE CONSTRUCTION CAMERA (TLCC) 1
11 PART 3 – EXECUTION 2
12 3.1. REQUIREMENTS FOR DIGITAL PHOTOGRAPHS 2
13 3.2. REQUIREMENTS FOR TIME LAPSE PHOTOGRAPHS 2
14 3.3. PROJECT MANAGEMENT WEB SITE (SHAREPOINT) 2
15

16 **PART 1 – GENERAL**

17
18 **1.1. SCOPE**

- 19 A. The General Contractor (GC) shall be required to take weekly digital photographs of interior and exterior
20 construction progress and upload the photos directly to the Project Management Web Site (SharePoint).
21 B. The GC shall be required to provide digital time-lapse photo service of the project exterior construction progress.
22

23 **1.2. RELATED SPECIFICATION SECTIONS**

- 24 A. Section 01 29 76 Progress Payment Procedures
25 B. Section 01 31 23 Project Management Web Site (SharePoint)
26 C. Section 01 32 19 Submittals Schedule
27 D. Section 01 32 33 Submittals
28 E. Section 01 77 00 Closeout Procedures
29

30 **1.3. SUBMITTALS**

- 31 A. The GC shall provide general information on the type of camera being used for interior and exterior digital
32 photographs.
33 1. Information may be written on Contractor’s transmittal sheet.
34 a. Include camera name/type, aspect ratio setting, and average file size
35 b. Provide sample project pictures as part of PDF submittal.
36 B. The GC shall provide sufficient information on the type of time lapse system being used that meets the
37 requirements identified in section 2.2 below.
38

39 **PART 2 – PRODUCTS**

40
41 **2.1. DIGITAL CAMERA**

- 42 A. All digital photographs shall be taken with a good quality digital camera, cell phone, tablet, and other such digital
43 device.
44 B. Digital photographs shall be formatted to achieve a good, clear, and detailed image where the final file size is
45 between 600 KB and 3.0 MB (3000KB).
46

47 **2.1. TIME LAPSE CONSTRUCTION CAMERA (TLCC)**

- 48 A. The TLCC shall be a high quality weather proof camera owned and operated, or leased, by the GC for the
49 duration of this contract with the following minimum capabilities:
50 1. Pan-Tilt-Zoom (PTZ) capable.
51 2. Wireless internet or built in cellular technology capable.
52 a. The use of memory cards will not be permitted.
53 3. Widescreen, high resolution (5-30 MP rating).
54 4. Powered by 120V AC.
55 a. The use of battery packs will not be permitted.
56 5. Web/cloud hosted access to archived photos and video.
57 6. Provides complete time lapse video capability.
58 7. 24/7 service and support for equipment, software, and hosting services.

- 1 B. Approved equipment/services include but are not limited to the following:
2 1. OxBBlue Corporation, www.oxblue.com
3 2. EarthCam, www.earthcam.net
4 3. TrueLook, www.truelook.com
5

6 **PART 3 – EXECUTION**
7

8 **3.1. REQUIREMENTS FOR DIGITAL PHOTOGRAPHS**

- 9 A. The GC shall take a minimum of two (2) exterior photographs each week. Exterior photographs will not be
10 required on projects that do not include any exterior work.
11 1. Exterior photos shall be taken from approximately the same location each week for the duration of the
12 project.
13 2. When applicable this requirement shall begin prior to commencing any site work.
14 3. This requirement shall only be applicable when there is exterior work actively being conducted with the
15 project. Periods of inactivity due to weather (winter conditions) do not require a photograph.
16 4. This requirement shall end when the exterior work has been substantially completed.
17 5. This requirement may be suspended due to weather conditions or substantial delays in exterior progress.
18 B. The GC shall take interior photographs each week that document interior construction progress.
19 1. This requirement will begin when exterior wall framing begins.
20 a. When an interior remodeling project includes demolition work interior photos shall be taken
21 during the demolition process.
22 2. Pictures do not need to be taken from the same location each week.
23 3. This requirement shall end when the interior work has been substantially completed.
24 C. Digital photographs shall be properly zoomed in/out, and flash used as needed, to capture a level of detail
25 required to properly show the progress being captured by the photograph.
26 1. Blurry and dark pictures will not be accepted.
27 D. The camera default naming convention is acceptable. The GC does not need to rename or specifically identify
28 pictures with a title.
29 E. All digital photographs shall be saved in a JPEG (.jpg) format and uploaded directly to the SharePoint Project
30 Images Library.
31 1. The GC shall upload the photos to the folder that designates the appropriate construction week and date
32 (beginning Monday date). If no folder exists, contact the CPM/CCM prior to uploading photos.
33

34 **3.2. REQUIREMENTS FOR TIME LAPSE PHOTOGRAPHS**

- 35 A. The GC shall be responsible for all of the following:
36 1. Verify with the CPM/CCM a suitable place for mounting the camera and related equipment prior to
37 installation.
38 2. The complete installation, setup, maintenance, and removal of the camera and related equipment.
39 3. The hosting and access of all photographs and videos taken by the camera during the project.
40 4. Production of a final time lapse video (minimum of 3 minutes in length) of the project provided in a
41 viewable format to the Owner on a thumb drive or CD.
42 B. Time lapse photos shall be taken from the same fixed position at approximately ten (10) minute intervals.
43 1. Time lapse shall start before normal daily activities begin and end after normal daily activities have been
44 completed.
45 a. The GC shall adjust the camera time lapse schedule as needed to accommodate any periods of
46 overtime or weekend work.
47 b. Time lapse shall not be taken during major periods of no activity including night hours, holidays,
48 weather related (winter) inactivity, etc.
49 C. All photos taken during the execution of this contract shall be accessible from a web based service. Archived
50 photos shall be organized by date and time so that they can be easily retrieved and viewed as needed.
51 1. If necessary the GC shall coordinate usernames and passwords for access to the photos. The City of
52 Madison would prefer that the access be generic to accommodate a wide audience.
53

54 **3.3. PROJECT MANAGEMENT WEB SITE (SHAREPOINT)**

- 55 A. The CPM/CCM shall provide weekly progress folders in the Project Images Library on SharePoint.
56 1. Progress folders are labeled with the Construction Week Number and the date for Monday of that week.
57 2. The GC shall notify the CPM/CCM if additional weekly progress folders need to be created.

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- B. The GC shall upload the weekly digital photographs to the appropriate progress folder in the Project Images Library.
- C. Copies of Time Lapse video shall be uploaded to a separate project folder in the Project Images Library prior to Construction Closeout.

END OF SECTION

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SECTION 01 33 23
SUBMITTALS

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10 3.1. GENERAL CONTRACTORS PROCEDURES 2
11 3.2. SUBMITTAL REVIEW 2
12 3.3. PROJECT ARCHITECTS REVIEW 3

PART 1 – GENERAL

1.1. SUMMARY

- 17 A. The General Contractor (GC) shall be responsible for providing submittals for review of all contractors and sub-
18 contractors as designated in the construction documents. Submittals shall include but not be limited to all of the
19 following:
- 20 1. Equipment specified and pre-approved in the specification; to ensure quality, construction, and
21 performance specifications have not changed since final design.
 - 22 2. Equipment specified by performance in the specification; to ensure that the intended quality,
23 construction, and performance specified is met by the selected material or product.
 - 24 3. Shop, piece, erection, and other such drawings as indicated in the specifications to ensure all structural,
25 dimensional, and assembly requirements are being met.
 - 26 4. Submittals indicating installation sequencing
 - 27 5. Submittals indicating control sequencing
 - 28 6. Contractor licensing, certification, and other such regulatory documentation when required by a
29 specification.
 - 30 7. Other submittals as may be required by individual specifications.
- 31 B. The submittal process shall not be used to determine alternates to specified products or equipment. All
32 considerations shall be reviewed during the bidding process and acceptable alternates shall be acknowledged by
33 addendum prior to the closing of bidding. See bidding instructions for the information on submitting alternates
34 for consideration.
- 35 D. In the event that a manufacturer has significantly changed a product (discontinued a model, changed dimension
36 or performance data changed available colors, etc.) since bid opening the GC shall submit a Request for
37 Information (RFI) to the Project Architect requesting other approved alternates prior to uploading a digital
38 submittal.
- 39 E. Contractors and sub-contractors shall be responsible for knowing the submittal requirements of ALL sections
40 within their scope of work under the contract. The Owner reserves the right to request documentation on any
41 materials, equipment, or product being installed where a submittal is not on file. If the material, equipment, or
42 product installed is determined not to meet the intent of the specification the contractor/sub-contractor shall be
43 required to remove and replace the items involved. The GC shall be solely responsible for all costs associated
44 with the removal and replacement.

1.2. RELATED REFERENCES

- 47 A. Section 01 29 76 Progress Payment Procedures
48 B. Section 01 31 23 Project Management Web Site
49 C. Section 01 32 19 Submittals Schedule
50 D. Section 01 32 26 Construction Progress Reporting
51 E. Section 01 91 00 Commissioning
52 F. All Technical Specifications, contract documents, construction drawings, and any published addendums during
53 the bidding process.
54 G. All contract documents generated during the execution of the contract including but not limited to Requests for
55 Information (RFI) and Construction Bulletins (CB).
56

1.3. SUBMITTAL REQUIREMENTS

- 57 A. A completed submittal shall meet the following requirements:
58

- 1 1. Digital submittal shall be original PDF of manufacturer's data sheets or high quality color scan of the
- 2 same.
- 3 a. Submittals shall not include sales fliers or other similar documents that typically do not provide
- 4 complete manufacturers data.
- 5 2. Documents within the PDF submittal shall be printable to a sized sheet no less than 8-1/2 by 11 inches
- 6 and no larger than 24 by 36 inches.
- 7 3. At the beginning of each submittal the contractor shall identify the plan reference (WC-1, EF-3, etc.) in
- 8 RED block letters that the submittal is for.
- 9 4. Where multiple model numbers appear in a table the contractor shall identify the specific model being
- 10 submitted by using a RED square, box, or other designation to distinguish the correct model from others
- 11 on the page.
- 12 B. A complete submittal will include all information associated with the product or equipment as presented in
- 13 plans, equipment tables, and specifications. Information shall include but not be limited to the following:
- 14 1. Dimensional data
- 15 2. Performance data
- 16 3. Resource requirements, power, water, waste, etc
- 17 4. Clearance and maintenance requirements
- 18 5. Finish information, colors, textures, etc.
- 19 6. Warranty information
- 20 C. Where a submittal includes material samples (carpet, tile, paint draw downs, etc.) the contractor shall do the
- 21 following:
- 22 1. The Contractor shall submit the sample(s) as indicated in the specification.
- 23 2. The Contractor shall include a quality photograph(s) of the product with the digital submittal.
- 24 Photographs shall meet the following requirements:
- 25 a. Formatted to be between 500Kb and 1.0 Mb in file size
- 26 b. Have no glare or flash reflection on the sample
- 27 c. Sample fills the frame of the photo and shows detail as needed. Include multiple photos from
- 28 other angles as needed.
- 29 d. Scanned copies of products or photos are not acceptable.
- 30 D. Uploaded submittals should be relative and related to a specific written specification.
- 31 1. Do not upload submittals under a broad category or division (I.E. HVAC 23 00 00). Always upload by the
- 32 specific specification that identifies a required product or performance to be met.
- 33 2. Group related items together if the specification is written that way. (I.E. all of the plumbing fixtures and
- 34 trim relative to one specific specification should be submitted together).
- 35 3. Submittals shall be grouped and adhere to the divisions in the submittal schedule. Submittals that do not
- 36 conform to the submittal schedule and/or specification divisions will be rejected for re-submittal.

37
38 **PART 2 – PRODUCTS – THIS SECTION NOT USED**

39
40 **PART 3 - EXECUTION**

41
42 **3.1. GENERAL CONTRACTORS PROCEDURES**

- 43 A. All required submittals will be uploaded to the Construction Administration-Submittal Drawings Library on the
- 44 Project Management Web Site (PMWS) by the GC.
- 45 1. The GC shall open a new Submittal Form in the Submittals Drawings Library for each required submittal
- 46 from the Submittals schedule.
- 47 2. Fill in required information on the form that will be used for routing the review and comments.
- 48 3. Attach all documentation as described in Section 1.3 above.
- 49 a. Submit samples under separate cover to the Project Architect when necessary.
- 50 B. Uploading the submittal indicates that the GC has reviewed and approved the submittal against the contract
- 51 document requirements.
- 52 C. The GC shall discuss submittal status at all progress meetings and shall monitor submittal review/approval/re-
- 53 submittal so as to not incur delays in the project schedule.
- 54 D. A completed upload of the submittal to the PMWS initiates the review process workflow.
- 55 E. The GC and sub-contractors shall provide re-submittals as required.
- 56

1 **3.2. SUBMITTAL REVIEW**

- 2 A. Upon completion of the submittal upload by the GC the PMWS automatically notifies the appropriate
3 Architect/Engineer and Owner Representative, including CxA, by Division/Specification number that there is a
4 submittal for review.
5 B. The submittal shall be reviewed internally by the required Architect/Engineer and Owner Representative and
6 CxA in a timely fashion and provide commentary on missing items, incorrect information, or incomplete shop
7 drawings, etc as needed.
8 C. When the internal review is completed the PMWS will notify the Project Architect the submittal is ready for final
9 review.
10

11 **3.3. PROJECT ARCHITECTS REVIEW**

- 12 A. Upon completion of the internal review the Project Architect shall review all internal review comments, confer
13 with the CPM and CxA as needed and determine the appropriate disposition status for the submittal (approved
14 or resubmit).
15 C. The Project Architect shall summarize final internal review comments onto the submittal cover sheet, provide a
16 final disposition of the submittal and update the review status of the submittal to "Complete..." (with or w/o
17 comments) or "Rejected".
18 D. A completed Final Review status initiates the PMWS to notify the GC and appropriate sub-contractor(s) that the
19 review of the submittal has been completed.
20
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23 **END OF SECTION**
24

**SECTION 01 41 00
REGULATORY REQUIREMENTS**

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11

PART 1 – GENERAL

1.1. REQUIREMENT INCLUDED

Unless otherwise specifically directed by Contractor each Subcontractor and each Sub-subcontractor shall comply with provisions of this Section as required for proper execution and completion of their Work or portions thereof

1.2. PROCEDURES

Comply with and give notices required by applicable laws, statutes, ordinances, codes, rules, and regulations, and lawful orders of public authorities having jurisdiction applicable to performance of the Work. Comply with and give notices required by Owner’s and Contractor’s insurance companies, local utilities and labor regulations relating to the performance of the Work, the protection of adjacent property, and the maintenance of passage ways, guard fences and other protective facilities.

The Contractor shall acquire all permits, licenses, and approvals necessary for the execution of this Contract and performance of the Work and provide evidence of such applicable permits, licenses, and approvals at the Pre-Construction Meeting or before commencement of the Work.

Where Contract Documents require abatement of asbestos containing materials, prior written Notice to the State of Wisconsin, Department of Natural Resources is required. The Contractor shall provide evidence of such Notice prior to commencement of the Work.

Procure all certificates of inspection, use, and occupancy, and all permits and licenses, pay all charges and fees and give all notices necessary and incidental to the due and lawful prosecution of the Work. Certificates of inspection, use and occupancy shall be delivered to the Owner upon completion of the Work in sufficient time for occupation of the Project in accordance with the approved schedule for the Work. The costs of such procurement, payment and delivery shall be included within the Base Bid.

Exercise precaution at all times for the protection of persons (including employees) and property. Observe the safety provisions of applicable laws, building and construction codes. Refer to the Manual of Accident Prevention in Construction, published by the Associated General Contractors of America.

It is not Contractor’s responsibility to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, and rules and regulations. However, if Contractor observes that portions of the Contract Documents are at variance therewith, Contractor shall promptly notify A/E and Owner in writing, and necessary changes shall be accomplished by appropriate Modification.

If Contractor performs Work knowing it to be contrary to applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities having jurisdiction, the Contractor shall assume full responsibility for such Work and shall bear the costs attributable to correction.

Refer to the Sections of the Work for referenced codes, standards, tests, etc., applicable to the Work.

1.3. NOTICES

Concealed or Unknown Conditions:

If the Contractor encounters conditions at the site are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual

1 nature, that differ materially from those ordinarily found to exist and generally recognized as inherent in construction
2 activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the
3 Owner and the Architect before conditions are disturbed and in no event later than 21 days after first observance of the
4 conditions. The Architect will promptly investigate such conditions and, if the Architect determines that they differ
5 materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any of the
6 Work, will recommend and equitable adjustment in the Contract Sum or Contract Time, or both. If the Architect
7 determines that the conditions at the site are not materially different from those indicated in the Contract Documents
8 and that no change in the terms of the Contract is justified, the Architect shall promptly notify the Owner and
9 Contractor in writing, stating the reasons.

10
11 If, in the course of the Work, the Contractor encounters human remains or recognizes the existence of burial markers,
12 archaeological sites, or wetlands not indicated in the Contract Documents, the Contractor shall immediately suspend
13 any operations that would affect them and shall notify the Owner and Architect. Upon receipt of such notice, the
14 Owner shall promptly take any action necessary to obtain governmental authorization required to resume operations.
15 The Contractor shall continue to suspend operations until otherwise instructed by the Owner but shall continue with all
16 other operations that do not affect those remains or features.

17
18 **1.4 PERMITS**

19 Permits, Fees, Licenses, and Inspections: Unless otherwise provided in the Contract Documents, Contractor shall secure
20 and pay for the building permit as well as for other permits, fees, licenses, inspections and approvals by government and
21 utility agencies, necessary for proper execution and completion of the Work that are customarily secured after
22 execution of the Contract and legally required at the time bids are received or negotiations concluded.

23
24 Owner will obtain plan approvals and pay all fees required by the Wisconsin Department of Safety and Professional
25 Services.

26
27 Contractor shall obtain all permits and pay all fees required by local utilities for permanent electric and gas service.

28
29 Contractor shall obtain copies of all required permits and certificates of inspection applicable to the work.

30
31 Contractor shall furnish A/E and Owner with copy of all required permits and certificates.

32
33 **PART 2 – PRODUCTS - THIS SECTION NOT USED**

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35 **PART 3 – EXECUTION - THIS SECTION NOT USED**

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END OF SECTION

SECTION 01 45 16
FIELD QUALITY CONTROL PROCEDURES

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16 3.5. CONSTRUCTION CLOSEOUT 3
17

PART 1 – GENERAL

1.1. SUMMARY

- A. The City of Madison has developed a multi-faceted Quality Management Program that begins with contract signing and runs through contract closeout to ensure the best quality materials, workmanship, and product are delivered for the contracted Work.
1. The Progress Management Web Site is a Construction Management tool that provides contractors and staff a single on-line location for the daily operations and progression of the Work.
2. The Quality Management Observation (QMO) is an ongoing observation of the construction process as it progresses. The City of Madison does not use a “Punch List” or “Corrections List” as it is typically known throughout the construction industry. The QMO process acts as an “in progress punch list”.
- a. By using the QMO process the City of Madison’s goal is to have a zero item punch list prior to the 90% progress payment and owner occupancy.
- B. All contractors shall be required to review the specifications identified in Section 1.2 below, and other related specifications identified therein to become familiar with the terminology and expectations of this City of Madison Public Works contract.
- C. It is the intent of this specification to outline the requirements, expectations, and responsibilities of the General Contractor (GC), Project Architect, and other representatives of the Owner for items of Quality Assurance and Quality Control.
1. This specification is not intended to conflict with Specification 01 40 00 Quality Requirements or other specifications requiring testing and inspecting services.
2. This specification does not relieve the GC from any requirements associated with regulatory inspections performed by the City of Madison Building Inspection Unit, or inspectors from other agencies as required by code.
3. Any testing performed by an Owner’s Representative does not relieve the GC from performing any testing that may be required by the construction documents.

1.2. RELATED SPECIFICATION SECTIONS

- A. Section 01 26 13 Request for Information (RFI)
B. Section 01 29 76 Progress Payment Procedures
C. Section 01 31 13 Project Coordination
D. Section 01 31 23 Project Management Web Site
E. Section 01 40 00 Quality Requirements
F. Section 01 77 00 Closeout Procedures
G. Section 01 78 13 Completion and Correction List
H. Section 01 91 00 Commissioning

1.3. PERFORMANCE REQUIREMENTS

- A. All contractors shall be responsible for a proper quality assurance/quality control (QA/QC) program throughout the execution of the Work defined within the construction documents, including all recognized construction industry standards and all applicable regulatory codes.

- 1 B. The GC shall be responsible for all of the following:
2 1. Monitor the quality of all workmanship, supplies, materials, and products being installed by all
3 contractors and installers to ensure they meet or exceed the minimum requirements set forth by the
4 construction documents.
5 2. Submit a Request for Information (RFI) whenever manufacturers' instructions or referenced standards
6 conflict with the construction documents before proceeding with the Work.
7 3. Ensure that Work requiring special certifications or licensing is being performed by is being performed
8 and supervised by personnel that meet the appropriate requirements.
9 a. Ensure that all certificates and licenses are current throughout the execution of the project.
10 C. The CoM and its representatives shall perform quality assurance and quality control activities throughout the
11 execution of this project. This in no way relieves the GC of maintaining an acceptable QA/QC program. =
12

13 **1.4. QUALITY ASSURANCE**

- 14 A. The GC shall be responsible for the following:
15 1. All materials, equipment, and products shall be new, clean, undamaged, and meet the performance
16 specifications defined within the construction documents including favorably reviewed submittals.
17 a. Any material, equipment, or product that does not meet the requirements of the construction
18 documents shall be removed and replaced, including any adjacent and related work, at the GCs
19 expense.
20 2. All Work shall be performed by persons properly trained and/or qualified to produce workmanship of the
21 quality specified in the construction documents.
22 3. Providing access to updated as-builts, addenda, submittals, bulletins and other related construction
23 documents at the project site.
24 B. The CoM and its representatives may be responsible for any of the following:
25 1. Attend pre-installation meetings
26 2. Attend construction progress meetings
27 3. Review all submittals
28 4. Conduct field visits for QA/QC purposes, provide feedback to the GC and sub-contractors using Quality
29 Management Observation (QMO) reports.
30 5. Review delivered equipment
31 6. Witness equipment installations, startups, testing as specified in other specifications
32

33 **1.5. QUALITY MANAGEMENT OBSERVATION REPORT**

- 34 A. The Quality Management Observation report or QMO is used as a QA/QC tool by those entities responsible for
35 QA/QC activities, including but not limited to, the GC, CoM, PA, CX agent, etc.
36 B. QMOs are designed to be an early observation of non-conforming construction work before it becomes buried
37 by follow on work. As such it is most often used as an "in progress punch list".
38 C. QMO forms are part of the Quality Control Library on the Project Management Web Site.
39

40 **PART 2 – PRODUCTS - THIS SECTION NOT USED**

41
42 **PART 3 - EXECUTION**

43
44 **3.1. QUALITY MANAGEMENT RESPONSIBILITIES**

- 45 A. While making routine progress visits to the construction project the GC, CPM, CxA and A/E, and applicable others
46 shall observe the details of the construction and installations to ensure that the intent of the construction
47 documents is being followed.
48 B. If during the progress visit there is a determination of contract non-conformance a QMO report shall be initiated
49 to begin the documentation process.
50 1. The GC field superintendent shall be informed immediately of any issue that may cause harm, damage to
51 finished work, or be buried prior to properly filing a QMO report.
52 C. The following information when filing a QMO report:
53 1. Open a QMO report in the Quality Control Library on the Project Management Web Site
54 2. Enter the date and time of the field visit
55 2. Provide references to construction documents if any (examples; specification, drawing page, details,
56 approved submittals, RFI, CB, etc)
57 3. Provide a short title for the observation being made
58 4. Provide a detailed description of the observation being made

- 1 5. Select all categories (Sitework, Structure, Enclosure, Interior, etc) from the given list that may apply to
2 the observation being reported.
3 a. For each category selected additional boxes shall open with contractor names associated with
4 each category.
5 6. Select all contractors from the lists provided that may need to be aware of the observation.
6 7. Provide any attachments that may help provide reference to the observation.
7 8. Click the SAVE button before closing the form.
8 D. The software for the Project Management Website will email notifications that a QMO report has been initiated.
9 The software will automatically select and notify the following:
10 1. The GC, PA, and CPM for all observation reports being filed.
11 2. Others depending on the observation categories selected.
12 3. Contractors based on the selections made in the sub-contractors lists.

13
14 **3.2. RESPONDING TO A QMO**

- 15 A. All contractors receiving email notification of a QMO Observation shall review the details of the observation.
16 B. The GC shall be responsible for determining the course of action required to remedy the non-conforming issue
17 and shall coordinate and direct the contractor(s) responsible for any work related to the observation.
18 C. All contractors assigned to remedy the observation by the GC shall provide follow-up responses on the QMO
19 report as follows:
20 1. Open the QMO report in the Quality Control Library on the Project Management Web Site.
21 2. In the "Follow-Up Response" area enter a description of your follow-up response in the box provided.
22 a. Click "Insert Item" if additional boxes are required.
23 3. Add attachments (pictures) if needed to show the work has been completed.
24 4. Click the SAVE button before closing the form.

25
26 **3.3. GENERAL CONTRACTORS FOLLOW-UP**

- 27 A. The GC shall inspect the work to ensure that all assigned contractors have remedied the observation to the
28 intent of the construction documents.
29 B. The GC shall respond with any additional comments in his/her response box.
30 1. If no comments are to be made the GC at a minimum must date the response box to trigger the next
31 work flow.
32 C. Click the SAVE button before closing the form.
33 D. The software will email a notification to the CPM and the person who initiated the QMO that the issue has been
34 remedied.

35
36 **3.4. QMO CLOSEOUT PROCEDURE**

- 37 A. The person who initiated the QMO shall review the remedied work and if properly corrected shall close and date
38 the QMO form.
39 1. Click SAVE and the software will email a notification to the CPM that final review of the Observation is
40 required.
41 2. In the event there are still issues the Quality Manager can add additional comments in the response area,
42 click SAVE and re-issue the QMO for additional review as needed.
43 B. Once the person who initiated the QMO has closed the item the CPM shall review and verify with the PA that the
44 Observation has been properly remedied and provide final closure on the QMO.

45
46 **3.5. CONSTRUCTION CLOSEOUT**

- 47 A. The GC shall note that successful close out QMOs are required for construction closeout as follows:
48 1. Certain progress payments as identified in Specification 01 29 76 are contingent QMO reports being properly
49 closed out.
50 2. Specification 01 77 00 defines all construction closeout requirements.

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54 **END OF SECTION**

55

SECTION 01 45 29
TESTING LABORATORY SERVICES

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3		
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PART 1 – GENERAL

1.1. REQUIREMENTS INCLUDED

- A. The Contractor shall employ and pay for the services of an independent testing laboratory to perform specified services and testing.
- B. Testing Laboratory inspection, sampling and testing is required for:
 - 1. Section 03 30 00: Cast-In-Place Concrete
 - 2. Section 05 12 00: Structural Steel Framing
 - 3. Section 05 40 00: Cold-Formed Steel Framing
 - 4. Section 31 20 00: Earthwork

1.2. RELATED REQUIREMENTS

- A. Conditions of the Contract: Inspections and testing required by laws, ordinances, rules, regulations, orders or approvals of public authorities.
- B. Related Requirements Specified in Other Sections:
 - 1. Division 22 and 23: Testing of Mechanical Systems
 - 2. Division 26: Testing of Electrical Systems

1.3. QUALIFICATION OF LABORATORY

- A. Meet “Recommended Requirements of Independent Laboratory Qualification” published by American Council of Independent Laboratories.
- B. Meet basic requirements of ASTM E 329, “Standards of Recommended Practice for Inspection and Testing Agencies for Concrete and Steel as Used in Construction.”
- C. Authorized to operate in State in which the Project is located.

1.4. LABORATORY DUTIES

- A. Cooperate with Owner, A/E and Contractor; provide qualified personnel after due notice.
- B. Perform specified inspections, sampling and testing of materials and methods of construction:
 - 1. Comply with specified standards.
 - 2. Ascertain compliance of materials with requirements of Contract Documents.
- C. Promptly notify the Owner, A/E and Contractor of observed irregularities or deficiencies of work or products.
- D. Promptly submit written report of each test and inspection; one copy each to A/E, Consulting Engineer, Owner and Contractor. Each report shall include:
 - 1. Date issued.
 - 2. Project Title and number.
 - 3. Testing laboratory name, address and telephone number.
 - 4. Name and signature of laboratory inspector.
 - 5. Date and time of sampling or inspection.
 - 6. Record of temperature and weather conditions.
 - 7. Date of test.
 - 8. Identification of product and specification section.
 - 9. Location of sample or test in the Project.
 - 10. Type of inspection or test.
 - 11. Results of tests and compliance with Contract Documents.

- 1 12. Interpretation of test results, when requested by A/E or the Contractor.
2 E. Perform additional tests as required by Owner, A/E or the Contractor.
3
- 4 **1.5. LIMITATIONS OF AUTHORITY OF TESTING LABORATORY**
- 5 A. Laboratory is not authorized to:
- 6 1. Release, revoke, alter, or enlarge on requirements of Contract Documents.
7 2. Approve or accept any portions of the Work other than those portions of the Work scheduled for testing.
8 3. Perform any duties of the Contractor.
9
- 10 **1.6. CONTRACTOR'S RESPONSIBILITIES**
- 11 A. Cooperate with laboratory personnel, provide access to Work and to manufacturer's operations.
12 B. Secure and deliver to the laboratory, adequate quantities of representative samples of materials proposed to be
13 used and which require testing. Submit concrete mix designs to A/E for approval prior to pouring concrete.
14 C. Provide to the laboratory the preliminary design mix proposed to be used for concrete, and other material mixes
15 that require control by the testing laboratory.
16 D. Furnish copies of Product test reports as required.
17 E. Furnish incidental labor and facilities:
- 18 1. To provide access to Work to be tested.
19 2. To obtain and handle samples at the Project site or at the source of the product to be tested.
20 3. To facilitate inspections and tests.
21 4. For storage and curing of test samples.
- 22 F. Notify laboratory sufficiently in advance of operations to allow for laboratory assignment of personnel and
23 scheduling of tests.
24 G. Make arrangements with laboratory and pay for additional samples and tests required for Contractor's
25 convenience.
26 H. Employ and pay for the services of a separate, equally qualified independent testing laboratory to perform
27 additional inspections, sampling and testing required when initial tests indicate work does not comply with
28 Contract Documents.
29 I. Temporarily halt the progress of the Work when tested materials do not comply with Contract Documents and
30 promptly notify the Owner or his designated representative and A/E.
31 J. Remove and replace at no cost to the Owner, all defective materials discovered upon testing not to comply with
32 Contract Documents, including cost for retesting and re-inspecting replaced Work that failed to comply with the
33 Contract Documents.
34
- 35 **1.7. SPECIFIC TEST, INSPECTIONS, AND METHODS REQUIRED**
- 36 A. **Section 03 30 00: Cast-In-Place Concrete**
- 37 1. Secure sample of aggregates Contractor proposes to use and test for compliance with Specifications.
38 2. Certify compliance with Specifications of cement proposed for use by the Contractor.
39 3. Review and approve the Contractor's proposed concrete mix proportions for the required concrete
40 strengths using materials Contractor proposed to use on the project. Incorporate specified admixtures
41 and not less than amounts of cement specified.
42 4. Perform appropriate laboratory tests, including compression tests of cylinders and slump test to
43 substantiate mix designs.
44 5. Inspect and test materials during concrete work to substantiate compliance with Specifications and mix
45 requirements.
- 46 a. Testing:
- 47 i. Sample and test concrete in accordance with ASTM C 31, ASTM C 143, ASTM C 172, and
48 ASTM C 231.
49 ii. Perform slump tests in accord with ASTM C 143 from same concrete batch used for test
50 cylinders and record results and comments on compression test reports.
51 iii. Perform compression tests in accordance with ASTM C39.
52 iv. When air-entrained concrete is used, a minimum of one (1) air content test shall be
53 performed in accordance with ASTM C 231 for each set of test cylinders taken.
54 v. Identify all test cylinders with symbols to indicate location on the job where concrete test
55 was made. Record on project record drawings.
56 vi. Strength tests shall be made for: each day's pour; each class of concrete; each change of
57 supplies or sources; and for each 100 cubic yards of concrete or fraction thereof.

- 1 vii. One slump test shall be made for each set of test cylinders taken following the procedure
2 in ASTM C 143.
- 3 b. Test Cylinders for all Concrete
- 4 i. Each test shall consist of a minimum of four cylinders.
- 5 ii. Make test cylinders in conformity with ASTM C 31.
- 6 iii. After 24 hours three cylinders to be carefully transported to the testing laboratory for
7 moisture curing and one cylinder to be field cured.
- 8 iv. One field cured cylinder to be tested at 7 days and two laboratory cured cylinders to be
9 tested at 28 days. Reserve one cylinder for further testing.
- 10 v. The average of all strength tests representing each class of concrete, as well as the average
11 of any three consecutive strength tests for each class of concrete, shall be equal to or
12 greater than the specified strength.
- 13 vi. If the A/E has reason to believe that cylinder strength tests are not representative of the
14 strength of concrete in place, A/E shall require drilled cores to be cut and tested at the
15 Contractor's expense. Coring and testing shall be in accordance with ASTM C 42 Standard
16 Method of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
- 17 B. **Section 05 12 00: Structural Steel Framing**
- 18 1. Welding:
- 19 a. Provide inspection of shop and field welding in accordance with Section 6 of AWS D1.1.
- 20 b. Visually inspect all welds, perform appropriate non-destructive tests on apparent defective welds.
21 Verify conformance with Specifications.
- 22 c. Non-destructive testing shall be performed on 20 percent of the total length of all full penetration
23 welds. If a sufficient number of welds are deficient, additional testing may be performed at the
24 discretion of the testing lab, at no cost to Owner.
- 25 2. Bolting:
- 26 a. Visually inspect all connections for proper number, size and type of bolt.
- 27 b. Review all bolted connections for compliance with "snug tight" requirements of AISC.
- 28 c. No Slip-critical (SC) connections/bolts are required for this project.
- 29 d. Shear Connectors, Headed/Deformed Bar Concrete Anchors:
- 30 i. Verify pre-production test records for installation of shear connectors, concrete anchors
31 and threaded studs.
- 32 ii. Shear connectors shall be struck with a hammer. Those not producing a "clean" pinging
33 sound indicative of a fully attached shear connector shall be bent 15 degrees off vertical
34 towards the nearest support by striking with a hammer. If shear connector does not
35 become loose and weld is not broken, it shall be considered acceptable, and shall be left in
36 the bent position. Replace failing shear connectors and test as before.
- 37 iii. A visual inspection shall be made of shear connectors and headed/deformed bar concrete
38 anchors after installation. If visual inspection reveals that a sound weld and a 360 degree
39 flash has not been obtained, the connector/anchor shall also be tested by bending a
40 minimum of 15 degrees off vertical opposite to the missing weld/flash, irrespective of the
41 results of the "ping" test required for shear connectors. If the connector/anchor does not
42 become loose it shall be considered acceptable and shall be left in this position. Replace
43 failing connector/anchors and inspect as before.
- 44 C. **Section 05 40 00: Cold Formed Steel Framing**
- 45 1. As directed by A/E, Contractor's testing agency may inspect the maintenance of a quality control program
46 including spot checking weldments and welding procedures in accordance with AWS standards.
- 47 D. **Section 31 20 00: Soil Compaction Control and Trenching and Backfilling**
- 48 1. Soils Engineer to be onsite during excavation operation.
- 49 2. Visually inspect, test, and certify that exposed undisturbed underlying soil is suitable for required footing
50 bearing capacity and placement of fills.
- 51 3. Maximum and minimum density of fill soil for compaction percentage of relative density and moisture
52 density shall be determined in accordance with ASTM Designation D 1557. Testing agency will test
53 compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937,
54 as applicable.
- 55 4. Number of tests as follows:
- 56 a. Subgrade, Undisturbed and Demolition Surfaces: Visual inspection and probe; test if required.
- 57 b. Interior Fills: One test per 2,500 sq. ft for each two foot or less lift.
- 58 c. Exterior Fills: One test per 2,500 sq. ft for each two foot or less lift.

1 d. Utility Trenches: One test per 50 lineal feet for each two foot or less lift.

2

3 **PART 2 – PRODUCTS – THIS SECTION NOT USED**

4

5

6 **PART 3 – EXECUTION – THIS SECTION NOT USED**

7

8

9

END OF SECTION

SECTION 01 50 00
TEMPORARY FACILITIES AND CONTROLS

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27

PART 1 – GENERAL

1.1. SUMMARY

- A. This Section includes general procedural requirements for temporary facilities and controls including, but not limited to the following:
1. Temporary Utilities
 2. Telecommunications Services
 3. Temporary Sanitary Facilities
 4. Barriers
 5. Fencing
 6. Exterior Enclosures
 7. Security
 8. Vehicular Access and Parking
 6. Waste Removal
 7. Project Identification
 8. Field Offices

1.2. RELATED SPECIFICATION SECTIONS

- A. Section 01 31 19 Progress Meetings
B. Section 01 31 23 Project Management Web Site
C. Section 01 74 19 Construction Waste Management and Disposal

1.3. QUALITY ASSURANCE

- A. Regulations: Comply with industry standards and applicable laws and regulations if authorities having jurisdiction, including but not limited to:
1. Building Code requirements
 2. Health and safety regulations
 3. Utility company regulations
 4. Police, Fire Department and Rescue Squad rules
 5. Environmental protection regulations
 6. Joint Commission - Hospital Accreditation Standards

- 1 B. Standards: Comply with NFPA 241 "Standard for Safeguarding Construction, Alterations, and Demolition
2 Operations," ANSI A10 Series standards for "Safety Requirements for Construction and Demolition," and NECA
3 Electrical Design Library "Temporary Electrical Facilities".
4 C. Electrical Service: Comply with NEMA, NECA, and UL standards and regulations for temporary electric service.
5 Install service in compliance with NFPA 70 "National Electric Code".
6

7 **1.4. TEMPORARY UTILITIES**

- 8 A. Owner will provide the following:
9 1. Electrical power and metering, consisting of existing facilities.
10 2. Water supply, consisting of existing facilities.
11 B. General:
12 1. Existing facilities may be used.
13 2. New permanent facilities may be used.
14 C. Water Service: water is available from existing building services.
15 1. Use trigger-operated nozzles for water hoses, to avoid waste of water.
16 D. Temporary Electric Power Service: Electrical Contractor shall extend temporary power from existing building
17 services.
18 E. Temporary Lighting: Electrical Contractor shall provide temporary lighting with local switching
19 1. Install and operate temporary lighting, minimum of 30 fc, to fulfill security and protection requirements,
20 without operating the entire system, and will provide adequate illumination for all areas of work,
21 including construction operations and traffic conditions.
22 F. Temporary Heat: General Contractor shall provide temporary heat required by construction activities, for curing
23 or drying of completed installations or protection of installed construction from adverse effects of low
24 temperatures or high humidity. Select safe equipment that will not have a harmful effect on completed
25 installations or elements being installed. Coordinate ventilation requirements to produce the ambient condition
26 required and minimize consumption of energy.
27 1. Heating Facilities: Except where use of the permanent system is authorized, provide vented self-
28 contained LP gas or fuel oil heaters with individual space thermostatic control.
29 a. Use of gasoline-burning space heaters, open flame, or salamander type heating units is
30 prohibited.
31

32 **1.5. TELECOMMUNICATIONS SERVICES AND WI-FI**

- 33 A. Provide, maintain, and pay for telecommunications services to field office at time of project mobilization through
34 construction closeout.
35 B. Telecommunications services shall include:
36 1. Windows-based personal computer dedicated to project telecommunications.
37 2. Shared access to the internet via WIFI or similar wireless connection.
38 a. Access must be capable to support minimum of <10> wireless devices.
39 3. Email Account/address dedicated for GC Project Manager of GC Supervisor on site.
40

41 **1.6. TEMPORARY SANITARY FACILITIES**

- 42 A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.
43 B. Temporary toilets: Comply with regulations and health codes for the type, number, location, operation, and
44 maintenance of fixtures and facilities. Install where facilities will best serve the Project's needs.
45 1. Provide toilet tissue, paper towels, paper cups, and similar disposable materials for each facility. Provide
46 covered waste containers for used material.
47 2. Toilets: Install self-contained toilet units. Shield toilets to ensure privacy.
48 C. Maintain daily in clean and sanitary condition
49 D. Water: Provide potable water approved by local health authorities
50

51 **1.7. BARRIERS**

- 52 A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be
53 hazardous to workers or the public and to protect existing facilities and adjacent properties from damage from
54 construction operations and demolition.
55

56 **1.8. FENCING**

- 57 A. Construction: Refer to Plan Documents and Specification Section 01 76 00: Fencing Materials and Barricades
58

1 **1.9. EXTERIOR ENCLOSURES**

- 2 A. Provide temporary weather tight closure of exterior openings to accommodate acceptable working conditions
3 and protection for Products, to allow for temporary heating and maintenance of required ambient temperatures
4 identified in individual specification sections, and to prevent entry of unauthorized persons. Provide access doors
5 with self-closing hardware and locks.
6

7 **1.10. SECURITY**

- 8 A. Provide security and facilities to protect Work, existing facilities, and Owner's operations from unauthorized
9 entry, vandalism, or theft.
10

11 **1.11. VEHICULAR ACCESS AND PARKING**

- 12 A. Comply with regulations relating to use of streets and sidewalks, access to emergency facilities, and access for
13 emergency vehicles.
14 B. Coordinate access and haul routes with governing authorities and Owner.
15 C. Provide and maintain access to fire hydrants, free of obstructions.
16 D. Existing parking areas located at 1101 E Washington Ave may NOT be used for construction parking.
17

18 **1.12. WASTE REMOVAL**

- 19 A. See Section 01 74 19 - Waste Management, for additional requirements.
20 B. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.
21 C. Provide containers with lids. Remove trash from site periodically.
22 D. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible
23 containers; locate containers holding flammable material outside the structure unless otherwise approved by the
24 authorities having jurisdiction.
25 E. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.
26

27 **1.13. PROJECT IDENTIFICATION**

- 28 A. Provide project identification sign of design and construction indicated in Section 01 58 13.
29 B. Erect on site at location determined by Owner .
30 C. No other signs are allowed without Owner permission except those required by law.
31

32 **1.14. FIELD OFFICES**

- 33 A. Office: Weather tight, with lighting, electrical outlets, heating, cooling equipment, and equipped with sturdy
34 furniture, drawing rack and drawing display table.
35 B. Field Office shall be located at project site .
36 C. Provide space for Project Meetings with table and chairs to accommodate a minimum of <fifteen (15)> persons.
37 D. Provide a minimum of a 40" LCD monitor or other digital projection device to be connected to the computer
38 identified in Section 1.4 Telecommunications Services (above), for use during progress meetings in connection
39 with reviewing construction progress information posted to the Project Management Web Site (Specification 01
40 31 23) hosted by the Owner.
41

42 **PART 2 - PRODUCTS**

43
44 **2.1. TEMPORARY PARTITIONS**

- 45 A. Provide dustproof partitions to limit dust and dirt migration and to separate occupied areas from fumes and
46 noise.
47 1. Non-fire rated partitions, standard
48 a. Wood stud framing, 6-mil polyethylene
49

50 **2.2. EQUIPMENT**

- 51 A. Temporary Lifts and Hoists: Contractors requiring temporary lifts and hoists shall provide facilities for hoisting
52 materials and employees.
53 B. Electrical Outlets: Electrical Contractor shall provide properly configured NEMA polarized outlets to prevent
54 insertion of 110-120 volt plugs into higher voltage outlets. Provide receptacle outlets equipped with ground-fault
55 circuit interrupters, reset button and pilot light, for connection of power tools and equipment.
56 C. Electrical Power Cords: Contractors requiring power cords shall provide grounded extension cords; use "hard-
57 service" cords where exposed to abrasion and traffic. Provide waterproof connectors to connect separate

- 1 lengths of electric cords, if single lengths will not reach areas where construction activities are in progress. Do
2 not exceed safe length-voltage ratio.
- 3 D. Lamps and Light Fixtures: Electrical Contractor shall provide general service incandescent lamps of wattage
4 required for adequate illumination. Provide guard cages or tempered glass enclosures, where exposed to
5 breakage. Provide exterior fixtures where exposed to moisture.
- 6 E. Heating Units: General Contractor shall provide temporary heating units that have been tested and labeled by
7 UL, FM or another recognized trade association related to the type of fuel being consumed.
- 8 F. First Aid Supplies: General Contractor shall provide first aid supplies complying with governing regulations.
- 9 G. Fire Extinguishers: General Contractor shall provide hand-carried, portable UL-rated, fire extinguishers of NFPA
10 recommended classes for the exposures, extinguishing agent and size required by location and class of fire
11 exposure.

12
13 **PART 3 - EXECUTION**

14
15 **3.1. TEMPORARY FIRE PROTECTION**

- 16 A. Until fire protection needs are supplied by permanent facilities, General Contractor shall install and maintain
17 temporary fire protection facilities of the types needed to protect against reasonably predictable and
18 controllable fire losses.
- 19 B. Comply with NFPA 10 "Standard for Portable Fire Extinguishers," and NFPA 241 "Standard for Safeguarding
20 Construction, Alterations and Demolition Operations".
- 21 C. Locate fire extinguishers where convenient and effective for their intended purpose.
- 22 D. Store combustible materials in containers in fire-safe locations.
- 23 E. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire protection facilities, stairways
24 and other access routes for fighting fires.
- 25 F. Prohibit smoking on the premises.
- 26 G. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition
27 according to requirements of authorities having jurisdiction.
- 28 H. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site
- 29 I. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods
30 and procedures. Post warnings and information.

31
32 **3.2. COLLECTION AND DISPOSAL OF WASTE**

- 33 A. Collect waste from construction areas and elsewhere daily
- 34 B. Comply with requirements of NFPA 241 for removal of combustible waste material and debris. Enforce
35 requirements strictly.
- 36 C. Do not hold materials more than 7 days during normal weather or 3 days when the temperature is expected to
37 rise above 80 deg F.
- 38 D. Handle hazardous, dangerous, or unsanitary waste materials separately from other waste by containerizing
39 properly. Dispose of material in a lawful manner.

40
41 **3.3. ENVIRONMENTAL PROTECTION**

- 42 A. Provide protection, operate temporary facilities and conduct construction in ways and by methods that comply
43 with environmental regulations, and minimize the possibility that air, waterways and subsoil might be
44 contaminated or polluted, or that other undesirable effects might result.
- 45 B. Avoid use of tools and equipment which produce harmful noise.
- 46 C. Restrict use of noise making tools and equipment to hours that will minimize complaints from persons or firms
47 near the site.

48
49 **3.4. REMOVAL OF TEMPORARY UTILITIES, FACILITIES, AND CONTROLS**

- 50 A. Remove temporary utilities, equipment, facilities, and materials prior to Substantial Completion inspection.
- 51 B. Remove underground installations to a minimum depth of 2 feet (600 mm). Grade site as indicated.
- 52 C. Clean and repair damage caused by installation or use of temporary work.
- 53 D. Restore existing facilities used during construction to original condition.
- 54 E. Restore new permanent facilities used during construction to specified condition.

55
56
57
58

END OF SECTION

SECTION 01 58 13
TEMPORARY PROJECT SIGNAGE

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PART 1 – GENERAL

1.1. SECTION INCLUDES

- A. Project identification sign.

1.2. QUALITY ASSURANCE

- A. Design sign and structure to withstand 50 miles/hr wind velocity.
- B. Sign Painter: Experienced as a professional sign painter for minimum three years.
- C. Finishes, Painting: Adequate to withstand weathering, fading, and chipping for duration of construction.

1.3. SUBMITTALS

- A. See Section 01 30 00 – Administrative Requirements for submittal procedures.
- B. Shop Drawing: Show content, layout, lettering, color, structure, sizes.

PART 2 - PRODUCTS

2.1. SIGN MATERIALS

- A. Structure and Framing: New, wood, structurally adequate.
- B. Sign Surfaces: Exterior grade plywood with medium density overlay, minimum 3/4" thick, standard large sizes to minimize joints.
- C. Rough Hardware: Galvanized

2.2. PROJECT IDENTIFICATION SIGN

- A. One painted sign, 32 sq ft area, bottom 6 feet above ground.
- B. Content:
 - 1. Project title, City of Madison, Metro Transit logo and name of Owner as indicated on Contract Documents.
 - 2. Names and title of Architect.
 - 3. Name of Prime Contractor.
 - 4. Full color project rendering from high resolution image as furnished by Architect.

PART 3 - EXECUTION

3.1. INSTALLATION

- A. Install project identification sign within 30 days after date fixed by Notice to Proceed.
- B. Erect at designated location.
- C. Install sign surface plumb and level, with butt joints. Anchor securely.

3.2. REMOVAL

- A. Remove sign, framing supports, and foundations at completion of Project and restore the area.

END OF SECTION

SECTION 01 60 00
PRODUCT REQUIREMENTS

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18

PART 1 – GENERAL

1.1. SUMMARY

- A. The purpose of this specification is to provide general guidelines and responsibilities related to the receiving, handling, and storage of all materials and products from arrival on the job site through installation.
1. Immediate inspection of delivered goods means a timely replacement if damaged.
 2. Proper storage helps prevent damage and loss by weather, vandalism, theft, and job site accidents.
 3. Proper storage helps with job site performance and safety.
 2. Proper handling helps prevent damage and job site accidents.
- B. Each Contractor shall be directly responsible for the receiving, handling, and storage of all materials and products associated with the Work of their Division or Trade.
- C. Each Contractor responsible for Work associated with Owner provided materials or products shall be responsible for the receiving, handling and storage of the material/product as outlined in Section 3.8 below..

1.2. RELATED SPECIFICATIONS

- A. Parts of this specification will reference articles within “The City of Madison Standard Specifications for Public Works Construction”.
1. Use the following link to access the Standard Specifications web page:
<http://www.cityofmadison.com/business/pw/specs.cfm>
 - a. Click on the “Part” chapter identified in the specification text. For example if the specification says “Refer to City of Madison Standard Specification 210.2” click the link for Part II, the Part II PDF will open.
 - b. Scroll through the index of Part II for specification 210.2 and click the text link which will take you to the referenced text.
 - c. City Standard Detail Drawings (SDD) may be located from the index in Part VIII.
- B. Section 01 57 21 Indoor Air Quality
- C. Section 01 74 13 Progress Cleaning
- D. Section 01 76 00 Protecting Installed Construction
- E. Other Divisions and Specifications that may address more specifically the requirements for the storage and handling of materials and products associated Work of other Divisions or Trades.

1.3. QUALITY ASSURANCE

- A. The GC shall be responsible for ensuring that these minimum storage and handling requirements are met by all contractors on the project site including but not limited to the following:
1. Receiving deliveries of materials, products, and equipment.
 - a. Inspect all deliveries upon arrival for damage, completeness, and compliance with the construction documents.
 - i. Deliveries shall remain in original packaging or crates, shipping manifest shall be kept with the delivery and the packaging shall have visible identification of the items within the packaging.

- 1 b. Immediately report any damaged products or equipment to the GC, begin arrangements for
2 immediate replacement.
- 3 c. Materials or equipment that have been damaged, are incomplete, or do not comply with the
4 construction documents shall not be permitted to be installed.
- 5 2. All materials and products shall be stored within the designated limits of the project site. Only store the
6 amount of material necessary for upcoming operations so as not to interfere with other construction
7 activities and access to Work by the Owner and Architect. Any offsite storage shall be at the expense of
8 the contractor storing the material or product. All offsite storage requirements shall comply with this
9 specification. All offsite storage of materials is subject to Owner Representative Quality Management
10 review at any time.
- 11 3. Large storage containers may be used but shall be weather tight, securable, placed on concrete blocks,
12 timbers, or jack stands and shall be level.
- 13 4. When lifting equipment is required the equipment rating shall be greater than the loading requirements
14 of the item being lifted. In addition all of the following shall apply as necessary:
15 a. Only designated and/or designed lift points shall be used.
16 b. Large items shall have tag lines and handlers at all times during lifting operations.
17 c. Lift at multiple points as needed to prevent bending.
- 18 5. Materials and products stored inside of the structure shall comply with all of the following:
19 a. Storage shall not be allowed to impede the flow of work in progress.
20 b. Storage shall not be allowed to hide completed work from review and inspections.
21 c. Storage shall not exceed the design loads of the structural components it is being stored upon.
- 22 6. All materials and products shall be stored according the manufacturers minimum recommended
23 requirements. All of the following shall be considered before storing any product or material:
24 a. Dust and dirt
25 b. Moisture and humidity, including rain and snow
26 c. Excessive temperatures, direct sun, etc
27 d. Product or material weight and size
28 e. Potential for breakage
29 f. Product incompatibility with other products such as corrosiveness, chemical reactions,
30 flammability, etc.
31 g. Product or material value and replacement cost
- 32 7. The Contractor shall be responsible for providing fully functional tarps or plastic wrap, to protect
33 materials and products from the weather. All coverings shall be free of large holes and tears, and shall be
34 tied, strapped, or weighted down to resist blowing.
- 35 8. The Contractor shall be responsible for any temporary heating, cooling, or other utility requirement that
36 may be associated with the storage of a material or product.
- 37 9. The Contractor shall be responsible for securing materials and products of value such as copper, A/V
38 equipment, etc. Such items shall be stored in securable shipping containers, job trailers or other such
39 storage devices. Container shall be kept secured when not in use.
- 40 B. The GC shall inspect the job site daily to ensure that all products and materials stay weather tight and are
41 secured against vandalism or theft as required by this specification.
- 42 C. The Owners Representative may at any time request improvements regarding storage of any material or product
43 being provided under these construction documents.
- 44

45 **PART 2 – PRODUCTS – THIS SECTION NOT USED**

46

47 **PART 3 - EXECUTION**

48

49 **3.1. GENERAL CONTRACTOR REQUIREMENTS**

- 50 A. Designate material storage and handling areas as needed including all of the following:
51 1. Designate specific areas of the site for delivery and storage of materials to be used during the execution
52 of the Work.
53 2. Designated areas shall not be located so as to interfere with the installation of any Work including Work
54 by others such as the installation of utilities or the maintenance of existing utilities. This shall include not
55 storing items in active utility easements as designated by the site plan.
- 56 B. Arrange for openings in the building as needed to allow delivery and installation of large items. Openings shall
57 be appropriately sized to include the use of booms, slings, and other such lifting devices that may be larger than
58 the item being installed.

- 1 1. When openings are required in completed Work (new or existing) the GC shall be responsible for
2 providing an appropriate opening and for restoring the opening to the original or better condition upon
3 completion. Restoration shall be weather tight and complete.
- 4 C. Repeated moving and handling of items being stored shall not be allowed. The GC shall be responsible for any
5 damage and replacement because of mishandling or excessive handling.
- 6
- 7 **3.2. BULK MATERIAL**
- 8 A. Bulk material such as sand, gravel, top soil and other types of fill shall be stored away from the construction area
9 and shall be stock piled as follows:
- 10 1. All bulk material shall be piled safely and efficiently in as small an area as practical. Only store the
11 amount of material necessary for upcoming operations so as not to interfere with other construction
12 activities and access to Work by the Owner and Architect.
- 13 2. All stock piles shall have silt fence/sock properly installed around the perimeter to prevent erosion and
14 loss of material. Refer to City of Madison Standard Specification Section 210.1(f) and other related
15 specification or details.
- 16 3. Fine grained material shall be protected with tarps to prevent blowing. Tarps shall be weighted or staked
17 to stay in place.
- 18 B. Bulk material such as brick, concrete block, stone, and other palletized materials shall be stored on original
19 shipping pallets until ready for use.
- 20
- 21 **3.3. DRY PACKAGED MATERIAL**
- 22 A. Dry packaged material such as cement, mortar, etc shall be stored on pallets, on slightly elevated ground or clear
23 stone pad to keep water away from the base of the material being stored. Protect from moisture.
- 24
- 25 **3.4. STRUCTURAL AND FRAMING MATERIAL**
- 26 A. All structural and framing material shall be stored in an organized manner arranged by type, size and dimension.
27 Materials shall be stored on pallets or timbers as necessary and shall not be allowed to lie directly on the ground.
- 28 B. Long and heavy items shall be supported at several points to prevent bending and warping.
- 29
- 30 **3.5. EQUIPMENT**
- 31 A. Equipment delivered to the site shall be stored away from all construction activities until the item can either be
32 moved inside or properly installed.
- 33 B. Equipment shall be stored on slightly elevated ground or clear stone pad to keep water away from the base of
34 the equipment.
- 35
- 36 **3.6. FINISH PRODUCTS**
- 37 A. Finish products such as flooring, tile, counters, lockers, toilets, partitions, lighting, and other similar items should
38 not be delivered and stored until the structure has been enclosed, is weather tight, temperature controlled and
39 the contractor is ready for such items to be installed.
- 40 1. Storage of finished products outside for any length of time shall not be allowed.
- 41 B. Products that cannot be stored inside the structure shall be stored in secured containers or job trailers until such
42 time as they are ready to be installed.
- 43 C. Products with a high potential for breakage such as glass, mirrors, tiles, toilet fixtures, etc. shall be stored with
44 additional protection as necessary such as but not limited to the following:
- 45 1. Store in original shipping containers until ready for installation.
- 46 2. Do not store in high traffic areas.
- 47 3. Shield with other materials such as cardboard, plywood, or similar products.
- 48
- 49 **3.7. DUCTWORK, PIPING, AND CONDUIT**
- 50 A. All piping and conduit shall be stored horizontally unless otherwise specified by the manufacturer or Division and
51 Trade Specifications.
- 52 1. Do not store directly on grade.
- 53 2. Cover metal pipes and tubes to prevent rust and corrosion, allow ventilation to prevent condensation.
- 54 3. Whenever possible use pipe stands for storing pipe and conduit to prevent tripping and rolling hazards.
- 55 B. All ductwork shall be stored horizontally or vertically as necessary unless otherwise specified by the
56 manufacturer or Division and Trade Specifications.
- 57 1. During storage, both ends of each duct shall be protected with plastic sheathing to prevent dust and dirt
58 from getting inside the duct. Sheathing shall be sufficiently taped to the duct.

- 1
- 2
- 3
- 4 **3.8. OWNER PROVIDED, CONTRACTOR INSTALLED EQUIPMENT**
- 5 A. Section 3.8.A. shall apply to all equipment being provided to any contractor directly from the Owner for
- 6 installation under the contract.
- 7 1. The Owner or Owners Representative shall do the following:
- 8 a. Inspect all deliveries upon receipt and notify manufacturer of any issues directly.
- 9 b. Review the received shipment with the contractor.
- 10 i. Only provide products or materials to the contractor that were not damaged through
- 11 shipping or handling.
- 12 ii. Confirm missing products or materials and anticipated delivery schedule if known.
- 13 2. The Contractor responsible for the installation of Work associated with Owner provided materials or
- 14 products shall “take ownership” and provide safe and secure storage and handling as previously
- 15 described within this specification.
- 16 i. The Contractor shall be liable for the repair or replacement of any material or product
- 17 damaged after taking ownership of the product from receipt through final acceptance.
- 18 B. Section 3.8.B. shall apply to all equipment being provided by the Owner but shipped directly to any sub-
- 19 contractor or the project site for installation under the contract.
- 20 1. The GC and/or Contractor responsible for the Work associated with the Owner provided materials or
- 21 products shall do the following:
- 22 a. Inspect all deliveries upon receipt and notify the Owner or Owners Representative of any issues
- 23 directly.
- 24 i. Owner or Owners Representative shall notify manufacturer of any issues directly.
- 25 b. Review the received shipment with the Owner or Owners Representative
- 26 i. Confirm missing products or materials and anticipated delivery schedule if known.
- 27 2. The Contractor shall “take ownership” and provide safe and secure storage and handling as previously
- 28 described within this specification.
- 29 i. The Contractor shall be liable for the repair or replacement of any material or product
- 30 damaged after taking ownership of the product from receipt through final acceptance.

31
32
33
34 **END OF SECTION**
35

**SECTION 01 71 23
FIELD ENGINEERING**

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PART 1 – GENERAL

1.1. REQUIREMENTS INCLUDED

- A. The Contractor shall provide and pay for field engineering services required for the Project:
1. Land surveying services required to execute the Work, to include building addition location and layout, and location and layout of pavements and all proposed site improvements.
 2. Verification of existing building dimensions, elevations, and relationship to proposed additions.
 3. Professional Engineering services to execute Contractor’s construction methods.
 4. Registered Professional Engineer in the State of Wisconsin to determine the load capacity of the existing structure for use of Contractors temporary facilities, equipment, lifts, machinery, material storage, etc.

1.2. RELATED REQUIREMENTS

- A. Conditions of the Contract

1.3. PROCEDURES

- A. A property survey has been prepared for the Owner and has been bound with Contract Drawings. Surveys shall describe physical characteristics, legal limitations and utility locations for the site of the Project, and a legal description of the site. If information is incomplete, notify Owner to furnish additional information. Verify easement locations, front, side, and rear yard restrictions, if any; and property line locations. Verify control points, and establish bench marks. Locate and layout roads, walks, parking areas and all civil structures and all proposed site improvements.
- B. Verify locations of underground services, utilities, structures, etc. which may be encountered or affected by the Work.

1.4. PROJECT SURVEY REQUIREMENTS

- A. Using datum, the lot lines and present levels have been established as indicated on the Drawings. Other grades, lines, levels and benchmarks, shall be established and maintained by the Contractor, who shall be responsible for them. As work progresses, the Contractor shall layout on forms and floor, the locations of all partitions, walls and fix column centerlines as a guide to all trades. The Contractor shall make provision to preserve property line stakes, benchmarks, or datum point. If any are lost, displaced or disturbed through neglect of any Contractor, Contractor’s agents or employee, the Contractor responsible shall pay the cost of restoration.
- B. Establish lines and levels, locate and layout, by instrumentation and similar appropriate means, additions, column locations, floor levels, stakes for walks, etc.
- C. Provide data to all Subcontractors for their use as applicable.
- D. From time to time, verify layouts by same methods.

1.5. RECORDS

- A. Maintain a complete, accurate log of all control and survey work as it progresses.

PART 2 – PRODUCTS – THIS SECTION NOT USED

PART 3 – EXECUTION – THIS SECTION NOT USED

END OF SECTION

**SECTION 01 73 29
CUTTING AND PATCHING**

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PART 1 – GENERAL

1.1. SUMMARY

- A. This Section includes general procedural requirements for cutting and patching including, but not limited to the following:
1. Examination
 2. Preparation
 3. Performance
 4. Cleanup and Restoration

1.2. RELATED SPECIFICATION SECTIONS

- A. Divisions 02 through 32 Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.
- B. Division 07 Section "Penetration Fire Stopping" for patching fire-rated construction.

1.3. DEFINITIONS

- A. Cutting: Removal of in-place construction necessary to permit installation or performance of other Work.
- B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.
- C. Level Alpha

1.4. QUALITY ASSURANCE

- A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.
- B. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that may result in increased maintenance or decreased operational life or safety.
- C. Miscellaneous Elements: Do not cut and patch miscellaneous elements or related components in a manner that could change their load-carrying capacity that results in reducing their capacity to perform as intended, or that may result in increased maintenance or decreased operational life or safety. Some miscellaneous elements include the following:
1. Water, moisture, or vapor barriers
 2. Membranes and flashings
 3. Exterior curtain-wall construction
 4. Equipment supports
 5. Piping, ductwork, vessels, and equipment
 6. Noise and vibration control elements and systems
- D. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

1 **1.5. WARRANTY**

- 2 A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting
3 and patching operations, by methods and with materials so as not to void existing warranties.
4 B. All cutting and patching work performed under this contract shall be warranted like new work as defined by the
5 Specification governing the work.
6

7 **PART 2 - MATERIALS**

8
9 **2.1. GENERAL**

- 10 A. Comply with requirements specified within other sections of the Specifications.
11 B. In-Place Materials: Use materials identical to existing in-place materials. For exposed surfaces use materials that
12 visually match in-place adjacent surfaces to the fullest extent possible.
13 1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the
14 visual and functional performance of in-place materials.
15

16 **PART 3 - EXECUTION**

17
18 **3.1. EXAMINATION**

- 19 A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.
20 1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including
21 compatibility with in-place finishes or primers.
22 2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.
23

24 **3.2. PREPARATION**

- 25 A. Temporary Support: Provide temporary support of Work to be cut.
26 B. Protection: Protect in-place construction and existing conditions during cutting and patching to prevent damage.
27 Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting
28 and patching operations. If the failure to protect, or the lack of protection, of in-place construction and/or
29 existing conditions results in damage, the contractor shall be responsible for repair to previous condition.
30 C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
31 D. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be
32 removed, relocated, or abandoned, bypass such services/systems before cutting to eliminate interruption to
33 occupied areas.
34

35 **3.3. PERFORMANCE**

- 36 A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the
37 earliest feasible time, and complete without delay.
38 1. Cut in-place construction to provide for installation of other components or performance of other
39 construction, and subsequently patch as required to restore surfaces to their original condition.
40 B. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations,
41 including excavation, using methods least likely to damage elements retained or adjoining construction. If
42 possible, review proposed procedures with original Installer; comply with original Installer's written
43 recommendations.
44 1. In general, use hand or small power tools designed for sawing and grinding, not hammering and
45 chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance
46 of adjacent surfaces. Temporarily cover openings when not in use.
47 2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
48 3. Concrete or Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
49 4. Excavating and Backfilling: Comply with requirements in applicable Division 31 Sections where required by
50 cutting and patching operations.
51 5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap,
52 valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other
53 foreign matter after cutting.
54 6. Proceed with patching after construction operations requiring cutting are complete.
55 C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following
56 performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and
57 comply with installation requirements specified in other Sections.

1 D. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of
2 installation.
3

4 **3.4. CLEANUP AND RESTORATION**

5 A. Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a
6 manner that will eliminate evidence of patching and refinishing.

7 1. Clean piping, conduit, and similar features before applying paint or other finishing materials.

8 2. Restore damaged pipe covering to its original condition.

9 3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another,
10 patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish,
11 color, texture, and appearance. Remove in-place floor and wall coverings and replace with new
12 materials, if necessary, to achieve uniform color and appearance.

13 4. Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch
14 and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats
15 until patch blends with adjacent surfaces.

16 5. Ceilings: Patch, repair, or re-hang in-place ceilings as necessary to provide an even-plane surface of
17 uniform appearance.

18 6. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weather tight
19 condition.

20 7. Cleaning: Clean areas and spaces where cutting and patching are performed. Completely remove paint,
21 mortar, oils, putty, and similar materials.

22 8. Any smoke and fire caulking that has been disturbed must be replaced by the Contractor as required by
23 code.
24
25

26 **END OF SECTION**
27
28

**SECTION 01 74 13
PROGRESS CLEANING**

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13 3.3. PROGRESS CLEANING 2
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15 3.5. CALL BACK WORK 4
16

PART 1 – GENERAL

1.1. SUMMARY

- 20 A. Throughout the execution of this contract all contractors shall be responsible for maintaining the project site in a
21 standard of cleanliness as described in this specification.
22 B. All contractors shall also comply with the requirements for cleaning as described in other specifications.
23 C. Work included in this specification shall include but not be limited to:
24 1. Safety Cleaning
25 2. Project Site Cleaning
26 3. Progress Cleaning
27 4. Final Cleaning
28

1.2. RELATED SPECIFICAITONS

- 30 A. Section 01 35 00 Special Procedures
31 B. Section 01 60 00 Product Requirements
32 C. Section 01 74 19 Construction Waste Management and Disposal
33 D. Section 01 76 00 Protecting Installed Construction
34

1.3. QUALITY ASSURANCE

- 36 A. The General Contractor (GC) shall conduct daily inspections, more often if necessary, of the entire project site to
37 ensure the requirements of cleanliness are being met as described within these specifications.
38 B. All contractors shall comply with other regulatory requirements as they apply to waste recycling, reuse, hauling,
39 and disposal requirements of any governmental authority having jurisdiction.
40 C. The Owner reserves the right to have work done by others in the event any contractor fails to perform cleaning
41 as described within these specifications. The cost of any Owner provided cleaning shall be charged to the
42 contractor through a deduct change order.
43

PART 2 - PRODUCTS

2.1. CLEANING MATERIALS AND EQUIPMENT

- 47 A. The Contractor shall provide all required personnel, equipment, and materials necessary to maintain the
48 required level of cleanliness as described in this specification.
49 B. Use only cleaning materials and equipment that are compatible with the surface being cleaned, as
50 recommended by the manufacturer, or as approved by the A/E.
51 C. Use only cleaning materials, equipment, and methods as recommended in the manufacturers care and use guide
52 of the material, finish or equipment being cleaned.
53

PART 3 - EXECUTION

3.1. SAFETY CLEANING

- 57 A. All Contractors shall be responsible for safety cleaning as required by OSHA and other regulatory requirements
58 as applicable.

- 1 B. Safety Cleaning shall include but not be limited to the following:
2 1. All work areas, passageways, ramps, and stairs shall be kept free of debris, scrap materials, pallets, and
3 other large items that would obstruct exiting routes. Small items such as tools, electrical cords, etc are
4 picked up when not in use.
5 2. Form and scrap lumber shall have nails/screws removed or bent over. Lumber shall be neatly stacked in
6 an area designated by the GC.
7 3. Spills of oil, grease, and other such liquids shall be cleaned immediately or sprinkled with sand/oil-dry
8 first, then cleaned.
9 4. Oily, flammable, or hazardous items shall be stored in appropriate covered containers and storage
10 devices unless actively being used.
11 5. Oily, or flammable rags, and other such waste shall only be disposed of in authorized covered containers.
12 6. Disposal by burning shall not be allowed at any time.

13
14 **3.2. PROJECT SITE CLEANING**

- 15 A. This section applies to the general cleanliness of the project site as a whole for the duration of the execution of
16 this contract.
17 B. Exterior Project Site Areas
18 1. The GC and other Contractors as appropriate shall ensure the following levels of cleanliness are applied
19 to the exterior project site areas.
20 a. The overall appearance of the project site is neat and orderly. Defined areas for material storage,
21 material waste, job trailers, and the project area are clean and well maintained.
22 b. The construction fence is maintained, erect with no gaps, and properly posted per all regulatory
23 requirements.
24 c. All erosion control measures are properly maintained, cleaned, and repaired as necessary.
25 d. All loose materials (construction or waste) are properly tied or weighted down to resist blowing.
26 e. All construction materials are properly covered with fully functional tarps or plastic wrap,
27 protected from the weather, coverings are tied, strapped, or weighted down to resist blowing.
28 f. Dust control is applied as necessary or as required by any regulatory requirement.
29 C. Interior Project Site Areas
30 1. All Contractors shall ensure the following levels of cleanliness are applied to the interior project site
31 areas.
32 a. The overall appearance of the project site is neat and orderly. Defined areas for material storage,
33 material waste, and project area are clean and well maintained.
34 b. Stored materials are kept in original shipping containers whenever possible. Stored materials not
35 in shipping containers are properly stored and protected according to other applicable
36 specifications.
37 c. All scraps and debris shall be properly disposed of as often as necessary to keep work areas,
38 passageways, stairs, and ramps free of debris and clear for emergency exiting.
39 d. Boxes, pallets, and other such shipping containers, are broken down, stored in a consolidated area
40 or, disposed of as often as is necessary.
41 e. Hand tools, supplies, materials, electrical cords not being used are picked up and stored in gang
42 boxes, not left as walking hazards in work areas, passageways, etc.
43 D. Job Trailer
44 1. The interior of the job trailer shall be kept clean and available as a work space at all times. The GC shall
45 ensure that the following is provided for within the job trailer:
46 a. Meeting space including tables and chairs.
47 b. Sufficient space for all contractors to access the official construction documents, provide updates,
48 etc.

49
50 **3.3. PROGRESS CLEANING**

- 51 A. This sub-section shall apply to all Progress Cleaning prior to the installation of finishes, fixtures, and trim (IE
52 rough-in).
53 1. For the purposes of this section "clean" shall be defined as a level of cleanliness free of dust and other
54 material capable of being removed by use of reasonable effort using a good quality janitor broom and
55 shop-vac.
56 2. Daily cleanings shall be conducted by all contractors at the end of the work day as follows:
57 a. Debris in excavated areas shall be removed prior to backfill and compaction.
58 b. Debris in wall cavities, chase spaces, etc shall be removed prior to enclosing the spaces.

- 1 c. Large items shall be properly stored, returned to designated areas, or disposed of as necessary.
2 d. Loose materials shall be properly secured.
3 e. Flammable or hazardous materials are properly stored or disposed of.
4 3. Weekly cleaning shall be conducted by all contractors as designated by the GC. Weekly cleanings shall
5 include all the above for a daily cleaning and other necessary cleaning as designated by the GC.
6 B. This sub-section shall apply to Progress Cleaning in preparation for the installation of finishes, fixtures, and trim.
7 a. Surfaces receiving finishes shall be thoroughly cleaned prior to contractors applying finish
8 materials. The GC shall be responsible for inspecting the area and surfaces being cleaned for
9 finish prior to the sub-contractor applying the finish. This shall include but not be limited to the
10 following:
11 i. Wall surfaces shall be wiped clean of dirt and oily residues, vacuumed free of dust, and
12 shall be free of surface imperfections prior to painting or installing wall coverings.
13 ii. Metal surfaces shall be wiped clean of dirt and oily residues, and be free of surface
14 imperfections prior to painting.
15 iii. Flooring shall be broom swept of large and loose items then vacuumed clean of dust and
16 small particles, and damp mopped clean and dried prior to installing any flooring finish.
17 Additional cleaning may be required depending on the preparation requirements
18 recommended by the flooring material manufacturer.
19 C. This sub-section shall apply to Progress Cleaning after the installation of finishes, fixtures, and trim.
20 1. For the purposes of this section "clean" shall be defined as a level of cleanliness free of dust and other
21 material capable of damaging or visually disfiguring finished work, finishes, fixtures, and trim.
22 2. Progress Cleaning at this point in the contract shall be conducted immediately as follows:
23 a. Dust, dirt, etc shall be swept and vacuumed off of finish flooring and trim.
24 b. Liquid spills shall be cleaned up according to the spill type. This shall include drips and spills
25 caused by paint, stain, sealants, and other such items.
26 3. The Contractor(s) at no additional cost to the Owner shall be responsible for replacing any finished work,
27 finishes, fixtures, and trim damaged or disfigured because of inadequate or improper cleaning.
28

29 **3.4. FINAL CLEANING**

- 30 A. As noted in Specification 01 29 76 Progress Payment Procedures, Progress Payment Milestone Schedule, Final
31 Cleaning shall not be conducted prior to requesting the 90% contract total progress payment and all of the
32 following shall be complete:
33 1. All final regulatory inspections including but not limited to Building Inspection Department and Madison
34 Fire Department inspections have been successfully completed.
35 2. All Quality Management Observation (QMO) reports have been closed out.
36 3. All Demonstration and Training has been completed.
37 4. All Attic Stock has been consolidated and located to its designated area
38 5. All protection for installed construction shall be removed prior to final cleaning by the contractor
39 responsible for providing the protections. This shall include the removal of any adhesive residues left
40 behind from tapes. Contractors shall only use manufacturer authorized cleaning materials for removing
41 adhesives, etc.
42 B. For the purposes of this section "clean" shall be defined as a level of cleanliness generally provided by skilled
43 cleaners using commercial quality building maintenance equipment and materials.
44 C. The GC shall be responsible for ensuring that all requirements under this section are being met.
45 D. General Requirements
46 1. Employ experienced personnel or professional cleaners for final cleaning as necessary for the areas or
47 equipment being cleaned.
48 2. Cleaning equipment used shall be commercial grade equipment commonly used by professional cleaners.
49 3. Cleaning equipment and materials shall be cleaned, rinsed, or replaced to ensure a uniform level of
50 cleanliness is being maintained during the final cleaning. This shall include but not be limited to the
51 following:
52 a. Vacuum cleaner bags and/or filters are changed and/or cleaned as often as necessary.
53 b. Dust & wipe down rags are washed, rinsed, or replaced before starting each room.
54 c. Mopping equipment
55 i. Mop water for washing shall have cleaning solution added to the amount and temperature
56 per manufacturer's recommendations. Mop washing water shall be replaced often to
57 maintain the levels of the cleaning solution and temperature required.
58 ii. Mop water for rinsing shall remain clean, clear, and be replaced as often as necessary.

- 1 iii. Mop heads shall be rinsed often and replaced as necessary.
- 2 iv. Mop heads and buckets shall be thoroughly rinsed with each change of water.
- 3 v. Only new mop heads shall be used for rinsing.
- 4 E. Refer to all other specifications in this contract for specific requirements regarding final cleaning of finishes,
5 fixtures, equipment, etc.
- 6 F. Exterior Cleaning shall include but not be limited to the following:
 - 7 1. All exterior glazing surfaces have been professionally cleaned and are free of dust and streaking.
 - 8 2. Metal roofs, siding, and other surfaces shall be clean of dirt and free of splashed or excess materials such
9 as sealants, mortar, paint, etc.
 - 10 3. All exterior furnishings shall be clean, waste receptacles shall be empty.
 - 11 4. Paved areas shall be clean, free of dirt, oily stains and other such blemishes
 - 12 5. Exterior lights and diffusers are clean and free of dust.
- 13 G. Interior Cleaning shall include but not be limited to the following:
 - 14 1. Remove all labels, stickers, tags, and other such items which are not required by code as permanent
15 labels.
 - 16 2. All interior glazing surfaces, including mirrors, have been professionally cleaned and are free of dust and
17 streaking.
 - 18 3. All interior surfaces have been cleaned of excess materials such as paint, sealants, etc and have been
19 wiped free of dust.
 - 20 4. Interior metals, fixtures, and trim have been cleaned free of dust and oily residues
 - 21 5. Carpet flooring has been thoroughly cleaned; vacuumed free of dust, excess glues and other stains
22 removed per manufacturers use and care instructions.
 - 23 6. Resilient flooring has been thoroughly cleaned; vacuumed free of dust, excess glues and other stains
24 removed, mopped and buffed per manufacturers use and care instructions.
 - 25 7. Interior non-occupied concrete floors shall be broom cleaned, vacuumed free of dust, excess glues and
26 other stains removed per manufacturers use and care instructions.
 - 27 8. Light fixtures, lamps, diffusers and other such items have been dusted and cleaned as necessary.
 - 28

29 **3.5. CALL BACK WORK**

- 30 A. The GC shall be responsible for ensuring that any contractor returning to the project site for completion or
31 correction work has re-cleaned and restored the area to the levels described in section 3.4 above upon
32 completion of the work. This shall include but not be limited to the following:
 - 33 1. The immediate area(s) where work was completed.
 - 34 2. Adjacent areas where dust or debris may have traveled.
 - 35 3. Other areas occupied during the completion of the call back work.
 - 36 4. Path of entrance/exit, to/from the area(s) of work.
 - 37
 - 38
 - 39

40 **END OF SECTION**

41

**SECTION 01 74 19
 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL**

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PART 1 – GENERAL

1.1. SUMMARY

- A. This specification includes administrative and procedural requirements for the recycling, re-use, salvaging, and disposal of non-hazardous construction and demolition waste.
- B. The General Contractor (GC) shall be fully responsible for complying with all applicable ordinances and other such regulatory requirements during the execution of this contract.

1.2. RELATED SPECIFICAITONS

- A. 01 29 76 Progress Payment Procedures
- B. 01 31 23 Project Management Web site
- C. 01 32 19 Submittals Schedule
- D. 01 33 23 Submittals
- E. 01 77 00 Closeout Procedures
- F. Other Divisions and Specifications that may address the proper disposal of construction or demolition waste as it pertains to work being conducted under that particular specification.

1.3. CITY ORDINANCES

- A. There are two (2) Madison General Ordinances (MGO) that the City of Madison has regarding construction and demolition waste.
 - 1. MGO 10.185, Recycling and Reuse of Construction and Demolition Debris, describes the requirements associated with this ordinance including definitions, documentation requirements, and penalties.
 - 2. MGO 28.185, Approval of Demolition (Razing, Wrecking) and Removal, describes the requirements associated with applying for and receiving a demolition permit.
- B. All City of Madison, Board of Public Works, contracts being conducted by City Engineering, Facility Management, for construction, remodeling, or demolition shall comply with the above ordinances regardless of project type or size.

1.4. DEFINITIONS

- A. Clean: Untreated and unpainted material, free of contamination caused by oils, solvents, caulks, and other chemicals.
- B. Construction and Demolition Debris: Materials resulting from the construction, remodeling, repair, and demolition of utilities, structures, buildings, and roads.
- C. Disposal: Off-site removal of construction and demolition debris and the subsequent sale, recycling, reuse, or deposit in authorized landfill or incinerator.
- D. Hazardous: Exhibiting the characteristics of hazardous substance, i.e. ignitability, corrosiveness, toxicity, or reactivity and including but not limited to asbestos containing materials, lead, mercury and PCBs.
- E. Non-hazardous: Exhibiting none of the characteristics of a hazardous substance.

- 1 F. Nontoxic: Not immediately poisonous to humans or poisonous after a long period of exposure.
- 2 G. Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured
- 3 into a new product.
- 4 H. Recycle: Any process by which construction or demolition debris is diverted from final disposal as solid waste at
- 5 a permitted landfill and instead is collected, separated, and/or processed into raw materials for new, reused, or
- 6 reconstituted products; or for the recovery of materials for energy production processes.
- 7 I. Recycler: Any recycling facility, transfer station, or other waste handling facility which accepts construction and
- 8 demolition debris for recycling, or for other transferring to a recycling facility.
- 9 J. Recycling: The process of sorting, cleaning, treating, or reconstituting solid waste and other discarded materials
- 10 for the purpose of preparing the material to be recyclable. Recycling does not include burning, incinerating or
- 11 thermally destroying waste.
- 12 K. Return: To give back reusable items or unused products to vendors for credit.
- 13 L. Reuse: Shall mean any of the following:
- 14 1. The on-site use of reprocessed construction and demolitions debris.
- 15 2. The off-site redistribution of a material, for use in the same manner or similar manner at another
- 16 location.
- 17 3. The use of non-toxic, clean wood as an alternative fuel source.
- 18 M. Salvage: To remove a waste material from the project site for resale or reuse by the Owner or others.
- 19 N. Toxic: Poisonous to humans either immediately or after a long period of exposure.
- 20 O. Trash: Any product or material unable to be re-used, returned, recycled, or salvaged.
- 21 P. Waste: Extra materials or products that have reached the end of its useful life or its intended use. Waste
- 22 includes salvageable, returnable, recyclable and re-useable construction and demolition materials, and trash.
- 23

24 **1.5. PERFORMANCE REQUIREMENTS**

- 25 A. The GC shall develop a Waste Management Plan that results in end-of-project rates for salvage/recycling/reuse
- 26 of 95 percent (minimum) by weight of the total waste generated by the Work. Percentages may be adjusted on
- 27 a project by project basis depending on selected LEED goals associated with the project.
- 28 B. The GC shall salvage or recycle 100 percent of all uncontaminated packaging materials including but not limited
- 29 to the following:
- 30 1. Paper
- 31 2. Cardboard
- 32 3. Beverage containers
- 33 4. Boxes
- 34 5. Plastic Sheet and film
- 35 6. Polystyrene packaging
- 36 7. Wood crates and pallets
- 37 8. Plastic pails and buckets
- 38 C. Promote a resourceful use of supplies and materials through proper planning and handling. Generate the least
- 39 amount of waste possible by minimizing errors, poor planning, breakage, mishandling, contamination or other
- 40 similar factors.
- 41 D. Use all reasonable means to divert construction waste from landfills and incinerators through recycling, reuse, or
- 42 salvage as appropriate.
- 43

44 **1.6. SUBMITTALS AND DELIVERABLES**

- 45 A. The GC shall provide his/her completed Waste Management Plan to the Project Management Web Site as a
- 46 submittal for review by the Project Architect and City Project Manager.
- 47 1. See item 1.8 below for Waste Management Plan submittal requirements.
- 48 2. The Waste Management Plan shall be completed, submitted, and approved as a pre-requisite for
- 49 Progress Payment number 1.
- 50 3. Copies of all documentation required by this specification shall be submitted to the appropriate Project
- 51 Management Web Site Library. Documentation shall be reviewed by the City Project Manager during all
- 52 Progress Payment reviews for compliance and accuracy.
- 53 B. The Waste Management Coordinator shall provide copies of items 1 through 5 below to the appropriate Project
- 54 Management Web Site Library and shall update the Waste Management Summary Log to reflect the records
- 55 being submitted.
- 56 1. Records of Donations: Indicate receipt and acceptance of itemized salvageable waste donated to
- 57 individuals or organizations. Indicate if the organization is tax exempt.

- 1 2. Records of Sales: Indicate receipt and acceptance of itemized salvageable waste sold to individuals or
2 organizations. Indicate if the organization is tax exempt.
- 3 3. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by
4 recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts and
5 invoices.
- 6 4. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and
7 incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts and invoices.
- 8 5. Statement of Refrigerant Recovery: The Refrigerant Recovery Technician responsible for recovering
9 refrigerant shall provide the GC with a statement indicating all of the following:
10 a. All recovery was performed according to EPA Regulations.
11 b. All refrigerant present was recovered; indicate the total quantity recovered by unit.
12 c. Date of Recovery.
13 d. Name, address, company name, and phone number of technician performing the recovery.
14 e. Technician shall sign and date the statement.
- 15 C. LEED Submittal: The GC shall provide the following information using the appropriate LEED letter template upon
16 project completion: indicating that the requirements of the credit have been met. *NOTE: This requirement shall*
17 *only apply to projects having a LEED certification goal.*
18 1. Total waste material generated.
19 2. Total waste material diverted by diversion method; recycling, salvage, re-use, etc.
20 3. Statement that the credit requirements have been met.
21 4. GC shall sign the letter.

22
23 **1.7. QUALITY ASSURANCE**

- 24 A. Waste Management Coordinator: The GC shall be responsible for designating a Waste Management
25 Coordinator. Coordinator may be the GC Supervisor, GC Project Manager or other member of the GC staff
26 having knowledge of proper waste management procedures and all applicable regulations.
- 27 B. Regulatory Requirements: comply with all hauling and disposal regulations of authorities having jurisdiction.
- 28 C. The Waste Management Coordinator shall comply with Specification 01 31 19 Project Meetings, Section 3.7.B.1
29 and conduct a Waste Management Conference at the job site. This conference shall be repeated as necessary as
30 additional trades are added to the Work. The conference shall include but not be limited to the following:
31 1. Identify the Waste Management Coordinator; provide trade contractors with name, phone, and email
32 information.
33 2. Review and discuss the Waste Management Plan and the roles of the Coordinator.
34 3. Review the requirements for documenting and reporting procedures of each type of waste and its
35 disposition.
36 4. Review procedures for material separation; indicate availability and locations of containers and bins.
37 5. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
38 6. Review waste management procedures specific to each trade.
- 39 D. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.

40
41 **1.8. WASTE MANAGEMENT PLAN**

- 42 A. Develop a plan consisting of waste identification, a waste reduction work plan, and cost/revenue analysis.
43 Indicate quantities by weight or volume. Use the same units of measure throughout the waste management
44 plan.
45 1. Waste Identification: Indicate anticipated types and quantities of site clearing, demolition waste, and
46 construction waste that will be generated during the execution of this contract. Include assumptions for
47 the estimates.
- 48 2. Waste Reduction Work Plan: The work plan shall consist of but not be limited to all of the following:
49 a. Identify methods for reducing construction waste. Re-using, framing and forming materials, re-
50 planning material cuts to minimize waste, etc.
51 b. Identify what types of materials will be recycled. Provide lists of local companies that receive
52 and/or process the materials. Include names, addresses, and phone numbers.
53 c. Identify what types of materials will be disposed of and whether it will be disposed of in a landfill
54 facility or by incineration facility. Provide lists of local companies that receive and/or process the
55 materials. Include names, addresses, and phone numbers.
56 d. Identify methods to be used on site for separating waste including all of the following:
57 i. Sizes of containers to be used.
58 ii. Labels to be used on the containers to identify the type of waste allowed in the container.

- 1 iii. Designated locations on the project site for waste material containers.
2 B. If project requires demolition incorporate the ordinance required (MGO 28.185) Recycling and Reuse Plan into
3 the Waste Management Plan.
4 C. Provide all of the following for the Waste Management Coordinator:
5 1. Name, employer, employer address, phone number, and email address of the designated coordinator.
6 a. The GC shall also provide this information with the required Project Directory Submittal at the
7 beginning of the project.
8 D. If at the option of the GC, he/she chooses to contract with a Waste Management Disposal Company that allows
9 comingled and unsorted waste materials, the GC shall include with his/her Waste Management Plan the
10 following:
11 1. Name, address, phone number, state permitting information, and other pertinent information about the
12 disposal company.
13 2. Documentation from the disposal company indicating company policies and procedures regarding
14 comingled and unsorted waste materials to include:
15 a. GC responsibilities on the project site.
16 b. Disposal company procedures for receiving, sorting, recycling, and disposing of comingled and
17 unsorted waste material.
18

19 **PART 2 – PRODUCTS – THIS SECTION NOT USED**

20
21 **PART 3 - EXECUTION**

22
23 **3.1. PLAN IMPLEMENTATION**

- 24 A. Implement the approved waste management plan. Provide adequate containers, storage space, signage,
25 transportation and other items required to implement the plan during the execution of this contract.
26 B. The GC and Waste Management Coordinator shall be responsible for monitoring and reporting the status of the
27 Waste Management Plan and shall monitor the waste management practices on site as frequently as needed.
28 C. Train all workers, sub-contractors, and suppliers on proper waste management procedures as appropriate for
29 the work being conducted on the project site.
30 1. Distribute the waste management plan to everyone concerned within seven (7) days of submittal
31 approval.
32 2. Distribute the waste management plan to new workers, sub-contractors, and suppliers when they first
33 appear on the project site.
34 3. Conduct additional training as needed during the execution of the contract to keep a positive focus on
35 the waste management plan.
36 D. Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways,
37 and other adjacent and used facilities.
38 1. Designate and label specific areas on the project site necessary for separating materials to be salvaged,
39 recycled, reused, donated, and sold.
40 2. Comply with any specification or regulatory requirements pertaining to dust, dirt, environmental
41 protection, and noise control.
42

43 **3.2. HAZARDOUS AND TOXIC WASTE**

- 44 A. The Owner shall be responsible under separate contract for the removal of any asbestos related materials. All
45 other materials shall be removed by the GC.
46 B. All hazardous and toxic waste shall be separated, stored, and disposed of according to all applicable regulations.
47 C. All hazardous and toxic materials on site shall have a Material Safety and Data Sheet (MSDS) available that
48 indicates storage requirements, emergency information, and disposal requirements as necessary.
49

50 **3.3. GENERAL GUIDELINES FOR ALL WASTES**

- 51 A. Recycle all paper and beverage containers used by workers, sub-contractors, suppliers and visitors to the project
52 site.
53 B. All revenues, savings, rebates, tax credits, and other such incentives received from recycling, reusing, or
54 salvaging waste materials shall accrue to the GC unless specified otherwise in the contract documents.
55 C. Separate recyclable, reusable, and salvageable waste from other waste materials, trash, and debris except where
56 Waste Management Disposal Company allows comingled waste materials, see section 1.8.D above.
57 1. Separate by type in appropriate containers or designated areas according to the approved waste
58 management plan away from the construction area. Do not store within the drip lines of existing trees.

- 1 2. Inspect containers and bins frequently for contamination and inappropriately sorted materials. Remove
- 2 contaminated materials and resort as necessary.
- 3 3. Stockpile bulk materials such as sand, topsoil, stone, etc., on site away from the construction area and
- 4 without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water, and
- 5 cover to prevent windblown dust. Do not store within the drip lines of existing trees.
- 6 4. Whenever possible store items off the ground and/or protect them from the weather.
- 7

8 **3.4. GUIDELINES FOR RECYCLABLE, RE-USABLE, AND SALVAGEABLE WASTE**

- 9 A. The following guidelines is not a complete or all inclusive list and shall be adjusted as needed by the methods
- 10 and procedures identified in the Waste Management Plan.
- 11 B. Asphalt Paving: Break-up into transportable pieces or grind, transport to an authorized recycling facility.
- 12 C. Carpet and Pad: Separate carpet and pad scraps, containerize and transport to an authorized recycling facility.
- 13 D. Ceiling System Components: Suspended ceiling system components shall be sorted by material type as follows:
- 14 1. Broken, cut, or damaged tiles shall be containerized, transport to an authorized recycling facility.
- 15 2. Damaged, or cut tracks, trim and other metal grid system components shall be sorted with other metals
- 16 of similar types, palletize, transport to an authorized recycling facility.
- 17 E. Clean Fill: When allowed by Division 31 Specifications; concrete, masonry, stone, asphalt pavement, sand and
- 18 other such materials may be used as clean fill on this project site. The GC shall verify with the Project Architect,
- 19 Structural Engineer, or Civil Engineer as necessary prior to using any materials as clean fill. Materials shall be
- 20 processed, placed, and compacted as specified. If not being re-used on site, transport to an authorized recycling
- 21 facility.
- 22 F. Clean Wood Materials: Including but not limited framing cutoffs, wood sheathing or paneling materials,
- 23 structural or engineered wood products, and pallets or crates. Clean Wood shall be free of paints, stains, oils,
- 24 preservatives and other such contaminants.
- 25 1. Useable pieces shall be sorted by type and dimension, bundled and transported off site by the GC or
- 26 returned to the supplier.
- 27 2. Non-useable pieces shall be palletized or containerized, transport to an authorized recycling facility.
- 28 3. Clean, uncontaminated sawdust and wood shavings shall be bagged, transport to an authorized recycling
- 29 facility.
- 30 G. Concrete: Break-up into transportable pieces, remove all reinforcing and other metals, transport to an
- 31 authorized recycling facility.
- 32 H. Glass Products: Shall be sorted by types, do not include light fixture lamps and bulbs. Products broken in
- 33 shipment shall be returned to the supplier. Broken or cracked items still in frames shall be taped to prevent
- 34 further breakage and injury to workers. Transport to an authorized recycling facility.
- 35 I. Gypsum Board: Stack large clean pieces on wooden pallets or container, store in a dry location, transport to an
- 36 authorized recycling facility.
- 37 J. Light Fixture Lamps and Bulbs: Fluorescent tubes shall be containerized, transport to an authorized recycling
- 38 facility.
- 39 K. Masonry and CMU: Remove all metal reinforcing, anchors, and ties, clean undamaged pieces and neatly stack on
- 40 pallets, transport damaged pieces to an authorized recycling facility.
- 41 L. Metals: Sort metals by type as follows, this does not include piping:
- 42 1. Architectural metals including but not limited to siding, soffit, and roofing panels shall be sorted by
- 43 material, palletize or bundle as needed and transport to an authorized recycling facility.
- 44 2. Structural steel, sort by size and type; palletize and transport to an authorized recycling facility.
- 45 3. Miscellaneous metals such as aluminum, brass, bronze, etc shall be sorted by type, containerized or
- 46 palletized as necessary, transport to an authorized recycling facility.
- 47 M. Packaging and shipping materials
- 48 1. Cardboard boxes and containers: Breakdown all cardboard boxes and containers into flat sheets. Bundle
- 49 and store in a dry location until transported for recycling.
- 50 2. Pallets:
- 51 a. Whenever possible require deliveries using pallets to remove them from the project site.
- 52 b. Neatly stack pallets in preparation for reusing them or providing them to other companies for
- 53 salvage or re-use.
- 54 c. Break down pallets into component wood pieces that comply with the requirements for recycling
- 55 clean wood materials. Neatly stack or palletize pieces in preparation for transportation.
- 56 3. Crates: Break down crates into component wood pieces that comply with the requirements for recycling
- 57 clean wood materials. Neatly stack or palletize pieces in preparation for transportation.
- 58 4. Polystyrene Packaging: Separate and bag materials.

- 1 N. Piping and conduit: Reduce all piping and conduit to straight lengths, sort and store by size, material and type.
2 Remove supports, hangers, valves, boxes, sprinkler heads, and other such components, sort and store by size,
3 material and type. Transport to authorized recycling facilities according to material types.
4 O. Roofing: Roofing materials shall be sorted and containerized by type, transport to authorized recycling facilities
5 according to material types.
6 P. Site-Clearing Waste: Sort all site waste by type.
7 1. Only stockpile soils types and quantities required for re-use on the project site. All remaining quantities
8 shall be transported off site to an authorized facility that receives such materials.
9 2. Brush, branches, and trees with no marketable re-use shall be transported to facilities for chipping into
10 mulch.
11 3. Trees with a marketable re-use shall be salvaged and transported to facilities that specialize in processing
12 trees for future use as wood products.
13

14 **3.5. GUIDELINES FOR DISPOSAL OF WASTES**

- 15 A. The following guidelines shall be adjusted as needed by the methods and procedures identified in the Waste
16 Management Plan.
17 B. Any waste that is contaminated, organic, or cannot be recycled, re-used, or salvaged shall be legally disposed of
18 in an authorized landfill or incinerator. Disposal methods shall follow all applicable regulatory requirements.
19 C. No waste material of any kind, except those types designated as clean fill in section 3.4 above, shall be allowed
20 to be buried on the project site at any time.
21 D. No burning of any kind of waste material shall be permitted on this project site at any time.
22 E. Paint and Stain: Paints, stains, and their containers shall be disposed of as follows:
23 1. Whenever possible containers should be thoroughly cleaned immediately after emptying and sorted with
24 as appropriate (metal or plastic) for recycling
25 2. Empty containers, regardless of type or base material, may be disposed of with lids off with general
26 garbage.
27 3. Latex paint may be placed with general garbage if properly solidified as follows:
28 a. Small amounts (an inch or less in can): Remove lids and allow paint to dry out in the can and
29 harden. Protect cans from rain and freezing.
30 b. Large amounts (more than one inch): Mix paint with equal amounts of cat litter, stir and allow to
31 completely dry. Alternate method: mix with commercial paint hardener.
32 4. Oil-based or combustible paints and stains, regardless of liquid or solid, shall be transported to an
33 approved facility that takes such items such as Dane County Clean Sweep Sites.
34 F. Treated Wood Materials: Treated wood materials including but not limited to wood that has been painted,
35 stained, or chemically treated shall not be recycled or incinerated.
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END OF SECTION

**SECTION 01 76 00
 PROTECTING INSTALLED CONSTRUCTION**

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PART 1 – GENERAL

1.1. SUMMARY

- 25 A. The purpose of this specification is to provide clear responsibilities, guide lines, and requirements related to
 26 providing protection to already installed construction.
 27 B. Already installed construction shall include but not be limited to the following:
 28 1. Any existing site feature such as pavement, curbs, drainage features, utilities, landscaping features (trees,
 29 shrubbery, plantings, flagpoles, etc) and other such exterior items not associated with the building
 30 whether on or adjacent to the project site.
 31 2. Any existing structure on or adjacent to the project site.
 32 3. Any existing interior work that may be adjacent to the new work including all paths of ingress/egress to
 33 areas associated with accessing the Work.
 34 4. Any existing feature of any kind within the public right-of-way that may be on the project site property,
 35 adjacent to the project site or across the street from the project site.
 36 C. All contractors shall be familiar with the specifications of their Division of Work for specific requirements on
 37 protection of the Work.
 38 D. The requirements noted within this specification do not relieve any contractor of the responsibility for
 39 compliance with any code, statute, ordinance, or other such regulatory requirement having jurisdictional
 40 authority over these contract documents.
 41

1.2. QUALITY ASSURANCE

- 43 A. It shall be the responsibility of every contractor and worker assigned to the project to be diligent in protecting all
 44 existing work, and newly installed construction.
 45 B. It shall be the General Contractors’ (GC) responsibility under the contract to provide all reasonable protection
 46 methods, materials, or precautionary measures required to protect new or existing construction as described in
 47 within this specification to the project as a whole.
 48 1. The GC shall be responsible to ensure any damaged new or existing construction is repaired or replaced
 49 at no additional cost to the Contract.
 50 2. The GC at his/her discretion may direct other contractors to provide and maintain protection of
 51 completed work associated with their Division of Work. I.E.: The carpet installer may be required by the
 52 GC to provide carpet protection along traveled paths, ingress/egress, etc after installation.
 53 C. It shall be the responsibility of the GC to ensure that all materials being used to protect installed construction are
 54 compatible with, and/or adjacent to, the materials being protected. This shall include but not be limited to the
 55 material used as covering, tapes used to fasten protective materials, etc.

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1.3. RELATED SPECIFICATIONS

- A. Parts of this specification will reference articles within “The City of Madison Standard Specifications for Public Works Construction”.
 - 1. Use the following link to access the Standard Specifications web page:
<http://www.cityofmadison.com/business/pw/specs.cfm>
 - a. Click on the “Part” chapter identified in the specification text. For example if the specification says “Refer to City of Madison Standard Specification 210.2” click the link for Part II, the Part II PDF will open.
 - b. Scroll through the index of Part II for specification 210.2 and click the text link which will take you to the referenced text.
 - c. City Standard Detail Drawings (SDD) may be located from the index in Part VIII.
- B. Section 01 60 00 Product Requirements
- C. Section 01 74 13 Progress Cleaning

PART 2 - PRODUCTS

2.1. FENCING MATERIALS AND BARRICADES

- A. Except where noted in other areas of the construction documents, the responsible contractor shall provide a six foot galvanized chain link fence including full height mesh screen at the project lines as shown on the Civil Drawings. For temporary barricade situations, the responsible contractor may provide one of the following that sufficiently provide a sturdy physical barrier and/or visual barrier as necessary for the intended application.
 - 1. Standard orange construction barrels each with a standard rubber base ring and reflective tape
 - a. Provide flashing amber lights as needed to increase night time visibility
 - 2. Steel “T” style fence posts
 - 3. 4’0” high standard orange construction fence
 - 4. Traffic barricades
 - 5. Jersey barriers
 - 6. Other types of fencing or barricades typically used in the construction industry
- B. The contractor responsible for providing the fencing materials and barricades shall also be responsible for maintaining them. This shall include but not limited to fixing damaged fencing, standing up barrels that have been knocked over, realigning barrels, and ensuring flashing lights are fully operational at all times.
- C. The following fencing and barricade designations, and their use descriptions shall be used throughout this specification to provide uniformity in describing protection requirements.
 - 1. Type A, Jersey Barriers, to be used as permanent blocking devices to deny access to alternate project site entrances or exits.
 - 2. Type B, Traffic Barricades, to be used as temporary blocking devices to deny access to alternate project site entrances or exits.
 - 3. Type C, Construction Barrels without construction fencing shall be used for lane closures, temporary blocking devices to deny access and the protection of single locations (I.E. identify the location of an access structure) that do not require fencing.
 - 4. Type D, Construction Barrels with construction fencing where it becomes necessary to surround an object with a complete visual barricade and it is impractical or unacceptable to install fence posts. The surround shall be constructed in such a manner as to provide a buffer zone around and access to the item being protected.
 - 5. Type E, Steel “T” Fence Posts shall be used at the project lines, as indicated on the Civil Drawings, with six foot galvanized chain link fencing to surround an object with a complete visual barricade and it is practical to install fence posts. The surround shall be constructed in such a manner as to provide a buffer zone around and access to the item being protected. All posts shall be driven installed. Surface mounted posts to only be used for temporary barricades.
 - 6. Type X, Other fencing or barricade types that may be designated and detailed within the construction documents shall use additional alpha numeric designations.

2.2. EROSION CONTROL PROTECTION

- A. Refer to City of Madison Standard Specification 210.2 for authorized materials associated with erosion control materials.

1 **2.3. INTERIOR FINISH PROTECTION MATERIALS**

- 2 A. Except where noted in other areas of the construction documents or this specification the responsible
3 contractor:
4 1. Shall not provide the cheapest or least effective method as an effort to meet any protection requirement.
5 2. Shall provide materials of sufficient quality, and durability to provide adequate protection based on the
6 seasonal conditions and the anticipated duration at the time the protection will be needed.
7 3. Shall provide sufficient quantity of protection material to protect the construction as needed.
8 B. Prior to installing protective measures the responsible contractor shall propose to the GC, Project Architect (PA)
9 and City Project Manager (CPM) the proposed plan for protection, materials to be used and samples as
10 necessary.
11 1. The PA and CPM reserve the right to disapprove any proposed method and/or material and/or make
12 alternate proposals.

13
14 **PART 3 - EXECUTION**

15
16 **3.1. GENERAL EXECUTION REQUIREMENTS**

- 17 A. The GC shall be responsible for ensuring all of the following procedures and requirements are implemented as
18 needed for the duration of the Work performed under this contract.
19 B. The GC shall also be responsible for the following:
20 1. Reporting any incident of damage to existing property, right-of-way, or utility to the CPM immediately
21 upon rendering the incident safe, and notifying emergency response teams, and emergency utility crews
22 as needed.
23 2. Conduct a site walk through prior to leaving at the end of each day to assess:
24 a. Protection measures are properly in place, provide correction actions as necessary.
25 b. Note damage to existing completed work and schedule repair/replacement as needed.
26 3. Ensure all contractors and workers are being diligent in protecting existing work, and newly installed
27 construction.

28
29 **3.2. PROTECT ADJACENT PROPERTIES**

- 30 A. Whenever possible through the design process the City of Madison shall have previously provided notice to
31 adjacent property owners that work will be occurring on or near their property. The City of Madison shall also
32 have obtained any permanent or temporary easements that may be necessary to complete any Work on
33 adjacent properties.
34 B. It shall be the responsibility of the GC to do the following for all Work under this contract being performed on or
35 adjacent to the property line:
36 1. Contact the adjacent property owner and provide him/her with information on the work to be done,
37 equipment to be used, and estimated duration of the work. Information to be updated and
38 communicated to property owner(s) as construction progresses and site conditions change.
39 a. If any adjacent property is a rented or leased space the GC shall also make contact and provide
40 the same information to the tenants.
41 b. Determine from the owner and/or tenants if there are any concerns for children, pets, special
42 plantings, or other concerns.
43 2. Discuss the following with all contractors performing work on or near the property line.
44 a. Work to be completed and timeline.
45 b. Concerns of adjacent property owners/tenants from item 1 above.
46 c. Which protective measures will be necessary to protect adjacent properties and address the
47 concerns of adjacent property owners/tenants.
48 3. Ensure all protective measures are placed and maintained during the execution of Work on or adjacent to
49 the property line. Interact with the adjacent property owners/tenants as needed.
50 C. Any contractor doing work on or adjacent to the property line shall install and maintain any protective measure
51 identified in the contract documents, this specification, or as directed by the GC.
52 D. The GC shall be responsible for restoring any damage to structure and property located on or adjacent to the
53 property line.
54 1. Restoration shall include but not be limited to repair or replacement using like materials and finishes to
55 its original condition or better.
56 2. Restoration of landscaping materials shall include watering of any seed, sod, or other planting of any kind
57 for a reasonable period of time to encourage germination and root development.
58 E. The GC shall keep the CPM informed directly to any issues pertaining to adjacent property owners and tenants.

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3.3. PROTECT LANDSCAPING FEATURES

- A. Except where specifically stated in other areas of the construction documents the following minimal protection requirements shall apply under this section.
 - 1. Whenever possible do not install new landscape features until exterior building construction has been completed, equipment such as scaffolding and lifts are no longer needed and have been removed, and heavy equipment operation is no longer required.
 - 2. Whenever possible remove and temporarily store all existing landscape features such as benches, waste receptacles, signage, and other such features that will be within the area of Work that can be removed.
 - 3. Landscape features that cannot be removed such as flag poles, light poles, light bollards, etc. shall be protected with Type D fencing for areas on pavement or Type E fencing for areas on soil.
 - 4. Planting beds shall be protected using Type E fencing around the exposed perimeter of the planting bed as needed.
 - 5. The City of Madison Standard Specification 107.13 shall apply to all tree protection in and around the project site at all times.

3.4. PROTECT UTILITIES

- A. The contractor shall be responsible for notifying all utilities to determine emergency response procedures and protection requirements prior to installing any construction protection.
 - 1. This includes requesting utility marking through Diggers Hotline.
 - a. Call 811 or 1-800-242-8511 to request a public utility locate
 - b. For emergency locate call (262) 432-7910 or (877) 500-9592
 - 2. Contact the Owner and CPM for any available private utility information on the property that may be available prior to calling a private utility locating company.
- B. Except where specifically stated in other areas of the construction documents the following minimal protection requirements shall apply under this section.
 - 1. Hydrants, lamp posts, electrical transformers, and other utility pedestals shall be protected with Type D fencing for areas on pavement or Type E fencing for areas on soil. Fence posts shall be located so as to not be directly over the utility main.
 - 2. Storm sewer structures in pavement shall have proper inlet protection according to City of Madison Standard Specification 210.1(g) and Type C Construction Barrels when necessary.
 - 3. Storm sewer structures in turf and other landscaped areas shall have proper inlet protection according to City of Madison Standard Specification 210.1(g) and Type E fencing for areas on soil.
 - 4. Stormwater management features such as greenways, retention/detention ponds, bio-filtration ponds and other such features shall be properly protected according to the appropriate erosion control measure specified on the Erosion Control Plan. See multiple sections of City of Madison Standard Specification 210.1
 - a. For the protection of hard to see items such as structures, castings, inlets, etc. in grassy areas provide Type E fencing for areas on soil.
 - c. For the protection of storm water management features having special soils and plants such as bio-filtration ponds provide Type E fencing for areas on soil.
 - 5. Other structures and covers including but not limited to cleanouts, wiring hand holes, valve boxes, access structures, grease trap structures, etc shall be protected as follows:
 - a. Provide Type E fencing for areas on soil.
 - b. When paving operations are complete provide a construction barrel or cone near structures as necessary depending on required heavy construction traffic.

3.5. PROTECT PUBLIC RIGHT OF WAY

- A. Except where specifically stated in other areas of the construction documents the following minimal protection requirements shall apply under this section.
 - 1. All public right-of-way (area from behind the sidewalk to the centerline of the street) shall remain open and accessible except during periods of active work. At such times the public right of way shall be properly closed and signed as referenced in City of Madison Standard Specification 107.9.
 - 2. Bus stops and bus stop structures shall remain accessible at all times.
 - 3. Traffic signage and traffic signals, traffic control boxes shall be protected with Type D fencing for areas on pavement or Type E fencing for areas on soil.
 - a. Protection at traffic signage/signals shall not obstruct the viewing of the sign/signal for its intended purpose at any time.

- 1 B. When additional protection for traffic control is required, the use of barricades, guardrails, lane closures and
2 other such procedures will be detailed within the construction documents.
3 C. When additional protection for overhead sidewalk cover is required the contract documents shall indicate the
4 specific location and structural requirements of the protective structure.
5

6 **3.6. PROTECT STORED MATERIALS**

- 7 A. All contractors shall refer to Specification 01 60 00 Product Requirements for all storage and protection
8 requirements of building materials and products delivered to the site.
9

10 **3.7. PROTECT WORK - EXTERIOR**

- 11 A. Provide all temporary services that may be required to protect the installed material from heat, cold, humidity,
12 etc, while materials such as concrete, mortar, sealants, paints, etc, are drying and/or curing.
13 B. Open trenches, pits, and other such excavations shall be properly covered, lined, or shored as needed during
14 periods of inclement weather to prevent the caving of soils onto existing work in progress. Refer to the
15 appropriate specifications and/or regulatory requirements governing this type of work as necessary.
16 C. Provide adequate protection at all openings with heavy duty tarps, plastic sheathing, or wood framing and
17 sheathing as needed to protect interior work in progress from inclement weather as needed.
18 D. Protect exterior finishes of all kinds with heavy duty tarps or plastic sheathing as needed while landscaping is
19 being installed through full germination of seeded areas or installation of filter fabric and mulches to keep dust,
20 dirt, and mud off of finished exterior surfaces.
21 E. Designate specific curb mounting points and provide wood blocking where small vehicles, skid loaders and other
22 such equipment may need access to areas being landscaped.
23 F. Provide plywood turning pads for skid loaders to turn on to prevent tire marking on new pavement.
24 G. Do not permit the parking of vehicles with any kind of fluid leaks to park on new pavement.
25 H. The contractor shall be responsible for cleaning, repairing, or replacing any completed work or work in progress
26 under this specification as deemed necessary by the CPM without additional cost to the contract.
27

28 **3.8. PROTECT WORK - INTERIOR**

- 29 A. The GC shall do all of the following:
30 1. Provide all temporary services that may be required to protect the installed material from heat, cold,
31 humidity, etc, while materials such as concrete, mortar, sealants, paints, etc, are drying and/or curing.
32 2. Provide adequate visual and/or physical protection as needed to protect newly completed interior work
33 such as paint, flooring material, sealants, grouts, etc that may be drying and/or curing.
34 3. Provide adequate space and materials for cleaning boots, tool boxes, supplies, and other items coming
35 into the project site once finish work has begun.
36 4. Clean dirtied areas and repair/replace damaged areas immediately.
37 B. The contractors responsible for interior work shall be responsible for protecting their work and finishes from dirt,
38 mud, snow, spills, splatters, and physical damage after installation as follows:
39 1. Protect vinyl composite, rubber composite, painted/stained concrete, and tiled flooring as follows:
40 a. Define foot traffic areas and protect with Ramboard Temporary Floor Protection products as a
41 minimum basis of design or other protection product(s) compatible with installed flooring product
42 if Ramboard is not compatible. Products to be used shall be new.
43 i. Tape all edges, seams, etc with a good quality tape that does not leave sticky residue. Do
44 not allow any debris or other material between the installed flooring and the protection
45 material.
46 ii. Repair tears immediately, replace worn areas with like material as necessary.
47 2. Protect carpeted areas as follows:
48 a. Define foot traffic areas and protect with a minimum of 6mil, clear, polyethylene sheeting 3 feet
49 wide. Products to be used shall be new.
50 i. Tape all edges, seams, etc with a good quality tape that does not leave sticky residue. Do
51 not allow any debris or other material between the installed flooring and the protection
52 material.
53 ii. Repair tears immediately, replace worn areas with like materials as necessary.
54 3. Protect all finished walls in high traffic areas with Ramboard Temporary Wall protection products or
55 approved equal.
56 i. Tape all edges, seams, etc with a good quality tape that does not leave sticky residue. Do
57 not allow any debris or other material between the installed flooring and the protection
58 material.

- 1 ii. Repair tears immediately, replace worn areas with like materials as necessary.
- 2 3. Protect counter tops, cabinets, and other finished surfaces with large sheets of thick cardboard or
- 3 Ramboard products. Do not allow toolboxes, finish materials, parts and other such items to be placed on
- 4 finished materials.
- 5 C. All protection shall stay in place until the CPM, PA, and GC mutually deem the project is ready for Final Cleaning.
- 6 The contractors responsible for protecting the work shall be responsible for removing the protection and
- 7 removing any adhesive residue at that time. Contractors shall only use manufacturer authorized cleaning
- 8 materials for removing adhesives, etc.
- 9 D. Contractors doing work in un-protected areas of finished work shall be required to provide drop cloths and other
- 10 protection as noted within this specification for the duration of their work.
- 11 1. Finished areas shall be sufficiently covered to accommodate all equipment, and materials being used to
- 12 complete the work being done.
- 13 2. Finished areas shall be sufficiently covered to prevent splatters, over spray, etc when doing touch-up
- 14 work.
- 15 3. Contractors who do not provide sufficient protection under this sub-section shall be responsible for any
- 16 costs associated with cleaning, repairing or replacing already finished construction at no additional cost
- 17 to the contract.
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END OF SECTION

**SECTION 01 77 00
CLOSEOUT PROCEDURES**

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PART 1 – GENERAL

1.1. SUMMARY

- A. The purpose of this specification is to clearly define and quantify the requirements associated with closing a City of Madison Public Works Contract for facility related work.
- B. All contracts have two distinct but related paths. Each path needs to be properly closed independently in order to close the contract as a whole.
1. Construction closeout is related to closing out all of the Work associated with the construction documents.
 - a. It shall be the responsibility of all contractors to be fully aware of the required Work and closeout requirements involved in their individual trades.
 2. Contract closeout is related to closing out all of the administrative aspects of the contract in general.
 - a. It shall be the responsibility of all contractors to be fully aware of the administrative requirements required by the contract and to provide the supporting documentation required.
 3. Construction Closeout must be completed before Contract Closeout can begin.
- C. This specification will provide general knowledge associated with the following areas:
1. Construction Closeout Requirements
 2. Construction Closeout Procedure
 3. Contract Closeout Requirements
 4. Contract Closeout Procedure
 5. Final Payment and Certificate of Completion

1.2. RELATED SPECIFICATIONS

- A. Contractors shall review all references to other specifications including specifications relating to the execution of the Work associated with their Division or Trade.
- B. Section 01 29 76 Progress Payment Procedures
- C. Section 01 31 23 Project Management Web Site
- D. Section 01 32 26 Construction Progress Reporting
- E. Section 01 45 16 Field Quality Control Procedures
- F. Section 01 74 13 Progress Cleaning
- G. Section 01 45 16 Construction Waste Management and Disposal
- H. Section 01 76 00 Protecting Installed Construction
- I. Section 01 78 13 Completion and Correction List
- J. Section 01 78 23 Operation and Maintenance Data
- K. Section 01 78 36 Warranties
- L. Section 01 78 39 As-Built Drawings
- M. Section 01 78 43 Spare Parts and Extra Materials
- N. Section 01 79 00 Demonstration and Training
- O. Section 01 91 00 Commissioning
- P. Other requirements as noted in the contract documents signed by the General Contractor

1 **1.3. DEFINITIONS**

- 2 A. **Substantial Compliance:** A letter provided to the City of Madison Building Inspection and signed by the Project
3 Architect indicating that all Work has been completed to a level that would allow Owner Occupancy and that all
4 construction is in compliance with the construction documents. A copy of this letter is also provided to the
5 State of Wisconsin Department of Health and Safety as necessary to clear plan review requirements. This letter
6 does not represent construction closeout.
- 7 B. **Certificate of Occupancy:** The Regulatory letter from the City of Madison Building Inspection Department
8 indicating that all regulatory requirements and inspections have been completed and the building may now be
9 occupied for its intended use. This letter does not represent construction closeout.
- 10 C. **Certificate of Substantial Completion:** A letter provided by the Department of Public Works, signed by the City
11 Engineer indicating that Construction activities are substantially complete. This letter does represent
12 construction closeout and the date of this letter begins the date of the Warranty Period.
- 13 D. **Construction Closeout:** The point in the contract where all contractual requirements associated the execution of
14 the Work as described in the plans, specifications, and other documents have been successfully met and the
15 items described in 1.3.A, .B, and .C above have been completed.
- 16 E. **Final Progress Payment:** The progress payment associated with achieving Construction closeout as described in
17 1.3.D above. At this point the contractor may request all monies associated with the contract be paid with the
18 exception of held retainage.
- 19 F. **Contract Closeout:** The point in the contract where all contractual requirements associated with the City of
20 Madison, Board of Public Works contract has been successfully met.
- 21 G. **Final Payment:** The final contract payment submittal that may be approved by the City of Madison after all
22 contractual requirements of the Public Works Contract have been met and any remaining monies (retainage)
23 due to the contractor may be released for the Final Payment.

24
25 **1.4. QUALITY ASSURANCE – CONSTRUCTION CLOSEOUT**

- 26 A. All contractors shall be responsible for properly executing the construction closeout requirements associated
27 with their Work as described in the specifications governing their Work.
- 28 B. The GC shall be responsible for all of the following:
- 29 1. Ensuring that all contractors have met the construction closeout requirements associated with their
30 Work.
- 31 2. Coordinate the collection of all construction closeout deliverables from all contractors, provide the
32 deliverables to the Project Architect and City Project Manager for review as necessary, and ensure all
33 contractors correct deficiencies of deliverables and resubmit as needed for final acceptance.
- 34 3. Ensure all closeout requirements identified in the Construction Closeout Checklist below have been
35 completed as intended by the construction documents.

36
37 **1.5. QUALITY ASSURANCE – CONTRACT CLOSEOUT**

- 38 A. The City of Madison, Department of Civil Rights (DCR) monitors contract compliance for construction and
39 procurement contracts to ensure that local, state and federal regulations are followed by contractors working on
40 City of Madison Public Works (PW) projects. DCR will monitor all PW projects from contract award through the
41 final payment at the close of the project. Contractors will be required to submit reporting paperwork
42 throughout the PW project process.
- 43 1. Contractors are encouraged to visit the web site identified below for additional information, checklists,
44 forms, and other information provided by DCR as it relates to Contract Compliance.
45 <http://www.cityofmadison.com/Business/PW/contractCompliance.cfm>
- 46 2. Questions regarding the process should be directed to parties and offices as identified on the various
47 forms, documents, and instructions or contact:
48 City of Madison, Department of Civil Rights
49 210 Martin Luther King Jr. Blvd., Room 523
50 Madison, WI 53703
51 (608) 266-4910
- 52 B. All Sub-Contractors have submitted the applicable required documents described in item 1.5.D below to the
53 General Contractor (GC) for Contract Closeout.
- 54 C. The GC has submitted the required applicable documents described in item 1.5.D below for all contractors to the
55 appropriate City of Madison Agency per instructions associated with each submittal.
- 56 D. The documents required for submittal to the City of Madison for Contract Closeout may include any/all of the
57 items listed below depending on contract type. It is the sole responsibility of all contractors to know and submit
58 the required and complete documentation in a timely fashion.

- 1 1. Weekly Payroll Reports
- 2 2. Employee Utilization Reports
- 3 3. Documentation required for Small Business Enterprise (SBE) goals
- 4 4. Other documents as maybe required or requested through the Finalization Review Process

6 **PART 2 – PRODUCTS – THIS SECTION NOT USED**

8 **PART 3 - EXECUTION**

10 **3.1. CONSTRUCTION CLOSEOUT CHECKLIST**

- 11 A. All contractors shall be responsible for reviewing the drawings and specifications within their Divisions of Work to provide a complete and comprehensive list of all Construction Closeout Requirements to the GC.
- 12 1. The checklist shall include all items identified within the construction documents that require any of the
- 13 following (and examples) prior to moving into Contract Closeout Procedures:
- 14 a. Documents indicating a specified level of performance has been achieved, such as:
- 15 i. Test reports of all types
- 16 ii. Startup reports
- 17 b. Required documentation, such as:
- 18 i. As-builts and record drawings
- 19 ii. Operation and maintenance data
- 20 c. Physical items to be turned over to the owner, such as:
- 21 i. Attic stock
- 22 ii. Keys
- 23 d. Required maintenance completed, such as:
- 24 i. Ducts cleaned
- 25 ii. Filters replaced
- 26 e. Commissioning and LEED related items and submittals
- 27 f. Owner and Maintenance Training
- 28 B. Each list shall indicate the title of the closeout requirement, the associated specification of the requirement, the
- 29 required result or deliverable, the responsible contractor(s), and a column to verify the item has been turned in
- 30 and completed.
- 31 C. The GC shall be responsible for all of the following:
- 32 1. Consolidating all the closeout lists into one master Construction Closeout Checklist.
- 33 a. The checklist shall be in a tabular data format similar to the sample below
- 34 2. Upload the completed checklist to the Contract Closeout-Miscellaneous Documents Library on the
- 35 Project Management Web Site for review.
- 36 3. Resubmit the checklist as needed after initial reviews have been completed.
- 37 D. The GC shall work with all contractors to amend the Construction Closeout Checklist throughout the execution of
- 38 the project based on changes and modifications as necessary.
- 39
- 40

<u>Title</u>	<u>Specification</u>	<u>Description</u>	<u>Responsibility</u>	<u>Completed</u>
Quality Management Observation Reports	01 45 16	All QMO reports have been properly responded to, reviewed and closed by the CPM.	All, GC	
As-Built Drawings	01 78 39	As-Built drawings have been reviewed and accepted per the specification	All, GC	
Testing and Balancing of HVAC	23 09 23	Provide final TnB reports indicating design performance has been achieved	HVAC	

42 **3.2. CONSTRUCTION CLOSEOUT REQUIREMENTS**

- 43 A. The timely submittal or completion of closeout requirements shall go hand in hand with the Progress Payment Milestone Schedule that can be found in Specification 01 29 76 Progress Payments. No payments shall be made until all requirements for that payment have been met.
- 44 1. The GC and all major Subcontractors, PA, and CPM, shall review all requirements for
- 45 Construction/Contract Closeout during two (2) special meetings.
- 46 a. The first meeting shall be held at the 50% Contract Total Payment milestone. This meeting shall
- 47 discuss the requirements associated with various construction/contract closeout documentation
- 48 and events when they are due with respect to progress payments.
- 49
- 50

- 1 b. The second meeting shall be held at the 70% Contract Total Payment milestone. This meeting
2 shall review the contractors progress regarding the closeout checklist, begin making plans for
3 upcoming deadlines such as scheduling training, where to put attic stock, and when they are due
4 with respect to progress payments.
5 2. The GC, PA, and CPM, shall utilize the Construction Closeout checklist to ensure that all construction
6 closeout requirements have been met.
7

8 **3.3. CONSTRUCTION CLOSEOUT PROCEDURE**

- 9 A. Upon successful completion and final acceptance of all Construction Closeout Requirements the GC may submit
10 to the CPM and PA the request for Final Progress Payment (100% contract total, less retainage).
11 B. The PA will confirm with the design consultants, CPM, and other City of Madison staff that all requirements of
12 the Work have been completed and will do the following:
13 1. Approve the final progress payment application
14 2. Provide the required signed payment documents to the CPM
15 3. Provide the required Letter of Substantial Compliance to the following as required:
16 a. State Safety and Building Division
17 b. Local Building Inspection office
18 c. GC
19 d. CPM
20 C. The CPM shall draft the City Letter of Substantial Completion for signature by the City Engineer. This letter shall
21 state any of the following that may still be tied to the contract and/or warranty:
22 1. Indicate that the date of the letter shall also be the beginning of the Warranty period.
23 2. Indicate any allowed due outs, reasons for them, and anticipated dates of finalization.
24 a. QMO issues such as off season testing of equipment
25 b. Off season training of equipment
26 D. The GC and all subcontractors shall finalize all warranty letters associated with their Work using the date noted
27 on the City Letter of Substantial Completion, and provide the CPM with all warranties as described in
28 Specification 01 78 36 Warranties. Upon receipt and final approval of the Warranties the CPM may initiate final
29 processing of the Final Progress Payment (100% contract total, less retainage).
30

31 **3.4. CONTRACT CLOSEOUT REQUIREMENTS**

- 32 A. The GC and all sub-contractors shall follow all requirements associated with documenting contract compliance
33 and provide documentation as required or requested by DCR or PW staff. All contractors are encouraged to stay
34 current with submissions of the following documentation:
35 1. Weekly Payroll Reports no later than the Progress Payment equal to 50% of the contract total.
36 2. Employee Utilization Reports
37 3. Agent or Subcontractor Affidavit of Compliance with Prevailing Wage Rate Determination
38 4. Prime Contractor Affidavit of Compliance with Prevailing Wage Rate Determination
39 5. Documentation required for Small Business Enterprise (SBE) goals
40 6. Other documents as maybe required or requested through the Finalization Review Process
41 B. Near the Progress Payment equal to 80% of the contract total the GC shall request in writing a Finalization
42 Review. At that time DCR or PW staff shall prepare a report of all contract documentation submitted to date. A
43 list of missing items or outstanding issues will be emailed to the GC. No additional follow-up will be generated
44 by DCR or PW Staff.
45

46 **3.5. CONTRACT CLOSEOUT PROCEDURE**

- 47 A. The Contract Closeout Procedure will not begin until the Construction Closeout Procedure has been completed.
48 B. When the GC feels he/she has successfully met all of the Contract Closeout Requirements associated with
49 Section 3.3 above the GC may submit to the request for Final Payment to the CPM.
50 C. The CPM shall sign and submit the Final Payment request for processing.
51 D. DCR and PW staff shall do a complete review of all documentation associated with item 3.3.A above.
52 E. The GC shall be notified directly by DCR or PW Staff of any documentation that may still be missing, have
53 incomplete information, or other outstanding issues. It shall be the responsibility of the GC to continue follow-
54 up with DCR and PW staff until all documentation has been successfully submitted and accepted.
55 F. When all required documentation associated with Contract Closeout has been successfully submitted and
56 accepted by DCR and PW Staff the City of Madison shall process the Final Payment of any remaining monies
57 including retainage.
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END OF SECTION

SECTION 01 78 13
COMPLETION AND CORRECTION LIST

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10 **PART 1 – GENERAL**

11
12 **1.1. SUMMARY**

- 13 A. The City of Madison has developed a multi-faceted Quality Management Program that begins with contract
14 signing and runs through contract closeout to ensure the best quality materials, workmanship, and product are
15 delivered for the contracted Work.
- 16 1. The Progress Management Web Site is a Construction Management tool that provides contractors,
17 consultants, and staff a single on-line location for the daily operations and progression of the Work.
- 18 2. The Quality Management Observation (QMO) is an ongoing observation of the construction process as it
19 progresses. The City of Madison does not use a “Punch List” or “Corrections List” as it is typically known
20 throughout the construction industry. The QMO process acts as an “in progress punch list”. Work
21 identified as not in compliance with the contract documents by the Owner, Owner Representatives,
22 Owner Consultants, etc. shall be resolved immediately at the Contractor’s expense. Unresolved issues
23 will be subject to withholding of progress payment(s) until completed.
- 24 3. Very stringent expectations are tied to Construction Closeout and Contract Closeout procedures. Specific
25 milestones throughout the project need to be met and the milestones are tied to the Progress Payment
26 Schedule.
- 27 B. All contractors shall be required to review the specifications identified in Section 1.2 below, and other related
28 specifications identified therein to become familiar with the terminology and expectations of this City of
29 Madison Public Works contract.
30

31 **1.2. RELATED SPECIFICATIONS**

- 32 A. Section 01 29 76 Progress Payment Procedures
33 B. Section 01 31 23 Project Management Web Site
34 C. Section 01 45 16 Field Quality Control Procedures
35 D. Section 01 77 00 Closeout Procedures
36

37 **PART 2 – PRODUCTS – THIS SECTION NOT USED**

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39 **PART 3 – EXECUTION – THIS SECTION NOT USED**

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END OF SECTION

SECTION 01 78 23
OPERATION AND MAINTENANCE DATA

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PART 1 – GENERAL

1.1. SUMMARY

- A. The purpose of this specification is to provide clear responsibilities and guide lines related to providing well documented and complete Operation and Maintenance (O&M) Data related to general facility use, equipment, systems, finishes, and materials to City of Madison Staff (Owner, Owner Representatives, Maintenance, and Custodial Personnel) as needed.
- B. Operation and Maintenance Data shall apply to both of the following categories except where specific requirements are noted under their separate titles as follows:
1. Operation and Maintenance Data: Generally shall mean the owner manual that provides information on start-up, shut-down, operation, troubleshooting, maintenance, parts, and other such documentation as it pertains to all equipment and systems installed under the Work.
 2. Use and Care instructions: Where applicable use and care instructions shall also be considered O&M for such things as flooring, tile, partitions, and other such finishes and trim related items, installed under the Work.

1.2. RELATED SPECIFICATIONS

- A. Section 01 29 76 Progress Payment Procedures
B. Section 01 31 23 Project Management Web Site
C. Section 01 77 00 Closeout Procedures
D. Section 01 78 13 Completion and Correction List
E. Section 01 78 19 Maintenance Contracts
F. Section 01 78 36 Warranties
G. Section 01 79 00 Demonstration and Training
H. Section 01 91 00 Commissioning
I. Other Divisions and Specifications that may address more specifically the requirements for O&M Data.

1.3. QUALITY ASSURANCE

- A. All O&M Data shall meet the requirements identified in Section 1.4 below.
- B. All contractors shall provide O&M Data for each piece of equipment, system, or finish installed during the installation of the Work. O&M Data shall be provided to the General Contractor (GC) for verification and submittal.
- C. The GC shall be responsible for receiving all required O&M Data files from all contractors for verifying that all files submitted meet the requirements in Section 1.4 below.

1.4. O&M DATA REQUIREMENTS

- A. O&M Data shall be provided in digital PDF format as follows:
1. PDF files shall be complete first generation consumer useable editions of PDF documents as provided by any of the following:
 - a. Product manufacturer
 - b. Supplier of product
 - c. Product manufacturer internet site

- 1 2. Acceptable PDF files shall have the following functionality:
- 2 a. Word searchable
- 3 b. Key areas are bookmarked
- 4 c. Table of Contents and/or Index linked to content is preferred whenever possible.
- 5 3. Scanned printed material, with word searchable capabilities, saved as a PDF, is not acceptable and will be
- 6 rejected without further review.
- 7 B. O&M Data shall include but not be limited to the following manufacturers' published information as appropriate
- 8 for the equipment, system, material, or finish:
- 9 1. Installation instructions
- 10 2. Parts lists, assembly diagrams, explosion diagrams
- 11 3. Wiring diagrams
- 12 4. Start-up, shut-down, troubleshooting and other related operation procedures
- 13 5. Lubrication, testing, parts replacement, and other such maintenance procedures
- 14 6. General use, care, and cleaning instructions
- 15 7. Special precautions and safety requirements
- 16 8. A list of certified equipment vendors, service companies, parts suppliers including company name,
- 17 address, and phone number
- 18 9. A list of the recommended spare parts to have on hand at all times
- 19 10. A list by type of all recommended lubes, oils, packing material, and other maintenance supplies
- 20 11. Copies of final test reports, balance reports, and other related documentation
- 21 12. Warranty information for equipment and systems
- 22

23 **1.5. O&M DATA SUBMITTALS**

- 24 A. O&M Data shall be prepared as identified in this specification and shall be submitted for review as per the
- 25 schedule identified in Specification Section 01 29 76, Progress Payment Procedures.
- 26 B. O&M Data Draft submittals will be reviewed for content, procedure, and compliance only. A general critique
- 27 with recommendations for improvement will be made but re-submittals will not be required.
- 28 C. O&M Data Final submittals will be reviewed for content, procedure, and compliance. Re-submittals will be
- 29 required until such time as each submittal is accepted.
- 30

31 *NOTE: Acceptance of O&M Data Final submittals is required to be complete prior to scheduling and conducting owner*
32 *related training and construction closeout.*

33

34 **PART 2 – PRODUCTS – THIS SECTION NOT USED**

35

36 **PART 3 - EXECUTION**

37

38 **3.1. O&M DATA PREPARATION - GENERAL**

- 39 A. All contractors shall prepare O&M Data for draft and final submission as follows:
- 40 1. Obtain digital PDF files for each piece of equipment, system, material or finish as described in Sections
- 41 1.4.A.1 and 1.4.A.2 above.
- 42 2. Verify that all information as described in Section 1.4.B above is included with the PDF file. Obtain
- 43 missing information as necessary for a complete submittal.
- 44 B. Rename each individual PDF file as follows.
- 45 1. Do not use special characters such as #, %, &, /, etc. These characters are reserved by the Project
- 46 Management Web Site software the City of Madison uses; however the under-score (or under-bar) '_' is
- 47 an allowed character.
- 48 2. Use the following format and examples for renaming your file:
- 49 a. Format: ***Equipment name_What_METRO TRANSIT - SERVICE LANE ADDITION - PHASE***
- 50 ***1_Contract number_Year***
- 51 i. *Equipment Name* represents the name of any equipment, system, material or finish as
- 52 designated in the Contract Documents.
- 53 ii. *What* represents what the file is about
- 54 iii. *METRO TRANSIT - SERVICE LANE ADDITION - PHASE 1* represents the title of the project or
- 55 contract. A shortened version of the title may be identified by the City Project Manager to
- 56 be used by all contractors.
- 57 iv. *Contract number* is the specific identification number the Work was bid under and appears
- 58 on the plan set title sheet and in each sheet title block

- v. *Year* represents the year the contract will be closed out
- b. Examples of file names
 - i. AHU 2_Operation Manual_Fire Admin_1234_2015
 - ii. CPT 2_Use and Care_MPD West_9876_2011
- C. All contractors shall submit the completed digital PDF files to the GC in sufficient time for the GC to meet the O&M Data submission deadlines as described in Specification Section 01 29 76, Progress Payment Procedures.
- D. O&M Data shall be submitted and reviewed as described in sections 3.2 and 3.3 below.

3.2. O&M DATA DRAFT SUBMITTAL

- A. All contractors shall prepare and submit the following for an O&M Data Draft review submittal:
 - 1. Prepare three (3) complete O&M Data file samples as described in section 3.1 above.
 - 2. Review all specifications within his/her Division of Work and prepare a complete O&M Data checklist listing all equipment, systems, materials, or finishes. Checklist shall be in tabular form similar to the example below and shall indicate the title (and plan identifier when applicable) of the O&M Data, the associated specification, and a column to verify the item has been turned in and completed.
- B. The GC shall be required to review all contractors' samples and checklists for compliance with this specification and shall return any to the originating contractor that are insufficient for re-submittal.
 - 1. When acceptable to the GC, he/she shall upload each O&M Data draft submittal file to the O&M Draft library on the Project Management Web Site.
- C. The Project Architect, City Project Manager, CxA, Consulting Staffs and Owner Representatives shall review the O&M Data draft submittals and checklist within fifteen (15) working days as follows:
 - 1. Provide general critique comments by Division on O&M Data samples submitted. Critique is intended to provide all contractors with information on strengths and weaknesses of their submittals.
 - a. Re-submittal of the O&M Data samples will not be required.
 - 2. Review in detail the O&M Data Checklist for completeness. Provide comments as needed.
 - a. Re-submittal of the O&M Checklist will be required until accepted.

<u>Title</u>	<u>Specification</u>	<u>Completed</u>
Overhead Door Operator	08 36 00	
Air Handling Unit (AHU-3)	23 00 00	
Water Heater (WH-1)	22 30 00	

3.3. O&M DATA FINAL SUBMITTAL

- A. All contractors shall prepare and submit the following for an O&M Data Final review submittal:
 - 1. Prepare complete O&M Data files as described in Section 3.1 above according to their approved checklist as described in Section 3.2 above.
 - 2. Submit completed checklist and all final O&M Data files to the GC for final submittal review.
- B. The GC shall be required to spot check all contractors' submittals for completeness against their checklists and for compliance with this specification and shall return any to the originating contractor that are insufficient for re-submittal.
 - 1. When acceptable to the GC, he/she shall upload each O&M Data final submittal file to the O&M Final library on the Project Management Web Site.
- C. The Project Architect, City Project Manager, CxA, Consulting Staffs and Owner Representatives shall review the O&M Data final submittals and checklist within fifteen (15) working days as follows:
 - 1. Review the files submitted against the checklist and request any missing files through the GC.
 - 2. Review in detail all of the O&M Data files for completeness.
 - a. Submittals shall be accepted or rejected as individual PDF files.
 - b. Contractors shall re-submit entire O&M submittal if any portion is rejected or incomplete.

3.4. CONSTRUCTION CLOSEOUT

- A. All contractors shall review Specification 01 77 00, Closeout Procedures and Specification 01 79 00 Demonstration and Training.
 - 1. Acceptance of all final O&M Data submittals is required prior to scheduling Demonstration and Training Sessions.
 - 2. Completion of all Demonstration and Training Sessions is required to receive the Substantial Compliance for Occupancy Certificate, and to begin Construction Closeout procedures.

END OF SECTION

SECTION 01 78 36
WARRANTIES

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PART 1 – GENERAL

1.1. SUMMARY

- 20 A. The purpose of this specification is to provide clear responsibilities and guide lines related to providing all
21 Warranties and Guarantees related to the Work, workmanship, materials, equipment, and other such items
22 required by the Construction Documents.
23 B. Manufacturers’ disclaimers and limitations on product warranties do not relieve any contractor of the warranty
24 on the Work that includes the product.
25 C. Manufacturers’ disclaimers and limitations on product warranties do not relieve suppliers, manufacturers and
26 any contractor required to provide special warranties under the contract documents.
27

1.2. RELATED SPECIFICATIONS

- 29 A. Section 01 29 76 Progress Payment Procedures
30 B. Section 01 31 23 Project Management Web Site
31 C. Section 01 77 00 Closeout Procedures
32 D. Section 01 78 23 Operation and Maintenance Data
33 E. Section 01 91 00 Commissioning
34 F. Other Divisions and Specifications that may address more specifically the requirements for Warranties related to
35 the installation of all items and equipment installed under the execution of the Work.
36

1.3. DEFINITIONS

- 38 A. See specification 01 77 00 for the definitions of the following terms that may also be used in this specification:
39 1. Substantial Compliance
40 2. Certificate of Occupancy
41 3. Certificate of Substantial Completion
42 4. Construction Closeout
43 5. Contract Closeout
44 B. Emergency Repair: The Owner or Owner Representative reserves the right to make emergency repairs as
45 required to keep equipment or materials in operation or to prevent damage to property and injury to persons
46 without voiding the contractors warranty or bond or relieving the contractor of his/her responsibilities during
47 the warranty period.
48 C. Installer: The company or contractor hired to install a finished product that was manufactured and supplied
49 specifically for the Work within this contract. The Installer may or may not be the same company that supplied
50 the product. See the definition for supplier.
51 D. Supplier: Any company that makes a specific finished product for the Work from information within the Contract
52 Documents. Examples of suppliers would include custom cabinets, steel stairs and railings, etc. A supplier would
53 not be a company that distributes items manufactured by others such as an electrical or plumbing supplier.
54 E. Warranty: A written guarantee from the manufacturer to the owner on the integrity of a product and its
55 installation, and the manufacturers’ responsibility to repair or replace the defective product or components
56 within a specified time from the date of ownership. Warranty may also be used interchangeably with
57 Guarantee. The following warranty types may be part of any specification within the Work associated with the
58 Construction Documents:

- 1 1. Expressed Warranty: A warranty that provides specific repair or replacement for covered components of
- 2 a product over a specified length of time.
- 3 2. Implied Warranty: A warranty that is not stated explicitly by a seller or manufacturer that the product is
- 4 merchantable and fit for the intended purpose.
- 5 3. Standard Product Warranty: Preprinted written warranties published by individual manufacturers for
- 6 particular products and are specifically endorsed by the manufacturer to the Owner. Standard warranties
- 7 may be for any amount of time but shall not be for anything less than one (1) year from the warranty
- 8 date.
- 9 4. Special Warranty: A written warranty required by the Contract Documents either to extend the time
- 10 limit provided under a standard warranty or to provide greater rights to the Owner.
- 11 F. Warranty Date: The effective date that begins all warranty periods required for products, installations, and
- 12 work-manship associated with the execution of the Work for this contract. The Warranty Date shall be set by
- 13 the CPM.
- 14 G. Related Damages and Losses: When correcting failed or damaged Warranted Work, remove and reinstall (or
- 15 replace if necessary) the construction that has been damaged as a result of the failure or the construction that
- 16 must be removed and replaced to obtain access for the correction of Warranted Work.
- 17 H. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected reinstate the
- 18 warranty by a new written endorsement. The reinstated warranty shall be equal to the original warranty with an
- 19 equitable adjustment for depreciation unless specifically noted otherwise in a specification.
- 20 I. Replacement Cost: All costs that may be associated with Work being replaced under warranty including but not
- 21 limited to the following:
- 22 1. Related damages and losses
- 23 2. Labor, material and equipment
- 24 3. Permits and inspection fees
- 25 4. This shall be regardless of any benefit the Owner may have had from the Work through any portion of its
- 26 anticipated useful service life.
- 27 J. Replacement Work: All materials, products, required labor, and equipment necessary to replace failed or
- 28 damaged warranted to an acceptable condition that complies with the requirements of the original Construction
- 29 Documents.
- 30 K. Owners Recourse: Expressed warranties made to the Owner are in addition to implied warranties and shall not
- 31 limit the duties, obligations, rights, and remedies otherwise available under the law. Expressed warranty periods
- 32 shall not be interpreted as limitations on the time in which the Owner can enforce such other duties, obligations,
- 33 rights, and remedies.
- 34 1. Rejection of Warranties: The Owner reserves the right to reject any warranty and to limit the selection of
- 35 products with warranties not in conflict with the requirements of the contract documents.
- 36 2. Where the Contract Documents require a Special Warranty or similar commitment on the Work or
- 37 product, the Owner reserves the right to refuse acceptance of the Work until the Contractor presents
- 38 evidence the entities required to countersign such required commitments have done so.
- 39

40 **1.4. GENERAL CONTRACTORS RESPONSIBILITIES**

- 41 A. The General Contractor (GC) shall be responsible to remedy, at his/her expense, any defect in the Work and any
- 42 damage to City owned or controlled real or personal property when the damage is a result of:
- 43 1. The GC's failure to conform to Contract Document requirements.
- 44 a. Any substitutions not properly approved and authorized may be considered defective.
- 45 2. Any defect in workmanship, materials, equipment, or design furnished by the GC or Sub-contractors.
- 46 B. All warranties as described in this specification and these Contract Documents shall take effect on the date
- 47 established by the CPM, as noted in Section 1.3F above.
- 48 1. All warranties shall remain in effect for one (1) year thereafter unless specifically stated otherwise in the
- 49 Contract Documents or where standard manufacturer warranties are greater.
- 50 C. The GC's warranty with respect to Work repaired or replaced, including restored or replaced Work due to
- 51 damage, will run for one (1) year from the date of Owner Acceptance of said repair or replacement.
- 52 1. This shall be regardless of any benefit the Owner may have had from the Work through any portion of its
- 53 anticipated useful service life.
- 54 D. Warranty Response
- 55 1. See Section 3.5 of this specification.

1 **PART 2 – PRODUCTS - THIS SECTION NOT USED**

2

3 **PART 3 - EXECUTION**

4

5 **3.1. WARRANTY CHECKLIST**

- 6 A. All contractors shall be responsible for reviewing the drawings and specifications within their Divisions of Work
7 to provide a complete and comprehensive list of all Warranty Requirements to the GC.
- 8 B. Each list shall indicate the title (and plan identifier when applicable) of the warranted item, the associated
9 specification of the warranted item, the terms of the warranty (years), and a column to verify the item has been
10 turned in and completed.
- 11 C. The GC shall be responsible for all of the following:
- 12 1. Consolidating all the warranty lists into one master Warranty Checklist.
- 13 a. The checklist shall be in a tabular data format similar to the sample below.
- 14 2. Upload the completed checklist to the Submittal Library on the Project Management Web Site for review.
15 See Specification 01 33 23 Submittals for more information on this procedure.
- 16 3. Resubmit the schedule as needed after initial reviews have been completed.
- 17 D. The GC shall work with all contractors to amend the Warranty Checklist throughout the execution of the project
18 based on changes and modifications as necessary.
- 19

<u>Title</u>	<u>Specification</u>	<u>Terms</u>	<u>Completed</u>
Overhead Door Operator	08 36 00	MFR 2yr	
Exterior Bench and Trash Receptacles	12 93 00	MFR 3 year warranty on finish	
Kitchen Sink (SK-1)	22 42 00	MFR 5 year	
Disposal (D-1)	22 42 00	MFR 7 year parts and in-home service	
Toilet (WC-1)	22 42 00	MFR 1 year limited	

20

21 **3.2. LETTERS OF WARRANTY**

- 22 A. All letters of warranty shall be in a typed letter format and provide the following information:
- 23 1. The letter shall be on official company stationary including company name, address, and phone number.
- 24 2. Indicate METRO TRANSIT - SERVICE LANE ADDITION - PHASE 1, contract number, and contract address
25 the warranty is for on the reference line.
- 26 3. Provide a description of the warranty(ies) being provided.
- 27 a. Include Division, Trade, or Specification information as necessary.
- 28 b. Only combine warranties of related Divisional Work together. Create new letters for additional
29 Divisions as necessary.
- 30 4. Indicate the effective Warranty Date. As noted in Section 1.3.F above, the Warranty Date shall be the
31 date the Certificate of Substantial Completion was signed by the City Engineer.
- 32 5. Contractor Letters of Warranty shall only be signed by a principal officer of the company.
- 33 6. After signing the letter provide the GC with a high quality color scanned image in PDF format and the
34 original signed letter.
- 35 B. The GC shall be responsible for the Final Warranty submittal as identified in Section 3.4 below.
- 36 C. The GC shall obtain letters of warranty from all of the following:
- 37 1. The General Contractor shall provide warranty letters for all Work that was self performed under the
38 contract documents, identify all trades or Divisions of Work.
- 39 2. All Sub-contractors shall provide warranty letters for Work performed under the contract documents;
40 identify all trades or Divisions of Work.
- 41 3. Suppliers, as required by other specifications within the Construction Documents where the manufacture
42 of a specific product unique to the Work of this contract was required.
- 43 a. The terms and conditions of the Supplier Letter of Warranty shall be as defined by the
44 specifications associated with the Work but shall not be less than the industry standard of repair,
45 or replace defective materials and workmanship within one (1) year of the warranty date.
- 46 b. When the supplier is also the installer a single written letter may be submitted identifying both
47 the warranty for the manufacture of the product and the warranty for the installation of the
48 product.
- 49 4. Installers as required by other specifications within the Construction Documents where the installation of
50 a specific product unique to the Work of this contract was required.

- 1 1. The terms and conditions of the Installer Letter of Warranty shall be as defined by the
2 specifications associated with the Work but shall not be less than the industry standard of repair,
3 or replace defective materials and workmanship associated with the installation of the product
4 within one (1) year of the warranty date.
5 5. Special Letters of Warranty shall be required from any contractor, supplier, installer or manufacturer who
6 agrees to provide warranty services required by any Division Specification in excess of their Standard
7 Product Warranty.
8

9 **3.3. STANDARD PRODUCT WARRANTY**

- 10 A. All contractors shall be responsible for collecting and providing copies of all standard product warranties for
11 commercially available products purchased and installed under this contract.
12 B. Only one copy of the manufacturers' standard warranty needs to be submitted as representative for all
13 quantities of the same model number used throughout the Work.
14 C. Provide the manufacturers certificate, letter, or other standard documentation for each Standard Product
15 Warranty submitted as follows:
16 1. Whenever possible a PDF version of the document shall be used.
17 a. If a PDF version is used all additional information shall be completed using simple PDF editing
18 tools such as text boxes, highlight, etc.
19 b. If a PDF version is not available and an original document is furnished the additional information
20 shall be neatly hand written and highlighted on the document in such a fashion so that it does not
21 obscure any part of the written warranty.
22 2. Provide the following additional information on each warranty document:
23 a. Contract warranty date.
24 b. Provide the manufacturer name and model number of the product if not specified within the
25 warranty.
26 i. Where the manufacturer name and model number is specified within the warranty it shall
27 be highlighted for visibility.
28 c. Provide the plan identifier (LAV-1, WC-2, etc) when applicable.
29 D. Each completed warranty shall be saved as a digital PDF. The file shall be named using the specification number
30 and item description. I.E. 22 42 00 Toilet (WC-1).pdf
31 a. Where an original certificate was furnished provide a high quality colored scan of the completed
32 document with the additional information. Save the scanned image in PDF format and use the
33 same naming convention as indicated above.
34 E. Provide all PDF files and any original documents to the GC for final consolidation to be provided to the Owner.
35

36 **3.4. FINAL WARRANTY SUBMITTAL**

- 37 A. The GC shall receive all required warranties (digital PDF and any original documents) from all contractors,
38 suppliers, installers and manufacturers.
39 B. The GC shall inventory all received warranties with the Warranty Submittal List to ensure all required warranties
40 have been received and all warranty periods are correct according to the specifications.
41 C. Provide with each Operation and Maintenance Manual a complete copy of any associated warranty.
42 D. Scan all warranties into a single organized electronic PDF file as follows:
43 1. Organize the PDF file into an orderly sequence based on the table of contents of the Specifications.
44 2. Provide a typed Table of Contents for the entire file at the front of the document.
45 3. Provide bookmarks and links to each individual PDF to enable quick navigation through the PDF
46 document.
47 E. Upload the warranty submittal to the appropriate document library on the Project Management Web Site for
48 review by the PA and CPM.
49 F. Correct any deficiencies or omissions and resubmit as necessary.
50

51 **3.5. WARRANTY NOTIFICATION, RESPONSE, EXECUTION AND FOLLOW-UP**

- 52 A. Warranty Notification:
53 1. The City of Madison, Project Management Web Site, uses an email notification system for all warranty
54 related issues. The GC will be required to provide, and keep current during the warranty period, a
55 minimum of two (2) email addresses and phone numbers of current employees to receive email
56 notifications and provide response regarding Work associated with these construction documents.
57 a. In the event a Warranty Issue is deemed by the City of Madison to be an emergency, the GC shall
58 first receive a phone call with a follow-up email from the Project Management Web Site.

- 1 b. The Contract Closeout-Warranty Issue Library on the Project Management Web Site uses a form
2 for each warranty issue that is logged into the system.
3 i. The GC shall open each warranty issue form, review the issue description and any attached
4 documentation or photos.
5 ii. The GC shall also notify any other sub-contractor, supplier, or installer that may be
6 required to review the warranty issue.
- 7 B. Warranty Response:
- 8 1. The GC shall upon notification by the City of Madison provide warranty response as follows:
- 9 a. Critical Systems or equipment: Where damage to equipment and other building components, or
10 injury to personnel is probable provide immediate emergency shut-down information and an on-
11 site response team as soon as possible but in no case shall on-site response exceed 24 hours.
12 b. For non-critical responses where damage or injury is unlikely provide on-site response no later
13 than the next business day.
14 c. Where Technical Assistance support is part of the written warranty provide all assistance
15 necessary via phone, text, or internet systems as indicated by the warranty. If issues cannot be
16 resolved provide on-site response no later than the next business day.
17 d. If the request cannot be supported in sufficient time as outlined above the Owner (or Owner
18 Representative) reserves the right to contact other contractors or service companies having
19 similar capability to expedite the repair or replacement and shall invoice all associated costs to
20 the Owner back to the GC.
- 21 C. Warranty Execution:
- 22 1. The GC shall provide all repairs or replacements as necessary to restore broken or damaged Work to the
23 original level of acceptance as intended by the Contract Documents.
- 24 a. Provide all materials, equipment, products, and labor necessary to complete the repair or
25 replacement associated with the Warranty Issue.
26 b. Provide all cleaning services as may be required before, during, and after the repair or
27 replacement as per Specification 01 74 13 Progress Cleaning.
28 c. Provide any protection necessary for existing construction as per Specification 01 76 00 Protecting
29 Installed Construction
30 d. Provide new letters of warranty when required.
- 31 D. Warranty Follow-up:
- 32 1. Logged Warranty Issues:
- 33 a. The GC shall provide complete documented responses of all logged Warranty Issues. Responses
34 shall provide a description of work completed, by who, inclusive dates, and photos of completed
35 or repaired work.
- 36 i. Provide call back response if work is not acceptable.
37 b. The City Project Manager shall review the submitted response documentation and do a field
38 inspection if necessary.
- 39 i. If work is not acceptable, contact GC to review details and expectations of the repair as
40 needed.
41 ii. If work is acceptable close the Warranty Issue.
- 42 2. Quarterly Warranty Reviews:
- 43 a. The GC shall be responsible for scheduling quarterly on-site review with all of the following:
- 44 i. City Project Manager, and other City staff as needed
45 ii. Owner and Owner Tenant Representative
46 iii. Commissioning Agent (CxA)
47 iv. Plumbing, Heating, Electrical Sub-contractors
48 v. Other Sub-contractors that may be responsible for open Warranty issues
- 49 b. Quarterly reviews shall be scheduled at 3 months, 6 months, and 11 months after the effective
50 date of the warranty. The review meetings shall:
- 51 i. Review the status of all open Warranty Issues, determine course of action and estimated
52 date of completion.
53 ii. In the appropriate quarter, provide shut-down, start-up, testing, and training of off-season
54 equipment as required by the contract documents.
55 iii. The 11th month review shall review all open Warranty Issues, final plan for resolution, and
56 all Warranty Issues where a new letter of warranty may have been issued.
57
58

END OF SECTION

**SECTION 01 78 39
AS-BUILT DRAWINGS**

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PART 1 – GENERAL

1.1. SUMMARY

- A. This specification is intended to provide clear guidelines and identify the responsibilities of all contractors as they pertain to City of Madison contract procedures regarding the accurate recording of the Work associated with the execution of this contract. This shall include but not be limited to work that will be hidden, concealed, or buried.
- B. Each contractor shall be responsible for maintaining an accurate record of all installations, locations, and changes to the contract documents during the execution of this contract as it may relate to their specific division or trade.
- C. The General Contractor (GC) shall be responsible for ensuring all contractors provide as-built record information to the Master As-Built Document Set as described in this specification.

1.2. RELATED SPECIFICATIONS

- A. 00 31 21 Survey Information
- B. 01 26 13 Request for Information
- C. 01 31 23 Construction Bulletin
- D. 01 32 33 Photographic Documentation
- E. 01 26 63 Change Orders
- F. 01 29 76 Progress Payment Procedures
- G. 01 31 23 Project Management Web Site
- H. 01 33 23 Submittals
- I. 01 77 00 Closeout Procedures
- J. 01 91 00 Commissioning
- K. Other Divisions and Specifications that may address more specifically the requirements for field recording the installation of all items associated with the execution of this contract by Division or Trade.

1.3. RELATED DOCUMENTS

- A. Other related documents shall include but not be limited to the following:
 - 1. Bidding documents including drawings, specifications, and addenda.
 - 2. Required regulatory documents of conditional approval.
 - 3. Field orders, verbal or written by inspectors having regulatory jurisdiction.
 - 4. Shop drawings and installation drawings.

1.4. PERFORMANCE REQUIREMENTS

- A. The GC shall be responsible for maintaining the “Master As-Built Document Set” in the job trailer at all times during the execution of this contract. This document set shall include all of the following:
 - 1. Master As-Built Plan Set
 - 2. Master As-Built Specification Set
 - 3. Other Document Sets

- 1 B. The GC shall designate one person of the GC staff to be responsible for maintaining the Master As-Built
2 Document Set at the job trailer. This shall include, posting updates, revisions, deletions and the monitoring of all
3 contractors posting as-built information as described in this specification.
4 C. All contractors shall use this specification as a general guideline regarding the requirements for documenting
5 their completed Work. Contractors shall explicitly follow additional specification requirements within their own
6 Division of Trade as it may apply to this specification.
7

8 **1.5. QUALITY ASSURANCE**

- 9 A. The GC shall be responsible for all of the following:
10 a. Spot checking all sub-contractors field documents to insure daily information is being recorded as
11 work progresses.
12 b. Discuss as-built recording to the plan set at weekly job meetings with all sub-contractors on site.
13 c. Schedule time with sub-contractors in the job trailer for recording as-built information to the plan
14 set.
15 d. Insure that all sub-contractors are providing clear and accurate information to the plan set in a
16 neat and organized manner.
17 e. Insure sub-contractors who have completed work have finalized recording all as-built information
18 to the plan set before releasing them from the project site.
19 B. The Project Architect, the City Project Manager, Commissioning Agent and other design team staff will perform
20 random checks of the Master As-Built Document Set during the execution of this contract to ensure as-built
21 information is being recorded in a timely fashion as the Work progresses. An updated and current Master As-
22 Built Document Set is a stipulation for approval of the progress payment.
23

24 **PART 2 – PRODUCTS**

25
26 **2.1. OFFICE SUPPLIES**

- 27 A. The GC shall provide a sufficient supply of office products in the job trailer at all times for all contractors to use in
28 recording as-built information into the plan set. This shall include but not be limited to the following:
29 a. Red ink pens, medium point. Pens that bleed through paper, markers, and felt tips will not be
30 accepted.
31 b. The use of highlighters is acceptable. Assign colors to various trades for consistency in recording
32 information.
33 c. Straight edges of various lengths for drawing dimension, extension and other lines.
34 d. Civil and Architectural scales
35 e. Clear transparent, non-yellowing, single sided tape.
36 f. Correction tape or correction fluid for correcting small errors.
37

38 **PART 3 - EXECUTION**

39
40 **3.1. FIELD DOCUMENT AS-BUILTS**

- 41 A. The GC and all Sub-contractors shall be responsible for keeping their own field set of as-built documents
42 including plans, specifications and published changes.
43 B. Field sets shall be kept dry and in good condition at all times.
44 C. No Work shall be buried, covered, or hidden, by any additional Work, regardless of Contractor or Trade, until
45 locations of all materials and equipment has been properly documented as described below.
46 D. All contractors shall be required to record the following as-built information:
47 a. Notes on the daily installation of materials and equipment.
48 b. Sketches, corrections, and markups indicating final location, positioning, and arrangement of
49 materials and equipment such as pipes, conduits, valves, cleanouts, pull boxes and other such
50 items. Note all final locations on plan sheets, indicate dimension off identifiable building features.
51 Riser diagrams need only be corrected for significant changes in locations, routing or
52 configuration.
53 i. The use of photographs in lieu of hand drawn sketches is acceptable.
54 ii. Photos shall be taken according to Specification 01 32 33 Photographic Documentation
55 iii. Print photo and markup with dimensions or notes as necessary.
56 c. Identify by the use of existing plan symbology and notes the size, type, quantity, and use as
57 applicable of materials such as pipes, valves, conduits, etc.

- 1 d. Note whether horizontal runs are below slab or above ceiling, include dimensions above or below
2 finished floor elevation.
3 E. All contractors shall be responsible for transferring the information from their field set of documents to the
4 Master As-Built Plan Set kept in the GC job trailer. See Section 3.3.D. below for the proper procedure.
5 F. All contractors shall update the GC Master Plan Set as often as necessary, but not less than once per work week.
6

7 **3.2. SITE SURVEY AS-BUILT**

- 8 A. The Land Surveyor Sub-Contractor shall provide digital as-built information including but not be limited to the
9 following:
10 a. For underground buried utility laterals and services of all types locate all of the following that may
11 apply:
12 i. Connection points at all mains
13 ii. Storm discharge points to open air
14 iii. All corners and bends regardless of angle, large radius sweeps shall have multiple point
15 locations sufficient to define the sweep.
16 iv. All vertical drops
17 v. All wells
18 vi. Private buried utilities such as buried electrical cables, irrigation systems, etc.
19 v. Other information that may need to be located in the future by the owner prior to digging
20 b. Record all surface features including but not limited to the following:
21 i. Building corners, pavement edges, and other permanent structural features.
22 ii. All surface covers for inlets, catch basins, cleanouts, access structures, curb stops and
23 other such devices.
24 iii. Other permanent surface features such as hydrants, lamp posts, and other permanent site
25 amenities.
26 c. The following data shall be recorded while locating items in sub-sections 3.2.a and 3.2.b above:
27 i. Flow lines at both ends of pipes
28 ii. Pipe sizes and material types
29 iii. Rim elevations for all covers
30 iv. Sump elevations and invert elevations of all structures
31 v. Spot elevations for all pads, driveways, walks, stoops, and floors
32 B. The Surveyor shall provide the final digital as-built on a media and in a format specified in Specification 00 31 21
33 Survey Information to the GC for turn in to the Project Architect and the Civil Engineer.
34 C. The Surveyor shall provide two printed as-built site plans to the GC for inclusion in the Master As-Built Plan Set
35 as follows:
36 1. One sheet to show all features (but not contour information) with text neatly organized for each item
37 identified.
38 2. One sheet showing contours, contour labels, and features from item 1 above, but with no additional text.
39

40 **3.3. MASTER AS-BUILT DOCUMENT SET**

- 41 A. The GC shall be responsible for maintaining the Master As-Built Document Set in the job trailer at all times.
42 1. The Master As-Built Plan Set (Plan Set) shall begin with one complete bid set of drawings and any
43 additional sheets that were supplied by published addenda during the bidding process. The cover sheet
44 shall be titled as the "Master As-Built Plan Set" in large bold red letters approximately 2" in height and
45 shall not be used for any other purpose.
46 a. The Plan Set shall be kept dry, legible, and in good condition at all times.
47 b. The Plan Set shall be kept up to date with new revisions within two (2) working days of
48 supplemental drawings being issued. Revisions shall be posted as follows:
49 i. Insert new, revised sheets into the plan set. Void old sheets but do not remove them from
50 the plan set. Indicate date received and what document (RFI, CB, CO, etc) caused the
51 change.
52 ii. Insert new, revised individual details into the plan set. Void old details, tape new details
53 over the old details with a "tape hinge" to allow them to be viewed. Indicate date
54 received and what document (RFI, CB, CO, etc) caused the change.
55 iii. Add new details in appropriate white space on relevant sheets. If no space is available use
56 the back side of the previous sheet or insert a new sheet. Indicate date received and what
57 document (RFI, CB, CO, etc) caused the change.

- 1 c. The Plan Set shall be available at anytime for easy reference during progress meetings and for
2 emergency location information of new work already completed.
- 3 2. The Master As-Built Specification Set (Spec Set) shall begin with one complete bid set of specifications
4 and any additional specifications that were supplied by published addenda during the bidding process.
5 The Spec Set shall be provided in three "D" ring type binders of sufficient thickness to accommodate the
6 specification set. Multiple binders are allowed as necessary. Label the front cover and binding edge with
7 "Master As-Built Specifications" in bold red letters. Provide other information as necessary to distinguish
8 the contents of multi-volume sets.
- 9 a. The Spec Set shall be kept dry, legible, and in good condition at all times.
10 b. The Spec Set shall be kept up to date with new revisions within two (2) working days of
11 supplemental drawings being issued.
- 12 c. The Spec Set shall be available at anytime for easy reference during progress meetings.
- 13 3. Other Document Sets may be kept at the GCs option in three "D" ring type binders of sufficient thickness
14 to accommodate the documentation. Other documentation sets may include but not be limited to RFIs,
15 CBs, COs, etc.
- 16 C. The Land Surveyor Sub-Contractor shall be required to use digital surveying for all exterior site surveying, and
17 provide deliverable digital as-builts as specified in Specification 00 31 21 Survey Information. As soon as practical
18 the surveyor shall provide the GC with a preliminary copy of installed buried utilities for inclusion with the plan
19 set in the job trailer. The surveyor shall provide final digital as builts as per section 3.2 above.
- 20 D. All contractors shall be responsible for updating the Plan Set from their field sets at least once per work week.
21 Updates shall include but not be limited to the following procedures:
- 22 a. All updates shall be done only in red ink. Place a "cloud" around small areas of correction to call
23 attention to the change.
- 24 b. Whenever possible place general work notes, field sketches, supplemental details, photos, and
25 other such information on the reverse side of the preceding sheet. Installation notes including
26 dates shall be kept neatly organized in chronological order as necessary.
- 27 c. Accurately locate items on the plan set as follows:
- 28 i. For items that are located as dimensioned provide a check mark or circle indicating the
29 dimension was verified.
- 30 ii. For items that are within 5 feet of the location indicated on the plans leave as shown and:
- 31 • Provide correct dimensions to existing dimension strings or,
32 • Accurately locate with new dimension strings
- 33 iii. For items that are more than 5 feet from the location indicated on the plans
- 34 • Accurately draw the items in the new location as installed and,
35 • Accurately locate with new dimension strings and,
36 • Note that the existing location is void.
- 37 d. Include dimensioned locations for items that will be buried, concealed, or hidden in the ground,
38 under floors, in walls or above ceilings.
- 39 i. Dimensions shall be pulled from identifiable building features, not from centers of columns
40 or other buried features.
- 41 ii. When necessary pull more dimensions as needed from opposing directions to properly
42 locate single items.

44 3.4. AS-BUILT REVIEW AND ACCEPTANCE

- 45 A. The GC shall provide the Master As-Built Plan Set to the Project Architect (PA), the City Project Manager (CPM),
46 the Commissioning Agent (CxA) and other design team staff for content review prior to the Progress Payment
47 Milestone indicated in Specification 01 29 76 Progress Payment Procedures. The submitted plan set shall include
48 the digital survey information produced under Section 3.2 above.
- 49 1. If the plan set is not approved:
- 50 a. The PA and CPM shall only be required to generalize deficiencies by trade there shall be no
51 requirement or expectation to generate a "punch list" of required corrections.
- 52 b. The GC and Sub-contractors as necessary shall be responsible for inspecting the installation and
53 correcting the drawings as needed.
- 54 c. The GC shall re-submit the plan set for review.
- 55 2. If the plan set is approved the PA shall take possession of the plan set to be used in providing the owner
56 with digital CAD record drawings. Upon completion of transferring the information to CAD the PA shall
57 provide the Owner with CAD record drawings, record PDFs, and the Master As-Built Plan Set.
- 58

1 **3.5. CHANGES AFTER ACCEPTANCE**

- 2 A. No Contractor shall be responsible for making changes to the As-Built record documents after acceptance by the
3 PA and CPM except when necessitated by changes resulting from any Work made by the Contractor as part of
4 his/her guarantee.

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END OF SECTION

SECTION 01 78 43
SPARE PARTS AND EXTRA MATERIALS

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16 3.5. CLOSEOUT PROCEDURE 3
17

PART 1 – GENERAL

1.1. SUMMARY

- 21 A. This specification is intended to provide clear guidelines and identify the responsibilities of all contractors as they
22 pertain to City of Madison contract procedures regarding spare parts, special tools, special materials, and extra
23 materials.
24 B. Each contractor shall be responsible for knowing the specific requirements of their Division Specifications as they
25 may relate to the general information provided in this specification.
26 C. The General Contractor (GC) shall be responsible for ensuring all contractors provide spare parts and extra
27 materials as described in this specification.
28

1.2. RELATED SPECIFICAITONS

- 30 A. 01 29 76 Progress Payment Procedures
31 B. 01 31 23 Project Management Web Site
32 C. 01 77 00 Closeout Procedures
33 D. Other Divisions and Specifications that may address more specifically how to proceed with spare parts, special
34 tools, special materials, and extra materials.
35

1.3. DEFINITIONS

- 37 A. Spare Parts: Any component of a product or assembly that comes pre-packaged or was specially ordered for the
38 explicit use of the product or assembly. This shall include but not be limited to fastening devices, mounting
39 brackets, replacement parts, wheels, pulleys, wiring, alternate assembly pieces, etc.
40 B. Special Tools: Any tool of any kind that was pre-packaged or specially ordered, and is required to be used for the
41 installation or maintenance of an installed product or assembly as part of this contract.
42 C. Special Materials: Any oil, lubricant, glue, touch-up paint, or other such material that comes pre-packaged or
43 was specially ordered and is required to be used for the installation or maintenance of an installed product or
44 assembly as part of this contract.
45 D. Extra Materials (Attic Stock): Any surplus materials in new and useable condition that was installed a part of this
46 contract. Attic Stock shall include but not be limited to the following: ceiling tiles, paint, stain, floor coverings,
47 ceramic tiles, light bulbs/lamps, filters, strainers, etc. Attic Stock shall include partially opened bulk items and
48 additional unopened quantities as directed by other specifications.
49

1.4. PERFORMANCE REQUIREMENTS

- 51 A. All contractors shall be responsible for consolidating spare parts, special tools, special materials, and attic stock
52 as it pertains to the specific Work within their Division or Trade.
53 B. All contractors shall use this specification as a general guideline regarding the requirements for turning spare
54 parts, special tools, special materials, and attic stock over to the owner. Contractors shall explicitly follow
55 specification requirements within their own Division of Trade.
56

1.5. QUALITY ASSURANCE

- 58 A. The General Contractor (GC) shall be responsible for all of the following:

- 1 1. Coordinate the location for and the delivery of all spare parts, special tools, special materials, and attic
2 stock being provided by all contractors under this contract to one centralized location as designated by
3 the Owner.
4 2. Verify that all items being delivered are:
5 a. Clean, new, and in a usable condition.
6 b. Properly sealed, protected, and labeled
7 c. Properly documented
8

9 **PART 2 – PRODUCTS – THIS SECTION NOT USED**

10
11 **PART 3 - EXECUTION**

12
13 **3.1. PACKAGING**

- 14 A. Whenever possible all surplus items should remain in their original packaging such as parts envelopes.
15 B. Package small parts in re-sealable plastic bags (Ziploc) or envelopes with clasp fasteners. Do not use envelopes
16 that seal with glue or tape envelopes closed. Do not leave packaging unsealed.
17 C. Package like parts together for products or assemblies. I.E. keep all spare parts for flushometers together.
18 D. Many small packages may be grouped together into a larger container by trade.
19 E. Do not use unrelated boxes or containers for packaging spare items. I.E. do not use a light fixture box for spare
20 breakers, or flushometers parts.
21

22 **3.2. LABELING**

- 23 A. Whenever possible the original labeling indicating part numbers and other pertinent information shall remain on
24 the original packaging.
25 B. If original labeling is not available the contractor shall label all parts and packages using tape or labels and
26 permanent black markers. Tape or labels being used shall absorb the permanent marker without bleeding or
27 allowing ink to be smeared or rubbed off.
28 C. Labels shall include the name of the product or equipment the item belongs to, part number and/or name, and
29 any other information that would assist maintenance personnel in identifying the piece and related product.
30 D. Labels shall include plan or specification designations (WC-1, LAV-3, DF-2, CPT-1, etc) that identify the particular
31 product or finish material it represents.
32 E. Labels for parts stored in clear re-sealable plastic bags may be placed inside the bag. Label shall face out and be
33 able to be read from one side. Multiple bags shall be numbered individually for identification.
34 F. Label the outside of large containers with the trade name (Plumbing, Electrical, etc).
35

36 **3.3. INVENTORY**

- 37 A. All contractors shall provide the GC with complete inventories of all spare parts, special tools, special materials,
38 and attic stock that they are providing at the end of the contract. The inventories shall be organized as follows:
39 1. The cover sheet shall indicate the Contractors name, address, phone number, identify that the document
40 is the "Spare Parts and Extra Materials Inventory", and identify the Division or Trade the inventory is for.
41 2. Provide an inventory in a tabular format of all items being provided under this and other specifications.
42 The minimum information to be provided for each item on the inventory shall be as follows:
43 a. Bag or container number, all items of one bag or container shall be grouped together on the
44 inventory
45 b. Item description
46 c. Item size (if applicable)
47 d. Total quantity provided
48 e. Identify if item is a spare part, tool, special material, or attic stock
49 B. The GC shall consolidate inventories from all sub-contractors into one tabular data sheet organized by Division or
50 Trade of Work.
51 1. Upon completing the consolidated list the GC shall upload the completed inventory to the Contract
52 Closeout-Attic Stock Library on the Project Management Web Site.
53 2. The GC shall notify the Project Architect and City Project Manager that the scans have been uploaded.
54 3. Consulting Staff and Owner Staff shall review the inventories prior to Final Review to verify that minimum
55 required quantities have been met. Deficiencies shall be noted and returned back to the GC for
56 corrective action.
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3.4. STORAGE

- A. Prior to the 80% Progress Payment milestone the GC shall coordinate with the City Project Manager and Maintenance Personnel where spare parts, special tools, special materials, and attic stock shall be stored.
- B. The GC shall instruct all contractors as to the location and proper storage procedures.
- C. The GC shall be responsible for ensuring the storage area is kept neat and orderly as follows:
 - 1. Like items are stored together by material, product, or trade as necessary.
 - 2. Liquids are stored in sealable containers and the lids have been properly installed to prevent drying out, spillage, etc.
 - 3. All labels are clearly visible and provide the required information.
- D. Large items shall be stored so as not to damage other items. Do not stack heavy items or items with distinct shapes/outlines on softer items that may get crushed or imprinted.

3.5. CLOSEOUT PROCEDURE

- A. Prior to the 90% Progress Payment milestone the GC shall review all attic stock already stored by the contractors to ensure the following:
 - 1. Materials are stored in the proper location(s).
 - 2. All boxes, containers and items are properly labeled according to the submitted/approved inventory.
 - 3. Quantities are correct according to the submitted/approved inventory.
- B. The GC shall ensure that all deficiencies are corrected prior to conducting Demonstration and Training Sessions.
- C. The GC shall review with Maintenance Staff all inventories and labeling during the scheduled Demonstration and Training Sessions.
- D. Any discrepancies associated with Attic Stock shall be resolved and verified prior to the CPM releasing the 90% CT progress payment.

END OF SECTION

**SECTION 01 79 00
DEMONSTRATION AND TRAINING**

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PART 1 – GENERAL

1.1. SUMMARY

- 20 A. The purpose of this specification is to provide clear responsibilities and guidelines related to providing
21 Demonstration and Training (D&T) Sessions related to general facility use, equipment, systems, finishes, and
22 materials to City of Madison Staff (Owner, Owner Representatives, Maintenance, and Custodial Personnel) as
23 needed.
24 B. All D&T shall be coordinated through the General Contractor (GC), Project Architect (PA) and City Project
25 Manager (CPM), and will be based on or customized to the needs of City of Madison Staff being trained. New
26 equipment and systems may have complete D&T sessions as described in this specification while equipment or
27 systems staff is familiar with may have sessions more focused on maintenance only.
28

1.2. RELATED SPECIFICATIONS

- 30 A. Section 01 29 76 Progress Payment Procedures
31 B. Section 01 78 13 Completion and Correction List
32 C. Section 01 78 19 Maintenance Contracts
33 D. Section 01 78 23 Operation and Maintenance Data
34 E. Section 01 78 36 Warranties
35 F. Section 01 78 39 As-Built Drawings
36 G. Section 01 78 43 Spare Parts and Extra Materials
37 H. Section 01 91 00 Commissioning
38 I. Other Divisions and Specifications that may address more specifically the requirements for D&T sessions related
39 to the installation of all items and equipment installed under the execution of the Work.
40

1.3. QUALITY ASSURANCE

- 42 A. All contractors shall have the responsibility of preparing for and conducting D&T sessions as determined by this
43 and other Division or Trade related specifications, Owner Operation and Maintenance Manuals, and other such
44 documentation related to the Work.
45 B. The GC shall have responsibility for:
46 1. Ensuring that all contractors required to conduct a D&T session have successfully completed all of the
47 following:
48 a. Turned in all required documentation for review and documentation has been approved/accepted
49 prior to scheduling D&T sessions.
50 b. Other required documentation as needed is available and ready for use during the D&T session.
51 c. All systems have been started, tested, and running as per appropriate specification and/or
52 manufacturers recommendations prior to scheduling D&T sessions.
53 d. All contractors are sufficiently prepared for their D&T session
54 e. Documents the D&T session including date, time, contractor and company name, attendees and
55 other information regarding the session
56 2. Organizing the coordination and scheduling of all D&T sessions between all contractors and the
57 appropriate representatives of the Owner. These representatives may include any of the following
58 depending on the Work of the Contract:

- 1 a. Owner – end users
- 2 b. Facility Maintenance personnel
- 3 i. Facility general operation procedures including custodial services
- 4 ii. Electrical
- 5 iii. Mechanical
- 6 iv. Plumbing
- 7 v. Site
- 8 c. Information Technology (IT) Department
- 9 d. Traffic Engineering – Radio Shop
- 10 e. Architects, Engineers and Facility Management staff as project completion overview
- 11

12 **PART 2 – PRODUCTS – THIS SECTION NOT USED**

13

14 **PART 3 - EXECUTION**

15

16 **3.1. GENERAL REQUIREMENTS**

- 17 A. The GC shall develop a specific D&T plan to be scheduled and conducted as described below but no sooner than
- 18 the meeting discussed in 3.2.A.2 below.
- 19 C. The GC shall not schedule D&T sessions to preclude required personnel from attending multiple sessions.
- 20

21 **3.2. COORDINATING AND SCHEDULING THE TRAINING**

- 22 A. The GC, PA, CxA and CPM, shall review all Training and Demonstration requirements during two (2) special
- 23 meetings.
- 24 1. The first meeting shall be held at the 50% Contract Total Payment. During this meeting the following
- 25 shall be discussed:
- 26 a. Preliminary schedule of training dates to be completed prior to beginning construction closeout.
- 27 b. List of documentation and items that need to be completed and available before and during the
- 28 training session.
- 29 c. Who (Owner, Maintenance, etc) will be attending what training session(s).
- 30 2. The second meeting shall be held at the 80% Contract Total Payment. This meeting shall review due outs
- 31 that have not yet been completed for the 90% Contract Total Payment and the requirements necessary
- 32 for Construction Closeout. All Demonstration and Training sessions shall be completed prior to receiving
- 33 the 90% progress payment and beginning Construction Closeout Procedures (see Specification 01 77 00).
- 34 a. This does not include any requirement associated with off season equipment preparation and/or
- 35 demonstration and Training Sessions.
- 36 B. All of the Construction Work shall be operationally ready prior to conducting training as follows:
- 37 1. All contractors shall have their As-Built Drawing Records available for reviewing locations of system
- 38 components during training.
- 39 2. All final and approved Operations and Maintenance Data shall be completed no less than two (2) full
- 40 weeks prior to the scheduled training.
- 41 3. All systems shall have been started, functionally tested, balanced, and fully operational, and all piping
- 42 and equipment labeling complete at least two (2) days prior to the scheduled training.
- 43 a. Seasonal equipment shall not be trained out of season. Contractors having seasonal equipment
- 44 shall work with the GC and CPM for coordinating additional training sessions as appropriate for
- 45 seasonal equipment.
- 46 C. Correction list items that prevent a piece of equipment or system from being fully operational for training shall
- 47 be corrected prior to conducting the training.
- 48

49 **3.3. TRAINING OBJECTIVES**

- 50 A. For each piece of equipment or system installed train on the following objectives/topics as applicable:
- 51 1. System design, concept, and capabilities
- 52 2. Review of related contractor as-built drawings
- 53 3. Facility walkthrough to identify key components of the system
- 54 4. System operation and programming including weekly, monthly, annual test procedures
- 55 5. System maintenance requirements
- 56 6. System troubleshooting procedures
- 57 7. Testing, inspection, and reporting requirements associated with any regulatory requirements
- 58 8. Identification of any correction list items still outstanding

- 1 9. Review of system documentation including the following:
- 2 a. Operation and maintenance data
- 3 b. Warranties
- 4 c. Valve charts, tags, and pipe identification markers
- 5 B. For each piece of specialty equipment train on the following objectives/topics as applicable:
- 6 1. Manufacturers operations instructions
- 7 2. Manufacturers use and care instructions
- 8 3. Manufacturers maintenance and troubleshooting instructions
- 9 4. System operation and programming including weekly, monthly, annual test procedures
- 10 5. Identification of any correction list items still outstanding
- 11 6. Review of system documentation including the following:
- 12 a. Operation and maintenance data
- 13 b. Warranties
- 14 C. End User Orientation
- 15 1. Facility walkthrough
- 16 2. Security and emergency features
- 17 3. General facility operation procedures
- 18 D. Facility General Use and Custodial Services – if requested
- 19 1. Facility walkthrough
- 20 2. Security and emergency features
- 21 3. General facility operation procedures
- 22 4. Care and maintenance of specialty items, finishes, etc as requested
- 23 5. Attic stock inventory and material designations
- 24

25 **3.4. DEMONSTRATION AND TRAINING PROGRAM PREPARATION**

- 26 A. Each contractor having a responsibility for providing D&T sessions shall meet with the GC, CPM, and other City
- 27 Staff as needed to review the extent of the Training Objectives in section 3.3 above needed for each piece of
- 28 equipment, system, finish, etc. This meeting shall occur no less than four (4) weeks prior to the anticipated
- 29 training session.
- 30 B. The contractor shall use the information from item 3.4.A above to prepare a formal training program for each
- 31 piece of equipment or system based on the Training Objectives in 3.3 above.
- 32 1. The formal training program shall include the following information:
- 33 a. Session title
- 34 b. List of systems, equipment, use, care, etc to be covered during the session
- 35 c. Provide the following for each systems, equipment, use, care, etc to be covered during the session
- 36 i. Name and affiliation of each instructor to be used. As needed and discretion of the Owner
- 37 the GC to require attendance by the installing technician, installing Contractor and the
- 38 appropriate trade or manufacturer’s representative.
- 39 ii. Qualifications of each instructor to be used. Practical building operation expertise as well
- 40 as in-depth knowledge of all modes of operation of the specific piece of equipment as
- 41 installed in this project is required by the training personnel. If Owner determines training
- 42 was not adequate, the training shall be repeated until acceptable to Owner.
- 43 iii. A checklist of all documentation and system/equipment requirements necessary to
- 44 complete a successful training session and the current status of each
- 45 iv. Any additional documents, training aids, video or other items to be used to complete the
- 46 training
- 47 v. Any special requirements or needs associated with item iv above to complete the training
- 48 d. The intended audience for the training
- 49 e. The approximate duration of each objective or topic to be covered
- 50 2. Submit the completed training program to the GC for review and approval by the PA and CPM.
- 51 C. The PA and CPM shall work with staff as necessary to ensure all points of anticipated training needs have been
- 52 met. The PA and CPM will approve the program as submitted or recommend changes for re-submittal as
- 53 necessary.
- 54

55 **3.5. CONDUCTING A DEMONSTRATION AND TRAINING SESSION**

- 56 A. All contractors shall conduct their required D&T Sessions as follows:
- 57 1. Begin with a classroom session
- 58 a. Provide a sign in sheet indicating all training to be conducted, instructors, etc.

- 1 b. Provide an overview of the training to be conducted including the approximate schedule.
- 2 2. Conduct a general walk-through of the site.
- 3 a. Point out locations of various equipment, valves, charts, and other related items.
- 4 b. Use the Division or Trade As-Built record drawings to indicate locations of hidden or buried items.
- 5 3. Provide a demonstration of general equipment/system operation including using the O&M manual.
- 6 a. Startup and shutdown procedures.
- 7 b. Normal operational levels as depicted by any gauges, software, etc.
- 8 c. Indicate warning devices, signs etc. and demonstrate emergency shut-down procedures.
- 9 4. Provide a demonstration of all owner level maintenance using the O&M manual.
- 10 a. Indicate frequency of maintenance.
- 11 b. Provide and review all spare parts, special tools, and special materials.
- 12 5. Provide and review all spare parts, special tools, special materials, or attic stock as applicable.
- 13 6. While conducting D&T sessions:
- 14 a. Allow hands on training whenever practical.
- 15 b. Answer questions promptly
- 16 c. Repeat demonstrations and procedures as necessary.
- 17 B. Within two (2) working days of completing the D&T session the contractor responsible for the session shall turn-
- 18 in any documentation generated including the sign in roster to the GC.
- 19 C. The GC shall turn over all training documentation to the PA and CPM upon completion of D&T sessions.
- 20 D. Re-schedule any training that has been determined to be inadequate or inappropriate for any reason including
- 21 but not limited to any of the following;
- 22 1. Unqualified instructor
- 23 2. System installation incomplete or untested to the specifications
- 24 3. Equipment failure during demonstration
- 25 4. Un-expected cancellation

26
27 **3.6. CLOSEOUT PROCEDURE**

- 28 A. Prior to receiving the 90% Progress payment the GC shall:
- 29 1. Verify with the PA and CPM that each Demonstration and Training Session was conducted properly and
- 30 according to the submitted plan.
- 31 2. Any required "Off Season" equipment testing, balancing, and Demonstration and Training Sessions have
- 32 been tentatively scheduled with the GC, necessary sub-contractors, instructors and Owner/Owner
- 33 Representatives as necessary.
- 34
- 35

36 **END OF SECTION**

37

**SECTION 01 91 00
COMMISSIONING**

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PART 1 – GENERAL

1.1. SUMMARY

- A. Purpose: Define the responsibilities of the parties involved and the procedures related to the commissioning process

1.2. RELATED SPECIFICATIONS

- A. Section 01 31 13 Project Management and Coordination
B. Section 01 31 19 Project Meetings
C. Section 01 31 23 Project Management
D. Section 01 32 26 Construction Progress Reporting
E. Section 01 33 23 Submittals
F. Section 01 45 16 Field Quality Control
G. Section 01 77 00 Closeout Procedures
H. Section 01 78 23 Operation and Maintenance Data
I. Section 01 78 39 As-Built Drawings
J. Section 01 79 00 Demonstration and Training
K. Section 01 81 13 Sustainable Design Requirements
L. Section 01 95 00 Measurement & Verification
M. Section 23 05 93 Testing, Adjusting, and Balancing for HVAC
N. Section 23 09 00 Instrumentation and Control for HVAC
O. Section 23 09 23 Direct Digital Control (DDC) System for HVAC
P. Section 23 09 93 Sequence of Operations for HVAC DDC

1.3 REFERENCES

- A. ASHRAE Guideline 1.1-2007, "HVAC&R Technical Requirements for The Commissioning Process".
B. ASHRAE Guideline 0-2005, "The Commissioning Process".
C. NEBB – Procedural Standards for Building Systems Commissioning.

1.4 DEFINITIONS

- A. Acceptance Phase. Phase of construction after startup and initial checkout when functional performance tests are performed.
B. Commissioning Authority (CxA). An independent entity, not otherwise associated with the A/E team members or the Contractor and reports directly to the Owner. The CxA directs and coordinates the commissioning activities.

- 1 C. Commissioning Plan (Cx Plan). An overall plan, developed before or after bidding, that provides the structure,
2 schedule and coordination planning for the commissioning process. The Cx Plan is included in the bid documents
3 and is to be reviewed by all contractors before submitting their bid.
- 4 D. Contract Documents. The documents binding on parties involved in the construction of this project (drawings,
5 specifications, change orders, amendments, contracts, Cx Plan, etc.).
- 6 E. Construction Checklist (CC). a list of items to inspect and test equipment and components to verify proper
7 installation of equipment. The CCs are provided by the CxA to the Sub.
- 8 F. Datalogging. - Monitoring flows, currents, status, pressures, etc. of equipment using stand-alone dataloggers
9 separate from the control system.
- 10 G. Deferred System Performance Tests. SPT's that are performed later, after substantial completion, due to partial
11 occupancy, equipment, seasonal requirements, design or other site conditions that prevent the tests from being
12 performed earlier.
- 13 H. Deficiency. A condition in the installation or function of a component, piece of equipment or system that is not in
14 compliance with the Contract Documents (that is, does not perform properly or is not complying with the
15 Owner's Project Requirements).
- 16 I. Factory Testing. Testing of equipment on-site or at the factory by factory personnel with an Owner's
17 representative present.
- 18 J. Indirect Indicators. Indicators of a response or condition, such as a reading from a control system screen
19 reporting a damper to be 100% closed.
- 20 K. Manual Test. Using hand-held instruments, immediate control system readouts or direct observation to verify
21 performance (contrasted to analyzing monitored data taken over time to make the "observation").
- 22 L. Monitoring. Recording parameters (flow, current, status, pressure, etc.) of equipment operation using
23 dataloggers or the trending capabilities of control systems.
- 24 M. Over-written Value. Writing over a sensor value in the control system to see the response of a system (e.g.,
25 changing the outside air temperature value from 75F to 50F to verify economizer operation). See also "Simulated
26 Signal."
- 27 N. Owner's Project Requirements (OPR). A document that describes what the Owner and stakeholders want to
28 achieve with this project and what expectations they have of the completed project.
- 29 O. Sampling. Reviewing or testing only a fraction of the total number of identical or near identical pieces of
30 equipment.
- 31 P. Seasonal Performance Tests. SPT's that are deferred until the system(s) will experience conditions closer to their
32 design conditions.
- 33 Q. Simulated Condition. Condition that is created for the purpose of testing the response of a system (e.g., applying
34 a hair blower to a space sensor to see the response in a VAV box).
- 35 R. Simulated Signal. Disconnecting a sensor and using a signal generator to send an amperage, resistance or
36 pressure to the transducer and DDC system to simulate a sensor value.
- 37 S. System Performance Test (SPT). Dynamic testing of entire systems (rather than just components of the system)
38 under full operation.
- 39 T. Trending. Monitoring of control points using the building automation system.

40
41 **1.5 DESCRIPTION**

- 42 A. General: Commissioning (Cx) is a systematic process of verifying that all building systems perform interactively to
43 meet the Owner's Project Requirements (OPR). This is achieved by beginning in the planning phase with
44 documenting the OPR and continuing through design, construction, acceptance, and the warranty period with
45 verification of performance. The Cx process shall encompass and coordinate the traditionally separate functions
46 of system documentation, equipment startup, control system calibration, tesTing and balancing, performance
47 testing and training. Cx during the construction phase is intended to achieve the following specific objectives
48 according to the Contract Documents:
 - 49 1. Verify that applicable equipment and systems are installed according to the manufacturer's
50 recommendations and to industry accepted minimum standards and that they receive adequate
51 operational checkout by installing contractors.
 - 52 2. Verify and document proper performance of equipment and systems.
 - 53 3. Verify that O&M documentation is complete.
 - 54 4. Verify that the Owner's operating personnel are adequately trained.
- 55 B. The Cx process does not take away from or reduce the responsibility of the system designers or installing
56 contractors to provide a finished and fully functioning product.
- 57 C. The commissioning authority (CxA) has no authority to change, modify or direct any work. The CxA can only
58 provide comments and suggestions.

- 1 D. Commissioning Plan. The Cx Plan provides guidance in the execution of the Cx process. The CxA will update the
2 Cx Plan regularly as the project progresses. The Drawings and Specifications will take precedence over the Cx
3 Plan.
4
- 5 **1.6 RESPONSIBILITIES**
- 6 A. General Contractor (GC) and Subcontractors (Subs)
- 7 1. Construction and Acceptance Phase
- 8 a. Provide assistance to the Construction Manager CM in the coordination of the Cx work by
9 the CxA, and with the CM and CxA ensure that Cx activities are being scheduled into the
10 master schedule.
- 11 b. Provide an updated construction schedule to the CxA any time the schedule changes.
- 12 c. Include the Cx activities in the contract.
- 13 d. Furnish a copy of all submittals and shop drawings pertaining to the commissioned
14 systems for review concurrently with the Architect and Engineers.
- 15 e. Furnish a copy of all construction meeting agendas and minutes to the CxA.
- 16 f. In each purchase order or subcontract written, include requirements for submittal data,
17 O&M data, Cx tasks and training.
- 18 g. GC will ensure that all Subs execute their Cx responsibilities according to the Contract
19 Documents and schedule.
- 20 h. A representative from the GC and each sub associated with the Cx process shall attend the
21 Cx pre- construction meeting and the regular Cx meetings scheduled by the CxA to
22 facilitate the Cx process.
- 23 i. Coordinate and execute the training of Owner personnel.
- 24 j. Prepare O&M manuals, according to the Contract Documents, including clarifying and
25 updating the original sequences of operation to as-built conditions.
- 26 k. Prepare and submit draft forms, including but not limited to start-up procedures, Testing
27 and Balancing (TAB) forms, calibration forms, etc. for review by the CxA before execution.
- 28 l. Submit test reports to the CxA of all tests performed on components and equipment to be
29 commissioned that are not included as part of the Construction Checklist and SPT
30 procedures.
- 31 m. Complete all construction checklist and functional performance test forms as required by
32 the Cx process.
- 33 n. Support the CxA with verification of the completion of construction checklist and
34 functional performance tests as outlined in PART 3.
- 35 o. Complete and inspect all installations. Certify that all components and systems are
36 operating as intended per Contract Documents.
- 37 p. Remedy all deficiencies immediately as they are identified throughout construction.
- 38 q. Demonstrate functionality of all systems and equipment.
- 39 r. Maintain an updated set of record drawings (on a daily basis) on the construction site.
- 40 s. Provide support and instrumentation to verify TAB reports, start-up reports, calibration
41 reports, and any other report pertinent to the commissioned equipment and systems.
- 42 t. Notify the CxA no less than 21 days before all testing, start-up, and training.
- 43 u. Update the CxA on a weekly basis on the progress of the Cx activities.
- 44 v. Submit trend data in electronic format or allow access to trending data by internet
45 connection as requested by the CxA.
- 46 w. Install access points by every sensor such that the sensor can be calibrated without
47 removal (P/T plugs, plugged holes in ducts etc.).
- 48 2. Warranty Period
- 49 a. Execute seasonal or deferred functional performance testing, witnessed by the CxA,
50 according to the specifications.
- 51 b. Correct deficiencies and make necessary adjustments to O&M manuals and record
52 drawings for applicable issues identified in any seasonal testing.
- 53 B. Equipment Suppliers
- 54 1. Provide all requested submittal data, including detailed start-up procedures and specific
55 responsibilities of the Owner to keep warranties in force.
- 56 2. Assist in equipment testing per agreements with Subs.
- 57 3. Include all special tools and instruments (only available from vendor, specific to a piece of
58 equipment) required for testing equipment according to these Contract Documents in the base

- 1 bid price to the Contractor, except for stand-alone data logging equipment that may be used by
2 the CxA.
3 4. Provide information requested by CxA regarding equipment sequence of operation and testing
4 procedures.
5 5. Review test procedures for equipment installed by factory representatives.
6

7 **1.7 SYSTEMS TO BE COMMISSIONED**

- 8 A. The HVAC system for the Service Lane Addition
9 B. Building Automation System (BAS) for the HVAC system
10 C. Building envelope and roofing system as it pertains to HVAC
11 D. Lighting and Lighting Controls
12

13 **PART 2 – PRODUCTS**

14
15 **2.1 TEST INFORMATION**

- 16 A. All instruments needed to verify sensor readings, component performance, and system performance will be
17 provided by GC and Subs and be available to the CxA. These instruments will not be beyond what the contractors
18 need to complete the work specified in these construction documents. Any data logging equipment required in
19 addition to the BAS will be provided by the CxA.
20 B. All instruments shall be of sufficient quality and accuracy to test and/or measure system performance with the
21 tolerances specified in the Contract Documents. Refer to specification section 23 05 93- Testing, Adjusting, and
22 Balancing for required instrument tolerances.
23

24 **PART 3 - EXECUTION**

25
26 **3.1 COMMISSIONING TEAM**

- 27 A. The members of the commissioning team consist of the Commissioning Authority (CxA), the Owner's Project
28 Manager (PM), the designated representative of the Owner's Construction Management team (CM), the General
29 Contractor (GC or Contractor), the architect and design engineers, the Mechanical Contractor, the Electrical
30 Contractor, the TAB Contractor, the Controls Contractor, any other installing subcontractors or suppliers of
31 equipment.
32 B. Each Cx Team member shall designate one person who is responsible for coordinating the commissioning efforts
33 with the CxA.
34

35 **3.2 SCHEDULING AND MEETINGS**

- 36 A. Scheduling. The CxA will work with the other members of the Cx Team according to established protocols to
37 schedule the Cx activities. The CxA will provide sufficient notice to the Cx Team for scheduling Cx activities. The
38 GC will integrate all Cx activities into the master schedule. All parties will address scheduling problems and make
39 necessary notifications in a timely manner in order to expedite the Cx process.
40 B. The CxA will provide the initial schedule of primary Cx events at the Cx pre-construction meeting. The Cx Plan
41 provides a format for this schedule. As construction progresses more detailed schedules are developed by the
42 CxA. The Cx Plan also provides a format for detailed schedules.
43 C. Pre-Construction Meeting. Within 60 days of selection of the GC, the CxA will schedule, plan, and conduct a Cx
44 pre-construction meeting with the entire Cx team in attendance. Meeting minutes will be distributed to all
45 parties by the CxA. Information gathered from this meeting will allow the CxA to revise the Cx Plan which will
46 also be distributed to all parties.
47 D. Meetings. The Cx meetings will be scheduled approximately once a month during construction. These meetings
48 will be scheduled directly before or after the regular construction meetings if practical. These meetings will cover
49 coordination, deficiency resolution and planning issues with particular Subs. The CxA will plan these meetings
50 and will minimize unnecessary time being spent by Subs
51

52 **3.3 REPORTING**

- 53 A. The CxA will provide regular reports to the Owner as construction and Cx progresses. Standard forms are
54 provided and referenced in the Cx Plan.
55 B. The CxA will regularly communicate with all members of the Cx team, keeping them apprised of Cx progress and
56 scheduling changes through memos, progress reports, etc.
57 C. Testing or review approvals and non-conformance and deficiency reports are made regularly with the review and
58 testing as described in later sections.

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3.4 RECORD DRAWINGS

- A. The CxA will verify that the record drawings are updated throughout the construction. If a discrepancy is found between the record drawings and the installations, the CxA will notify the GC immediately. It is the GC and subcontractors responsibility to then inspect the installations and immediately and completely update the record drawings such that they accurately reflect the installation.

3.5 CONSTRUCTION COMMISSIONING PROCEDURES

- A. The following procedures apply to all equipment to be commissioned.
- B. General. Construction checklists are important to ensure that the equipment and systems are hooked up and operational. It ensures that system performance testing (in-depth system checkout) may proceed without unnecessary delays. Each piece of equipment receives full checkout. No sampling strategies are used. All construction checklists for a given system must be successfully completed prior to formal system performance testing of equipment or subsystems of the given system.
- C. Construction Checklists.
 - 1. The primary purpose of the construction checklists is to provide the individual workers with the key criteria for a successful installation. The secondary purpose is to track the progress of the delivery and installation.
 - 2. The CxA will develop construction checklists for all commissioned equipment and distribute these to the responsible contractor. The GC and Subs will review the construction checklists for each equipment type and provide comments to the CxA. The CxA will then print and distribute the construction checklist for each individual component.
 - 3. The GC and Subs are responsible for all requirements in the specification, not only the requirements listed on the checklists.
 - 4. The checklists answer format will be to circle yes /no or provide a brief answer such as providing the model or serial numbers.
 - 5. These checklists are provided by the CxA to the GC. The GC determines which trade is responsible for executing and documenting each of the line item tasks and notes that trade on the form. Each form may have more than one trade responsible for its execution.
 - 6. The construction checklists shall be completed as delivery is completed and the installation progresses.
 - 7. Only individuals who have direct knowledge and witnessed that a line item task on the construction checklist was actually performed shall initial or check that item off. It is not acceptable for supervisors without direct knowledge or who have not witnessed the line item task on the construction checklist to fill out these forms.
 - 8. Any negative response shall immediately be brought to the attention of the CxA. All negative replies shall be explained in detail on the construction checklist.
 - 9. The GC and Subs are responsible for recording the completion of the checklists. Checklists shall be submitted electronically to SharePoint in .pdf format in separate files by Division. Each file shall be bookmarked by checklist tag.
 - 10. Non-itemized installations such as wiring, ductwork, piping etc. will not have checklists to be completed, but the GC and Subs will be provided the key criteria for successful installation.
 - 11. The CxA will verify the construction checklist completion by a sampling of the delivered and installed equipment. The sampling process will be described in the Cx Plan.
- D. Sensor Calibration. Calibration of all sensors shall be included as part of the construction checklists performed by the Contractors. Calibration information is provided in specification Section 23 09 23 - Direct Digital Control System for HVAC
- E. Deficiencies, Non-Conformance and Approval in Checklists and Startup.
 - 1. The Subs shall clearly list any outstanding items of the construction checklist that were not completed successfully, at the bottom of the procedures form or on an attached sheet. The procedures form and any outstanding deficiencies are provided to the CxA within two days of task completion.
 - 2. The CxA reviews the report and submits either a non-compliance report or an approval form to the Sub or CM. The CxA shall work with the Subs and vendors to correct deficiencies or uncompleted items. The CxA will involve the CM and others as necessary. The installing Subs or vendors shall correct all areas that are deficient or incomplete in the checklists and tests in a timely manner, and shall notify the CxA as soon as outstanding items have been corrected and include a Statement of Correction on the original non- compliance report. When satisfactorily

- 1 completed, the CxA recommends approval of the completion of the checklists to the CM using a
2 standard form.
- 3 3. Items left incomplete, which later cause deficiencies or delays during functional testing may result
4 in back charges to the responsible party.
- 5 F. System Performance Tests (SPT). SPTs shall be performed to demonstrate that each system is operating
6 according to the documented OPR and Contract Documents. System testing differs to the tests required in the
7 Construction Checklist in that they facilitate bringing all the individual components together to verify that they
8 operate collectively on a system level to provide the required design conditions.
- 9 1. Development of Test Procedures. The CxA shall prepare the SPT forms and procedures in
10 accordance with the criteria defined in the Cx Plan. The GC and Subs shall assist the CxA in the
11 preparation of these procedures by answering queries and forwarding site-specific information. A
12 sample System Performance Test form is provided at the end of this specification section.
- 13 2. Participation: The GC and the Subs are responsible for testing all systems to be commissioned
14 such that they function as described in the contract documents. The CxA will verify the
15 performance of the systems. The CxA will direct, witness and document the SPT verification and
16 GC and Subs will execute the verification tests.
- 17 G. Problem Solving. The CxA will recommend solutions to problems found, however the burden of responsibility to
18 solve, correct and retest problems is with the GC, Subs and A/E.
- 19 H. Seasonal Testing. During the warranty period, seasonal testing (tests delayed until weather conditions are closer
20 to the system's design) shall be completed as part of this contract. The CxA shall coordinate this activity. Tests
21 will be executed, documented and deficiencies corrected by the appropriate Subs, with facilities staff and the
22 CxA witnessing. Any final adjustments to the O&M manuals and record documents due to the testing will be
23 made.
- 24 I. Unforeseen Deferred Tests. If any check or test cannot be completed due to the building structure, required
25 occupancy condition or other deficiency, execution of checklists and functional testing may be delayed upon
26 approval of the PM. These tests will be conducted in the same manner as the seasonal tests.

27 28 **3.6 SENSOR AND ACTUATOR CALIBRATION**

- 29 A. Calibrate all field-installed temperature, relative humidity, carbon monoxide, carbon dioxide, and pressure
30 sensors and gages, and all actuators (dampers and valves) on this piece of equipment shall be calibrated. Sensors
31 installed in the unit at the factory with calibration certification provided need not be field calibrated.
- 32 B. Calibrate using the methods described below; alternate methods may be used, if approved by Owner
33 beforehand. See PART 2 for test instrument requirements. Record methods used on the relevant Construction
34 Checklist or other suitable forms, documenting initial, intermediate and final results.
- 35 C. All Sensors:
- 36 1. Verify that sensor location is appropriate and away from potential causes of erratic operation.
37 2. Verify that sensors with shielded cable are grounded only at one end.
38 3. For sensor pairs that are used to determine a temperature or pressure difference, for
39 temperature make sure they are reading within 0.2 degree F (0.1 degree C) of each other, and for
40 pressure, within tolerance equal to 2 percent of the reading, of each other.
41 4. Tolerances for critical applications may be tighter.
- 42 D. Sensors without Transmitters - Standard Application:
- 43 1. Make a reading with a calibrated test instrument within 6 inches (150 mm) of the site sensor.
44 2. Verify that the sensor reading, via the permanent thermostat, gage or building automation
45 system, is within the tolerances in the table below of the instrument-measured value.
46 3. If not, install offset, calibrate or replace sensor.
- 47 E. Sensors with Transmitters - Standard Application.
- 48 1. Disconnect sensor.
49 2. Connect a signal generator in place of sensor.
50 3. Connect ammeter in series between transmitter and building automation system control panel.
51 4. Using manufacturer's resistance-temperature data, simulate minimum desired temperature.
52 5. Adjust transmitter potentiometer zero until 4 mA is read by the ammeter.
53 6. Repeat for the maximum temperature matching 20 mA to the potentiometer span or maximum
54 and verify at the building automation system.
55 7. Record all values and recalibrate controller as necessary to conform with specified control ramps,
56 reset schedules, proportional relationship, reset relationship and P/I reaction.
57 8. Reconnect sensor.
58 9. Make a reading with a calibrated test instrument within 6 inches (150 mm) of the site sensor.

10. Verify that the sensor reading, via the permanent thermostat, gage or building automation system, is within the tolerances in the table below of the instrument-measured value.
 11. If not, replace sensor and repeat.
 12. For pressure sensors, perform a similar process with a suitable signal generator.
- F. Sensor Tolerances for Standard Applications: Plus/minus the following maximums:
1. Watthour, Voltage, Amperage: 1 percent of design.
 2. Pressure, Air, Water, Gas: 3 percent of design.
 3. Air Temperatures (Outside Air, Space Air, Duct Air): 0.4 degrees F (0.2 degree C).
 4. Relative Humidity: 4 percent of design.
 5. Barometric Pressure: 0.1 inch of Hg (340 Pa).
 6. Flow Rate, Air: 10 percent of design.
 7. Flow Rate, Water: 4 percent of design.
 8. Flow Rate, Steam: 3 percent of design.
 9. AHU Wet Bulb and Dew Point: 2.0 degrees F (1.1 degrees C).
 10. Hot Water Coil and Boiler Water Temperature: 1.5 degrees F (0.8 degrees C).
 11. Cooling Coil, Chilled and Condenser Water Temperatures: 0.4 degrees F (0.2 degree C).
 12. Combustion Flue Temperature: 5.0 degrees F (2.8 degrees C).
 13. Oxygen and CO2 Monitors: 0.1 percentage points.
 14. CO Monitor: 0.01 percentage points.
 15. Natural Gas and Oil Flow Rate: 1 percent of design.
- G. Critical Applications: For some applications more rigorous calibration techniques may be required for selected sensors. Describe any such methods used on an attached sheet.
- H. Valve/Damper Stroke Setup and Check:
1. For all valve/damper actuator positions checked, verify the actual position against the control system readout.
 2. Set pump/fan to normal operating mode.
 3. Command valve/damper closed; visually verify that valve/damper is closed and adjust output zero signal as required.
 4. Command valve/damper to open; verify position is full open and adjust output signal as required.
 5. Command valve/damper to a few intermediate positions.
 6. If actual valve/damper position does not reasonably correspond, replace actuator
- I. Isolation Valve or System Valve Leak Check: For valves not associated with coils.
1. With full pressure in the system, command valve closed.
 2. Use an ultra-sonic flow meter to detect flow or leakage.

3.7 NON-CONFORMANCE

- A. All deficiencies or non-conformance issues shall be noted and reported by the GC to the CM on a standard non-compliance form.
- B. Corrections of minor deficiencies identified may be made during the tests at the discretion of the CxA. In such cases the deficiency and resolution will be documented on the procedure form.
- C. Every effort will be made to expedite the testing process and minimize unnecessary delays, while not compromising the integrity of the procedures. However, the CxA will not be pressured into overlooking deficient work or loosening acceptance criteria to satisfy scheduling or cost issues, unless there is an overriding reason to do so at the request of the CM and the Owner.
- D. As tests progress and a deficiency is identified, the CxA discusses the issue with the executing contractor.
 1. When there is no dispute on the deficiency and the Sub accepts responsibility to correct it:
 - a. The CxA documents the deficiency and the Sub's response and intentions and they go on to another test or sequence. After the day's work, the CxA submits the non-compliance reports to the CM for signature, if required. A copy is provided to the Sub and CxA. The Sub corrects the deficiency, signs the statement of correction at the bottom of the non-compliance form certifying that the equipment is ready to be retested and sends it back to the CxA.
 - b. The CxA reschedules the test and the test is repeated.
 2. If there is a dispute about a deficiency, regarding whether it is a deficiency or who is responsible:
 - a. The deficiency shall be documented on the non-compliance form with the Sub's response and a copy given to the CM and to the Sub representative assumed to be responsible.

- 1 b. Resolutions are made at the lowest management level possible. Other parties are brought
- 2 into the discussions as needed. Final interpretive authority is with the A/E. Final
- 3 acceptance authority is with the Project Manager.
- 4 c. The CxA documents the resolution process.
- 5 d. Once the interpretation and resolution have been decided, the appropriate party corrects
- 6 the deficiency, signs the statement of correction on the non-compliance form and provides
- 7 it to the CxA. The CxA reschedules the test and the test is repeated until satisfactory
- 8 performance is achieved.
- 9 3. Cost of Retesting.
- 10 a. The cost incurred by the Subs to retest a construction checklist item or functional test, if
- 11 they are responsible for the deficiency, shall be theirs. If they are not responsible, any cost
- 12 recovery for retesting costs shall be negotiated with the GC.
- 13 b. For a deficiency identified, not related to any construction checklist or start-up fault, the
- 14 following shall apply: The CxA and CM will direct the retesting of the equipment once at no
- 15 "charge" to the GC for their time. However, the CxA's and CM's time for a second retest
- 16 will be charged to the GC, who may choose to recover costs from the responsible Sub.
- 17 c. The time for the CxA and CM to direct any retesting required because a specific
- 18 construction checklist or start-up test item, reported to have been successfully completed,
- 19 but determined during functional testing to be faulty, will be backcharged to the GC, who
- 20 may choose to recover costs from the party responsible for executing the faulty
- 21 installation or test.
- 22 d. The Contractor shall respond in writing to the CxA and CM at least as often as Cx meetings
- 23 are being scheduled concerning the status of each apparent outstanding discrepancy
- 24 identified during Cx. Discussion shall cover explanations of any disagreements and
- 25 proposals for their resolution.
- 26 e. The CxA retains the original non-conformance forms until the end of the project.
- 27 f. Failure Due to Manufacturer Defect. If 10%, or three, whichever is greater, of identical
- 28 pieces (size alone does not constitute a difference) of equipment fail to perform to the
- 29 Contract Documents (mechanically or substantively) due to manufacturing defect, not
- 30 allowing it to meet its submitted performance spec, all identical units may be considered
- 31 unacceptable by the CM or PM. In such case, the Contractor shall provide the Owner with
- 32 the following:
- 33 g. Within one week of notification from the CM or PM, the Contractor or manufacturer's
- 34 representative shall examine all other identical units making a record of the findings. The
- 35 findings shall be provided to the CM or PM within two weeks of the original notice.
- 36 h. Within two weeks of the original notification, the Contractor or manufacturer shall provide
- 37 a signed and dated, written explanation of the problem, cause of failures, etc. and all
- 38 proposed solutions which shall include full equipment submittals. The proposed solutions
- 39 shall not significantly exceed the specification requirements of the original installation. The
- 40 CM or PM will determine whether a replacement of all identical units or a repair is
- 41 acceptable.
- 42 i. Two examples of the proposed solution will be installed by the Contractor and the CM will
- 43 be allowed to test the installations for up to one week, upon which the CM or PM will
- 44 decide whether to accept the solution.
- 45 j. Upon acceptance, the Contractor and/or manufacturer shall replace or repair all identical
- 46 items, at their expense and extend the warranty accordingly, if the original equipment
- 47 warranty had begun. The replacement/repair work shall proceed with reasonable speed
- 48 beginning within one week from when parts can be obtained.
- 49 E. Approval. The CxA notes each satisfactorily demonstrated function on the test form. Formal approval of the
- 50 functional test is made later after review by the CxA and by the CM, if necessary. The CxA recommends
- 51 acceptance of each test to the CM using a standard form. The CM gives final approval on each test using the
- 52 same form, providing a signed copy to the CxA and the Contractor.
- 53
- 54

55 **END OF SECTION**

56

SECTION 02 41 19 SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
1. Selective demolition and removal of selected portions of building or structure as indicated on the drawings.
 2. Selective demolition and removal of equipment as indicated on the drawings.
 3. Salvage of existing items to be reused or recycled.

1.3 DEFINITIONS

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

1.4 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.

1.5 PREINSTALLATION MEETINGS

- A. Predemolition Conference: Conduct conference at Project site prior to commencement of work.
1. Inspect and discuss condition of construction to be selectively demolished.
 2. Review structural load limitations of existing structure.
 3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.

4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
5. Review areas where existing construction is to remain and requires protection.

1.6 INFORMATIONAL SUBMITTALS

- A. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, for dust control and, for noise control. Indicate proposed locations and construction of barriers.
- B. Schedule of Selective Demolition Activities: Indicate the following:
 1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's building manager and other tenants' on-site operations are uninterrupted.
 2. Interruption of utility services. Indicate how long utility services will be interrupted.
 3. Coordination for shutoff, capping, and continuation of utility services.
 4. Use of elevator and stairs.
 5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
- C. Predemolition Photographs or Video: Show existing conditions of adjoining construction, including finish surfaces that might be misconstrued as damage caused by demolition operations.

1.7 CLOSEOUT SUBMITTALS

- A. Warranties: Documentation indicating that existing warranties are still in effect after completion of selective demolition.
- B. Inventory: Submit a list of items that have been removed and salvaged.

1.8 FIELD CONDITIONS

- A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
- B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
 1. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.

- E. Storage or sale of removed items or materials on-site is not permitted.
- F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
 - 1. Maintain fire-protection facilities in service during selective demolition operations.

1.9 WARRANTY

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

1.10 COORDINATION

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

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

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting selective demolition operations.
- B. Review Project Record Documents of existing construction or other existing condition information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.
- C. Engage a professional engineer to perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.
 - 1. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

- D. Survey of Existing Conditions: Record existing conditions by use of measured drawings and preconstruction photographs or video.
1. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage operations.
 2. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.
- B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.
1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
 2. Arrange to shut off utilities with utility companies.
 3. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.

3.3 PROTECTION

- A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
 2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
 3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
 4. Cover and protect furniture, furnishings, and equipment that have not been removed.
- B. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
1. Strengthen or add new supports when required during progress of selective demolition.
- C. Remove temporary barricades and protections where hazards no longer exist.

3.4 SELECTIVE DEMOLITION, GENERAL

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

- E. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

- A. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, and then remove concrete between saw cuts.
- B. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, and then remove masonry between saw cuts.
- C. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, and then break up and remove.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

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

3.7 CLEANING

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

END OF SECTION 02 41 19

**SECTION 03 30 00
CAST-IN-PLACE CONCRETE**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes cast-in-place concrete, reinforcement, concrete materials, mixture design, placement procedures, and finishes.

1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with fly ash subject to compliance with requirements.
- B. W/C Ratio: The ratio by weight of water to cementitious materials.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
1. Cementitious materials.
 2. Admixtures.
 3. Steel reinforcement and accessories.
 4. Floor and slab treatments.
 5. Bonding agents.
 6. Adhesives.
 7. Vapor barriers.
 8. Semirigid joint filler.
 9. Joint-filler strips.
 10. Repair materials.
 11. Any other products used in association with concrete
 12. Aggregate Test Reports: From a qualified testing agency; service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.
- B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
1. Indicate amounts of mixing water to be withheld for later addition at Project site.
- C. Steel Reinforcement Shop Drawings: Placing Drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup

spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

- D. Field quality-control reports.
1. See Part 3 paragraph "Field Quality Control" for report requirements.
 2. Submit both in-progress reports showing test results within 48 hours of each test and final reports including results of all tests completed for each sample.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.
- B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.
1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- C. Testing Agency Qualifications: Contractor shall engage an independent agency, qualified according to ASTM C1077 and ASTM E329 for testing indicated.
1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
 2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Grade I. Testing agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician, Grade II.

1.6 DELIVERY, STORAGE, AND HANDLING

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

1.7 FIELD CONDITIONS

- A. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
1. When average high and low temperature is expected to fall below 40 deg F (4.4 deg C) for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301 (ACI 301M).
 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.

3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- B. Hot-Weather Placement: Comply with ACI 301 (ACI 301M) and ACI 305.1 (ACI 305.1M), and as follows:
1. Maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

- A. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
1. ACI 301 (ACI 301M).
 2. ACI 117 (ACI 117M).

2.2 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
1. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
 - a. High-density overlay, Class 1 or better.
 - b. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.
 - c. Structural 1, B-B or better; mill oiled and edge sealed.
 - d. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.
- D. Pan-Type Forms: Glass-fiber-reinforced plastic or formed steel, stiffened to resist plastic concrete loads without detrimental deformation.

- E. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.
- F. Chamfer Strips: Wood, metal, PVC, or rubber strips, $\frac{3}{4}$ by $\frac{3}{4}$ inch (19 by 19 mm).
- G. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.
 - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- H. Form Ties: Factory-fabricated, removable or snap-off glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 - 1. Furnish units that leave no corrodible metal closer than 1 inch (25 mm) to the plane of exposed concrete surface.
 - 2. Furnish ties that, when removed, leave holes no larger than 1 inch (25 mm) in diameter in concrete surface.

2.3 STEEL REINFORCEMENT

- A. Low allow steel Reinforcing Bars: ASTM A706/A706M, Grade 60 (Grade 420), deformed.
- B. Plain-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, plain, fabricated from as-drawn steel wire into flat sheets.

2.4 REINFORCEMENT ACCESSORIES

- A. Joint Dowel Bars: ASTM A615/A615M, Grade 60 (Grade 420), 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 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

2.5 CONCRETE MATERIALS

- A. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.
- B. Cementitious Materials:
 - 1. Portland Cement: ASTM C150/C150M; Type I, Type II, Type I/II, Type V, gray.
 - 2. Fly Ash: ASTM C618, Class F or C.

- C. Normal-Weight Aggregates: ASTM C33/C33M, coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.
1. Coarse Aggregate: Coarse Aggregate shall conform to the requirement of ASTM C33, Class 4S or better and shall be graded as follows:
 - a. C.A. Mix 200: Use Size No. 357 or a combination of Size No. 3 and Size No. 57 with aggregate Size No. 3 comprising 35 to 65 percent of the total amount of coarse aggregate (2-inch nominal maximum aggregate size.)
 - b. C.A. Mix 150: Use Size No. 467 or a combination of Size No.4 and Size No.67 with aggregate Size No.4 comprising 35 to 65 percent of the total amount of coarse aggregate (1½-inch nominal maximum aggregate size).
 - c. C.A. Mix 100: Use Size No. 57 (1-inch nominal maximum aggregate size).
 - d. C.A. Mix 075: Use Size No. 67 (¾-inch nominal maximum aggregate size).
 - e. C.A. Mix 050: Use Size No. 7 (½-inch nominal maximum aggregate size).
 2. Application of Coarse Aggregate: Nominal maximum size of coarse aggregate shall not exceed three-fourths of the minimum clear spacing between reinforcing bars, one-fifth of the narrowest dimension between sides of forms, or one-third of the thickness of slabs or toppings.
 3. Fine Aggregate: Fine aggregate shall conform to the requirements of ASTM C33, Paragraph 6, Grading, and shall be free of materials with deleterious reactivity to alkali in cement.
- D. Air-Entraining Admixture: ASTM C260/C260M.
- E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
 2. Retarding Admixture: ASTM C494/C494M, Type B.
 3. Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type D.
 4. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type G.
 6. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.
- F. Water: ASTM C94/C94M and potable.

2.6 WATERSTOPS

- A. Chemically Resistant Flexible Waterstops: Thermoplastic vulcanized elastomer rubber waterstops with factory-installed metal eyelets, for embedding in concrete to prevent passage of fluids through joints; resistant to oils, solvents, and chemicals. Factory fabricate corners, intersections, and directional changes.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. JP Specialties, Inc.; Earth Shield, TPV EYJP636.
 - b. Vinylex Corp.; PetroStop, VTWB6-316.
 - c. WESTEC Barrier Technologies, Inc.; 600 Series TPER, 619.
2. Profile: Ribbed with center bulb.
3. Dimensions: 6 inches by 3/16 inch thick (150 mm by 4.75 mm thick); nontapered.

2.7 VAPOR RETARDERS

- A. Sheet Vapor Retarder: ASTM E1745, Class A. Include manufacturer's recommended adhesive or pressure-sensitive tape.
 1. Maximum allowable water vapor transmission rate (WVTR) of less than 0.01 perms (grains/hour* ft^2 *in. HG) when tested per ASTM F 1249 or ASME E 96.
 2. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Insulation Solutions, Inc.; Viper VaporCheck 16.
 - b. Raven Industries Inc.; Vapor Block 15.
 - c. Stego Industries, LLC; Stego Wrap 15 mil Class A.
- B. Fine-Graded Granular Material: Clean mixture of crushed stone, crushed gravel, and manufactured or natural sand; ASTM D 448, Size 10, with 100 percent passing a 3/8-inch (9.5-mm) sieve, 10 to 30 percent passing a No. 100 (0.15-mm) sieve, and at least 5 percent passing No. 200 (0.075-mm) sieve; complying with deleterious substance limits of ASTM C 33 for fine aggregates.

2.8 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
- B. Moisture-Retaining Cover: ASTM C171, polyethylene film or white burlap-polyethylene sheet.
- C. Water: Potable.

2.9 POST WET-CURE, PENETRATING SEALER MATERIALS

- A. Clear, Breathable, High-Performance, Solvent-Borne, Silane Sealer, 100% Silane by Weight
 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. BASF Construction Chemicals - Building Systems; Hydrozo 100
 - b. ChemMasters; Aquanil Plus 100

c. Dayton Superior Corporation; Weather Worker S-100 (J-29-A)

2.10 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D1751, asphalt-saturated cellulosic fiber.
- B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, aromatic polyurea with a Type A shore durometer hardness range of 90 to 95 according to ASTM D2240.
- C. Bonding Agent: ASTM C1059/C1059M, Type II, nonredispersible, acrylic emulsion or styrene butadiene.

2.11 REPAIR MATERIALS

- A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch (3.2 mm) and that can be feathered at edges to match adjacent floor elevations.
 - 1. Cement Binder: ASTM C150/C150M, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C219.
 - 2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
 - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by underlayment manufacturer.
 - 4. Compressive Strength: Not less than 5000 psi (29 MPa) at 28 days when tested according to ASTM C109/C109M.
- B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch (6.4 mm) and that can be filled in over a scarified surface to match adjacent floor elevations.
 - 1. Cement Binder: ASTM C150/C150M, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C219.
 - 2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
 - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by topping manufacturer.
 - 4. Compressive Strength: Not less than 5000 psi (34.5 MPa) at 28 days when tested according to ASTM C109/C109M.

2.12 CONCRETE MIXTURES FOR BUILDING ELEMENTS

- A. Walls, Footings: Normal-weight concrete.
 - 1. Minimum Compressive Strength: 4000 psi (27.6 MPa) at 28 days.
 - 2. Maximum W/C Ratio: 0.50.
 - 3. Slump Limit: 8 inches (200 mm) for concrete with verified slump of 2 to 4 inches (50 to 100 mm) before adding high-range water-reducing admixture or plasticizing admixture.

4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for ¾-inch (19-mm) nominal maximum aggregate size.
- B. Slabs-on-Grade, Elevated Slab: Normal-weight concrete.
1. Minimum Compressive Strength: 4000 psi (27.6 MPa) at 28 days.
 2. Minimum Cementitious Materials Content:
 - a. 1½-inch nominal aggregate size: 470 lb/cu. yd. (279 kg/cu. m).
 - b. 1-inch nominal aggregate size: 520 lb/cu. yd. (309 kg/cu. m).
 - c. ¾-inch nominal aggregate size: 540 lb/cu. yd. (320 kg/cu. m).
 - d. ½-inch nominal aggregate size: 610 lb/cu. yd. (348 kg/cu. m).
 3. Maximum W/C Ratio: 0.50.
 4. Slump Limit: 8 inches (200 mm) for concrete with verified slump of 2 to 4 inches (50 to 100 mm) before adding high-range water-reducing admixture or plasticizing admixture.
 5. Air Content: For exterior concrete 6 percent, plus or minus 1.5 percent at point of delivery for ¾-inch (19-mm) nominal maximum aggregate size.
 6. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.
- C. Concrete Toppings: Normal-weight concrete.
1. Minimum Compressive Strength: 3500 psi at 28 days.
 2. Maximum Cementitious Materials Content: 610 lb/cu. yd.
 3. 1/2-inch nominal aggregate size
 4. Maximum W/C Ratio: 0.50.
 5. Slump Limit: 8 inches (200 mm) for concrete with verified slump of 2 to 4 inches (50 to 100 mm) before adding high-range water-reducing admixture or plasticizing admixture.
 6. Air Content: Do not allow air content of trowel-finished toppings to exceed 3 percent.

2.13 FABRICATING REINFORCEMENT

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

2.14 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C94/C94M, and furnish batch ticket information.
1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1½ hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 PROVISIONS FOR FINISHES

- A. Floor elevations shown on the floor plans are finished floor elevations and represent the top elevation of any finishes or flooring systems to be applied over the base slab.
- B. Depress slabs on grade where floor mats, ceramic tile, or other flooring systems or finishes are scheduled, specified or noted, to maintain full required base slab thickness and achieve finish floor elevations shown or noted.
- C. Depress slabs full thickness of special flooring systems where those systems are scheduled.
- D. Slope grades under sloped floors or grade to maintain full specified slab thickness at all times.
- E. Do not apply curing compounds to surfaces to receive subsequent finishes.

3.2 FORMWORK INSTALLATION

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301 (ACI 301M), to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117 (ACI 117M).
- C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
 - 1. Class A, 1/8 inch (3.2 mm) for smooth-formed finished surfaces.
 - 2. Class B, 1/4 inch (6 mm) for rough-formed finished surfaces.
- D. Construct forms tight enough to prevent loss of concrete mortar.
- E. Construct forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
 - 1. Install keyways, reglets, recesses, and the like, for easy removal.
 - 2. Do not use rust-stained steel form-facing material.
- F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- H. Chamfer exterior corners and edges of permanently exposed concrete.

- I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.3 EMBEDDED ITEM INSTALLATION

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

3.4 REMOVING AND REUSING FORMS

- A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations and curing and protection operations need to be maintained.
 - 1. Leave formwork for beam soffits, joists, slabs, and other structural elements that support weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
 - 2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
- B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material are not acceptable for exposed surfaces. Apply new form-release agent.
- 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 Architect.

3.5 SHORING AND RESHORING INSTALLATION

- A. Comply with ACI 318 (ACI 318M) and ACI 301 (ACI 301M) for design, installation, and removal of shoring and reshoring.

3.6 VAPOR-RETARDER INSTALLATION

- A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E1643 and manufacturer's written instructions.
 - 1. Lap joints 6 inches (150 mm) and seal with manufacturer's recommended tape.

3.7 STEEL REINFORCEMENT INSTALLATION

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

3.8 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete. Place wall, floor, and curb isolation, contraction and construction joints as shown on plans or, where not covered on the plans, as specified herein.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
 - 1. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated.
 - 1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch (3.2 mm). Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces. Grooved joints are allowed only on exterior slabs on grade.
 - 2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3.2-mm-) wide

joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
 2. Terminate full-width joint-filler strips not less than ½ inch (13 mm) or more than 1 inch (25 mm) below finished concrete surface where joint sealants, specified in Section 07 92 00 "Joint Sealants," are indicated.
 3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
- E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.9 WATERSTOP INSTALLATION

- A. Flexible Waterstops: Install in construction joints and at other joints indicated to form a continuous diaphragm. Install in longest lengths practicable. Support and protect exposed waterstops during progress of the Work. Field fabricate joints in waterstops according to manufacturer's written instructions.

3.10 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items are complete and that required inspections are completed.
- B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.
- C. Deposit concrete continuously in one layer such that there are no seams or planes of weakness. If a section cannot be placed continuously, submit construction joint and concrete placement plan. Deposit concrete to avoid segregation.
1. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
 2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301 (ACI 301M).
 3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

- D. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
1. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 2. Maintain reinforcement in position on chairs during concrete placement.
 3. Screed slab surfaces with a straightedge and strike off to correct elevations.
 4. Slope surfaces uniformly to drains where required.
 5. 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.

3.11 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
1. Apply to concrete surfaces not exposed to view.
- B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
1. Apply to concrete surfaces exposed to public view, to receive a rubbed finish, or to be covered with a coating or covering material applied directly to concrete.
- C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.12 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of ¼ inch (6 mm) in one direction.
1. Apply scratch finish to surfaces indicated and to receive concrete floor toppings to receive mortar setting beds for bonded cementitious floor finishes per flooring manufacturer's instructions.
- C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.

1. Apply float finish to surfaces indicated to receive trowel finish and to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.
- D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighthen until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
1. Apply a trowel finish to surfaces indicated exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
 2. Finish and measure surface, so gap at any point between concrete surface and an unlevelled, freestanding, 10-ft.- (3.05-m-) long straightedge resting on two high spots and placed anywhere on the surface does not exceed 3/16 inch (4.8 mm).
- E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces indicated where ceramic or quarry tile is to be installed by either thickset or thinset method. While concrete is still plastic, slightly scarify surface with a fine broom.
1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.
- F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.
1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.13 MISCELLANEOUS CONCRETE ITEM INSTALLATION

- A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel finish concrete surfaces.

3.14 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 305.1 (ACI 305.1M) for hot-weather protection during curing.

- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for remainder of curing period.
- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
- E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
 - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.

3.15 JOINT FILLING

- A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.
- C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches (50 mm) deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.16 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1-part portland cement to 2½ parts fine aggregate passing a No. 16 (1.18-mm) sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than ½ inch (13 mm) in any dimension to solid concrete. Limit cut depth to ¾ inch (19 mm). Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
 2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar matches surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
 3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch (0.25 mm) wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
 2. After concrete has cured at least 14 days, correct high areas by grinding.
 3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
 4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
 5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of ¼ inch (6 mm) to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
 6. Repair defective areas, except random cracks and single holes 1 inch (25 mm) or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a ¾-inch (19-mm) clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
 7. Repair random cracks and single holes 1 inch (25 mm) or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

- E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.
- F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.17 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.
- B. Inspections:
 - 1. Steel reinforcement placement.
 - 2. Steel reinforcement welding.
 - 3. Headed bolts and studs.
 - 4. Verification of use of required design mixture.
 - 5. Concrete placement, including conveying and depositing.
 - 6. Curing procedures and maintenance of curing temperature.
 - 7. Verification of concrete strength before removal of shores and forms from beams and slabs.
- C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C172/C172M shall be performed according to the following requirements:
 - 1. Testing Frequency: Obtain at least one composite sample for each 30 cu. yd. (76 cu. m) or fraction thereof of each concrete mixture placed each day.
 - 2. Slump: ASTM C143/C143M; one test at point of placement for each composite sample. Perform additional tests when concrete consistency appears to change.
 - 3. Air Content: ASTM C231/C231M, pressure method, for normal-weight concrete; one test for each composite sample.
 - 4. Concrete Temperature: ASTM C1064/C1064M; one test hourly when air temperature is 40 deg F (4.4 deg C) and below or 80 deg F (27 deg C) and above, and one test for each composite sample.
 - 5. Unit Weight: ASTM C567/C567M, fresh unit weight of structural lightweight concrete; one test for each composite sample
 - 6. Compression Test Specimens: ASTM C31/C31M.
 - a. Cast and laboratory cure (5) standard 6 inch diameter, 12 inch tall cylinder specimens for each composite sample.
 - 7. Compressive-Strength Tests: ASTM C39/C39M; test one cylinder at 7 days and one set of two specimens at 28 days and hold the rest of the cylinders. If all 28 day tests on entire project pass then remaining cylinders may be discarded. If any 28 day test fails hold remaining all cylinders until instructed to test them.
 - a. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from the same composite sample and tested at age indicated.

8. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).
9. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
10. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
11. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42/C42M or by other methods as directed by Architect.
12. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
13. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

END OF SECTION 03 30 00

**SECTION 03 45 00
PRECAST ARCHITECTURAL CONCRETE**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

1. Architectural precast concrete cladding and load-bearing units.
2. Insulated, architectural precast concrete units.

- B. Related Requirements:

1. Section 03 30 00 "Cast-in-Place Concrete" for installing connection anchors in concrete.
2. Section 05 12 00 "Structural Steel Framing" for furnishing and installing connections attached to structural-steel framing.
3. Section 05 50 00 "Metal Fabrications" for kickers and other miscellaneous steel shapes.

1.3 DEFINITIONS

- A. Design Reference Sample: Sample of approved architectural precast concrete color, finish and texture, preapproved by Architect.

1.4 PREINSTALLATION MEETINGS

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

1.5 ACTION SUBMITTALS

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

- B. Design Mixtures: For each precast concrete mixture. Include compressive strength and water-absorption tests.

- C. Shop Drawings:

1. Detail fabrication and installation of architectural precast concrete units.
2. Indicate locations, plans, elevations, dimensions, shapes, and cross sections of each unit.
3. Indicate joints, reveals, drips, chamfers, and extent and location of each surface finish.
4. Indicate details at building corners.
5. Indicate separate face and backup mixture locations and thicknesses.

6. Indicate type, size, and length of welded connections by AWS standard symbols. Detail loose and cast-in hardware and connections.
 7. Indicate locations, tolerances, and details of anchorage devices to be embedded in or attached to structure or other construction.
 8. Indicate locations, extent, and treatment of dry joints if two-stage casting is proposed.
 9. Include plans and elevations showing unit location and sequence of erection for special conditions.
 10. Indicate location of each architectural precast concrete unit by same identification mark placed on panel.
 11. Indicate relationship of architectural precast concrete units to adjacent materials.
 12. If design modifications are proposed to meet performance requirements and field conditions, submit design calculations and Shop Drawings. Do not adversely affect the appearance, durability, or strength of units when modifying details or materials and maintain the general design concept.
- D. Samples: Design reference samples for initial verification of design intent, for each type of finish indicated on exposed surfaces of architectural precast concrete units, representative of finish, color, and texture variations expected; approximately 12 by 12 by 2 inches (300 by 300 by 50 mm). Deliver to architect.
- E. Delegated-Design Submittal: For architectural precast concrete indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
1. Show governing panel types, connections, types of reinforcement, including special reinforcement, and concrete cover on reinforcement. Indicate location, type, magnitude, and direction of loads imposed on the building structural frame from architectural precast concrete. Provide free body diagrams of loads resolved on each component.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and fabricator.
- B. Welding certificates.
- C. Material Certificates: For the following items:
1. Cementitious materials.
 2. Reinforcing materials and prestressing tendons.
 3. Admixtures.
 4. Bearing pads.
 5. Stainless steel components
 6. Structural-steel shapes and hollow structural sections.
 7. Insulation.
- D. Material Test Reports: For aggregates.
- E. Source quality-control test reports.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: A precast concrete erector qualified and designated by PCI's Certificate of Compliance to erect Category A (Architectural Systems) and Category S2 (Complex Structural Systems) for load-bearing members.
- B. Installer Qualifications: A precast concrete erector who has retained a "PCI-Certified Field Auditor" to conduct a field audit of a project in same category as this Project and who can produce an Erectors' Post-Audit Declaration.
- C. Fabricator Qualifications: A firm that assumes responsibility for engineering architectural precast concrete units to comply with performance requirements. This responsibility includes preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.
 - 1. Designated as a PCI-certified plant for Group A, Category A1 - Architectural Cladding and Load Bearing Units at time of bidding.
- D. Quality-Control Standard: For manufacturing procedures and testing requirements, quality-control recommendations, and dimensional tolerances for types of units required, comply with PCI MNL 117, "Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products."
- E. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D.1.1M, "Structural Welding Code - Steel"; and AWS D1.4/D1.4M, "Structural Welding Code - Reinforcing Steel."

1.8 COORDINATION

- A. Furnish loose connection hardware and anchorage items to be embedded in or attached to other construction without delaying the Work. Provide locations, setting diagrams, templates, instructions, and directions, as required, for installation.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Support units during shipment on nonstaining shock-absorbing material.
- B. Store units with adequate dunnage and bracing and protect units to prevent contact with soil, to prevent staining, and to prevent cracking, distortion, warping or other physical damage.
- C. Place stored units so identification marks are clearly visible, and units can be inspected.
- D. Handle and transport units in a manner that avoids excessive stresses that cause cracking or damage.
- E. Lift and support units only at designated points indicated on Shop Drawings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, to design architectural precast concrete units.
- B. Design Standards: Comply with ACI 318 (ACI 318M) and design recommendations of PCI MNL 120, "PCI Design Handbook - Precast and Prestressed Concrete," applicable to types of architectural precast concrete units indicated.
- C. Calculated Fire-Test-Response Characteristics: Provide architectural precast concrete units with fire-resistance rating indicated as calculated according to ACI 216.1 (ACI 216.1M) PCI MNL 124, "Design for Fire Resistance of Precast Prestressed Concrete," and acceptable to authorities having jurisdiction.
- D. Structural Performance: Provide architectural precast concrete units and connections capable of withstanding the design loads indicated on the drawings.
 - 1. Vehicular Impact Loads: Design precast element subject to traffic to resist a single 16000-lb (26.7-kN) load applied horizontally and perpendicular to the element, with anchorages or attachments capable of transferring this load to the structure beyond. Design these precast elements assuming the load to act at a height of 18 or 27 inches (457 or 686 mm) above the floor or ramp surface, whichever is more severe, on an area not to exceed 1 sq. ft. (0.0929 sq. m).

2.2 MOLD MATERIALS

- A. Molds: Rigid, dimensionally stable, non-absorptive material, warp and buckle free, that provides continuous and true precast concrete surfaces within fabrication tolerances indicated; nonreactive with concrete and suitable for producing required finishes.
 - 1. Mold-Release Agent: Commercially produced form-release agent that does not bond with, stain or adversely affect precast concrete surfaces and does not impair subsequent surface or joint treatments of precast concrete.
- B. Form Liners: Units of face design, texture, arrangement, and configuration indicated to match those used for precast concrete design reference sample. Use with manufacturer's recommended form-release agent that does not bond with, stain, or adversely affect precast concrete surfaces and does not impair subsequent surface or joint treatments of precast concrete.
- C. Surface Retarder: Chemical set retarder, capable of temporarily delaying final hardening of newly placed concrete mixture to depth of reveal specified.

2.3 REINFORCING MATERIALS

- A. Low-Alloy-Steel Reinforcing Bars: ASTM A706/A706M, deformed.
- B. Plain-Steel Welded Wire Reinforcement: ASTM A185/A185M, fabricated from as-drawn steel wire into flat sheets.
- C. Supports: Suspend reinforcement from back of mold or use bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place according to PCI MNL 117.

2.4 PRESTRESSING TENDONS

- A. Prestressing Strand: ASTM A416/A416M, Grade 270 (Grade 1860), uncoated, seven-wire, low-relaxation strand.
 - 1. Coat unbonded post-tensioning strand with post-tensioning coating complying with ACI 423.7 and sheath with polypropylene tendon sheathing complying with ACI 423.7. Include anchorage devices and coupler assemblies.

2.5 CONCRETE MATERIALS

- A. Portland Cement: ASTM C150/C150M, Type I or Type III, gray, unless otherwise indicated.
 - 1. For surfaces exposed to view in finished structure, use gray or white cement, of same type, brand, and mill source.
- B. Supplementary Cementitious Materials:
 - 1. Fly Ash: ASTM C618, Class C or F, with maximum loss on ignition of 3 percent.
 - 2. Ground Granulated Blast-Furnace Slag: ASTM C989, Grade 120.
- C. Normal-Weight Aggregates: Except as modified by PCI MNL 117, ASTM C33/C33M, with coarse aggregates complying with Class 5S. Stockpile fine and coarse aggregates for each type of exposed finish from a single source (pit or quarry) for Project.
 - 1. Face-Mixture-Coarse Aggregates: Selected, hard, and durable; free of material that reacts with cement or causes staining; to match selected finish sample.
- D. Lightweight Aggregates: Except as modified by PCI MNL 117, ASTM C330/C330M, with absorption less than 11 percent.
- E. Coloring Admixture: ASTM C979/C979M, synthetic or natural mineral-oxide pigments or colored water-reducing admixtures, temperature stable, and nonfading.
- F. Water: Potable; free from deleterious material that may affect color stability, setting, or strength of concrete and complying with chemical limits of PCI MNL 117.
- G. Air-Entraining Admixture: ASTM C260, certified by manufacturer to be compatible with other required admixtures.
- H. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and to not contain calcium chloride, or more than 0.15 percent chloride ions or other salts by weight of admixture.
 - 1. Water-Reducing Admixtures: ASTM C494/C494M, Type A.
 - 2. Retarding Admixture: ASTM C494/C494M, Type B.
 - 3. Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type D.
 - 4. Water-Reducing and Accelerating Admixture: ASTM C494/C494M, Type E.
 - 5. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.

6. High-Range, Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type G.
7. Plasticizing Admixture: ASTM C1017/C1017M, Type I.
8. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.
9. Corrosion Inhibiting Admixture: ASTM C1582/C1582M.

2.6 STEEL CONNECTION MATERIALS

- A. Carbon-Steel Shapes and Plates: ASTM A36/A36M.
- B. Carbon-Steel-Headed Studs: ASTM A108, AISI 1018 through AISI 1020, cold finished, AWS D1.1/D1.1M, Type A or Type B, with arc shields and with minimum mechanical properties of PCI MNL 117, Table 3.2.3.
- C. Carbon-Steel Plate: ASTM A283/A283M, Grade C.
- D. Malleable Iron Castings: ASTM A47/A47M, Grade 32510 or Grade 35028.
- E. Carbon-Steel Castings: ASTM A27/A27M, Grade 60-30 (Grade 415-205).
- F. High-Strength, Low-Alloy Structural Steel: ASTM A572/A572M.
- G. Carbon-Steel Structural Tubing: ASTM A500/A500M, Grade B or Grade C.
- H. Wrought Carbon-Steel Bars: ASTM A675/A675M, Grade 65 (Grade 450).
- I. Deformed-Steel Wire or Bar Anchors: ASTM A496/A496M or ASTM A706/A706M.
- J. Carbon-Steel Bolts and Studs: ASTM A307, Grade A or ASTM F1554, Grade 36 (ASTM F568M, Property Class 4.6); carbon-steel, hex-head bolts and studs; carbon-steel nuts, ASTM A563 (ASTM A563M); and flat, unhardened steel washers, ASTM F844.
- K. High-Strength Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325 (Grade A325M), Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, (ASTM A563M, Class 10S) heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers.
- L. Welding Electrodes: Comply with AWS standards.

2.7 STAINLESS STEEL CONNECTION MATERIALS

- A. Stainless Steel Plate: ASTM A666, Type 316.
- B. Stainless Steel Bolts and Studs: ASTM F593, Alloy Group 1 or 2 (ASTM F738M, Grade A1 or A4) hex-head bolts and studs; ASTM F594, Alloy Group 1 or 2 (ASTM F836M, Grade A1 or A4) stainless steel nuts; and flat, stainless steel washers.
 1. Lubricate threaded parts of stainless steel bolts with an antiseize thread lubricant during assembly.

- C. Stainless Steel-Headed Studs: ASTM A276, Alloy 304 or Alloy 316, with minimum mechanical properties of PCI MNL 117, Table 3.2.3.
- D. Weld stainless steel with stainless wire and welders dedicated to stainless steel welding.
- E. Grind, polish, brush and scrape stainless steel with grinding wheels, polishing wheels and other tools dedicated to stainless steel welding.

2.8 BEARING PADS

- A. Provide one of the following bearing pads for architectural precast concrete units:
 - 1. Random-Oriented-Fiber-Reinforced Elastomeric Pads: Preformed, randomly oriented synthetic fibers set in elastomer. Type A durometer hardness of 70 to 90, ASTM D2240; capable of supporting a compressive stress of 3000 psi (20.7 MPa) with no cracking, splitting, or delaminating in the internal portions of pad. Test one specimen for every 200 pads used in Project.
 - 2. Frictionless Pads: PTFE, glass-fiber reinforced, bonded to stainless or mild-steel plate, or random-oriented-fiber-reinforced elastomeric pads; of type required for in-service stress.
 - 3. High-Density Plastic: Multimonomer, nonleaching, plastic strip.

2.9 ACCESSORIES

- A. Precast Accessories: Provide clips, hangers, high-density plastic or steel shims, and other accessories required to install architectural precast concrete units.

2.10 GROUT MATERIALS

- A. Sand-Cement Grout: Portland cement, ASTM C150/C150M, Type I, and clean, natural sand, ASTM C144 or ASTM C404. Mix at ratio of 1 part cement to 2-1/2 to 3 parts sand, by volume, with minimum water required for placement and hydration. Water-soluble chloride ion content less than 0.06 percent by weight of cement when tested according to ASTM C1218/C1218M.
- B. Nonmetallic, Nonshrink Grout: Packaged, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, plasticizing and water-reducing agents, complying with ASTM C1107/C1107M, Grade A for drypack and Grades B and C for flowable grout and of consistency suitable for application within a 30-minute working time. Water-soluble chloride ion content less than 0.06 percent by weight of cement when tested according to ASTM C1218/C1218M.
- C. Epoxy-Resin Grout: Two-component, mineral-filled epoxy resin; ASTM C881/C881M, of type, grade, and class to suit requirements.

2.11 INSULATED PANEL ACCESSORIES

- A. Extruded-Polystyrene (XPS) Board Insulation: ASTM C578, Type IV, 1.55 lb/cu. ft. (25 kg/cu. m); square edges; with thickness of.

- B. Wythe Connectors: Epoxy-coated carbon-fiber grid manufactured to connect wythes of precast concrete panels.

2.12 CONCRETE MIXTURES

- A. Prepare design mixtures for each type of precast concrete required.
1. Use a single design mixture for units with more than one major face or edge exposed.
 2. Where only one face of unit is exposed use either a single design mixture or separate mixtures for face and backup.
- B. Limit use of fly ash and ground granulated blast-furnace slag to 20 percent of portland cement by weight; limit metakaolin and silica fume to 10 percent of portland cement by weight.
- C. Design mixtures may be prepared by a qualified independent testing agency or by qualified precast plant personnel at architectural precast concrete fabricator's option.
- D. Limit water-soluble chloride ions to maximum percentage by weight of cement permitted by ACI 318 (ACI 318M) or PCI MNL 117 when tested according to ASTM C1218/C1218M.
- E. Normal-Weight Concrete Mixtures: Proportion face and backup mixtures or full-depth mixtures, at fabricator's option by either laboratory trial batch or field test data methods according to ACI 211.1, with materials to be used on Project, to provide normal-weight concrete with the following properties:
1. Compressive Strength (28 Days): 5000 psi (34.5 MPa) minimum.
 2. Maximum Water-Cementitious Materials Ratio: 0.45.
- F. Water Absorption: 6 percent by weight or 14 percent by volume, tested according to ASTM C642, except for boiling requirement.
- G. Lightweight Concrete Backup Mixtures: Proportion mixtures by either laboratory trial batch or field test data methods according to ACI 211.2, with materials to be used on Project, to provide lightweight concrete with the following properties:
1. Compressive Strength (28 Days): 5000 psi (34.5 MPa).
 2. Unit Weight: Calculated equilibrium unit weight of 115 lb/cu. ft. (1842 kg/cu. m), plus or minus 3 lb/cu. ft. (48 kg/cu. m), according to ASTM C567.
- H. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content complying with PCI MNL 117.
- I. When included in design mixtures, add other admixtures to concrete mixtures according to manufacturer's written instructions.

2.13 MOLD FABRICATION

- A. Molds: Accurately construct molds, mortar tight, of sufficient strength to withstand pressures due to concrete-placement operations and temperature changes and for prestressing and detensioning operations. Coat contact surfaces of molds with release agent before reinforcement is placed. Avoid contamination of reinforcement and prestressing tendons by release agent.
1. Place form liners accurately to provide finished surface texture indicated. Provide solid backing and supports to maintain stability of liners during concrete placement. Coat form liner with form-release agent.
- B. Maintain molds to provide completed architectural precast concrete units of shapes, lines, and dimensions indicated, within fabrication tolerances specified.
1. Form joints are not permitted on faces exposed to view in the finished work.
 2. Edge and Corner Treatment: Uniformly chamfered.

2.14 FABRICATION

- A. Cast-in Anchors, Inserts, Plates, Angles, and Other Anchorage Hardware: Fabricate anchorage hardware with sufficient anchorage and embedment to comply with design requirements. Accurately position for attachment of loose hardware, and secure in place during precasting operations. Locate anchorage hardware where it does not affect position of main reinforcement or concrete placement.
1. Weld-headed studs and deformed bar anchors used for anchorage according to AWS D1.1/D1.1M and AWS C5.4, "Recommended Practices for Stud Welding."
- B. Furnish loose hardware items including steel plates, clip angles, seat angles, anchors, dowels, cramps, hangers, and other hardware shapes for securing architectural precast concrete units to supporting and adjacent construction.
- C. Cast-in reglets, slots, holes, and other accessories in architectural precast concrete units as indicated on the Contract Drawings.
- D. Cast-in openings larger than 10 inches (250 mm) in any dimension. Do not drill or cut openings or prestressing strand without Architect's approval.
- E. Reinforcement: Comply with recommendations in PCI MNL 117 for fabricating, placing, and supporting reinforcement.
1. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy the bond with concrete. When damage to epoxy-coated reinforcing exceeds limits specified in ASTM A775/A775M, repair with patching material compatible with coating material and epoxy coat bar ends after cutting.
 2. Accurately position, support, and secure reinforcement against displacement during concrete-placement and consolidation operations. Completely conceal support devices to prevent exposure on finished surfaces.
 3. Place reinforcing steel and prestressing strands to maintain at least ¾-inch (19-mm) minimum concrete cover. Increase cover requirements for reinforcing steel

- to 1½ inches (38 mm) when units are exposed to corrosive environment or severe exposure conditions. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position while placing concrete. Direct wire tie ends away from finished, exposed concrete surfaces.
4. Install welded wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh spacing and wire tie laps, where required by design. Offset laps of adjoining widths to prevent continuous laps in either direction.
- F. Reinforce architectural precast concrete units to resist handling, transportation, and erection stresses and specified in-place loads.
- G. Prestress tendons for architectural precast concrete units by either pretensioning or post-tensioning methods. Comply with PCI MNL 117.
1. Delay detensioning or post-tensioning of precast, prestressed architectural concrete units until concrete has reached its indicated minimum design release compressive strength as established by test cylinders cured under same conditions as concrete unit.
 2. Detension pretensioned tendons either by gradually releasing tensioning jacks or by heat-cutting tendons, using a sequence and pattern to prevent shock or unbalanced loading.
 3. If concrete has been heat cured, detension while concrete is still warm and moist to avoid dimensional changes that may cause cracking or undesirable stresses.
 4. Protect strand ends and anchorages with bituminous, zinc-rich, or epoxy paint to avoid corrosion and possible rust spots.
- H. Comply with requirements in PCI MNL 117 and requirements in this Section for measuring, mixing, transporting, and placing concrete. After concrete batching, no additional water may be added.
- I. Place face mixture to a minimum thickness after consolidation of the greater of 1 inch (25 mm) or 1.5 times the maximum aggregate size, but not less than the minimum reinforcing cover specified.
- J. Place concrete in a continuous operation to prevent cold joints or planes of weakness from forming in precast concrete units.
1. Place backup concrete mixture to ensure bond with face-mixture concrete.
- K. Thoroughly consolidate placed concrete by internal and external vibration without dislocating or damaging reinforcement and built-in items, and minimize pour lines, honeycombing, or entrapped air voids on surfaces. Use equipment and procedures complying with PCI MNL 117.
1. Place self-consolidating concrete without vibration according to PCI TR-6, "Interim Guidelines for the Use of Self-Consolidating Concrete in Precast/Prestressed Concrete Institute Member Plants." Ensure adequate bond between face and backup concrete, if used.
- L. Comply with PCI MNL 117 for hot- and cold-weather concrete placement.

- M. Identify pickup points of architectural precast concrete units and orientation in structure with permanent markings, complying with markings indicated on Shop Drawings. Imprint or permanently mark casting date on each architectural precast concrete unit on a surface that does not show in finished structure.
- N. Cure concrete, according to requirements in PCI MNL 117, by moisture retention without heat or by accelerated heat curing using low-pressure live steam or radiant heat and moisture. Cure units until compressive strength is high enough to ensure that stripping does not have an effect on performance or appearance of final product.
- O. Discard and replace architectural precast concrete units that do not comply with requirements, including structural, manufacturing tolerance, and appearance, unless repairs meet requirements in PCI MNL 117 and Architect's approval.

2.15 INSULATED PANEL CASTING

- A. Cast, screed, and consolidate bottom concrete wythe supported by mold.
- B. Place insulation boards abutting edges and ends of adjacent boards. Insert wythe connectors through insulation holes and consolidate concrete around connectors according to connector manufacturer's written instructions.
- C. Ensure bottom wythe and insulation layer are not disturbed after bottom wythe reaches initial set.
- D. Cast, screed, and consolidate top wythe to meet required finish.
- E. Maintain temperature below 150 deg F (65 deg C) in bottom concrete wythe.

2.16 FABRICATION TOLERANCES

- A. Fabricate architectural precast concrete units to shapes, lines, and dimensions indicated so each finished unit complies with PCI MNL 117 product tolerances as well as position tolerances for cast-in items.
- B. Fabricate architectural precast concrete units to shapes, lines, and dimensions indicated so each finished unit complies with the following product tolerances:
 - 1. Overall Height and Width of Units, Measured at the Face Exposed to View: As follows:
 - a. 10 feet (3 m) or under, plus or minus 1/8 inch (3 mm).
 - b. 10 to 20 feet (3 to 6 m), plus 1/8 inch (3 mm), minus 3/16 inch (5 mm).
 - c. 20 to 40 feet (6 to 12 m), plus or minus 1/4 inch (6 mm).
 - d. Each additional 10 feet (3 m), plus or minus 1/16 inch (1.5 mm).
 - 2. Overall Height and Width of Units, Measured at the Face Not Exposed to View: As follows:
 - a. 10 feet (3 m) or under, plus or minus 1/4 inch (6 mm).
 - b. 10 to 20 feet (3 to 6 m), plus 1/4 inch (6 mm), minus 3/8 inch (10 mm).

- c. 20 to 40 feet (6 to 12 m), plus or minus 3/8 inch (10 mm).
 - d. Each additional 10 feet (3 m), plus or minus 1/8 inch (3 mm).
3. Total Thickness or Flange Thickness: Plus 1/4 inch (6 mm), minus 1/8 inch (3 mm).
 4. Rib Thickness: Plus or minus 1/8 inch (3 mm).
 5. Rib to Edge of Flange: Plus or minus 1/8 inch (3 mm).
 6. Distance between Ribs: Plus or minus 1/8 inch (3 mm).
 7. Variation from Square or Designated Skew (Difference in Length of the Two Diagonal Measurements): Plus or minus 1/8 inch/72 inches (3 mm/1830 mm) or 1/2 inch (13 mm) total, whichever is greater.
 8. Length and Width of Block-outs and Openings within One Unit: Plus or minus 1/4 inch (6 mm).
 9. Location and Dimension of Block-outs Hidden from View and Used for HVAC and Utility Penetrations: Plus or minus 3/4 inch (19 mm).
 10. Dimensions of Haunches: Plus or minus 1/4 inch (6 mm).
 11. Haunch Bearing Surface Deviation from Specified Plane: Plus or minus 1/8 inch (3 mm).
 12. Difference in Relative Position of Adjacent Haunch Bearing Surfaces from Specified Relative Position: Plus or minus 1/4 inch (6 mm).
 13. Bowing: Plus or minus L/360, maximum 1 inch (25 mm).
 14. Differential Bowing: 1/4 inch from panel to panel.
 15. Local Smoothness: 1/4 inch/10 feet (6 mm/3 m).
 16. Warping: 1/16 inch/12 inches (1.5 mm/300 mm) of distance from nearest adjacent corner.
 17. Tipping and Flushness of Plates: Plus or minus 1/4 inch (6 mm).
 18. Dimensions of Architectural Features and Rustications: Plus or minus 1/8 inch (3 mm).
- C. Position Tolerances: For cast-in items measured from datum line location, as indicated on Shop Drawings.
1. Weld Plates: Plus or minus 1 inch (25 mm).
 2. Inserts: Plus or minus 1/2 inch (13 mm).
 3. Handling Devices: Plus or minus 3 inches (75 mm).
 4. Reinforcing Steel and Welded Wire Reinforcement: Plus or minus 1/4 inch (6 mm) where position has structural implications or affects concrete cover; otherwise, plus or minus 1/2 inch (13 mm).
 5. Reinforcing Steel Extending out of Member: Plus or minus 1/2 inch (13 mm) of plan dimensions.
 6. Tendons: Plus or minus 1/4 inch (6 mm), vertical; plus or minus 1 inch (25 mm), horizontal.
 7. Location of Rustication Joints: Plus or minus 1/8 inch (3 mm).
 8. Location of Opening within Panel: Plus or minus 1/4 inch (6 mm).
 9. Location of Flashing Reglets: Plus or minus 1/4 inch (6 mm).
 10. Location of Flashing Reglets at Edge of Panel: Plus or minus 1/8 inch (3 mm).
 11. Reglets for Glazing Gaskets: Plus or minus 1/8 inch (3 mm).
 12. Electrical Outlets, Hose Bibs: Plus or minus 1/2 inch (13 mm).
 13. Location of Bearing Surface from End of Member: Plus or minus 1/4 inch (6 mm).
 14. Allowable Rotation of Plate, Channel Inserts, and Electrical Boxes: 2-degree rotation or 1/4 inch (6 mm) maximum over the full dimension of unit.

15. Position of Sleeve: Plus or minus ½ inch (13 mm).
16. Location of Window Washer Track or Buttons: Plus or minus 1/8 inch (3 mm).

2.17 FINISHES

- A. Exposed faces shall be free of joint marks, grain, and other obvious defects. Corners, including false joints shall be uniform, straight, and sharp. Finish exposed-face surfaces of architectural precast concrete units to match approved mockups and as follows:
1. PCI's "Architectural Precast Concrete - Color and Texture Selection Guide," of plate numbers indicated.
 2. Exterior Surface:
 - a. Exposed Lower Section: Sand-Blast Finish, Use abrasive grit, equipment, application techniques, and cleaning procedures to texture surface.
 - b. Upper Metal Panel Concealed Section: Standard Grade, Normal plant-run finish produced in forms that impart a smooth finish to concrete. Surface holes smaller than 1/2 inch caused by air bubbles, normal color variations, form joint marks, and minor chips and spalls will be acceptable. Fill air holes greater than 1/4 inch in width that occur in high concentration (more than one per 2 in.²). Major or unsightly imperfections, honeycombs, or structural defects are not permitted. Allowable for joint offset limited to 1/8 inch.
 3. Interior:
 - a. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
 - b. Grade B Finish: Fill air pockets and holes larger than 1/4 inch in diameter with sand-cement paste matching color of adjacent surfaces. Fill air holes greater than 1/8 inch in width that occur in high concentration (more than one per 2 in.²). Grind smooth form offsets or fins larger than 1/8 inch. Repair surface blemishes due to holes or dents in forms. Discoloration is permitted at form joints.
- B. On precast surfaces exposed to view fill all lifting lug holes with patching mortar and finish to match adjacent surfaces.

2.18 SOURCE QUALITY CONTROL

- A. Quality-Control Testing: Test and inspect precast concrete according to PCI MNL 117 requirements. If using self-consolidating concrete, also test and inspect according to PCI TR-6, ASTM C1610/C1610M, ASTM C1611/C1611M, ASTM C1621/C1621M, and ASTM C1712.
- B. Owner will employ an independent testing agency to evaluate architectural precast concrete fabricator's quality-control and testing methods.

1. Allow Owner's testing agency access to material storage areas, concrete production equipment, concrete placement, and curing facilities. Cooperate with Owner's testing agency and provide samples of materials and concrete mixtures as may be requested for additional testing and evaluation.
- C. Strength of precast concrete units is considered deficient if units fail to comply with ACI 318 (ACI 318M) requirements for concrete strength.
- D. Testing: If there is evidence that strength of precast concrete units may be deficient or may not comply with ACI 318 (ACI 318M) requirements, precaster will employ an independent testing agency to obtain, prepare, and test cores drilled from hardened concrete to determine compressive strength according to ASTM C42/C42M and ACI 318 (ACI 318M).
1. A minimum of three representative cores shall be taken from units of suspect strength, from locations directed by Architect.
 2. Test cores in an air-dry condition.
 3. Strength of concrete for each series of three cores is considered satisfactory if average compressive strength is equal to at least 85 percent of 28-day design compressive strength and no single core is less than 75 percent of 28-day design compressive strength.
 4. Report test results in writing on same day that tests are performed, with copies to Architect, Contractor, and precast concrete fabricator. Test reports include the following:
 - a. Project identification name and number.
 - b. Date when tests were performed.
 - c. Name of precast concrete fabricator.
 - d. Name of concrete testing agency.
 - e. Identification letter, name, and type of precast concrete unit(s) represented by core tests; design compressive strength; type of break; compressive strength at breaks, corrected for length-diameter ratio; and direction of applied load to core in relation to horizontal plane of concrete as placed.
- E. Patching: If core test results are satisfactory and precast concrete units comply with requirements, clean and dampen core holes and solidly fill with precast concrete mixture that has no coarse aggregate, and finish to match adjacent precast concrete surfaces.
- F. Defective Units: Discard and replace recast architectural concrete units that do not comply with acceptability requirements in PCI MNL 117, including concrete strength, manufacturing tolerances, and color and texture range. Chipped, spalled, or cracked units may be repaired, subject to Architect's approval. Architect reserves the right to reject precast units that do not match approved samples, sample panels, and mockups. Replace unacceptable units with precast concrete units that comply with requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 INSTALLATION

- A. Install clips, hangers, bearing pads, and other accessories required for connecting architectural precast concrete units to supporting members and backup materials.
- B. Erect architectural precast concrete level, plumb, and square within specified allowable tolerances. Provide temporary supports and bracing as required to maintain position, stability, and alignment of units until permanent connections are completed.
 - 1. Install temporary steel or plastic spacing shims as precast concrete units are being erected. Tack weld steel shims to each other to prevent shims from separating.
 - 2. Maintain horizontal and vertical joint alignment and uniform joint width as erection progresses.
 - 3. Remove projecting lifting devices and grout fill voids within recessed lifting devices flush with surface of adjacent precast surfaces when recess is exposed.
 - 4. Unless otherwise indicated, maintain uniform joint widths of 3/4 inch (19 mm).
- C. Connect architectural precast concrete units in position by bolting, welding, grouting, or as otherwise indicated on Shop Drawings. Remove temporary shims, wedges, and spacers as soon as practical after connecting and grouting are completed.
 - 1. Do not permit connections to disrupt continuity of roof flashing.
- D. Welding: Comply with applicable requirements in AWS D1.1/D1.1M and AWS D1.4/D1.4M for welding, welding electrodes, appearance, quality of welds, and methods used in correcting welding work.
 - 1. Protect architectural precast concrete units and bearing pads from damage by field welding or cutting operations, and provide noncombustible shields as required.
 - 2. Welds not specified shall be continuous fillet welds, using no less than the minimum fillet as specified by AWS.
 - 3. Clean weld-affected metal surfaces with chipping hammer followed by brushing and apply a minimum 4.0-mil- (0.1-mm-) thick coat of galvanized repair paint to galvanized surfaces according to ASTM A780/A780M.
 - 4. Clean weld-affected metal surfaces with chipping hammer followed by brushing, and reprime damaged painted surfaces.
 - 5. Visually inspect welds and remove, reweld, or repair incomplete and defective welds.

- E. At bolted connections, use lock washers, tack welding, or other approved means to prevent loosening of nuts after final adjustment.
1. Where slotted connections are used, verify bolt position and tightness. For sliding connections, properly secure bolt but allow bolt to move within connection slot.
 2. For slip-critical connections, use one of the following methods to assure proper bolt pretension:
 - a. Turn-of-Nut: According to RCSC's "Specification for Structural Joints Using ASTM A325 or A 490 Bolts."
 - b. Calibrated Wrench: According to RCSC's "Specification for Structural Joints Using ASTM A325 or A 490 Bolts."
 - c. Twist-off Tension Control Bolt: ASTM F3125/F3125M, Grade 1852.
 - d. Direct-Tension Control Bolt: ASTM F3125/F3125M, Grade 1852.
 3. For slip-critical connections, use method and inspection procedure approved by Architect and coordinated with inspection agency.
- F. Grouting or Dry-Packing Connections and Joints: Grout connections where required or indicated. Retain flowable grout in place until hard enough to support itself. Alternatively, pack spaces with stiff dry-pack grout material, tamping until voids are completely filled. Place grout and finish smooth, level, and plumb with adjacent concrete surfaces. Promptly remove grout material from exposed surfaces before it affects finishes or hardens. Keep grouted joints damp for not less than 24 hours after initial set.

3.3 ERECTION TOLERANCES

- A. Erect architectural precast concrete units level, plumb, square, and in alignment without exceeding the noncumulative erection tolerances of PCI MNL 117, Appendix I.
- B. Erect architectural precast concrete units level, plumb, square, and in alignment, without exceeding the following noncumulative erection tolerances:
1. Plan Location from Building Grid Datum: Plus or minus ½ inch (13 mm).
 2. Plan Location from Centerline of Steel: Plus or minus ½ inch (13 mm).
 3. Top Elevation from Nominal Top Elevation: As follows:
 - a. Exposed Individual Panel: Plus or minus ¼ inch (6 mm).
 - b. Non-Exposed Individual Panel: Plus or minus ½ inch (13 mm).
 - c. Exposed Panel Relative to Adjacent Panel: ¼ inch (6 mm).
 - d. Non-Exposed Panel Relative to Adjacent Panel: ½ inch (13 mm).
 4. Support Elevation from Nominal Support Elevation: As follows:
 - a. Maximum Low: ½ inch (13 mm).
 - b. Maximum High: ¼ inch (6 mm).
 5. Maximum Plumb Variation over the Lesser of Height of Structure or 100 Feet (30 m): 1 inch (25 mm).
 6. Plumb in Any 10 Feet (3 m) of Element Height: ¼ inch (6 mm).
 7. Maximum Jog in Alignment of Matching Edges: ¼ inch (6 mm).

8. Joint Width (Governs over Joint Taper): Plus or minus ¼ inch (6 mm).
9. Maximum Joint Taper: 3/8 inch (10 mm).
10. Joint Taper in 10 Feet (3 m): ¼ inch (6 mm).
11. Maximum Jog in Alignment of Matching Faces: ¼ inch (6 mm).
12. Differential Bowing or Camber, as Erected, between Adjacent Members of Same Design: ¼ inch (6 mm).
13. Opening Height between Spandrels: Plus or minus ¼ inch (6 mm).

3.4 FIELD QUALITY CONTROL

- A. Special Inspections: Engage a qualified special inspector to perform the following special inspections and prepare reports:
 1. Erection of loadbearing precast concrete members.
- B. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.
- C. Visually inspect field welds and test according to ASTM E165 or to ASTM E709 and ASTM E1444. High-strength bolted connections are subject to inspections.
- D. Testing agency will report test results promptly and in writing to Contractor and Architect.
- E. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.
- F. Additional testing and inspecting, at Contractor's expense, shall be performed to determine compliance of replaced or additional work with specified requirements.

3.5 REPAIRS

- A. Repair architectural precast concrete units if permitted by Architect. Architect reserves the right to reject repaired units that do not comply with requirements.
- B. Mix patching materials and repair units so cured patches blend with color, texture, and uniformity of adjacent exposed surfaces and show no apparent line of demarcation between original and repaired work, when viewed in typical daylight illumination from a distance of 20 feet (6 m).
- C. Prepare and repair damaged galvanized coatings with galvanizing repair paint according to ASTM A780/A780M.
- D. Wire brush, clean, and paint damaged prime-painted components with same type of shop primer.
- E. Remove and replace damaged architectural precast concrete units when repairs do not comply with requirements.

3.6 CLEANING

- A. Clean surfaces of precast concrete units exposed to view.

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

END OF SECTION 03 45 00

**SECTION 04 20 00
UNIT MASONRY ASSEMBLIES**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Standard Specifications, Proposal Documents, Special Provisions, Supplemental Specifications, Bid Item Manual and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

1. Concrete masonry units.
2. Brick
3. Mortar and grout.
4. Steel reinforcing bars.
5. Masonry joint reinforcement.
6. Embedded Flashing.
7. Miscellaneous masonry accessories.

- B. Related Sections:

1. Division 03 Section "Cast-in-Place Concrete" for installing dovetail slots for masonry anchors.
2. Division 05 Section "Structural Steel Framing" for installing anchor sections of adjustable masonry anchors for connecting to structural-steel frame.
3. Division 07 Section "Sheet Metal Flashing and Trim" for sheet metal flashing and for furnishing manufactured reglets installed in masonry joints.

1.3 DEFINITIONS

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

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

1.4 PERFORMANCE REQUIREMENTS

- A. Provide structural unit masonry that develops indicated net-area compressive strengths at 28 days.

1. Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.

1.5 SUBMITTALS

- A. Shop Drawings: For the following:

1. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement."

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM C 1093 for testing indicated.
- B. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.
- C. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.
- D. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the Contract Documents.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- D. Deliver preblended, dry mortar mix in moisture-resistant containers designed for use with dispensing silos. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in covered weatherproof dispensing silos.
- E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.8 PROJECT CONDITIONS

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
 1. Extend cover a minimum of 24 inches (600 mm) down both sides of walls and hold cover securely in place.
- B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.
- C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
 2. Protect sills, ledges, and projections from mortar droppings.
 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
 4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
- D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F (4 deg C) and higher and will remain so until masonry has dried, but not less than 7 days after completing cleaning.
- E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.1 CONCRETE MASONRY UNITS

- A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
1. Provide special shapes for lintels, corners, jambs, movement joints, headers, bonding, and other special conditions.
- B. Integral Water Repellent: Provide units made with integral water repellent for exterior exposed units and where indicated.
1. Integral Water Repellent: Liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested according to ASTM E 514 as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive, with test period extended to 24 hours, shall show no visible water or leaks on the back of test specimen.
- C. CMUs: ASTM C 90.
1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 3750 psi (19.3 MPa).
 2. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.
 3. Exposed Faces: Provide color and texture matching the range represented by Architect's sample.

2.2 BRICK

- A. Clay Brick: Match existing size, texture and color.

2.3 MASONRY LINTELS

- A. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

2.4 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
- B. Hydrated Lime: ASTM C 207, Type S.
- C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.
- D. Aggregate for Mortar: ASTM C 144.
1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
 2. For joints less than ¼ inch (6 mm) thick, use aggregate graded with 100 percent passing the No. 16 (1.18-mm) sieve.
- E. Aggregate for Grout: ASTM C 404.
- F. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMUs, containing integral water repellent by same manufacturer.
- G. Water: Potable.

2.5 REINFORCEMENT

- A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60 (Grade 420).
- B. Masonry Joint Reinforcement, General: ASTM A 951/A 951M.
1. Interior Walls: Mill- galvanized, carbon steel.
 2. Exterior Walls: Hot-dip galvanized, carbon steel.
 3. Wire Size for Side Rods: 0.148-inch (3.77-mm) diameter.
 4. Wire Size for Cross Rods: 0.148-inch (3.77-mm) diameter.
 5. Wire Size for Veneer Ties: 0.187-inch (4.76-mm) diameter.
 6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches (407 mm) o.c.
 7. Provide in lengths of not less than 10 feet (3 m), with prefabricated corner and tee units.

- C. Masonry Joint Reinforcement for Single-Wythe Masonry: Either ladder or truss type with single pair of side rods.

2.6 MISCELLANEOUS ANCHORS

- A. Anchor Bolts: Headed steel bolts complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153/A 153M, Class C; of dimensions indicated.
- B. Corrugated buck anchor: Sheet metal, bent, for anchor new masonry to concrete or existing masonry.
1. Thickness: 16 gauge – 54 mil.
 2. Finish: Galvanized ATSM A653 G60
 3. Dimensions: 1¼" wide, 5½" minimum corrugated leg length, 1¼" minimum leg with hole.
 4. Fastening: 5/16" hole
 5. Deformation: 1/16" minimum corrugation amplitude
- C. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.
1. Load Capacity: Capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
 2. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5 unless otherwise indicated.
 3. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 2 (A4) stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).

2.7 EMBEDDED FLASHING MATERIALS

- A. Metal Flashing: Provide metal flashing complying with Division 07 Section "Sheet Metal Flashing and Trim."
- B. Solder and Sealants for Sheet Metal Flashings: As specified in Division 07 Section "Sheet Metal Flashing and Trim."

2.8 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene urethane or PVC.
- B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 or PVC, complying with ASTM D 2287, Type PVC-65406 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

- C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).
- D. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and hold reinforcing bars in center of cells. Units are formed from 0.148-inch (3.77-mm) steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.

2.9 MASONRY CLEANERS

- A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

2.10 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
 - 1. Do not use calcium chloride in mortar or grout.
 - 2. Use portland cement-lime mortar unless otherwise indicated.
 - 3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.
- B. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated.
 - 1. For masonry below grade or in contact with earth, use Type S.
 - 2. For reinforced masonry, use Type S.
 - 3. For mortar parge coats, use Type S.
 - 4. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type S.
- C. Grout for Unit Masonry: Comply with ASTM C 476.
 - 1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
 - 2. Proportion grout in accordance with ASTM C 476, paragraph 4.2.2 for specified 28-day compressive strength of 2500 psi (17.5 MPa).
 - 3. Provide grout with a slump of 8 to 11 inches (203 to 279 mm) as measured according to ASTM C 143/C 143M.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 INSTALLATION, GENERAL

- A. Build chases and recesses to accommodate items specified in this and other Sections.
- B. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.
- C. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
- D. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/194 sq. cm (30 g/30 sq. in.) per minute when tested per ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.

3.3 TOLERANCES

- A. Dimensions and Locations of Elements:
 - 1. For dimensions in cross section or elevation do not vary by more than plus ½ inch (12 mm) or minus ¼ inch (6 mm).
 - 2. For location of elements in plan do not vary from that indicated by more than plus or minus ½ inch (12 mm).
 - 3. For location of elements in elevation do not vary from that indicated by more than plus or minus ¼ inch (6 mm) in a story height or ½ inch (12 mm) total.
- B. Lines and Levels:
 - 1. For bed joints and top surfaces of bearing walls do not vary from level by more than ¼ inch in 10 feet (6 mm in 3 m), or ½ inch (12 mm) maximum.
 - 2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet (3 mm in 3 m), ¼ inch in 20 feet (6 mm in 6 m), or ½ inch (12 mm) maximum.

3. For vertical lines and surfaces do not vary from plumb by more than ¼ inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or ½ inch (12 mm) maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet (3 mm in 3 m), ¼ inch in 20 feet (6 mm in 6 m), or ½ inch (12 mm) maximum.
5. For lines and surfaces do not vary from straight by more than ¼ inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or ½ inch (12 mm) maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than ¼ inch in 10 feet (6 mm in 3 m), or ½ inch (12 mm) maximum.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm), with a maximum thickness limited to ½ inch (12 mm).
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch (3 mm).
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch (9 mm) or minus ¼ inch (6 mm).
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm).

3.4 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less than nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.
- C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4-inches (100-mm). Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.
- D. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar before laying fresh masonry.
- E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

- G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below and rod mortar or grout into core.
- H. Fill cores in hollow CMUs with grout 24 inches (600 mm) under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.
- I. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.

3.5 MORTAR BEDDING AND JOINTING

- A. Lay hollow CMUs as follows:
 - 1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
 - 2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
 - 3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
 - 4. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.
- B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
 - 1. Clean soiled surfaces with fiber brush and soap powder and rinse thoroughly with clear water.
 - 2. Allow cleaned surfaces to dry before setting.
 - 3. Wet joint surfaces thoroughly before applying mortar.
- C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

3.6 MASONRY JOINT REINFORCEMENT

- A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch (16 mm) on exterior side of walls, 1/2 inch (13 mm) elsewhere. Lap reinforcement a minimum of 6 inches (150 mm).
- B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.
- C. Provide continuous horizontal wire in the facing wythe.
- D. Provide continuity at wall intersections by using prefabricated T-shaped units.
- E. Provide continuity at corners by using prefabricated L-shaped units.

3.7 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

- A. Anchor masonry to structural steel and concrete where masonry abuts or faces structural steel or concrete to comply with the following:

1. Provide an open space not less than ½ inch wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
3. Space anchors as indicated, but not more than 24 inches (610 mm) o.c. vertically and 36 inches (915 mm) o.c. horizontally.

3.8 CONTROL AND EXPANSION JOINTS

- A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.
- B. Form control joints in concrete masonry as follows:
 1. Install preformed control-joint gaskets designed to fit standard sash block.
- C. If not shown on plans, provide at maximum 25 feet joint-to-joint and at maximum 12 joint-to-corner in locations to coincide with changes in wall height or thickness, construction joints in foundation, chases or recesses, columns, sides of wall opening, return angles or reentrant corners, as approved by Architect/Engineer.

3.9 LINTELS

- A. Provide masonry lintels where shown and where openings of more than 12 inches (305 mm) for brick-size units and 24 inches (610 mm) for block-size units are shown without structural steel or other supporting lintels.
 1. Provide (2) #5 in continuous bond beams immediately above the lintel and below the sill. Extend reinforcing a minimum of 2'-0" beyond jambs of openings.
- B. Provide minimum bearing of 8 inches (200 mm) at each jamb unless otherwise indicated.

3.10 FLASHING

- A. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.

3.11 REINFORCED UNIT MASONRY INSTALLATION

- A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
 1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.

2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other loads that may be placed on them during construction.
- B. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602.
- C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
1. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
 2. Limit height of vertical grout pours to not more than 60 inches (1520 mm).

3.12 REPAIRING, POINTING, AND CLEANING

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

3.13 MASONRY WASTE DISPOSAL

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

END OF SECTION 04 20 00

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SECTION 05 12 00 STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

1. Structural steel.
2. Grout.

1.3 DEFINITIONS

- A. Structural Steel: Elements of structural-steel frame, as classified by AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

1.4 SUBMITTALS

- A. Shop Drawings: Show fabrication of structural-steel components.

1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
2. Include embedment drawings.
3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.
4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.
5. Prepare erection drawings
 - a. Follow AISC Code of Standard Practice

- B. Mill test reports for structural steel, including chemical and physical properties.

1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications:

1. A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD.
2. Certified welders required perform all welding.

- B. Installer Qualifications:

1. Certified welders required perform all welding.

- C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- D. Comply with applicable provisions of the following specifications and documents:
 - 1. AISC 303-05. Code of Standard Practice for Steel Buildings and Bridges
 - 2. AISC 360-05. Specification for Structural Steel Buildings
 - 3. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

1.6 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. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

1.7 COORDINATION

- A. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.
- B. Coordinate steel detailing with mechanical equipment.

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

- A. W-Shapes: ASTM A 992/A 992M.
- B. Channels, Angles, M, S-Shapes: ASTM A 36/A 36M.
- C. Plate and Bar:
 - 1. Unless noted otherwise; ASTM A 36/A 36M.
 - 2. Selected plates on moment connections; ASTM A529 Gr 50.
- D. Cold-Formed Hollow Structural Sections: ASTM A 1085, structural tubing.
- E. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B.

- F. Steel Castings: ASTM A 216/A 216M, Grade WCB with supplementary requirement S11.
- G. Steel Forgings: ASTM A 668/A 668M.
- H. Welding Electrodes: Comply with AWS requirements.

2.2 BOLTS, CONNECTORS, AND ANCHORS

- A. Steel Bolts and Nuts: Heavy hexagon-head bolts, ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with heavy hex nuts, ASTM A 563 (ASTM A 563M); and, where indicated, ASTM F 436 (ASTM F 436M), Type 1, hardened carbon-steel washers; all with plain finish.
- B. High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), heavy-hex steel structural bolts; ASTM A 563, Grade C, (ASTM A 563M, Class 8S) heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M), Type 1, hardened carbon-steel washers; all with plain finish.
- C. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.
- D. Anchor Rods: ASTM F 1554, Grade 55.
 - 1. Configuration: Straight, headed or tacked nut.
 - 2. Nuts: ASTM A 563 (ASTM A 563M) heavy-hex carbon steel.
 - 3. Plate Washers: ASTM A 36/A 36M carbon steel.
 - 4. Washers: ASTM F 436 (ASTM F 436M), Type 1, hardened carbon steel.
 - 5. Finish: Plain.
- E. Threaded Rods: ASTM A 36/A 36M.
 - 1. Nuts: ASTM A 563 (ASTM A 563M) heavy-hex carbon steel.
 - 2. Washers: ASTM F 436 (ASTM F 436M), Type 1, hardened carbon steel.
 - 3. Finish: Plain.
- F. Clevises and Turnbuckles: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1035.
- G. Eye Bolts and Nuts: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1030.
- H. Sleeve Nuts: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1018.

2.3 GROUT

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

2.4 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC 360.
1. Camber structural-steel members where indicated.
 2. Fabricate beams with rolling camber up.
 3. Identify high-strength structural steel according to ASTM A 6/A 6M and maintain markings until structural steel has been erected.
 4. Mark and match-mark materials for field assembly.
 5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
- B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.
- C. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.
- D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- E. Cleaning: Clean and prepare steel surfaces according to SSPC-SP 6, "Commercial Blast Cleaning."
- F. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.
- G. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel framing members.
1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
 2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
 3. Weld threaded nuts to framing and other specialty items indicated to receive other work.
- H. Stainless steel shall be passivated after fabrication to restore non-corrosive properties to prevent corrosion or staining at welded joints.

2.5 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
1. Joint Type: Snug tightened.

- B. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.6/D1.6M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
1. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

2.6 SHOP PRIMING

- A. Shop prime steel surfaces except the following:
1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches (50 mm).
 2. Surfaces to be field welded.
 3. Surfaces to be high-strength bolted with slip-critical connections.
 4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
 5. Galvanized surfaces.
- B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
1. SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
- C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
 2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.
- D. Painting: Prepare steel and apply a one-coat, nonasphaltic primer complying with SSPC-PS Guide 7.00, "Painting System Guide 7.00: Guide for Selecting One-Coat Shop Painting Systems," to provide a dry film thickness of not less than 1.5 mils (0.038 mm).

2.7 FIELD-APPLIED PAINT FINISH

- A. Field paint all exposed steel in accordance with the architectural finish schedule and "Interior Painting" in Division 9 of the specifications.

2.8 GALVANIZING

- A. Hot-Dip Galvanized Finish: For all exterior steel apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/A 123M.
1. Complete all fabrication and cleaning before galvanizing.
 2. Fill vent and drain holes that will be exposed in the finished Work unless they will function as weep holes, by plugging with zinc solder and filing off smooth.

3. Galvanize lintels and welded door frames attached to structural-steel frame and located in exterior walls.

2.9 SOURCE QUALITY CONTROL

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

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

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

3.3 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.
- B. Base Bearing and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials and roughen surfaces prior to setting plates. Clean bottom surface of plates.
 - 1. Set plates for structural members on wedges, shims, or setting nuts as required.
 - 2. Weld plate washers to top of baseplate.
 - 3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
 - 4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."
- D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 - 1. Level and plumb individual members of structure.
 - 2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.
- E. Splice members only where indicated.
- F. Do not use thermal cutting during erection.
- G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.
- H. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.

3.4 FIELD CONNECTIONS

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

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.
- B. Bolted Connections: Bolted connections will be inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- C. Welded Connections: Field welds will be visually inspected according to AWS D1.1/D1.1M.
 - 1. In addition to visual inspection, field welds will be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
 - a. Liquid Penetrant Inspection: ASTM E 165.
 - b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
 - c. Ultrasonic Inspection: ASTM E 164.
 - d. Radiographic Inspection: ASTM E 94.
- D. In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1/D1.1M for stud welding and as follows:
 - 1. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
 - 2. Conduct tests on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1/D1.1M.
- E. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

3.6 REPAIRS AND PROTECTION

- A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780.

END OF SECTION 05 12 00

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**SECTION 05 31 00
STEEL DECKING****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

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

1.2 SUMMARY

- A. This Section includes the following:

1. Roof deck.
2. Composite Deck.

1.3 SUBMITTALS

- A. Shop Drawings: Show layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction. Include product data for each type of deck

1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency qualified according to ASTM E 329 for testing indicated.
- B. Welding: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."
- C. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."

1.5 DELIVERY, STORAGE, AND HANDLING

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

PART 2 - PRODUCTS**2.1 ROOF DECK**

- A. Steel Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 30, and with the following:

1. Galvanized: ASTM A 653/A 653M, Structural Steel (SS), Grade 33 (230), G60 (Z180) zinc coating.
2. Deck Profile: As indicated.
3. Profile Depth: As indicated.
4. Design Uncoated-Steel Thickness: As indicated.
5. Span Condition: Triple span or more.
6. Side Laps: Overlapped.

2.2 COMPOSITE DECK

- A. Composite Deck: Fabricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with "SDI Specifications and Commentary for Composite Steel Floor Deck," in SDI Publication No. 31, with the minimum section properties indicated, and with the following:
1. Galvanized: ASTM A 653/A 653M, Structural Steel (SS), Grade 33 (230), G60 (Z180) zinc coating.
 2. Profile Depth: As indicated.
 3. Design Uncoated-Steel Thickness: As indicated.
 4. Span Condition: Single

2.3 ACCESSORIES

- A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.
- B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.
- C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 (4.8-mm) minimum diameter.
- D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.
- E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi (230 MPa), not less than 0.0359-inch (0.91-mm) design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.
- F. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi (230 MPa), of same material and finish as deck, and of thickness and profile recommended by SDI Publication No. 30 for overhang and slab depth.
- G. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck, unless otherwise indicated.
- H. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, 0.0598 inch (1.52 mm) thick, with factory-punched hole of 3/8-inch (9.5-mm) minimum diameter.
- I. Sump Plate/Pan: Single-piece steel sheet, 0.0747 inch (1.90 mm) thick, of same material and finish as deck. For drains, cut holes in the field.

- J. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035, with dry film containing a minimum of 94 percent zinc dust by weight.
- K. Repair Paint: Match primer paint system specified in Division 9 painting section, of same color as primer.

2.4 FIELD-APPLIED PAINT FINISH

- A. Field paint all exposed steel in accordance with the architectural finish schedule and "Interior Painting" in Division 09 of the specifications.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

3.2 INSTALLATION, GENERAL

- A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 30, manufacturer's written instructions, and requirements in this Section.
- B. Install temporary shoring before placing deck panels, if required to meet deflection limitations.
- C. Locate deck bundles to prevent overloading of supporting members.
- D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.
- E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.
- F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.
- G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.
- H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.
- I. Locate mechanical fasteners as indicated and install according to deck manufacturer's written instructions.

3.3 ROOF-DECK INSTALLATION

- A. Fasten roof-deck panels to steel supporting members with fastener type and spacing as indicated but exceeding the lesser of the following:
1. Fasten edge and interior webs of deck units with a minimum of two fasteners per unit at each support.
 2. Space fasteners at 12 inches apart in the field of the roof and 6 inches apart in roof corners and perimeters, based on roof-area definitions in FMG Loss Prevention Data Sheet 1-28.
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of the following:
1. Mechanically fasten with self-drilling, No. 10 (4.8-mm-) diameter or larger, carbon-steel screws.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1½ inches (38 mm), with end joints as follows:
1. End Joints: Lapped 2 inches (51 mm) minimum.
- D. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and fasten flanges to top of deck. Space fasteners not more than 12 inches (305 mm) apart with at least one fastener at each corner.
1. Install reinforcing channels or zees in ribs to span between supports and fasten.
- E. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Fasten to substrate to provide a complete deck installation.
1. Fasten cover plates at changes in direction of roof-deck panels, unless otherwise indicated.
- F. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

3.4 FLOOR-DECK INSTALLATION

- A. Fasten floor-deck panels to steel supporting members with fastener type and spacing as indicated but exceeding the lesser of the following:
1. Fasten edge and interior webs of deck units with a minimum of two fasteners per unit at each support.
 2. Space fasteners at 12 inches apart in the field of the floor and 6 inches apart in floor corners and perimeters.
 3. As indicated.

- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports as indicated.
 - 1. Mechanically fasten with self-drilling, No. 10 (4.8-mm-) diameter or larger, carbon-steel screws.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm), with end joints as follows:
 - 1. End Joints: Lapped.
- D. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations unless otherwise indicated.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Fastener type, size, spacing, and layout shall be inspected while exposed for easy access and repair.
- C. Testing agency will report inspection results promptly and in writing to Contractor and COR.
- D. Remove and replace work that does not comply with specified requirements.
- E. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.6 REPAIRS AND PROTECTION

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

END OF SECTION 05 31 00

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**SECTION 05 50 00
METAL FABRICATIONS**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION

- A. Provide all labor, materials, and equipment to complete metal fabrications work as indicated in the Contract Documents.
- B. The Contractor shall take his own measurements, coordinate with equipment suppliers, and be solely responsible for proper fitting of the work under this Section to existing conditions.

1.3 SUMMARY

- A. Section Includes:
1. Steel framing and supports for countertops.
 2. Steel framing and supports for mechanical and electrical equipment.
 3. Steel framing and supports for applications where framing and supports are not specified in other Sections.
 4. Loose bearing and leveling plates for applications where they are not specified in other Sections.
 5. Ladders.
 6. Plank Grating.
- B. Products furnished, but not installed, under this Section:
1. Loose steel lintels.
 2. Anchor bolts indicated to be installed into concrete or masonry.

1.4 SUBMITTALS

- A. Product Data: Manufacturer's descriptive literature, including details of construction, materials, dimensions, preparation anchoring, profiles, configurations and finishes for each product used.
- B. Shop Drawings: Show fabrication and installation details for metal fabrications.
1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - 2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
 - 3. AWS D1.6, "Structural Welding Code - Stainless Steel."
- C. Workmanship and finish shall be first class and equal to best practice in modern fabrication shops. Shearing, clipping and burning shall be neatly and accurately done and all portions of work exposed to view shall be neatly finished.

1.6 PROJECT CONDITIONS

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

1.7 COORDINATION

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

PART 2 - PRODUCTS

2.1 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.2 FERROUS METALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Steel Tubing: ASTM A 500, cold-formed steel tubing.
- C. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40) unless otherwise indicated.
- D. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.

2.3 NONFERROUS METALS

- A. Bronze Castings: ASTM B 584, Alloy UNS No. C83600 (leaded red brass) or No. C84400 (leaded semired brass).
- B. Nickel Silver Extrusions: ASTM B 151/B 151M, Alloy UNS No. C74500.
- C. Nickel Silver Castings: ASTM B 584, Alloy UNS No. C97600 (20 percent leaded nickel bronze).
- D. Tubular Steel Members:
 - 1. Provide seal welded end plates/closure plates at ends of all tubular steel or cover plated beams exterior locations to prevent entry of water, dust and dirt.
 - 2. Provide prewelded backnuts inside members as necessary for bolted connections.
- E. Lintels: Galvanized in exterior walls. Shop primed elsewhere.

2.4 FASTENERS

- A. General: Unless otherwise indicated, provide hot dip galvanized steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with hex nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.
- C. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, ASTM F 593 (ASTM F 738M); with hex nuts, ASTM F 594 (ASTM F 836M); and, where indicated, flat washers.
- D. Anchor Bolts: ASTM F 1554, Grade 55, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.
 - 1. Hot-dip galvanized.
- E. Eyebolts: ASTM A 489.
- F. Machine Screws: ASME B18.6.3 (ASME B18.6.7M).
- G. Lag Screws: ASME B18.2.1 (ASME B18.2.3.8M).
- H. Plain Washers: Round, ASME B18.22.1 (ASME B18.22M).
- I. Anchor Rods: ASTM F 1554, Grade 55.
 - 1. Configuration: Straight, headed or tacked nut.
 - 2. Nuts: ASTM A 563 (ASTM A 563M) heavy-hex carbon steel.
 - 3. Plate Washers: ASTM A 36/A 36M carbon steel.

4. Washers: ASTM F 436 (ASTM F 436M), Type 1, hardened carbon steel.
5. Finish: Hot dip galvanized.

J. Post-Installed Anchors:

1. Wedge Anchors: Threaded stud with integral cone expander and single piece expander clip. The stud shall be carbon steel with a minimum 70ksi tensile strength.
2. Epoxy Anchor: Anchoring adhesive shall be a two-component high solids, epoxy-based system. Anchor rod shall be A36 threaded rod. The anchor system shall be tested and qualified for performance in cracked and uncracked concrete.
3. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, unless otherwise indicated.
4. Material for Exterior Locations hot dip galvanized steel.

2.5 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- C. Concrete: Comply with requirements in Section 03 30 00 "Cast-in-Place Concrete" for normal-weight, air-entrained, concrete with a minimum 28-day compressive strength of 3000 psi (20 MPa).

2.6 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work with accurate angles and surfaces and straight edges.
- E. Weld corners and seams continuously to comply with the following:
 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.
 3. Remove welding flux immediately.

- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.
- G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
 - 1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches (3.2 by 38 mm), with a minimum 6-inch (150-mm) embedment and 2-inch (50-mm) hook, not less than 8 inches (200 mm) from ends and corners of units and 24 inches (600 mm) o.c., unless otherwise indicated.

2.7 METAL LADDERS

A. General:

- 1. Comply with ANSI A14.3 unless otherwise indicated.

B. Steel Ladders:

- 1. Space siderails 16 inches (406 mm) minimum apart unless otherwise indicated.
- 2. Rungs should be 7" minimum from wall.
- 3. Space siderails of elevator pit ladders 12 inches (300 mm) apart.
- 4. Siderails: Continuous, 3/8-by-2½-inch (9.5-by-64-mm) steel flat bars, with eased edges.
- 5. Rungs: Schedule 40 steel pipe.
- 6. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
- 7. Provide nonslip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.
- 8. Support each ladder at top and bottom and not more than 60 inches (1500 mm) o.c. with welded or bolted steel brackets.
- 9. Prime interior ladders, including brackets and fasteners, in accordance with Section 09 91 23 "Interior Painting."

2.8 HANDRAIL & KICKPLATE

- A. 1¼" Schedule 40 steel pipe.
- B. ¼" x 4" steel plate, welded to vertical posts at ¼" above finished floor. Finish to match railing.

- C. Galvanize miscellaneous steel per ASTM A123.

2.9 MISCELLANEOUS STEEL TRIM

- A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.
- B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
 - 1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.

- C. Galvanize exterior steel.

2.10 LOOSE BEARING AND LEVELING PLATES

- A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.
- B. Galvanize miscellaneous steel per ASTM A123.

2.11 LOOSE STEEL LINTELS

- A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.
- B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span but not less than 8 inches (200 mm) unless otherwise indicated.
- C. Galvanize miscellaneous steel per ASTM A123.

2.12 STEEL WELD PLATES AND ANGLES

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

2.13 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish metal fabrications after assembly.
- C. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.14 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.
 - 1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
- B. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
- C. Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
- D. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

2.15 PLANK GRATING

- A. Roll formed steel plank
 - 1. Depth; 2 inches minimum.
 - 2. Maximum deflection; 0.375 inches with 300 lb point load.
 - 3. Maximum deflection; L/180 with uniform load = 20psf.
 - 4. Minimum strength; Support uniform load of 60 psf.
 - 5. Galvanized G90.

2.16 FIELD-APPLIED PAINT FINISH

- A. Field paint all exposed steel in accordance with the architectural finish schedule and "Interior Painting" in Division 09 of the specifications.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.
 3. Remove welding flux immediately.
 4. Field welding to components embedded in concrete or masonry shall implement low-heat welding rods of smallest practical size and shall use multiple passes of smaller welds to achieve required weld size to minimize thermal expansion and distortion of embedded components.
 5. Paint effected areas with galvanizing repair coating.
- D. Headed anchor studs shall be installed using stud welding devices designed for that purpose.
- E. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.
- F. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.
- B. Anchor supports for operable partitions securely to and rigidly brace from building structure.
- C. Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.
1. Where grout space under bearing plates is indicated for girders supported on concrete or masonry, install as specified in "Installing Bearing and Leveling Plates" Article.
- D. Install pipe columns on concrete footings with grouted baseplates. Position and grout column baseplates as specified in "Installing Bearing and Leveling Plates" Article.
1. Grout baseplates of columns supporting steel girders after girders are installed and leveled.

3.3 INSTALLING BEARING AND LEVELING PLATES

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.
- B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove

wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.

1. Use nonshrink grout, nonmetallic grout.
2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.4 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 1. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.
- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 09 91 13 "Exterior Painting" and Section 09 91 23 "Interior Painting."
- C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 05 50 00

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SECTION 05 51 13 METAL PAN STAIRS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

1. Preassembled steel stairs with cornet-filled treads

1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design metal stairs and landings, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

- B. Structural Performance of Stairs: Metal stairs shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated.

1. Uniform Load: 100 lbf/sq. ft. (4.79 kN/sq. m).
2. Concentrated Load: 300 lbf (1.33 kN) applied on an area of 4 sq. in. (2580 sq. mm).
3. Uniform and concentrated loads need not be assumed to act concurrently.
4. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
5. Limit deflection of treads, platforms, and framing members to L/240 or 1/4 inch (6.4 mm), whichever is less.

1.4 ACTION SUBMITTALS

- A. General: Provide action submittals for all items in this specification section for review within a single submittal to the Architect.

- B. Product data: Submit manufacturer's standard catalog literature showing products specified.

- C. Shop drawings: Submit shop drawings showing detail fabrication of steel stairs. Indicate layout, profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, fabrication and accessories. Include installation drawings, elevations, and details where applicable. Indicate welded connections using standard AWS welding symbols. Indicate net weld lengths.

- D. Design data: Submit design calculations, assumptions, and applicable loads. Design shall be in accordance with applicable codes.

- E. Manufacturer's certificates: Submit written statement(s) attesting that product or material conforms to or exceeds specified requirements.

1.5 INFORMATIONAL SUBMITTALS

- A. Test reports: Submit certified test reports showing compliance with specified performance characteristics and physical properties.

1.6 CLOSEOUT SUBMITTALS

- A. Warranties: Provide manufacturer warranties with requirements specified in "Warranties" article with submission of O&M manuals.

1.7 QUALITY ASSURANCE

- A. All materials, methods, procedures and applications shall be in accordance with appropriate industry standards including, but not necessarily limited to, the following:
 - 1. ASTM A36 - Structural Steel.
 - 2. AWS D1.1 - Structural Welding Code.
 - 3. SSPC - Steel Structure Painting Council- Paint, Oil: Iron Oxide, Ready Mix, Red and Brown.
- B. Engineer Qualifications: Design Engineer must be a Professional Engineer, legally authorized to practice in jurisdiction where Project is located and experienced in providing engineering services relative to the design of metal stairs, including handrails and railing systems, similar to this Project in material, design, and extent.
- C. Welding Standards: Comply with applicable provisions of AWS D1.1 "Structural Welding Code - Steel" and AWS D1.3 "Structural Welding Code - Sheet Steel."

1.8 WARRANTY

- A. The Contractor shall provide a written warranty that all work furnished and installed shall be free from faulty and/or defective materials and workmanship for a period of three (3) years from the date of final acceptance.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Delivery, storage and handling shall be accomplished in such a manner as required to prevent damage, deterioration, or the intrusion of foreign matter. Damaged items that cannot be restored to their original condition will be rejected.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: For surfaces exposed to view in the completed Work, provide materials selected for their surface flatness, smoothness, and freedom from surface blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names,

- roughness, or, for steel sheet, variations in flatness exceeding those permitted by referenced standards for stretcher-leveled sheet.
- B. Steel Plates, Shapes and Bars: ASTM A36.
 - C. Cold-Formed Steel Tubing: ASTM A500, Grade B. For exterior installations, or where indicated, provide tubing with hot-dipped galvanized coating per ASTM A53.
 - D. Steel Pipe: ASTM A53, standard weight (schedule 40), unless otherwise indicated, or another weight required by structural loads. Black finish, unless otherwise indicated.
 - E. Steel Bars for Gratings: ASTM A569 or ASTM A36.
 - F. Steel Sheets: ASTM A653 for galvanized deck and accessories.
 - G. Wire Rod for Grating Cross Bars: ASTM A510.
 - H. Rolled Steel Floor Plate: ASTM A786.
 - I. Uncoated Structural Steel Sheet: Cold-Rolled Structural Steel Sheet; ASTM A611, Grade A, unless otherwise indicated or required by design loading.
 - J. Uncoated Steel Sheet: Commercial quality, cold-rolled steel sheet; ASTM A366/A366M.
 - K. Galvanized Steel Sheet: Commercial quality; ASTM A526, G 90(Z 275) coating designation, unless otherwise indicated.
 - L. Fasteners:
 - 1. Bolts and Nuts: hexagon-head type, ASTM A307, Grade A; with hex nuts, ASTM A563, and where needed, flat washers.
 - 2. Lag Bolts: ANSI B18.2.1 (B18.2.3.8M).
 - 3. Expansion Anchors: Anchor bolt and sleeve assemblies with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E488.
 - 4. Provide plated fasteners complying with ASTM B633, Class Fe/Zn 25 for electrodeposited zinc coating, for exterior use or where built into exterior walls.
 - M. Shop Primer: Fast-curing, lead and chromate-free, universal modified alkyd primer complying with FS TT-P-664, for shop application and field touch-up.
 - N. Welding Materials: AWS D1.1; type required for materials being welded.
 - O. Grout: Nonshrink, nonmetallic grout complying with ASTM C1107. For exterior and interior applications, provide specific grout products recommended by manufacturer.
 - P. Concrete Materials and Properties (for concrete fill): Comply with requirements in specification section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi (20 MPa) unless otherwise indicated.

2.2 STAIR FABRICATION

- A. Verify dimensions on site prior to shop fabrication.
- B. Fabricate steel stair assemblies as indicated on Drawings and as accepted on shop drawings. Preassemble in shop to greatest extent possible to minimize field splicing and assembly.
- C. Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM "Metal Stair Manual" for commercial class of stairs
- D. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges. Fabricate items with joints tightly fitted and secured.
- E. At exposed welded connections, grind exposed welds smooth and flush so welded surface matches adjoining surfaces. Ease exposed edges to a radius of approximately 1/32 inch. Form bent-metal corners to smallest radius possible without impairing work.
- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible.
- G. If exposed mechanical fasteners are unavoidable, provide flush countersunk screws or bolts; unobtrusively located; consistent with design of structure, except where specifically noted otherwise.
- H. Supply components required for anchorage of metal fabrications. Fabricate anchorage and related components of same material and finish as metal fabrication, unless specifically noted otherwise.
- I. Metal-Pan Stairs: Form risers, subtread pans, and subplatforms to configurations shown from steel sheet of thickness needed to comply with performance requirements but not less than 0.067 inch (1.7 mm).
 - 1. Steel Sheet: Uncoated cold-rolled steel sheet unless otherwise indicated.
 - 2. Steel Sheet: Galvanized-steel sheet, where indicated.
 - 3. Directly weld metal pans to stringers; locate welds on top of subtreads where they will be concealed by concrete fill. Do not weld risers to stringers.
 - 4. Attach risers and subtreads to stringers with brackets made of steel angles or bars. Weld brackets to stringers and attach metal pans to brackets by welding, riveting, or bolting.
 - 5. Shape metal pans to include nosing integral with riser.
 - 6. Attach abrasive nosings to risers.
 - 7. At Contractor's option, provide stair assemblies with metal-pan subtreads filled with reinforced concrete during fabrication.
 - 8. Treads in subparagraphs below are an alternative to prefilled concrete treads.
 - 9. Provide epoxy-resin-filled treads, reinforced with glass fibers, with slip-resistant, abrasive surface.
 - 10. Provide subplatforms of configuration indicated or, if not indicated, the same as subtreads. Weld subplatforms to platform framing.

2.3 FINISH

- A. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
- B. Prime paint metal stairs after assembly with one coat shop primer.
- C. Apply shop primer to uncoated surfaces except those with a galvanized finish or those to be in direct contact bond with concrete, sprayed-on fireproofing, or masonry, or where field welding is required.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Obtain Architect/Engineer approval prior to any site cutting or making adjustments not scheduled.
- B. Coordinate and furnish anchorages, setting templates and drawings, and instructions for installing anchorages. Coordinate delivery of such items to Project site.

3.2 INSTALLATION

- A. Provide anchorage devices where necessary for securing steel stairs to in-place construction; include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts and other connectors as required.
- B. Perform cutting, fitting, and drilling required for installing steel stairs. Set units accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true and free of rack.
- C. Perform field welding in accordance with AWS D1.1.
- D. After installation, touch-up field welds and scratched or damaged surfaces with primer.
- E. Place and finish concrete fill for treads and platforms to comply with specification section "Cast-in-Place Concrete."

3.3 ADJUSTING AND CLEANING

- A. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
- B. For galvanized surfaces, clean welds, bolted connections and abraded areas and apply galvanizing repair paint to comply with ASTM A780.

END OF SECTION 05 51 13

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SECTION 05 52 13 PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
1. Steel pipe and tube railings.

1.3 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- C. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

1.4 ACTION SUBMITTALS

- A. Product Data: Include calculations, construction details, material descriptions, dimensions metal stairs, handrails and guardrails.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
1. Include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation registered in the state where the project is located.

1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:
1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings.
 - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabrication without field measurements. Coordinate wall construction to ensure that actual dimensions correspond to established dimensions.

1.7 COORDINATION

- A. Painted Steel: Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- C. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

1.9 FIELD CONDITIONS

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design pipe and tube railings, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Exterior Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Handrails and Top Rails of Guards:
 - a. Uniform load of 50 lbf/ ft. (0.73 kN/m) applied in any direction.
 - b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.

- c. Uniform and concentrated loads need not be assumed to act concurrently.
 - 2. Infill of Guards:
 - a. Concentrated load of 50 lbf (0.22 kN) applied horizontally on an area of 1 sq. ft. (0.093 sq. m).
 - b. Infill load and other loads need not be assumed to act concurrently.
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
- B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.
 - 1. Provide type of bracket with predrilled hole for exposed bolt anchorage and that provides 1½-inch (38-mm) clearance from inside face of handrail to finished wall surface.

2.3 STEEL AND IRON

- A. Tubing: ASTM A 500 (cold formed) or ASTM A 513.
- B. Pipe: ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.
 - 1. Provide galvanized finish for exterior installations and where indicated.
- C. Plates, Shapes, and Bars: ASTM A 36/A 36M.

2.4 FASTENERS

- A. General: Provide the following:
 - 1. Ungalvanized-Steel Railings: Plated steel fasteners complying with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5 for zinc coating.
 - 2. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.
- B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.
- C. Fasteners for Interconnecting Railing Components:

1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless otherwise indicated.
 2. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless exposed fasteners are unavoidable or are the standard fastening method for railings indicated.
 3. Provide tamper-resistant flat-head machine screws for exposed fasteners unless otherwise indicated.
- D. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to 6 times the load imposed when installed in unit masonry and 4 times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.
1. Material for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, unless otherwise indicated.

2.5 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- C. Intermediate Coats and Topcoats: Provide products that comply with Division 09 for "Exterior Painting" and "Interior Painting."
- D. Epoxy Intermediate Coat: Complying with MPI #77 and compatible with primer and topcoat.
- E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.
- F. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- G. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.
1. Water-Resistant Product: At exterior locations and where indicated provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

2.6 FABRICATION

- A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.
- B. Shop assemble railings to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.
- C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- D. Form work true to line and level with accurate angles and surfaces.
- E. Fabricate connections that are exposed to weather in a manner that excludes water. Provide weep holes where water may accumulate.
- F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
- G. Connections: Fabricate railings with welded connections unless otherwise indicated.
- H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove flux immediately.
 - 4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.
- I. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
 - 1. Fabricate splice joints for field connection using an epoxy structural adhesive if this is manufacturer's standard splicing method.
- J. Form Changes in Direction as Follows:
 - 1. By bending or by inserting prefabricated elbow fittings.
- K. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

- L. Close exposed ends of railing members with prefabricated end fittings.
- M. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is ¼ inch (6 mm) or less.
- N. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.
 - 1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers or other means to transfer loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.
- O. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.
- P. For railing posts set in concrete, provide only stainless-steel sleeves as required not less than 6 inches (150 mm) long with inside dimensions not less than ½ inch (13 mm) greater than outside dimensions of post, with metal plate forming bottom closure.
- Q. For removable railing posts, fabricate slip-fit sockets from steel or stainless-steel tube or pipe as required whose ID is sized for a close fit with posts; limit movement of post without lateral load, measured at top, to not more than one-fortieth of post height. Provide socket covers designed and fabricated to resist being dislodged.
 - 1. Provide chain with eye, snap hook, and staple across gaps formed by removable railing sections at locations indicated. Fabricate from same metal as railings.
- R. Toe Boards: Where indicated, provide toe boards at railings around openings and at edge of open-sided floors and platforms. Fabricate to dimensions and details indicated.

2.7 STEEL AND IRON FINISHES

- A. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Shop, Field, and Maintenance Painting of Steel," for field painting.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements are clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.2 INSTALLATION, GENERAL

- A. Fit exposed connections together to form tight, hairline joints.

- B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
1. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
 2. Set posts plumb within a tolerance of 1/16 inch in 3 feet (2 mm in 1 m).
 3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed ¼ inch in 12 feet (6 mm in 3.5 m).
- C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
1. Coat, with a heavy coat of bituminous paint, concealed surfaces of aluminum that are in contact with grout, concrete, masonry, wood, or dissimilar metals.
- D. Adjust railings before anchoring to ensure matching alignment at abutting joints.
- E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.3 RAILING CONNECTIONS

- A. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.

3.4 ANCHORING POSTS

- A. Anchor posts to metal surfaces with oval flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:
1. For steel pipe railings, weld flanges to post and bolt to metal supporting surfaces.

3.5 ATTACHING RAILINGS

- A. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces and welded to railing ends.
- B. Attach railings to wall with wall brackets, except where end flanges are used. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
- C. Secure wall brackets and railing end flanges to building construction as follows:
1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
 2. For hollow masonry anchorage, use toggle bolts.

3. For steel-framed partitions, use hanger or lag bolts set into wood backing between studs. Coordinate with stud installation to locate backing members.

3.6 FIELD PAINTING

- A. Clean and paint field installed railings as specified in Section 09 91 13 "Exterior Painting".

3.7 PROTECTION

- A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

END OF SECTION 05 52 13

**SECTION 06 10 53
MISCELLANEOUS ROUGH CARPENTRY**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes:
1. Wood blocking, cants, and nailers.
 2. Plywood backing panels.

1.3 DEFINITIONS

- A. Dimension Lumber: Lumber of 51 mm (2 inches) nominal or greater but less than 127 mm (5 inches) nominal in least dimension.
- B. Lumber grading agencies, and the abbreviations used to reference them, include the following:
1. NeLMA: Northeastern Lumber Manufacturers' Association.
 2. NHLA: National Hardwood Lumber Association.
 3. NLGA: National Lumber Grades Authority.
 4. SPIB: The Southern Pine Inspection Bureau.
 5. WCLIB: West Coast Lumber Inspection Bureau.
 6. WWPA: Western Wood Products Association.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.

2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece.
 3. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
 4. Provide dressed lumber, S4S, unless otherwise indicated.
- B. Maximum Moisture Content of Lumber: 15 percent for 50-mm (2-inch) nominal thickness or less, 19 percent for more than 50-mm (2-inch) nominal thickness unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

- A. Preservative Treatment by Pressure Process: AWWA U1; Use Category UC4a for items in contact with the ground.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.
- C. Application: Treat items indicated on Drawings, and the following:
1. Wood sills, sleepers, blocking, stripping, and similar concealed members in contact with masonry or concrete.
 2. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
 3. Wood framing members that are less than 18 inches above the ground in crawl spaces or unexcavated areas.
 4. Wood floor plates that are installed over concrete slabs-on-grade.

2.3 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
1. Blocking.
 2. Nailers.
 3. Rooftop equipment bases and support curbs.
 4. Cants.
- B. For items of dimension lumber size, provide Construction or No. 2 grade lumber and any of the following species:
1. Hem-fir (north); NLGA.
 2. Mixed southern pine; SPIB.
 3. Spruce-pine-fir; NLGA.
 4. Hem-fir; WCLIB or WWPA.
 5. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
- C. For concealed boards, provide lumber with 15 percent maximum moisture content and any of the following species and grades:

1. Mixed southern pine, No. 2 grade; SPIB.
 2. Hem-fir or hem-fir (north), Construction or No. 2 Common grade; NLGA, WCLIB, or WWPA.
 3. Spruce-pine-fir (south) or spruce-pine-fir, Construction or No. 2 Common grade; NeLMA, NLGA, WCLIB, or WWPA.
- D. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.
- E. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

2.4 PLYWOOD BACKING PANELS

- A. Telephone and Electrical Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged, in thickness indicated or, if not indicated, not less than 19 mm ($\frac{3}{4}$ -inch) nominal thickness.

2.5 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners of Type 304 stainless steel.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: NES NER-272.
- D. Wood Screws: ASME B18.6.1.
- E. Screws for Fastening to Metal Framing: ASTM C 1002 for non-load-bearing framing and ASTM C 954 for load-bearing framing, length as recommended by screw manufacturer for material being fastened.
- F. Lag Bolts: ASME B18.2.1.
- G. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.
- H. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.
1. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2.

2.6 MISCELLANEOUS MATERIALS

- A. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 1.0-mm (0.025-inches).

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry to other construction; scribe and cope as needed for accurate fit. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.
- B. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

3.2 WOOD BLOCKING, AND NAILER INSTALLATION

- A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated.

END OF SECTION 06 10 53

SECTION 07 19 00 WATER REPELLENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

1. Installation of clear water-repellent coatings for all new precast concrete wall panels.

1.3 PERFORMANCE REQUIREMENTS

- A. Provide water repellents with the following properties based on testing manufacturer's standard products, according to test methods indicated, applied to substrates simulating Project conditions using same materials and application methods to be used for Project.

1. Absorption: Minimum 90 percent reduction of absorption after 24 hours in comparison of treated and untreated specimens.
 - a. Brick: ASTM C 67.
 - b. Stone: ASTM C 97.
 - c. Concrete Unit Masonry: ASTM C 140.
 - d. Hardened Concrete: ASTM C 642.
2. Water-Vapor Transmission: Maximum 10 percent reduction in rate of vapor transmission in comparison of treated and untreated specimens, per ASTM E 96.
3. Water Penetration and Leakage through Masonry: Maximum 90 percent reduction in leakage rate in comparison of treated and untreated specimens, per ASTM E 514.
4. Durability: Maximum 5 percent loss of water repellency after 2500 hours of weathering in comparison to specimens before weathering, per ASTM G 53.
5. Permeability: Minimum 80 percent breathable in comparison of treated and untreated specimens, per ASTM D 1651.
6. Chloride-Ion Intrusion in Concrete: Transportation Research Board, National Research Council's NCHRP Report 244, Series 11 tests.
 - a. Reduction of Water Absorption: 80 percent.
 - b. Reduction in Chloride Content: 80 percent.

1.4 ACTION SUBMITTALS

- A. Product Data: Include manufacturer's specifications, surface preparation and application instructions, recommendations for water repellents for each surface to be treated, and

protection and cleaning instructions. Include data substantiating that materials are recommended by manufacturer for applications indicated and comply with requirements.

- B. Installer's Qualifications: Provide letter from manufacturer noting the requirements for qualified installers listed in the "Quality Assurance" Article of this section.

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with applicable rules of pollution-control regulatory agency having jurisdiction in Project locale regarding VOCs and use of hydrocarbon solvents.

- B. Installers Qualifications:

1. Installer shall be acceptable to Manufacturer as applicator of its specified product.
2. Minimum five (5) satisfactorily completed installations of comparable quality, scope, similar size, and complexity in the past two (2) use of Manufacturer's specified product.

- C. Preconstruction Testing:

1. Test substrate for moisture content. Do not apply if moisture contents of wall not within limits acceptable to Manufacturer.
2. Apply 10 foot (3 meter) square test application for review of substrate preparation procedures and applications methods.

- D. Weather and Substrate Conditions: Do not proceed with application of water repellent under any of the following conditions, except with written instruction of manufacturer:

1. Ambient temperature is less than 40 deg F (4.4 deg C) or greater than 100 deg F (38 deg C).
2. Concrete surfaces and mortar have cured for less than 28 days.
3. Rain or temperatures below 40 deg F (4.4 deg C) are predicted within 48 hours.
4. Application is earlier than 24 hours after surfaces have been wet.
5. Substrate is frozen, or surface temperature is less than 40 deg F (4.4 deg C).
6. Windy condition exists that may cause water repellent to be blown onto vegetation or surfaces not intended to be coated.

1.6 WARRANTY

- A. Special Warranty: Submit a written warranty, executed by the applicator and water-repellent manufacturer, covering materials and labor, agreeing to repair or replace materials that fail to provide water repellency within the specified warranty period. Warranty does not include deterioration or failure of coating due to unusual weather phenomena, failure of prepared and treated substrate, formation of new joints and cracks in excess of 1/16 inch (1.5 mm) wide, fire, vandalism, or abuse by maintenance equipment.

1. Warranty Period: Five (5) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Manufacturer and Product: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
1. Siloxanes: With more than 3.3 lb./gal. (400 g/L) VOCs.
 - a. Manufacturer: Chemprobe Coating Systems, a Div. of Tnemec Co.
2805 Industrial Lane, Garland, TX 74501
(972) 271-5551 | www.chemprobe.com
 - b. Product: Prime-A-Pell 200;

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Clean substrate of substances that might interfere with penetration or performance of water repellents. Test for moisture content, according to repellent manufacturer's written instructions, to ensure surface is sufficiently dry.
1. Formed Concrete: Remove oil, curing compounds, laitance, and other substances that could prevent adhesion or penetration of water repellents.
- B. Test for pH level, according to water repellent manufacturer's written instructions, to ensure chemical bond to silicate minerals.
- C. Protect adjoining work, including sealant bond surfaces, from spillage or blow-over of water repellent. Cover adjoining and nearby surfaces of aluminum and glass if there is the possibility of water repellent being deposited on surfaces. Cover live plants and grass.
- D. Coordination with Sealants: Do not apply water repellent until sealants for joints adjacent to surfaces receiving water-repellent treatment have been installed and cured.
1. Water-repellent work may precede sealant application only if sealant adhesion and compatibility have been tested and verified using substrate, water repellent, and sealant materials identical to those used in the work.
- E. Test Application: Before performing water-repellent work, including bulk purchase and delivery of products, prepare a small application in an unobtrusive location and in a manner approved by Architect to demonstrate the final effect (visual, physical, and chemical) of planned application. Proceed with work only after Architect approves test application or as otherwise directed.

3.2 APPLICATION

- A. Apply a heavy-saturation spray coating of water repellent on surfaces indicated for treatment using low- pressure spray equipment. Comply with manufacturer's written instructions for using airless spraying procedure, unless otherwise indicated.
- B. Apply a second saturation spray coating, repeating first application. Comply with manufacturer's written instructions for limitations on drying time between coats and after rainstorm wetting of surfaces between coats. Consult manufacturer's technical representative if written instructions are not applicable to Project conditions.

3.3 CLEANING

- A. Protective Coverings: Remove protective coverings from adjacent surfaces and other protected areas.
- B. Immediately clean water repellent from adjoining surfaces and surfaces soiled or damaged by water-repellent application as work progresses. Repair damage caused by water-repellent application. Comply with manufacturer's written cleaning instructions.

END OF SECTION 07 19 00

SECTION 07 21 00 THERMAL INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
1. Extruded polystyrene (XPS) foam-plastic board insulation.
 2. Glass-fiber blanket insulation.
 3. Spray polyurethane foam insulation.
 4. Vapor retarders.

1.3 ACTION SUBMITTALS

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

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
- B. Protect foam-plastic board insulation as follows:
1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
 2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.
 3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD

- A. Manufacturer's name and products are given to clarify the designer's intent and are not intended to limit selection of similar products from acceptable manufacturers. Qualification data for manufacturers and products not specified shall be made at time of submittal during construction. Preapproval will not be performed by the Government.
1. DiversiFoam Products; CertiFoam 25 SE.
 2. Dow Chemical Company (The); STYROFOAM™ Brand Square Edge.

3. Kingspan Insulation; GreenGuard® Type IV XPS Insulation Board.
4. Owens Corning; FOAMULAR® 250.

B. Characteristics:

1. Material: Extruded-polystyrene board (XPS) insulation
2. R-value per 25mm (1 inch) per ASTM C518: 5
3. Fire Rating per ASTM E 84: Class B – Flame spread / Smoke developed
4. Type and Minimum Compressive Strength per ASTM C 578: Type IV, 173 kPa (25 psi).
5. Water Absorption Maximum: Three-tenths (0.3) percent, volume
6. Board Edges: Square
7. Thickness: 51 mm (2 inches), unless noted otherwise on drawings.
8. Application:
 - a. As noted on the construction drawings.

2.2 GLASS-FIBER BLANKET

A. Manufacturer's name and products are given to clarify the designer's intent and are not intended to limit selection of similar products from acceptable manufacturers. Qualification data for manufacturers and products not specified shall be made at time of submittal during construction. Preapproval will not be performed by the Government.

1. CertainTeed Corporation; Sustainable Insulation.
2. Johns Manville; Formaldehyde-Free™ Fiber Glass Insulation with Bio-Based Binder
3. Knauf Insulation; EcoBatt® Insulation
4. Owens Corning; EcoTouch® PINK® FIBERGLAS™.

B. Characteristics:

1. Material: Glas-fiber blanket, unfaced insulation complying with the property requirements of ASTM C665, Type I
2. Fire Rating per ASTM E 84: Maximum Flame spread / Smoke developed indexes of 25 and 50 respectively.
3. Combustion Characteristics: Passing ASTM E 136.
4. Framing Type: Metal stud wall framing and light gauge metal stud roof trusses at attic.
5. R-Value: Per ASTM C 518 provided unfaced glass-fiber blanket insulation of the following thickness and R-Value.
 - a. Walls:
 - 1) Thickness: 89 mm (3-1/2 inches); R-Value: 13, minimum
 - 2) Thickness: 140 mm (5-1/2 inches); R-Value: 19, minimum
 - b. Attic, entire area:
 - 1) R-Value: 38, minimum

2.3 SPRAY POLYURETHANE FOAM INSULATION

- A. Closed-Cell Polyurethane Foam Insulation per ASTM C 1029, Type II.
- B. Manufacturer's name and products are given to clarify the designer's intent and are not intended to limit selection of similar products from acceptable manufacturers. Qualification data for manufacturers and products not specified shall be made at time of submittal during construction. Preapproval will not be performed by the Government.
 - 1. BASF; SPRAYTITE 81206 Series
 - 2. Certainteed; CertaSpray
 - 3. Johns Manville; JM Corbond III
 - 4. Characteristics:
 - a. Core Density: 1.9-2.2 lbs/cu. ft (ASTM D-1622),
 - b. R-Value: 6.5 per inch (ASTM C-518)
 - c. Fire Rating per ASTM E 84: Maximum flame-spread / smoke-developed indexes of 75 and 450, respectively.
 - d. Moisture Vapor transmission of 0.23 perms at 3 inches (ASTM C-518)
 - e. Air leakage rate of 0.00+/-0.01(L/s)/m² (ASTM E-96)
 - f. Fungi Resistance: Zero Rating (ASTM G-21)
 - g. Compressive Strength: 15-20 psi (ASTM D-1622)
 - h. Tensile Strength: 55-65 psi (ASTM D-1623)
 - i. Dimensional Stability: (7 days @ 158F,95%RH) 6% Vol. Change (ASTM D- 2126)

2.4 VAPOR RETARDERS

- A. Polyethylene Vapor Retarders: ASTM D 4397, 6 mils thick, with maximum permeance rating of 0.13 perm.
- B. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.
- C. Single-Component Nonsag Urethane Sealant: ASTM C 920, Type I, Grade NS, Class 25, Use NT related to exposure, and Use O related to vapor-barrier-related substrates.

2.5 ACCESSORIES

- A. Insulation for Miscellaneous Voids:
 - 1. Glass-Fiber Insulation: ASTM C 764, Type II, loose fill; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E 84.
- B. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and applications.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
- C. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

3.3 INSTALLATION OF SLAB INSULATION

- A. On vertical slab edge and foundation surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions.
 - 1. If not otherwise indicated, extend insulation a minimum of 36 inches (915 mm) Insert dimension below exterior grade line.
- B. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.
 - 1. If not otherwise indicated, extend insulation a minimum of 24 inches (610 mm) in from exterior walls.

3.4 INSTALLATION OF FOUNDATION WALL INSULATION

- A. Butt panels together for tight fit.
- B. Adhesive Installation: Install with adhesive or press into tacky waterproofing or damp proofing according to manufacturer's written instructions.

3.5 INSTALLATION OF INSULATION IN METAL FRAMED CONSTRUCTION

- A. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:
 - 1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.

2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
 3. Maintain 3-inch (76-mm) clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
 4. Attics: Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.
 5. For metal-framed wall cavities where cavity heights exceed 96 inches (2438 mm), support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
- B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
1. Glass-Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft. (40 kg/cu. m).

3.6 INSTALLATION OF SPRAY POLYURETHANE FOAM INSULATION

- A. Spray-Applied Insulation: Apply spray-applied insulation according to manufacturer's written instructions. Do not apply insulation until installation of pipes, ducts, conduits, wiring, and electrical outlets in walls in completed and windows, electrical boxes, and other items not indicated to receive insulation are masked. After insulation is applied, make flush with face of studs by using method recommended by insulation manufacturer.

3.7 INSTALLATION OF VAPOR RETARDERS

- A. Place vapor retarders on side of construction indicated on Drawings. Extend vapor retarders to extremities of areas to protect from vapor transmission. Secure vapor retarders in place with adhesives or other anchorage system as indicated. Extend vapor retarders to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.
- B. Seal vertical joints in vapor retarders over framing by lapping no fewer than two studs.
1. Seal overlapping joints in vapor retarders with vapor-retarder tape according to vapor-retarder manufacturer's written instructions. Seal butt joints with vapor-retarder tape. Locate all joints over framing members or other solid substrates.
- C. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarders.
- D. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarders.

3.8 PROTECTION

- A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is

subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 07 21 00

**SECTION 072726
FLUID-APPLIED MEMBRANE AIR BARRIER**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes:
1. Fluid-applied, air/vapor/moisture barriers.

1.3 DEFINITIONS

- A. Air-Barrier Material: A primary element that provides a continuous barrier to the movement of air, water vapor and moisture.
- B. Air-Barrier Accessory: A transitional component of the air barrier that provides continuity.
- C. Air-Barrier Assembly: The collection of air-barrier materials and accessory materials applied to an opaque wall, including joints and junctions to abutting construction, to control air, water vapor and moisture movement through the wall.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
1. Include manufacturer's written instructions for evaluating, preparing, and treating substrate; technical data; and tested physical and performance properties of products.
- B. Shop Drawings: For air-barrier assemblies.
1. Show locations and extent of air barrier. Include details for substrate joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
 2. Include details of interfaces with other materials that form part of air barrier.
- C. Qualification Data: For Installer. Include list of ABAA-certified installers and supervisors employed by the Installer, who work on Project.
- D. Product Certificates: From air-barrier manufacturer, certifying compatibility of air barriers and accessory materials with Project materials that connect to or that come in contact with the barrier.

1.5 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each air-barrier assembly, for tests performed by a qualified testing agency.

1.6 CLOSEOUT SUBMITTALS

- A. Warranties: Provide material and installation warranties as required in "Warranty" Article of this specification section.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- B. Installer shall be licensed by ABAA according to ABAA's Quality Assurance Program and shall employ ABAA-certified installers and supervisors on Project.
- C. Manufacturer: Obtain primary materials from a single manufacturer regularly engaged in manufacturing air and vapor barrier membranes. Obtain secondary materials from a source acceptable to the primary materials manufacturer.
- D. Preconstruction Meeting: Convene a minimum of two weeks prior to commencing Work of this Section. Agenda shall include, at a minimum, construction and testing of mock-up, sequence of construction, coordination with substrate preparation, materials approved for use, compatibility of materials, coordination with installation of adjacent and covering materials, and details of construction. Attendance is required by representatives of related trades including covering materials, substrate materials and adjacent materials.

1.8 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
- B. Review air-barrier requirements and installation, special details, air-leakage and bond testing, air-barrier protection, and work scheduling that covers air barriers.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Store liquid materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by air barrier manufacturer. Deliver materials to Project site in original packages with seals unbroken, labeled with manufacturer's name, product, date of manufacture, and directions for storage.
- B. Store materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by air and vapor barrier membrane manufacturer. Protect stored materials from direct sunlight.
- C. Remove and replace liquid materials that cannot be applied within their stated shelf life.
- D. Handle materials in accordance with manufacturer's recommendations.

1.10 FIELD CONDITIONS

- A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended by air-barrier manufacturer.
1. Protect substrates from environmental conditions that affect air-barrier performance.
 2. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

1.11 WARRANTY

- A. Material Warranty: Provide manufacturer's standard product warranty, for a minimum three (3) years from date of Substantial Completion.
- B. Installation Warranty: Provide installer's two (2) year warranty from date of Substantial Completion, including all components of the air and vapor barrier assembly, against failures including loss of air tight seal, loss of watertight seal, loss of adhesion, loss of cohesion, failure to cure properly.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Source Limitations: Obtain primary air-barrier materials and air-barrier accessories from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. General: Air barrier shall be capable of performing as a continuous vapor-retarding air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air-barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, tie-ins to installed waterproofing, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

2.3 FLUID-APPLIED MEMBRANE VAPOR/MOISTURE/ AIR BARRIER

- A. Manufacturers and Products: Manufacturer names and products are given to clarify the designer's intent and are not intended to limit selection of similar products from acceptable manufacturers.
1. Synthetic Polymer Membrane:
 - a. GCP Applied Technologies; Perm-A-Barrier Liquid.
 - b. Henry Company; Air-Bloc 32.
 - c. Rubber Polymer Corporation, Inc.; Rub-R-Wall Airtight.
 - d. Polyguard; AirLok Flex.
- B. Physical and Performance Properties:

1. Air Permeance: Maximum 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. (0.02 L/s x sq. m of surface area at 75-Pa) pressure difference; ASTM E 2178.
2. Vapor Permeance: Maximum 0.1 perm (5.8 ng/Pa x s x sq. m); ASTM E 96/E 96M.
3. Ultimate Elongation: Minimum 500 percent; ASTM D 412, Die C.

2.4 ACCESSORY MATERIALS

- A. General: Accessory materials recommended by air-barrier manufacturer to produce a complete air-barrier assembly and compatible with primary air-barrier material.
- B. Primer: Liquid waterborne primer recommended for substrate by air-barrier material manufacturer.
- C. Counterflashing Strip: Modified bituminous, 40-mil- (1.0-mm-) thick, self-adhering sheet consisting of 32 mils (0.8 mm) of rubberized asphalt laminated to an 8-mil- (0.2-mm-) thick, cross-laminated polyethylene film with release liner backing.
- D. Modified bituminous self-adhering strip in "Modified Bituminous Strip" Paragraph below is used to terminate air barrier to compatible roofing membranes. Verify compatibility with roofing membranes and revise strip material if necessary.
- E. Modified Bituminous Strip: Vapor retarding, 40 mils (1.0 mm) thick, smooth surfaced, self-adhering; consisting of 36 mils (0.9 mm) of rubberized asphalt laminated to a 4-mil- (0.1-mm-) thick polyethylene film with release liner backing.
- F. Joint Reinforcing Strip: Air-barrier manufacturer's glass-fiber-mesh tape.
- G. Substrate-Patching Membrane: Manufacturer's standard trowel-grade substrate filler.
- H. Adhesive and Tape: Air-barrier manufacturer's standard adhesive and pressure-sensitive adhesive tape.
- I. Sprayed Polyurethane Foam Sealant: One- or two-component, foamed-in-place, polyurethane foam sealant, 1.5- to 2.0-lb/cu. ft (24- to 32-kg/cu. m) density; flame-spread index of 25 or less according to ASTM E 162; with primer and noncorrosive substrate cleaner recommended by foam sealant manufacturer.
- J. Modified Bituminous Transition Strip: Vapor retarding, 40 mils (1.0 mm) thick, smooth surfaced, self-adhering; consisting of 36 mils (0.9 mm) of rubberized asphalt laminated to a 4-mil- (0.1-mm-) thick polyethylene film with release liner backing.
- K. Adhesive-Coated Transition Strip: Vapor-permeable, 17-mil- (0.43mm-) thick, self-adhering strip consisting of an adhesive coating over a permeable laminate with a permeance value of 37 perms (2145 ng/Pa x s x sq. m).
- L. Preformed Silicone-Sealant Extrusion: Manufacturer's standard system consisting of cured low-modulus silicone extrusion, sized to fit opening widths, with a single-component, neutral-curing, Class 100/50 (low-modulus) silicone sealant for bonding extrusions to substrates.

1. Manufacturers and Products: Manufacturer names and products are given to clarify the designer's intent and are not intended to limit selection of similar products from acceptable manufacturers.
 - a. Dow Corning Corporation; 123 Silicone Seal.
 - b. Momentive Performance Materials Inc.; US11000 UltraSpan.
 - c. Pecora Corporation; Sil-Span.
 - d. Tremco Incorporated, an RPM company; Spectrem Simple Seal.
- M. Joint Sealant: ASTM C 920, single-component, neutral-curing silicone; Class 100/50 (low modulus), Grade NS, Use NT related to exposure, and, as applicable to joint substrates indicated, Use O. Comply with Section 07 92 00 "Joint Sealants."
- N. Termination Mastic: Air-barrier manufacturer's standard cold fluid-applied elastomeric liquid; trowel grade.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
 1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
 2. Verify that concrete has cured and aged for minimum time period recommended by air-barrier manufacturer.
 3. Verify that concrete is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
 4. Verify that masonry joints are flush and completely filled with mortar.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

- A. Clean, prepare, treat, and seal substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for air-barrier application.
- B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.
- C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
- D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching membrane.
- E. Remove excess mortar from masonry ties, shelf angles, and other obstructions. Mask open eyes of masonry ties as necessary to properly receive veneer ties.

- F. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.
- G. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.

3.3 JOINT TREATMENT

- A. Concrete and Masonry: Prepare, treat, rout, and fill joints and cracks in substrate according to ASTM C 1193 and air-barrier manufacturer's written instructions. Remove dust and dirt from joints and cracks complying with ASTM D 4258 before coating surfaces.
- B. Prime substrate and apply a single thickness of air-barrier manufacturer's recommended preparation coat extending a minimum of 3 inches (75 mm) along each side of joints and cracks. Apply a double thickness of fluid air-barrier material and embed a joint reinforcing strip in preparation coat.

3.4 TRANSITION STRIP INSTALLATION

- A. General: Install strips, transition strips, and accessory materials according to air-barrier manufacturer's written instructions to form a seal with adjacent construction and maintain a continuous air barrier.
 - 1. Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
 - 2. Install modified bituminous strip on roofing membrane or base flashing so that a minimum of 3 inches (75 mm) of coverage is achieved over each substrate.
- B. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by fluid air-barrier material on same day. Reprime areas exposed for more than 24 hours.
- C. Connect and seal exterior wall air-barrier material continuously to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.
- D. At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.
- E. Apply joint sealants forming part of air-barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- F. Wall Openings: Prime concealed perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply modified bituminous transition strip, or elastomeric flashing sheet so that a minimum of 3 inches (75 mm) of coverage is achieved over each

substrate. Maintain 3 inches (75 mm) of full contact over firm bearing to perimeter frames with not less than 1 inch (25 mm) of full contact.

1. Modified Bituminous Transition Strip: Roll firmly to enhance adhesion.
 2. Elastomeric Flashing Sheet: Apply adhesive to wall, frame, and flashing sheet. Install flashing sheet and termination bars, fastened at 6 inches (150 mm) o.c. Apply lap sealant over exposed edges and on cavity side of flashing sheet.
- G. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air-barrier material with foam sealant.
- H. Seal strips and transition strips around masonry reinforcing or ties and penetrations with termination mastic.
- I. Seal top of through-wall flashings to air barrier with an additional 6-inch- (150-mm-) wide, modified bituminous strip.
- J. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.
- K. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches (150 mm) beyond repaired areas in strip direction.

3.5 FLUID AIR-BARRIER MEMBRANE INSTALLATION

- A. General: Apply fluid air-barrier material to form a seal with strips and transition strips and to achieve a continuous air barrier according to air-barrier manufacturer's written instructions. Apply fluid air-barrier material within manufacturer's recommended application temperature ranges.
1. Apply primer to substrates at required rate and allow it to dry.
 2. Limit priming to areas that will be covered by fluid air-barrier material on same day. Reprime areas exposed for more than 24 hours.
- B. Membrane Air Barriers: Apply a continuous unbroken air-barrier membrane to substrates according to the following thickness. Apply air-barrier membrane in full contact around protrusions such as masonry ties.
1. Vapor-Retarding Membrane Air Barrier: Total dry film thickness as recommended in writing by manufacturer to meet performance requirements, but not less than 40-mil (1.0-mm) dry film thickness, applied in one or more equal coats.
- C. Apply strip and transition strip a minimum of 1 inch (25 mm) onto cured air-barrier material or strip and transition strip over cured air-barrier material overlapping 3 inches (75 mm) onto each surface according to air-barrier manufacturer's written instructions.
- D. Do not cover air barrier until it has been tested and inspected by testing agency.
- E. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

3.6 FIELD QUALITY CONTROL

- A. Testing Agency: Contractor shall engage a qualified testing agency to perform tests and inspections.
- B. Inspections: Air-barrier materials, accessories, and installation are subject to inspection for compliance with requirements. Inspections may include the following:
1. Continuity of air-barrier system has been achieved throughout the building envelope with no gaps or holes.
 2. Continuous structural support of air-barrier system has been provided.
 3. Masonry and concrete surfaces are smooth, clean, and free of cavities, protrusions, and mortar droppings.
 4. Site conditions for application temperature and dryness of substrates have been maintained.
 5. Maximum exposure time of materials to UV deterioration has not been exceeded.
 6. Surfaces have been primed, if applicable.
 7. Laps in strips and transition strips have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fishmouths.
 8. Termination mastic has been applied on cut edges.
 9. Strips and transition strips have been firmly adhered to substrate.
 10. Compatible materials have been used.
 11. Transitions at changes in direction and structural support at gaps have been provided.
 12. Connections between assemblies (air-barrier and sealants) have complied with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.
 13. All penetrations have been sealed.
- C. Tests: As determined by testing agency from among the following tests:
1. Quantitative Air-Leakage Testing: Air-barrier assemblies will be tested for air leakage according to ASTM E 783.
 2. Adhesion Testing: Air-barrier assemblies will be tested for minimum air-barrier adhesion of 30 lbf/sq. in. (207 kPa) according to ASTM D 4541 for each 600 sq. ft. (56 sq. m) of installed air barrier or part thereof.
- D. Air barriers will be considered defective if they do not pass tests and inspections.
1. Apply additional air-barrier material, according to manufacturer's written instructions, where inspection results indicate insufficient thickness.
 2. Remove and replace deficient air-barrier components for retesting as specified above.
- E. Repair damage to air barriers caused by testing; follow manufacturer's written instructions.

3.7 CLEANING AND PROTECTION

- A. Protect air-barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.
 - 1. Protect air barrier from exposure to UV light and harmful weather exposure as required by manufacturer. If exposed to these conditions for more than 30 days, remove and replace air barrier or install additional, full-thickness, air-barrier application after repairing and preparing the overexposed membrane according to air-barrier manufacturer's written instructions.
 - 2. Protect air barrier from contact with incompatible materials and sealants not approved by air-barrier manufacturer.
- B. Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended by manufacturer of affected construction.
- C. Remove masking materials after installation.

END OF SECTION 07 27 26

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SECTION 07 42 13 METAL WALL PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

1. Exposed fastener metal wall panels as part of the assembly described in "System Description" article of this specification section.

1.3 REFERENCES

- A. American Architectural Manufacturer's Association (AAMA):

1. AAMA 620 - Voluntary Specification for High Performance Organic Coatings on Coil Coated Architectural Aluminum Substrates.
2. AAMA 621 - Voluntary Specification for High Performance Organic Coatings on Coil Coated Architectural Hot Dipped Galvanized (HDG) and Zinc-Aluminum Coated Steel Substrates.

- B. American Society of Civil Engineers (ASCE):

1. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.

- C. ASTM International (ASTM):

1. ASTM A 653/A 653M - Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
2. ASTM A 666 – Standard specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
3. ASTM A 755/A 755M - Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products.
4. ASTM A 792/A 792M – Standard specification for Steel Sheets, 55% Aluminum – Zinc Alloy. Coated by hot-dip process.
5. ASTM B 209 - Specification for Aluminum and Aluminum Alloy Sheet and Plate.
6. ASTM C 754 - Specification for Installation of Steel Framing Members to Receive Screw Attached Gypsum Panel Products.
7. ASTM C 920 - Specification for Elastomeric Joint Sealants.
8. ASTM E 72 - Standard Test Methods of Conducting Strength Tests of Panels for Building Construction.

9. ASTM E 283 - Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors under Specified Pressure Differences across the Specimen.
 10. ASTM E 331 - Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
- D. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA):
1. Architectural Sheet Metal Manual.

1.4 PERFORMANCE REQUIREMENTS

- A. General: Provide metal wall panel assemblies meeting performance requirements as determined by application of specified tests by a qualified testing agency on manufacturer's standard assemblies.
- B. Air Infiltration: When installed over Insulated Composite Backup Panels or Metal Liner Panels, maximum 0.06 cfm/sq. ft. (0.3 L/s per sq. m) per ASTM E 283 at a static-air-pressure difference of 1.57 lbf/sq. ft. (75 Pa), using minimum 10-by-10 foot (3050-by-3050 mm) test panel that includes side joints.
- C. Water Penetration, Static Pressure: When installed over Insulated Composite Backup Panels or Metal Liner Panels, no uncontrolled water penetration per ASTM E 331 at a minimum static differential pressure of 6.24 lbf/sq. ft. (299 Pa), using minimum 10-by-10 foot (3050-by-3050 mm) test panel that includes side joints.
- D. Maximum allowable deflection limitation.
1. Single Skin Panels greater than 1-inch (25-mm) in Depth: Limited to L/120 deflection of panel perimeter normal to plane of wall.
- E. Secondary Metal Framing: Design secondary metal framing for metal wall panel assembly according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions."
- F. Thermal Movements: Allow for thermal movements from variations in both ambient and internal temperatures. Accommodate movement of support structure caused by thermal expansion and contraction.
- G. Wall systems that incorporate foam plastic insulation must be tested by the foam plastic supplier in accordance with NFPA-285.

1.5 QUALITY ASSURANCE

- A. Manufacturer/Source: Provide metal wall panel and panel accessories from a single manufacturer.
- B. Manufacturer Qualifications: Approved manufacturer listed in this Section with minimum ten (10) years' experience in manufacture of similar products in successful use in similar applications.

1. Approval of Comparable Products: Submit the following in accordance with project substitution requirements, within time allowed for substitution review:
 - a. Product data, including certified independent test data indicating compliance with requirements.
 - b. Samples of each component.
 - c. Project references: Minimum of 5 installations not less than 5 years old, with Owner and Architect contact information.
 - d. Sample warranty.
 2. Substitutions following award of contract are not allowed except as stipulated in Division 01 General Requirements.
 3. Approved manufacturers must meet separate requirements of Submittals Article.
- C. Wall Systems Installer Qualifications: Experienced Installer with minimum of five (5) years' experience with successfully completed projects of a similar nature and scope.

1.6 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Conduct preinstallation meeting at site attended by Owner, Architect, manufacturer's representative, and other trade contractors.
1. Coordinate building framing in relation to metal wall panel assembly.
 2. Coordinate installation of building air and water barrier behind metal wall panel assembly.
 3. Coordinate window, door and louver, and other openings and penetrations of metal wall panel assembly.

1.7 ACTION SUBMITTALS

- A. Product Data: Manufacturer's data sheets, for specified products.
1. Include data indicating compliance with performance requirements.
- B. Shop Drawings: Provide shop drawings prepared by manufacturer or manufacturer's authorized Installer. Include full elevations showing openings and penetrations. Include details of each condition of installation and attachment. Provide details at a minimum scale 1½ inch per foot (1:8) of all required trim and extrusions needed for a complete installation.
1. Indicate points of supporting structure that must coordinate with metal wall panel assembly installation.
- C. Samples for Selection: For each product specified. Provide representative color charts of manufacturer's full range of colors.
- D. Qualification Information: For Installer firm.
- E. Manufacturer's sample warranty: Submit sample warranty.

1.8 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: Indicating compliance of products with requirements, from a qualified independent testing agency.

1.9 CLOSEOUT SUBMITTALS

- A. Maintenance data.
- B. Manufacturer's signed warranty in compliance with "Warranty" article of this this specification section.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Protect metal wall panel products during shipping, handling, and storage to prevent staining, denting, deterioration of components or other damage.
 - 1. Deliver, unload, store, and erect metal wall panel products and accessory items without misshaping panels or exposing panels to surface damage from weather or construction operations.

1.11 WARRANTY

- A. Special Manufacturer's Warranty: On manufacturer's standard form, in which manufacturer agrees to repair or replace components of metal wall panel assemblies that fail in materials and workmanship within two years from date of Substantial Completion.
- B. Special Panel Finish Warranty: On manufacturer's standard form, in which manufacturer agrees to repair or replace metal wall panels that display evidence of deterioration of finish within twenty (20) years from the date of substantial completion.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- A. Metal Wall Panels over Masonry Wall System: Single-skin exposed fastener metal wall panels applied as exterior rainscreen cladding over a masonry wall and rigid board insulation specified in Division 04 Section "Unit Masonry Assemblies" and an applied membrane that provides air, moisture, and water vapor control specified in Division 07 Section "Fluid-Applied Membrane Air Barrier." Metal wall panel installation specified in this Section includes secondary metal sub girt framing for panel attachment.
 - 1. Air, moisture, and water vapor control membrane is provided under Division 07 Section " Fluid-Applied Membrane Air Barrier."

2.2 MANUFACTURERS

- A. Basis of Design: Morin, Exposed Fastener Series Metal Wall Panels. Product selected because it matches the existing wall panel profile. Other metal wall panel profiles will not

be accepted. Provide basis of design product, or comparable product approved by Architect prior to bid.

1. Morin, A Kingspan Group Company | East 685 Middle Street | Bristol, CT | Tel: (860) 584-0900 | Fax: (860) 582-7503 | Toll Free: (800) 640-9501 | Web: www.Morincorp.com.

2.3 METAL WALL PANEL MATERIALS

A. Metallic-Coated Steel Face Sheet: Coil-coated, ASTM A 755/A 755M.

1. Aluminum-zinc alloy-coated (Galvalume) Steel Sheet: ASTM A 792/A 792 M, Class AZ50 Grade 50 (Class AZM150, Grade 275), structural steel quality.

2.4 EXPOSED FASTENER PROFILE METAL WALL PANELS

A. Metal Wall Panels, General: Factory-formed, Exposed fastener panels with interconnecting side joints, fastened to supports with exposed fasteners, with field-applied sealants in side laps when required to meet performance requirements.

B. Basis of design manufacturer's ribbed profile with lap joint MWP-1:

1. Basis of Design Product: Morin, BR-28.
2. Panel Coverage: 28 inches (711 mm).
3. Panel Height: 1.50 inches (38 mm).
4. Rib Spacing: 4 at 7.00 inches (178 mm) o.c.
5. Manufacturer's Profile: Option B
6. Perforated: No
7. Installation: Horizontal
8. Finish: Smooth
9. Color: Custom Color to match Existing Metal Panel Cream

C. Basis of design manufacturer's ribbed profile with lap joint MWP-2:

1. Basis of Design Product: Morin, VB-36.
2. Panel Coverage: 36 inches (914 mm).
3. Panel Height: 1.00 inches (25 mm).
4. Rib Spacing: 4 at 4.00 inches (100 mm) o.c.
5. Manufacturer's Profile: Option B
6. Perforated: No
7. Installation: Horizontal
8. Finish: Smooth
9. Color: Custom Color to match Metro Navy Blue - Pantone 540

D. Basis of design manufacturer's ribbed profile with lap joint MWP-3:

1. Basis of Design Product: Morin, VB-36.
2. Panel Coverage: 36 inches (914 mm).
3. Panel Height: 1.00 inches (25 mm).
4. Rib Spacing: 4 at 4.00 inches (100 mm) o.c.
5. Manufacturer's Profile: Option B

6. Perforated: Yes, 1/8" holes at 7/32" spacing for 30% total opening.
7. Installation: Horizontal
8. Finish: Smooth
9. Color: Custom Color to match Metro Navy Blue - Pantone 540

E. Exposed Coil-Coated Finish System:

1. Fluoropolymer Two-Coat System: 0.2 mil primer with 0.8 mil 70 percent PVDF fluoropolymer color coat, AAMA 621.
 - a. Basis of Design: CENTRIA Fluorofinish.

2.5 METAL WALL PANEL ACCESSORIES

- A. Metal Wall Panel Accessories, General: Provide complete metal wall panel assembly incorporating trim, copings, fasciae, parapet caps, soffits, sills, inside and outside corners, and miscellaneous flashings. Fabricate accessories in accordance with SMACNA Manual.
1. Metal wall panel accessories associated with the membrane roofing system such as adjacent trim, coping fasciae, parapet caps, and soffits shall be provided and installed by the membrane roofing contractor.
- B. Provide manufacturer's factory-formed clips, shims, flashings, gaskets, lap strips, closure strips, and caps for a complete installation as required for the following:
1. Single-skin application over furred masonry backup with air and water-resistant barrier.
- C. Extruded Trim: Manufacturer's complementary aluminum extrusions for head, jamb, sill, base, flush, reveal, inside and outside corner, end wall, and expansion joint details. Finish to match metal wall panels.
- D. Mitered Corners: Structurally-bonded horizontal interior and exterior trimless corners matching metal wall panel material, profile, and factory-applied finish, fabricated and finished by metal wall panel manufacturer.
1. Welded, riveted, fastened, or field- fabricated corners do not meet the requirements of this specification.
- E. Formed Flashing and Trim: Match material, thickness, and color of metal wall panel face sheets.
- F. Sealants: Type recommended by metal wall panel manufacturer for application, meeting requirements of Division 07 Section "Joint Sealants."
- G. Flashing Tape: 4-inch wide self-adhering butyl flashing tape.
- H. Fasteners: Self-tapping screws, bolts, nuts, and other acceptable fasteners recommended by panel manufacturer. All exposed fasteners must be stainless steel with heads matching color of metal wall panels by means of factory-applied coating.

2.6 SECONDARY METAL FRAMING

- A. Miscellaneous Framing Components, General: Cold-formed metallic-coated steel sheet, ASTM A 653/A 653M, G90 (Z180).
1. Hat Channels: 0.06 inch/16 ga. (1.52 mm) minimum – nominal thickness.
 2. Sill Channels: 0.06 inch/16 ga. (1.52 mm) minimum – nominal thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine metal wall panel substrate with Installer present. Inspect for erection tolerances and other conditions that would adversely affect installation of metal wall panels.
- B. Wall Substrate: Confirm that wall substrate is within tolerances acceptable to metal wall panel system manufacturer.
1. Maximum deviations acceptable:
 - a. ¼-inch in 20 feet (6.4 mm in 6 m) vertically or horizontally from face plane of framing.
 - b. ½-inch (12.7 mm) across building elevation.
 - c. 1/8-inch in 5 feet (3.2 mm in 1.5 m).
- C. Framing: Inspect framing that will support metal wall panels to determine if support components are installed as indicated on approved shop drawings. Confirm presence of acceptable framing members at recommended spacing to match installation requirements of metal wall panels.
- D. Openings: Verify that windows, doors, louvers and other penetrations match layout on shop drawings.
- E. Air/Moisture Barriers: Confirm that work has been completed, inspected, and tested as required.
- F. Advise General Contractor, in writing, of out-of-tolerance work and other deficient conditions prior to proceeding with metal wall panel system installation.
- G. Correct out of tolerance work and other deficient conditions prior to panel installation.

3.2 SECONDARY FRAMING INSTALLATION

- A. Secondary Metal Framing: Install secondary metal framing components to tolerances indicated, as shown on approved shop drawings. Install secondary metal framing and other metal panel supports per ASTM C 1007 and metal wall panel manufacturer's recommendations.

3.3 METAL WALL PANEL INSTALLATION

- A. General: Install metal wall panels in accordance with approved shop drawings and manufacturer's recommendations. Install metal wall panels in orientation, sizes, and locations indicated. Anchor metal wall panels and other components securely in place.
- B. Attach panels to metal framing using recommended screws, fasteners, sealants, and adhesives indicated on approved shop drawings.
 - 1. Fasteners for Steel Wall Panels: Stainless-steel for exterior locations and locations exposed to moisture; carbon steel for interior use only.
 - 2. Provide weatherproof escutcheons for pipe and conduit penetrating exterior walls.
 - 3. Dissimilar Materials: Where elements of metal wall panel system will come into contact with dissimilar materials, treat faces and edges in contact with dissimilar materials as recommended by manufacturer.
- C. Joint Sealers: Install joint sealants where indicated on approved shop drawings.

3.4 ACCESSORY INSTALLATION

- A. General: Install metal wall panel accessories with positive anchorage to building. Coordinate installation with flashings and other components.
 - 1. Install related flashings and sheet metal trim per requirements of Division 07 Section "Sheet Metal Flashing and Trim."
 - 2. Install components required for a complete metal wall panel assembly, including trim, copings, corners, lap strips, flashings, sealants, fillers, closure strips, and similar items.
 - 3. Comply with performance requirements and manufacturer's written installation instructions.
 - 4. Set units true to line and level as indicated.

3.5 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a service representative authorized by metal wall panel manufacturer to inspect completed installation. Submit written report.
- B. Correct deficiencies noted in manufacturer's report.

3.6 CLEANING AND PROTECTION

- A. Remove temporary protective films. Clean finished surfaces as recommended by metal wall panel manufacturer. Clear weep holes and drainage channels of obstructions, dirt, and sealant. Maintain in a clean condition during construction.
- B. Replace damaged panels and accessories that cannot be repaired by finish touch-up or minor repair.

END OF SECTION 07 42 13

SECTION 07 53 23
ETHYLENE-PROPYLENE-DIENE-MONOMER (EPDM) ROOFING SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Furnish and install elastomeric sheeting roofing system, EPDM, including:
1. Roofing manufacturer's requirements for the specified warranty
 2. Preparation of roofing substrates.
 3. Wood nailers and blocking for roofing attachments as stated in plans and specifications.
 4. Insulation.
 5. Elastomeric EPDM membrane roofing.
 6. Metal roof edging and coping
 7. Roof drains and scuppers.
 8. Flashings.
 9. Concrete pavers
 10. Other roofing –related items specified or indicated on the drawings or otherwise necessary to provide a complete weatherproof roofing system.
- B. Disposal of demolition debris and construction waste is the responsibility of the contractor. Perform disposal in a manner complying with all applications of federal, state, local regulations and sections within this project manual.
- C. Comply with the published recommendations and instruction of the roofing membrane manufacturer.
- D. Commence of work by the contractor shall constitute acknowledgement by the contractor that this specification can be satisfactorily executed, under the project conditions and with all necessary prerequisites for warranty acceptance by roofing membrane manufacturer. Any modification of the Contract Sum will be made in accordance with the stipulations of the contract Documents stated elsewhere.

1.3 DEFINITIONS

- A. Roofing Terminology: See ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definitions of terms related to roofing work in this Section.

1.4 PRE-BID AND PRE-INSTALLATION MEETINGS

- A. Pre-bid, refer to Section d for pre-bid meeting.
- B. Project meeting, Section 01 31 19 for pre-installation and project meetings.

1.5 ACTION SUBMITTALS

- A. Product Data Sheets: Provide membrane manufacturer's product data sheets for all components of the roofing system, including insulation and fasteners, comply with the specific requirements with the membrane manufacturer's requirements and recommendations for the system type specified; including data for each product used in conjunction with the roofing membrane.
- B. Installation instructions: Provide manufacturer's instruction to installer, marked up to show exactly how all components will be installed; where instructions allow installer options, clearly indicate which option will be used.
- C. Shop Drawings: Include roof plans, sections, details, and attachments to other work, including the following:
 - 1. Layout and thickness of insulation.
 - 2. Base flashings, membrane terminations, expansion joints, scupper and drain details.
 - 3. Flashing details at penetrations, wall and parapets.
 - 4. Any non-standard detailing such as ductwork penetration for RTU AC 1.
- D. Samples for Verification: For the following products:
 - 1. Roof paver.
 - 2. Paint samples for patching exterior through wall scupper.
 - 3. Metal flashing.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and Manufacturer.
- B. Manufacturer Certificates:
 - 1. Performance Requirement Certificate: Signed by roof membrane manufacturer, certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
 - a. Submit evidence of complying with performance requirements.
 - 2. Special Warranty Certificate: Signed by roof membrane manufacturer, certifying that all materials supplied under this Section are acceptable for special warranty.
- C. Product Test Reports: For components of roof membrane and insulation, for tests performed by a qualified testing agency, indicating compliance with specified requirements.
- D. Sample Warranties: For manufacturer's special warranties.

1.7 CLOSEOUT SUBMITTALS

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

1. Submittals
 2. As built shop drawings, including a roof plan showing areas of metal deck repair.
 3. Warranties
 4. Include in electronic format as specified under Section 01 78 23 "Operation and Maintenance Data."
- B. Certified statement from existing roof membrane manufacturer stating that existing roof warranty has not been affected by Work performed under this Section.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty. The warranty shall be provided by the primary roofing contractor, not a subcontractor of the primary roofing contractor.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
- C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
- D. Handle and store roofing materials, and place equipment in a manner to avoid permanent deflection of deck.

1.10 FIELD CONDITIONS

- A. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.
1. Special warranty includes roof membrane, base flashings, and other components of roofing system with a wind speed coverage rating of 55 mph.
 - a. Limits of liability: No dollar limitation.
 - b. Scope of Coverage: Repair leaks in the roofing system caused by:
 - 1) Ordinary wear and tear on the elements.
 - 2) Manufacturing defect in Manufacturer brand materials.

- 3) Defective workmanship used to install these materials.
- 4) Damage due to winds up to 55 mph.

c. Not Covered:

- 1) Damage due to winds in excess of 55 mph. ii.
- 2) Damage due to hurricanes or tornados.
- 3) Hail
- 4) Intentional damage
- 5) Unintentional damage due to normal rooftop inspections, maintenance, or service.

2. Warranty Period: Twenty (20) years from Date of Substantial Completion.

B. Special Project Warranty: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering the Work of this Section, including all components of roofing system such as roof membrane, base flashing, roof insulation, fasteners, roof pavers, for the following warranty period:

1. Warranty Period: Two (2) years from Date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Installed roofing system and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roofing and flashings shall remain watertight.

1. Accelerated Weathering: Roof membrane shall withstand 2000 hours of exposure when tested according to ASTM G 152, ASTM G 154, or ASTM G 155.
2. Impact Resistance: Roof membrane shall resist impact damage when tested according to ASTM D 3746, ASTM D 4272, or the Resistance to Foot Traffic Test in FM Approvals 4470.

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

C. Wind Uplift Resistance: Design roofing system to resist the following wind uplift pressures when tested according to FM Approvals 4474, UL 580, or UL 1897:

1. Zone 1 (Roof Area Field): 10 lbs/square foot
2. Zone 2 (Roof Area Perimeter): 12 lbs /square foot
 - a. Location: From roof edge to 12.0 feet inside roof edge.
3. Zone 3 (Roof Area Corners): 12 lbs /square foot
 - a. Location: 12.0 feet in each direction from building corner

- D. Exterior Fire-Test Exposure: ASTM E 108 or UL 790, Class A; for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- E. Fire-Resistance Ratings: Comply with fire-resistance-rated assembly designs indicated. Identify products with appropriate markings of applicable testing agency.

2.2 ETHYLENE-PROPYLENE-DIENE-TERPOLYMER (EPDM) ROOFING

- A. EPDM Sheet: ASTM D 4637/D 4637M, Type I, non-reinforced EPDM sheet with factory-applied seam tape.
 - 1. Approved Manufacturer: (NO SUBSTITUTIONS) The owner recently completed a reroofing project on the adjacent bus storage facility. The roof system for the addition shall receive the same roofing manufacturer's warranty.
 - a. Firestone Building Products: RubberGard™ EPDM Ballasted Membrane Roof System.
 - 2. Thickness: 60 nominal.
 - 3. Exposed Face Color: black
 - 4. Source Limitations: Obtain roof membrane manufacturer components for roofing system from roof membrane manufacturer or manufacturers approved by roof membrane manufacturer.

2.3 AUXILIARY ROOFING MATERIALS

- A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with other roofing components.
 - 1. Adhesive and Sealants: Comply with VOC limits of authorities having jurisdiction.
- B. Sheet Flashing: 60-mil thick EPDM, partially cured or cured, according to application.
- C. Slip Sheet: Manufacturer's standard, of thickness required for application.
- D. Prefabricated Pipe Flashings: As recommended by roof membrane manufacturer.
- E. Roof Vents: As recommended by roof membrane manufacturer.
 - 1. Size: Not less than 4-inch diameter.
- F. Pourable Sealer: Two-part polyurethane, two-color for reliable mixing; Pourable Sealer by manufacturer.
- G. Bonding Adhesive: Manufacturer's standard.
- H. Seaming Material: Single-component, butyl splicing adhesive and splice cleaner or Manufacturer's standard, synthetic-rubber polymer primer and 3-inch wide minimum, butyl splice tape with release film or Factory-applied seam tape, width as recommended by manufacturer.

- I. Lap Sealant: Manufacturer's standard, single-component sealant, colored to match membrane roofing.
- J. Water Cutoff Mastic: Manufacturer's standard butyl mastic sealant.
- K. Metal Termination Bars: Manufacturer's standard, predrilled stainless steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.
- L. Metal Battens: Manufacturer's standard, aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately 1 inch wide by 0.05 inch thick, pre-punched.
- M. Ballast Retaining Bar: Perimeter securement system consisting of a slotted extruded-aluminum retention bar with an integrated compression fastening strip.
 - 1. Fasteners: 1½ inch (38-mm) stainless steel fasteners with neoprene washers.
- N. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion- resistance provisions in FM Approvals 4470, designed for fastening components to substrate, and acceptable to roofing system manufacturer.
- O. Sheet Metal Accessories
 - 1. Metal Roof Edging and Fascia: Continuous metal edge member serving as termination of roof membrane and retainer for metal fascia; watertight with no exposed fasteners; mounted to roof edge nailer.
 - a. Wind Performance:
 - 1) Membrane Pull-Off Resistance: 100 lbs/ft. (1460 N/m), minimum, when tested in accordance with ANSI/SPRI ES-1 Test Method RE-1, current edition.
 - 2) Fascia Pull-Off Resistance: At least the minimum required when tested in accordance with ANSI/SPRI ES-1 Test Method RE-2, current edition.
 - 3) Fascia Pull-Off Resistance: At least the minimum required when tested in accordance with ANSI/SPRI ES-1 Test Method RE-2, current edition.
 - b. Description: Two-piece; 45 degree sloped galvanized steel sheet edge member securing top and bottom edges of formed metal fascia; Firestone EdgeGard or equivalent.
 - c. Fascia Face Height: Varies, field measure and refer to plans.
 - d. Fascia Material and Finish: 24 gage, 0.024 inch (0.06 mm) galvanized steel with Kynar 500 finish; matching concealed joint splice plates; factory-installed protective plastic film.
 - 1) Color: To match adjacent Metal Wall Panels – Custom Colors required.
 - e. Length: 144 inches.

- f. Functional Characteristics: Fascia retainer supports while allowing for free thermal cycling of fascia.
 - g. Aluminum Bar: Continuous 6063-T6 alloy aluminum extrusion with pre-punched slotted holes; miters welded; injection molded EPDM splices to allow thermal expansion.
 - h. Anchor Bar Cleat: 20 gage, 0.036 inch (0.9 mm) G90 coated commercial type galvanized steel with pre-punched holes.
 - i. Scuppers: Welded watertight
2. 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 or equivalent.
- a. Wind Performance:
 - 1) At least the minimum required when tested in accordance with ANSI/SPRI ES-1 Test Method RE-3, current edition.
 - b. 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.
 - c. Material and Finish: 24 gage, 0.024 inch (0.06 mm) thick galvanized steel with Kynar 500 finish; matching concealed joint splice plates; factory-installed protective plastic film.
 - 1) Color: To match adjacent Metal Wall Panels – Custom Colors required.
 - d. Dimensions:
 - 1) Wall Width: As indicated on the drawings.
 - 2) Piece Length: Minimum 144 inches.
 - e. Fasteners: Factory-furnished; electrolytically compatible; minimum pull out resistance of 240 pounds for actual substrate used; no exposed fasteners.

P. ACCESSORY MATERIALS

- 1. Wood Nailers: PS 20 dimension lumber, Structural Grade No. 2 or better Southern Pine, Douglas Fir; or PS 1, APA Exterior Grade plywood.
 - a. Width: 3½ inches nominal minimum, as determined during demolition, as indicated on plans or as wide as the nailing flange of the roof accessory to be attached to it.
 - b. Thickness: Same as thickness of roof insulation, as determined during demolition or as indicated on plans.

2. Roof Drains: Cast iron body, secured cast iron dome, 15" round, bottom outlet, flashing clamp, ravel stop, underdeck clamp, bearing pan, adjustable extension to match insulation thickness, outlet size as indicated on plans.
 - a. Acceptable Manufacturers: Zurn (Z-100), Smith (1010), Wade (3000), Josam (21500), Watts (RD-300), Mifab (R1200)
 3. Lambs Tongue Downspout Nozzle: Bronze Body, Integral Anchoring Flange, removable Stainless Steel Screen, outlet Size 6".
 - a. Acceptable Manufacturers: Zurn (Z-199), Smith (1770), Wade (3940), Josam (25010), Watts (RD-940), Mifab (R1940)
- Q. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, molded pipe boot flashings, preformed inside and outside corner sheet flashings, reinforced EPDM securement strips, T-joint covers, in-seam sealants, termination reglets, cover strips, and other accessories.

2.4 ROOF INSULATION

- A. General: Preformed roof insulation boards manufactured or approved by EPDM roof membrane manufacturer.
- B. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 1, Grade 2, felt or glass-fiber mat facer on both major surfaces.
 1. Compressive Strength: 20 psi.
 2. Size: 48 by 96 inches
- C. Thickness:
 1. Base Layer: 2 inches.
 2. Upper Layer: 2 inches.

2.5 INSULATION ACCESSORIES

- A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with other roofing system components.
- B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion- resistance provisions in FM Approvals 4470, designed for fastening roof insulation and cover boards to substrate, and acceptable to roofing system manufacturer.
- C. Tapered Insulation: Provide factory-tapered insulation boards as required for drains.

2.6 BALLAST

- A. General: Contractor has the option to reuse existing ballast or to supply new. If reusing ballast the contractor may need to supply additional ballast material to provide stated wind uplift protection.

- B. Aggregate Ballast: Smooth, washed, riverbed gravel or other acceptable smooth-faced stone that withstands weather exposure without significant deterioration and does not contribute to membrane degradation, of the following size:

1. Size: ASTM D 448, Size 4, ranging in size from ¾ to 1½ inches.

2.7 WALKWAYS

- A. Apply at locations as shown on plans.

- B. Walkway Roof Pavers: Heavyweight, hydraulically pressed concrete units, square edged, factory cast for use as roof pavers; absorption not greater than 5 percent, ASTM C 140/C 140M; no breakage and maximum 1 percent mass loss when tested for freeze-thaw resistance, ASTM C 67; and as follows:

1. Size: 24 by 24 inches. Manufacture pavers to dimensional tolerances of plus or minus 1/16 inch in length, height, and thickness.
2. Weight: 18 lb. /sq. ft.
3. Compressive Strength: 7500 psi, minimum.
4. Colors and Textures: As selected by Owner from manufacturer's standard range.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

1. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof- drain bodies are securely clamped in place.
2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
3. Inspect steel decking for buckling, rusting and deterioration. These conditions were identified from the underside of the deck and will be repaired on a unit cost basis per plans and specifications. Identify areas where decking may need to be replaced and consult with the City Project Manager prior to any replacement work. The City shall be responsible for retaining a Structural Engineer to evaluate any structural deck issues. Do not proceed with roof deck repairs without authorization from the City.

- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

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

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

3.3 ROOFING INSTALLATION, GENERAL

- A. Install roofing system according to roofing system manufacturer's written instructions, FM Approvals' RoofNav assembly requirements, and FM Global Property Loss Prevention Data Sheet 1-29.
- B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at end of workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

3.4 INSULATION INSTALLATION

- A. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at end of workday.
- B. Comply with roofing system and insulation manufacturer's written instructions for installing roof insulation.
- C. Installation Over Metal Decking:
 - 1. Install base layer of insulation with joints staggered not less than 24 inches in adjacent rows end joints staggered not less than 12 inches in adjacent rows and with long joints continuous at right angle to flutes of decking.
 - a. Locate end joints over crests of decking.
 - b. Where installing composite and non-composite insulation in two or more layers, install non-composite board insulation for bottom layer and intermediate layers, if applicable, and install composite board insulation for top layer.
 - c. Where installing composite and non-composite insulation in two or more layers, install non-composite board insulation for bottom layer and intermediate layers, if applicable, and install composite board insulation for top layer.
 - d. Make joints between adjacent insulation boards not more than 1/4 inch in width.
 - e. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus 24 inches (except for secondary overflow roof drains).
 - 1) Trim insulation so that water flow is unrestricted.
 - f. Fill gaps exceeding 1/4 inch with insulation.
 - g. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.
 - h. Loosely lay base layer of insulation units over substrate.

2. Install upper layers of insulation with joints of each layer offset not less than 12 inches from previous layer of insulation.
 - a. Staggered end joints within each layer not less than 24 inches in adjacent rows.
 - b. Install with long joints continuous and with end joints staggered not less than 12 inches in adjacent rows.
 - c. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 - d. Make joints between adjacent insulation boards not more than $\frac{1}{4}$ inch in width.
 - e. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus 24 inches (except for secondary overflow roof drains).
 - f. Trim insulation so that water flow is unrestricted.
 - g. Fill gaps exceeding $\frac{1}{4}$ inch with insulation.
 - h. Cut and fit insulation within $\frac{1}{4}$ inch of nailers, projections, and penetrations.
 - i. Loosely lay each layer of insulation units over substrate.

3.5 LOOSELY LAID AND BALLASTED MEMBRANE ROOFING INSTALLATION

- A. Loosely lay roof membrane over area to receive roofing according to roofing system manufacturer's written instructions.
- B. Unroll roof membrane and allow to relax before installing.
- C. Comply with requirements in SPRI RP-4 for System 1.
- D. Accurately align roof membrane, without stretching, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
- E. Apply roof membrane with side laps shingled with slope of deck where possible.
- F. Adhesive Seam Installation: Clean both faces of splice areas, apply splicing cement.
 1. Firmly roll side and end laps of overlapping roof membrane to ensure a watertight seam installation.
 2. Apply lap sealant and seal exposed edges of roofing terminations.
 3. Apply a continuous bead of in-seam sealant before closing splice if required by roofing system manufacturer.
- G. Tape Seam Installation: Clean and prime both faces of splice areas, apply splice tape.
 1. Firmly roll side and end laps of overlapping roof membrane to ensure a watertight seam installation.
 2. Apply lap sealant and seal exposed edges of roofing terminations.
- H. Factory-Applied Seam Tape Installation: Clean and prime surface to receive tape.

1. Firmly roll side and end laps of overlapping roof membrane to ensure a watertight seam installation.
 2. Apply lap sealant and seal exposed edges of roofing terminations.
- I. Leave seams uncovered until inspected by roofing system manufacturer.
 - J. Repair tears, voids, and lapped seams in roof membrane that do not comply with requirements.
 - K. Spread sealant or mastic bed over deck-drain flange at roof drains, and securely seal roof membrane in place with clamping ring.
 - L. Aggregate Ballast: Apply uniformly over roof membrane at the rate required by roofing system manufacturer, but not less than the following, spreading with care to minimize possibility of damage to roofing system. Lay ballast as roof membrane is installed, leaving roof membrane ballasted at end of workday.
 1. Ballast Weight: Size 4 aggregate, 10 lb. /sq. ft. at field.
 2. Ballast Weight: Size 2 4aggregate, 12 lb. /sq. ft. at corners and perimeter.
 - M. Roof-Paver: Install roof-paver according to manufacturer's written instructions and at locations noted on plans.

3.6 BASE FLASHING INSTALLATION

- A. Install sheet flashings and preformed flashing accessories, and adhere to substrates according to roofing system manufacturer's written instructions.
- B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate, and allow to partially dry. Do not apply to seam area of flashing.
- C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.
- D. Clean splice areas, apply splicing cement, and firmly roll side and end laps of overlapping sheets to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of sheet flashing terminations.
- E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.7 FIELD QUALITY CONTROL

- A. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion, in presence of City Project Manager, and to prepare inspection report.
- B. Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements.

3.8 PROTECTING AND CLEANING

- A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing system, inspect roofing system for deterioration and damage, describing its nature and extent in a written report, with copies to City Project Manager and Owner.
- B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.
- C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

3.9 MANUFACTURER'S WARRANTY

- A. Provide manufacturer's twenty (20) year warranty as stated above.

3.10 ROOFING INSTALLER'S WARRANTY

- A. WHEREAS _____ of _____, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:
 - 1. Owner: City of Madison
 - 2. Address: 210 Martin Luther King Jr. Blvd. Madison WI 53703
 - 3. Building Name/Type: Madison Metro Bus Garage
 - 4. Address: 1101 East Washington Ave. Madison WI 53703
Area of Work: EPDM Roofing System, Approx. 10,400 sq. ft.
 - 5. Acceptance Date:
 - 6. Warranty Period 2 years.
 - 7. Expiration Date:
- B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,
- C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period Roofing Installer will, at Roofing Installer's own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.
- D. This Warranty is made subject to the following terms and conditions:
 - 1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:
 - a. lightning;
 - b. peak gust wind speed exceeding 55 mph;

- c. fire;
 - d. failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
 - e. faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
 - f. vapor condensation on bottom of roofing; and
 - g. activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.
2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
 3. Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.
 4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.
 5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.
 6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
 7. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this _____ day of _____,

1. Authorized Signature: _____.
2. Name: _____.

3. Title: _____.

END OF SECTION 07 53 23

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**SECTION 07 62 00
SHEET METAL FLASHING AND TRIM**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Sheet metal flashings and trim work.
- B. Formed wall sheet metal fabrications (MP-2 Wall Panels).
- C. Formed low-slope roof sheet metal fabrications.
- D. Canopy enclosure sheet metal.

1.3 QUALITY ASSURANCE

- A. Sheet metal fabricator and installer shall have minimum five (5) years experience of shop fabrication and installation of shop fabricated roofing metals and flashings.
- B. Reference Standards
1. ASTM A525 Spec. for Steel Sheet, Zinc Coated (Galvanized) by the Hot Dip Process, Commercial Quality
 2. ASTM B209 Spec. for Aluminum and Aluminum Alloy Sheet and Plate
 3. ASTM C920 Spec. for Elastomeric Joint Sealants
 4. ASTM D746 Test Method for Brittleness Temperature of Plastics and Elastomers by Impact
 5. SMACNA Sheet Metal and Air Conditioning Contractor's National Association Architectural Sheet Metal Manual.

1.4 SUBMITTALS

- A. Refer to Division 01 for General Submittal Requirements.
- B. Product Data: Manufacturer's descriptive literature with technical data indicating materials, tests and installation and storage instructions.
- C. Shop Drawings: Plan layout with dimensions, details indicating profiles, fastening and connection methods and joints. Indicate all components, materials, and finishes.
- D. Samples
1. Two (2) samples for color and profile approval, printed color samples not allowed. Material samples shall be 4" wide x 12" long.

E. Warranty

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery, storage, and handling shall be accomplished in such a manner as required to prevent damage to components and their finishes.
- B. Materials shall be carefully handled to prevent damage to the surfaces, edges, ends, and shall be stored at the site above the ground in a covered and dry location. Damaged items that cannot be restored to original condition will be rejected.
- C. Factory fabricated items shall be delivered in manufacturer's original unopened containers with brand names and material designation clearly marked thereon.

1.6 WARRANTY

- A. Contractor shall guarantee materials and workmanship to be watertight for two (2) years, along with roofing system.
- B. Manufacturer's twenty (20) year guarantee for colorfastness and finish of standard color prefinished materials and five (5) year guarantee for special custom colors.

PART 2 - PRODUCTS2.1 MATERIALS

- A. Shop fabricated flashings (other than prefabricated parapet copings):
 - 1. Peterson Aluminum Company "Pac-Clad" .040 anodized aluminum stock, thickness as required for application.
 - a. Matching watertight fasteners where exposed.
 - b. Color:
 - 1) As selected from manufacturer's full range. Custom color as required.
 - 2) Metal Panel to concrete flashing: Custom Color to match Metro Navy Blue - Pantone 540.
- B. Prefabricated Coping System
 - 1. Metal Era Company "Perma-Tite" anodized aluminum coping system. Full snap-on design tapered style.
 - a. One piece galvanized metal wall cap with anchor clips both sides.
 - b. Concealed splice plate: Galvanized steel with factory applied sealant.
 - c. Cover: .050" aluminum.
 - d. Color: As selected from manufacturer's full range. Custom color as required to match existing cream color.
 - e. Custom fabricate to dimensions and profile indicated on drawings.

C. Shop Fabricated Counter Flashings and Reglets

1. Shop fabricate counter flashings to sizes and profile shown on the drawings.
 - a. Concealed: Aluminum .032" thick, mill finish.
 - b. Exposed to view: Anodized Aluminum .032" thick. Color to match coping and/or gravel stop.
 - c. Fabricate all flashings to lock into reglets and have spring pressure onto membrane flashings. Fabricate exposed counterflashings with concealed joint covers.
 - d. Fabricate reglets to accept counterflashings.

D. Shop Fabricated Counter Flashings

1. Shop fabricate counter flashings to sizes and profile shown on the drawings.
 - a. Concealed: Aluminum mill finish.
 - b. Exposed to view: Finish to match gravel stop and coping system.

E. Miscellaneous

1. Fasteners shall be as recommended by manufacturer for type and size for each application except as specified herein.
 - a. Stainless steel fasteners at aluminum - concealed.
 - b. Custom color finish to match aluminum finish at exposed fasteners.
 - c. Expansion anchors shall be drill in type, Tapcon, Phillips, or Rawl.
2. Sealants: Clear silicone GE, Dow, or approved equal.
3. Miscellaneous: Provide all necessary miscellaneous materials required for complete watertight installation as recommended by the manufacturer.

2.2 FABRICATION, GENERAL**A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.**

1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
2. Obtain field measurements for accurate fit before shop fabrication.
3. Form sheet metal flashing and trim to fit substrates without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
4. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.

B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of ¼ inch in 20 feet (6 mm in 6 m) on slope and location lines

- indicated on Drawings and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.
- C. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."
 - D. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.
 - 1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with butyl sealant concealed within joints.
 - 2. Use lapped expansion joints only where indicated on Drawings.
 - E. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.
 - F. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
 - G. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard and by FM Global Property Loss Prevention Data Sheet 1-49 for application, but not less than thickness of metal being secured.
 - H. Seams: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.
 - I. Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use.
 - J. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer.
 - K. Do not use graphite pencils to mark metal surfaces.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General Requirements
 - 1. Entire roofing and flashing systems shall be sealed against moisture penetration.
 - 2. Shop fabricate counter flashings only from approved shop drawings in conformance with the bidding documents.
- B. Workmanship: Design and anchor so work will not be objectionable, distorted, nor flashings seriously stressed from expansion and contraction of metal.
- C. Miscellaneous Roofing Flashings

1. Comply with drawings and roofing manufacturer's requirements for metal flashing and counter flashings.
2. Lap counter flashings minimum of 1" and provide clear sealant at all laps.

D. Gravel Stop/Fascia and Coping Systems

1. In accordance with manufacturer's printed instructions and approved shop drawings.
 - a. Accurate and straight in line with deviation of plane or edges of fascia.
 - b. Allow for expansion and contraction of coping cover.
 - c. Seal all joints beneath face metals to concealed joint covers except expansion joints.
2. Fasten galvanized metal wall cover into wood blocking thru membrane flashing with galvanized roofing nails.

3.2 ADJUST AND CLEAN

- A. Touch up paint all abraded exposed surfaces of prefinished metal.
- B. Clean premises of all litter, dirt and debris created by work of this Section.

END OF SECTION 07 62 00

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SECTION 07 84 13 PENETRATION AND JOINT FIRESTOPPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
1. Penetrations in fire-resistance-rated walls.
 2. Joints in or between fire-resistance-rated constructions.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Product Schedule: For each penetration firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing and inspecting agency.
1. Engineering Judgments: Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping system, submit illustration, with modifications marked, approved by penetration firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly. Obtain approval of authorities having jurisdiction prior to submittal.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Test Reports: For each penetration firestopping system, for tests performed by a qualified testing agency.

1.5 CLOSEOUT SUBMITTALS

- A. Installer Certificates: From Installer indicating that penetration firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A firm that has been approved by FM Approval according to FM Approval 4991, "Approval Standard for Firestop Contractors," or been evaluated by UL and found to comply with its "Qualified Firestop Contractor Program Requirements."

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install penetration firestopping system when ambient or substrate temperatures are outside limits permitted by penetration firestopping system manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.
- B. Install and cure penetration firestopping materials per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.8 COORDINATION

- A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping systems can be installed according to specified firestopping system design.
- B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping systems.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics:
 - 1. Perform penetration firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
 - 2. Test per testing standards referenced in "Penetration Firestopping Systems" Article. Provide rated systems complying with the following requirements:
 - a. Penetration firestopping systems shall bear classification marking of a qualified testing agency.
 - 1) UL in its "Fire Resistance Directory."
 - 2) Intertek Group in its "Directory of Listed Building Products."
 - 3) FM Approval in its "Approval Guide."

2.2 PENETRATION FIRESTOPPING SYSTEMS

- A. Penetration Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. 3M Fire Protection Products.
 - b. Grabber Construction Products.
 - c. Hilti, Inc.
 - d. STC Sound Control.

- e. Tremco, Inc.
- B. Penetrations in Fire-Resistance-Rated Walls: Penetration firestopping systems with ratings determined per ASTM E814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).
 - 1. F-Rating: Not less than the fire-resistance rating of constructions penetrated.
- C. Exposed Penetration Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, per ASTM E84.
- D. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping system manufacturer and approved by qualified testing and inspecting agency for conditions indicated.
 - 1. Permanent forming/damming/backing materials.
 - 2. Substrate primers.
 - 3. Collars.
 - 4. Steel sleeves.

2.3 JOINT FIRESTOPPING SYSTEMS

- A. Joint Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which joint firestopping systems are installed. Joint firestopping systems shall accommodate building movements without impairing their ability to resist the passage of fire and hot gases.
- B. Joints in or between Fire-Resistance-Rated Construction: Provide joint firestopping systems with ratings determined per ASTM E1966 or UL 2079.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. 3M Fire Protection Products.
 - b. ClarkDietrich.
 - c. Hilti, Inc.
 - d. Nelson Firestop; a brand of Emerson Industrial Automation.
 - e. Rockwool International.
 - f. Thermafiber, Inc.; an Owens Corning company.
 - g. Tremco, Inc.
 - 2. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of the wall, floor, or roof in or between which it is installed.
- C. Exposed Joint Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E84.

- D. Accessories: Provide components of joint firestopping systems, including primers and forming materials, that are needed to install elastomeric fill materials and to maintain ratings required. Use only components specified by joint firestopping system manufacturer and approved by the qualified testing agency for conditions indicated.

2.4 FILL MATERIALS

- A. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer sleeve lined with an intumescent strip, a flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.
- B. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.
- C. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.
- D. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced intumescent elastomeric sheet bonded to galvanized-steel sheet.
- E. Intumescent Putties: Nonhardening, water-resistant, intumescent putties containing no solvents or inorganic fibers.
- F. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.
- G. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.
- H. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives. Where exposed, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed.
- I. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.
- J. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants.

2.5 MIXING

- A. Penetration Firestopping Materials: For those products requiring mixing before application, comply with penetration firestopping system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

- A. Surface Cleaning: Before installing penetration firestopping systems, clean out openings immediately to comply with manufacturer's written instructions and with the following requirements:
 - 1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping materials.
 - 2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping materials. Remove loose particles remaining from cleaning operation.
 - 3. Remove laitance and form-release agents from concrete.
- B. Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

3.3 INSTALLATION

- A. General: Install penetration and joint firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications.
- B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings.
 - 1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not forming permanent components of firestopping.
- C. Install fill materials by proven techniques to produce the following results:
 - 1. Fill voids and cavities formed by openings, forming materials, accessories and penetrating items to achieve required fire-resistance ratings.
 - 2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
 - 3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

- A. Wall Identification: Permanently label walls containing penetration firestopping systems with the words "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," using lettering not less than 3 inches (76 mm) high and with minimum 0.375-inch (9.5-mm) strokes.
1. Locate in accessible concealed floor, floor-ceiling, or attic space at 15 feet (4.57 m) from end of wall and at intervals not exceeding 30 feet (9.14 m).
- B. Penetration Identification: Identify each penetration firestopping system with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches (150 mm) of penetration firestopping system edge so labels are visible to anyone seeking to remove penetrating items or firestopping systems. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
 2. Contractor's name, address, and phone number.
 3. Designation of applicable testing and inspecting agency.
 4. Date of installation.
 5. Manufacturer's name.
 6. Installer's name.
- C. Joint Identification: Identify joint firestopping systems with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches (150 mm) of joint edge so labels are visible to anyone seeking to remove or joint firestopping system. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
1. The words "Warning - Joint Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
 2. Contractor's name, address, and phone number.
 3. Designation of applicable testing and inspecting agency.
 4. Date of installation.
 5. Manufacturer's name.
 6. Installer's name.

3.5 FIELD QUALITY CONTROL

- A. Where deficiencies are found or penetration firestopping system is damaged or removed because of testing, repair or replace penetration firestopping system to comply with requirements.
- B. Proceed with enclosing penetration firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTION

- A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping system manufacturers and that do not damage materials in which openings occur.
- B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping material and install new materials to produce systems complying with specified requirements.

END OF SECTION 07 84 13

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SECTION 07 92 00 JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
1. Silicone joint sealants.
 2. Urethane joint sealants.
 3. Latex joint sealants.
 4. Acoustical joint sealants.

1.3 ACTION SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- C. Installer's Qualifications: Provide manufacturer's letter indicating the installer meets the requirements of the "Quality Assurance" Article in this Section.

1.4 CLOSEOUT SUBMITTALS

- A. Warranty: Provide special warranties noted in "Quality Assurance" Article in this Section as part of the Operation and Maintenance Manual as specified in Section 01 78 23.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Source Limitations: Obtain each kind of joint sealant from single source from single manufacturer.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle materials in compliance with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.7 PROJECT CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F (5 deg C).
 2. When joint substrates are wet.
 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
 4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.8 WARRANTY

- A. Special Installer's Warranty: Manufacturer's standard form in which Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
1. Warranty Period: Two (2) years from date of Substantial Completion.
- B. Manufacturer's Warranty: Manufacturer's standard form in which joint-sealant manufacturer agrees to furnish joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
1. Warranty Period: Two (2) years from date of Substantial Completion.
- C. Warranties specified in this article exclude deterioration or failure of joint sealants from the following:
1. Movement of the structure caused by structural settlement or errors attributable to design or construction resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
 2. Disintegration of joint substrates from natural causes exceeding design specifications.
 3. Mechanical damage caused by individuals, tools, or other outside agents.
 4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 PRODUCTS AND MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products specified. Manufacturers' names and products are given to clarify the designer's intent and are not intended to limit selection of similar products from acceptable manufacturers.

2.2 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- B. Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
- C. Stain-Test-Response Characteristics: Where sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.
- D. Colors of Exposed Joint Sealants: As selected by COR from manufacturer's full range.

2.3 SILICONE JOINT SEALANTS

- A. (JS-1) Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 50, for Use NT.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Dow Corning Corporation; 799.
 - b. Polymeric Systems, Inc.; PSI-631.
 - c. Pecora Corporation; 898
 - d. Tremco Incorporated; Tremsil 600.

2.4 URETHANE JOINT SEALANTS

- A. (JS-2) Multicomponent, Nonsag, Urethane Joint Sealant: ASTM C 920, Type M, Grade NS, Class 50, for Use NT, M, A, and O.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Pecora Corporation; Dynatrol II.
 - b. Polymeric Systems, Inc.; PSI-270.
 - c. Tremco Incorporated; Dymeric 240.
- B. (JS-3) Multicomponent, Nonsag, Traffic-Grade, Urethane Joint Sealant: ASTM C 920, Type M, Grade NS, Class 25, for Use NT, T, M, A, and O.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. BASF Building Systems; Sonolastic NP 2.
 - b. Pecora Corporation; Dynatred.

- c. Tremco Incorporated; Vulkem 227.

2.5 LATEX JOINT SEALANTS

- A. (JS-4) Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, mildew-resistant, ASTM C 834, Type OP, Grade NF.
 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. BASF Building Systems; Sonolac.
 - b. Bostik, Inc.; Chem-Calk 600.
 - c. Pecora Corporation; AC-20+.
 - d. Schnee-Morehead, Inc.; SM 8200.
 - e. Tremco Incorporated; Tremflex 834.

2.6 ACOUSTICAL JOINT SEALANTS

- A. (JS-5) Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Pecora Corporation; AC-20 FTR.
 - b. USG Corporation; SHEETROCK Acoustical Sealant.

2.7 JOINT SEALANT BACKING

- A. General: Provide sealant backings of material that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin) Type O (open-cell material, not for horizontal applications) Type B (bicellular material with a surface skin, not for horizontal applications) or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.8 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
 - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
 - 2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
 - a. Concrete.
 - b. Masonry.
 - c. Unglazed surfaces of ceramic tile.
 - d. Exterior insulation and finish systems.
 - 3. Remove laitance and form-release agents from concrete.
 - 4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:

- a. Metal.
 - b. Glass.
 - c. Porcelain enamel.
 - d. Glazed surfaces of ceramic tile.
- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
- 1. Do not leave gaps between ends of sealant backings.
 - 2. Do not stretch, twist, puncture, or tear sealant backings.
 - 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
- 1. Place sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses in each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
- 1. Remove excess sealant from surfaces adjacent to joints.
 - 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 - 3. Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.

- F. Acoustical Sealant Installation: At sound-rated assemblies and elsewhere as indicated, seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations.

3.4 FIELD QUALITY CONTROL

- A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
1. Extent of Testing: Test completed and cured sealant joints as follows:
 - a. Perform 10 tests for the first 1000 feet (300 m) of joint length for each kind of sealant and joint substrate.
 - b. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
 2. Inspect tested joints and report on the following:
 - a. Whether sealants filled joint cavities and are free of voids.
 - b. Whether sealant dimensions and configurations comply with specified requirements.
 - c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.
 3. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.
 4. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.
- B. Evaluation of Field-Adhesion Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.5 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.6 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.7 JOINT-SEALANT SCHEDULE

- A. Joint-Sealant Application: Exterior and interior joints in horizontal traffic surfaces. (JS-3)
1. Joint Locations:
 - a. Isolation and contraction joints in cast-in-place concrete slabs.
 - b. Control joints between concrete slabs and foundation walls, or other slab penetrations.
 - c. Joints between different materials listed above.
 - d. Other joints as indicated.
 2. Urethane Joint Sealant: Multicomponent, nonsag, traffic grade, Class 25.
 3. Joint-Sealant Color: As selected by COR from manufacturer's full range of colors.
- B. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces. (JS-2)
1. Joint Locations:
 - a. Construction joints in cast-in-place concrete, non-traffic conditions.
 - b. Control and expansion joints in unit masonry.
 - c. Joints between metal panels, where indicated.
 - d. Joints at perimeter of aluminum storefront and window assemblies
 - e. Sealed joints associated with terra cotta rainscreen systems.
 - f. Joints between different materials listed above and at exterior wall penetrations through the above materials and assemblies.
 - g. Perimeter joints between materials listed above and frames of doors, windows, and louvers.
 - h. Control and expansion joints in soffits and other overhead surfaces.
 - i. Other joints as indicated.
 2. Urethane Joint Sealant: Multicomponent, nonsag, Class 50.
 3. Joint-Sealant Color: As selected by COR from manufacturer's full range of colors.
- C. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces (JS-1).
1. Joint Locations:
 - a. Control and expansion joints on exposed interior surfaces of exterior walls.

- b. Perimeter joints of exterior openings where indicated.
 - c. Tile control and expansion joints.
 - d. Vertical joints on exposed surfaces of interior unit masonry walls and partitions.
 - e. Perimeter joints between interior wall surfaces and frames of interior doors windows, and mechanical/electrical components.
 - f. Other joints as indicated.
 2. Silicone Joint Sealant: Single component, nonsag, neutral curing, Class 50.
 3. Joint-Sealant Color: As selected by COR from manufacturer's full range of colors.
- D. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces (JS-4).
 1. Joint Sealant Location:
 - a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
 - b. Other joints as indicated.
 2. Joint Sealant: Acrylic latex or siliconized acrylic latex.
 3. Joint-Sealant Color: As selected by COR from manufacturer's full range of colors.
- E. Joint-Sealant Application: Interior acoustical joints in vertical surfaces and horizontal nontraffic surfaces (JS-5).
 1. Joint Location:
 - a. Acoustical joints where indicated.
 - b. Other joints as indicated.
 2. Joint Sealant: Acoustical.
 3. Joint-Sealant Color: As selected by COR from manufacturer's full range.

END OF SECTION 07 92 00

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**SECTION 07 95 00
EXPANSION CONTROL**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
1. Wall expansion control joints

1.3 ACTION SUBMITTALS

- A. Product Data: Submit manufacturer's descriptive and technical data and illustrations, clearly marked to show specific products, materials, and compliance with requirements. Clearly indicate movement capability of cover assemblies and suitability of material used in exterior seals for ultraviolet light exposure. Include manufacturer's printed installation instructions.
- B. Shop Drawings: Submit large-scale Shop Drawings showing full extent of expansion control including layouts, changes in direction, intersections, and terminations.
- C. Samples: Submit samples showing colors for the Architect's selection.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: Furnish manufacturer's printed recommendations for the care and maintenance of expansion joint cover assemblies to the Owner with submission of O&M manuals.

1.5 QUALITY ASSURANCE

- A. Qualifications, Installer: Installer shall be experienced in the installation of expansion control devices of the types required.
- B. Regulatory Requirements:
1. Expansion control devices and their installation shall be in compliance with requirements of the applicable building code and other regulations.
 2. Fire-Rated Assemblies:
 - a. Fire-rated expansion joint cover assemblies shall be identical to those of assemblies whose cycling capability has been determined in accordance with ASTM E1399 "Standard Test Method for Cyclic Movement and Measuring the Minimum and Maximum Joint Widths of Architectural Joint Systems" and fire resistance in accordance with ANSI/UL 2079 "Tests for

Fire Resistance of Building Joint Systems" or ASTM E1966 "Standard Test Method for Fire-Resistive Joint Systems", as acceptable to the authority having jurisdiction.

- b. Provide fire-rated expansion joint cover assemblies with fire ratings not less than that of adjacent construction, and as specified.
- c. Fire barriers shall be tested in maximum joint width condition with a field splice as a component of expansion control device including hose stream testing of vertical wall assemblies at full-rated period by UL.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle materials in manufacturer's original, unopened protective packaging, clearly identified with manufacturer's name and type of product.
- B. Store materials under cover in a dry, clean, and protected location.
- C. Comply with additional requirements of the manufacturer.

1.7 JOB CONDITIONS

- A. Field Measurements: Verify dimensions in areas of installation by field measurements before fabrication and show measurements on final Shop Drawings.
- B. Coordination:
 - 1. Coordinate expansion joint cover assemblies with the Work of other trades.
 - 2. Furnish anchorages, setting drawings, templates, and instructions for installation of expansion joint cover assemblies to be embedded in concrete or have recesses formed into edges of concrete slab for later placement and grouting-in of frames.
 - 3. Coordinate installation of fire-rated expansion control device materials with related Work so complete assemblies comply with assembly performance requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Basis-of-Design: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to following:
 - 1. Basis-of-Design Manufacturer: Emseal Joint Systems, Ltd.
 - 2. Basis-of-Design Typical Product: Emshield Security Seal SSW2
 - 3. Basis-of-Design Typical Interior Exposed Floor Transition: Emseal FN 50/20.

2.2 EXPANSION CONTROL DEVICES

- A. Security Seal: UL 2-hour fire-rated seal comprised of fire-retardant-impregnated foam that is factory pre-coated on both facing sides with an intumescent fire-proofing material. Seal shall be pre-compressed and self-expanding, have plus 25 percent and minus 25

percent (50 percent total) movement capability, and have a hardened pick-, vandal-, and tamper-resistant waterproof polyurethane surface:

1. Depth: 4-inches.
- B. Associated Materials: In compliance with UL listing requirements and as follows.
1. Adhesive: Epoxy-type with primer, as recommended in writing by the manufacturer to suit job conditions.
 2. Polyurethane Sealant: Manufacturer's standard field-injected polyurethane sealant.
 3. Intumescent Sealant: Manufacturer's standard field-injected intumescent sealant.

2.3 FABRICATION

- A. Fabricate expansion control devices in accordance with the final accepted Shop Drawings and as specified.
- B. Fabricate assemblies for joint sizes indicated, in lengths to minimize field splicing, and with the capability to accommodate variations in adjacent surfaces.
- C. Make directional changes and terminations into horizontal plane surfaces by factory-manufactured universal 90-degree single units containing minimum 12-inch long leg and 6-inch long leg or custom leg on each side of the direction change or through field fabrication in accordance with the manufacturer's printed installation instructions.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Verify that conditions are satisfactory for the installation of expansion control devices.
- B. Ensure that expansion openings have been constructed to required dimensions. Ensure that there is sufficient depth to receive the full depth of the size of the expansion control devices being installed.
- C. Do not begin installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Protection:
1. Protect adjacent surfaces and finishes from damage during installation of this expansion control.
 2. Protect products from damage during field handling and installation.
- B. Surface Preparation:
1. Prepare surfaces to receive expansion in compliance with the manufacturer's printed instructions and recommendations.

- a. Repair surfaces as required to ensure they are smooth, even, and sound.
- b. Clean surfaces adjacent to and including expansion openings prior to installation.
- c. Ensure that surfaces are free of debris, oil, dirt, dust, and other foreign and deleterious materials.

3.3 INSTALLATION

A. General Requirements:

1. Install expansion control in compliance with the manufacturer's printed instructions, accepted Shop Drawings, as indicated, and as specified. Notify COR in writing where discrepancies occur that will affect proper joint installation and performance.
2. Install factory-preformed units in true alignment and proper relationship to expansion joints and adjoining finished surfaces, measured from established lines and levels.
3. Install units in continuous contact with adjacent surfaces.
4. Maintain continuity of assemblies. Hold end joints to a minimum.
5. Seal transitions and butt joints watertight using manufacturer's recommended procedures.
6. No drilling, or screwing, or fasteners of any type are permitted to anchor the sealant system into the substrate.

B. Fire-Rated Assemblies:

1. In addition to general requirements, install fire-rated assemblies in compliance with their UL listing requirements to provide continuous, uninterrupted fire resistance throughout length of joint.
2. Prime joint surfaces and adhesively install pre-compressed wall seals.
3. Apply continuous field-injected sealant bands to seal wall seals at weather-facing surfaces.
4. Seal joints between wall seals bellows edges with polyurethane sealant and with intumescent sealant on foam faces.

3.4 COMPLETION

- A. When complete, each expansion joint over assembly shall be set square, plumb, and level; accurately aligned to position intended; and securely anchored to supporting Work.
- B. Components shall be flexible as applicable and waterproof as required.
- C. Exposed surfaces shall be clean and free from scratches, dents, tool marks, stains, discoloration, or other defects or damage.

3.5 PROTECTION

- A. Protect expansion joint cover assemblies from damage and deterioration, other than normal weathering, until time of completion and acceptance by the Owner.

END OF SECTION 07 95 00

**SECTION 07 95 13
EXPANSION JOINT COVER ASSEMBLIES**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including the Solicitation and Division 00 and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes the following:
1. Architectural joint systems for building interiors.

1.3 DEFINITIONS

- A. Maximum Joint Width: Widest linear gap a joint system tolerates and in which it performs its designed function without damaging its functional capabilities.
- B. Minimum Joint Width: Narrowest linear gap a joint system tolerates and in which it performs its designed function without damaging its functional capabilities.
- C. Movement Capability: Value obtained from the difference between widest and narrowest widths of a joint.
- D. Nominal Joint Width: The width of the linear opening specified in practice and in which the joint system is installed.

1.4 ACTION SUBMITTALS

- A. Product Data: Submit copies of manufacturer's latest published literature for materials specified herein for approval and obtain approval before materials are fabricated and delivered to the site. Data to clearly indicate movement capability of cover assemblies.
- B. Shop Drawings: Provide the following for each joint system specified and obtain approval prior to fabrication and shipment of materials to the job site:
1. Placement Drawings: Include line diagrams showing plans, elevations, sections, details, splices, blockout requirement, entire route of each joint system, and attachments to other work. Where joint systems change planes, provide isometric or clearly detailed drawing depicting how components interconnect.
- C. Color Charts: Provide manufacturer's color charts showing the standard range of colors and finishes available for each exposed metal and elastomeric seal material.

1.5 CLOSEOUT SUBMITTAL

- A. Warranty: Provide special warranties noted in "Quality Assurance" Article in this Section as part of the Operation and Maintenance Manual as specified in Section 01 78 23.

1.6 QUALITY ASSURANCE

- A. Source Limitations: Obtain all architectural joint systems through one source from a single manufacturer.

1.7 WARRANTY

- A. Special Warranty: Manufacturer to provide five (5) year warranty for all joint covers.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Aluminum: ASTM B 221, Alloy 6005A-T61, 6063-T5, 6061-T5, 6105-T5 for extrusions; ASTM B 209, Alloy 60601-T6, 3003-H14, 5005-H34 for sheet and plate.
1. Apply manufacturer's standard protective coating on aluminum surfaces to be placed in contact with cementitious materials.
 2. Class II, Color Anodic Finish: AA-M12C22A32/A34 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, integrally colored or electrolytically deposited color coating 0.010 mm or thicker) complying with AAMA 611.
- B. Accessories: Manufacturer's standard anchors, clips, fasteners, set screws, spacers, and other accessories compatible with material in contact, as indicated or required for complete installations.

2.2 ARCHITECTURAL JOINT SYSTEMS, GENERAL

- A. General: Provide architectural joint systems of design, basic profile, materials, and operation indicated. Provide units with capability to accommodate variations in adjacent surfaces.
- B. Design architectural joint systems for the following size and movement characteristics:
1. Nominal Joint Width: As indicated on Drawings.

2.3 ARCHITECTURAL JOINT SYSTEMS FOR BUILDING INTERIORS

- A. Basis-of-Design Manufacturer and Products: Manufacturer's name and products are given to clarify the designer's intent and are not intended to limit selection of similar manufacturer's with similar products.
- B. Manufacturer: Construction Specialties, Inc.
- C. Products:
1. Ceiling-to-Ceiling Joint Systems:

- a. Basis-of-Design Product: model FWF
 - 1) Type: Flat seal.
 - 2) Exposed Metal: Aluminum.
 - 3) Seal Material: Santoprene.
 - 4) Color: As selected by Architect from manufacturer's standard range.

2. Wall-to-Wall Joint Systems:

- a. Basis-of-Design Product: model FWF
 - 1) Type: Flat seal.
 - 2) Exposed Metal: Aluminum.
 - 3) Seal Material: Santoprene.
 - 4) Color: As selected by Architect from manufacturer's standard range.

2.4 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces and blockouts where architectural joint systems will be installed for installation tolerances and other conditions affecting performance of work.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates according to architectural joint system manufacturer's written instructions.
- B. Coordinate and furnish anchorages, setting drawings, and instructions for installing joint systems. Provide fasteners of metal, type, and size to suit type of construction indicated and to provide for secure attachment of joint systems.

3.3 INSTALLATION

- A. Comply with manufacturer's written instructions for storing, handling, and installing architectural joint assemblies and materials unless more stringent requirements are indicated.

- B. Metal Frames: Perform cutting, drilling, and fitting required to install joint systems.
 - 1. Install in true alignment and proper relationship to joints and adjoining finished surfaces measured from established lines and levels.
 - 2. Adjust for differences between actual structural gap and nominal design gap due to ambient temperature at time of installation. Notify COR where discrepancies occur that will affect proper joint installation and performance.
 - 3. Cut and fit ends to accommodate thermal expansion and contraction of metal without buckling of frames.
 - 4. Locate in continuous contact with adjacent surfaces.
 - 5. Retain one or both of first two subparagraphs below to suit Project.
 - 6. Standard-Duty Systems: Shim to level where required. Support underside of frames continuously to prevent vertical deflection when in service.
 - 7. Locate anchors at interval recommended by manufacturer, but not less than 3 inches from each end and not more than 24 inches o.c.

3.4 CLEANING AND PROTECTION

- A. Do not remove protective covering until finish work in adjacent areas is complete. When protective covering is removed, clean exposed metal surfaces to comply with manufacturer's written instructions.

- B. Protect the installation from damage by work of other Sections. Where necessary due to heavy construction traffic, remove and properly store cover plates or seals and install temporary protection over joints. Reinstall cover plates or seals prior to Substantial Completion of the Work.

END OF SECTION 07 95 13

**SECTION 08 11 13
HOLLOW METAL DOORS AND FRAMES**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
1. Galvanized insulated hollow metal doors and frames to be used at both interior and exterior applications.
 2. Galvanized hollow metal borrow lites.
 3. Door Glazing.

1.3 ACTION SUBMITTALS

- A. Product Data: Include construction details, material descriptions, core descriptions, label compliance, fire-resistance rating, and finishes for each type of steel door and frame specified.
- B. Shop Drawings: Provide a schedule of standard steel doors and frames using same reference numbers for details and openings as those on Drawings.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver doors and frames palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturer and Product: Basis-of-Design Manufacturer's name and products are given to clarify the designer's intent and are not intended to limit selection of similar products from acceptable manufacturers.
1. Ceco Door Products.
 2. Curries.
 3. Steelcraft; an Ingersoll-Rand Company.

2.2 ALL HOLLOW-METAL DOORS AND FRAMES

- A. Construct doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Maximum-Duty Doors and Frames: SDI A250.8, Level 4.
1. Physical Performance: Level A according to SDI A250.4.
 2. Doors:
 - a. Type: As indicated in the Door and Frame Schedule.
 - b. Thickness: 1-3/4 inches (44.5 mm)
 - c. Face: Metallic-coated steel sheet, Minimum thickness of 0.067 inch (1.7 mm) – 14 gauge, with minimum A40 (ZF120) coating.
 - d. Edge Construction: Model 1, Full Flush
 - e. Core: Manufacturer's standard polystyrene, polyurethane, or polyisocyanurate insulation.
 - f. Exterior and Interior Doors: Face sheets fabricated from metallic-coated steel sheet. Provide doors complying with requirements indicated below by referencing ANSI A250.8 for level and model and ANSI A250.4 for physical-endurance level:
 - g. Thermal Performance: Provide doors fabricated with thermal resistance value of R-5.0 or greater (excluding glazing) when tested according to ASTM C1363.
 - h. Glazing: Provide GL-1 as scheduled in "Glass and Glazing" section.
 - i. Installation of Accessories:
 - 1) Accessories are to be shop installed. Provide door reinforcing as required for each installation.
 - 2) Provide all hardware, framework, sealants, etc. for complete installation of each installation.
 3. Frames:
 - a. Materials: Metallic-coated steel sheet, minimum thickness of 0.067 inch (1.7 mm) – 14 gauge with minimum A40 (ZF120 coating)
 - b. Construction: Full profile welded.
 4. Exposed Finish: Factory Primed
 5. Supports and Anchors: Fabricated from electrolytic zinc-coated or metallic-coated steel sheet.
 6. Jamb Anchors: Masonry, stud-wall, compression, or post installed expansion type; not less than 0.042 inch thick.
 7. Frame Insulation Fill: Closed cell polyurethane spray foam insulation

2.3 STOPS AND MOLDINGS

- A. Moldings for Glazed Lites in Doors: Minimum 0.032 inch thick, fabricated from same material as door face sheet in which they are installed.

2.4 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum A40 zinc-iron-alloy (galvannealed) coating designation.
- D. Frame Anchors: ASTM A 879/A 879M, Commercial Steel (CS) 04Z (12 G) coating designation, mill phosphatized.
- E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
- F. Powder-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching standard steel door frames of type indicated.
- G. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15-mil (0.4-mm) dry film thick-ness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.5 FABRICATION

- A. General: Fabricate standard steel doors and frames to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
- B. Hollow-Metal Doors:
 - 1. Steel-Stiffened Door Cores: Provide minimum thickness 0.026 inch (0.66 mm), steel vertical stiffeners of same material as face sheets extending full-door height, with vertical webs spaced not more than 6 inches (152 mm) apart. Spot weld to face sheets no more than 5 inches (127 mm) o.c. Fill spaces between stiffeners with glass- or mineral-fiber insulation.
 - 2. Vertical Edges for Single-Acting Doors: Provide beveled or square edges at manufacturer's discretion.
 - 3. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets.
 - 4. Bottom Edge Closures: Close bottom edges of doors where required for attachment of weather stripping with end closures or channels of same material as face sheets.
 - 5. Exterior Doors: Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
 - 6. Glazed Lites: Factory cut openings in doors.

C. Hollow-Metal Frames:

1. Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
3. Floor Anchors: Weld anchors to bottoms of jambs with at least four spot welds per anchor; however, for slip-on drywall frames, provide anchor clips or countersunk holes at bottoms of jambs.
4. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Masonry Type: Locate anchors not more than 16 inches (406 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c., to match coursing, and as follows:
 - 1) Three anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
 - b. Stud-Wall Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:
 - 1) Four anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
 - c. Compression Type: Not less than two anchors in each frame.
 - d. Post installed Expansion Type: Locate anchors not more than 6 inches (152 mm) from top and bottom of frame. Space anchors not more than 26 inches (660 mm) Head Anchors: Two anchors per head for frames more than 42 inches (1067 mm) wide and mounted in metal-stud partitions.
5. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
 - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.

D. Fabricate concealed stiffeners and edge channels from either cold- or hot-rolled steel sheet.

E. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.

1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.

- F. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with mitered hairline joints.
 - 1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow-metal work.

2.6 BORROWED LITES

- A. Fabricate of metallic-coated steel sheet, minimum thickness of 0.042 inch (1.0 mm).
- B. Construction: Full profile welded.
- C. Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as metal as frames.
- D. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
- E. Glazing: Provide glazing type GL-2 as scheduled in "Glass and Glazing" section.

2.7 STEEL FINISHES

- A. Factory priming:
- B. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
 - 1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.
- C. Field-Applied Paint Finish: Field paint all hollow metal doors, frames, and borrowed lites in accordance with architectural finish schedule and the painting sections in Division 09 of the specifications.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

- A. General: Provide doors and frames of sizes, thicknesses, and designs indicated. Install standard steel doors and frames plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.
- B. Remove welded-in shipping spreaders installed at factory.
- C. Hollow-Metal Frames: Install hollow frames for doors other openings, of size and profile indicated. Comply with SDI 105.
 - 1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set.
 - 2. Install frames with removable stops located on secure side of openings.
 - 3. Install door silencers in frames before filling with foam insulation.
 - 4. Solidly fill space between frames and wall construction at jambs and head with spray foam frame insulation fill.
 - 5. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
 - 6. Installation Tolerances: Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.
- D. Hollow-Metal Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.
 - 1. Between Door and Frame Jambs and Head: 1/8 inch (3.2 mm) plus or minus 1/32 inch (0.8 mm).
 - 2. At Bottom of Door: 3/4 inch (19.1 mm) plus or minus 1/32 inch (0.8 mm).
 - 3. Between Door Face and Stop: 1/16 inch (1.6 mm) to 1/8 inch (3.2 mm) plus or minus 1/32 inch (0.8 mm).

3.4 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow-metal work that is warped, bowed, or otherwise unacceptable.
- B. Remove spray-fill insulation and other bonding material from hollow-metal work immediately after installation.
- C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
- D. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION 08 11 13

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SECTION 08 16 13
FIBERGLASS REINFORCED POLYESTER (FRP) DOORS AND ALUMINUM FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Fiberglass reinforced polyester doors.
2. Aluminum frames for fiberglass reinforced polyester doors.

B. Related Sections:

1. Division 08 Section "Glass and Glazing" for glass view panels in doors.
2. Division 08 Section "Hollow Metal Doors and Frames" for hollow metal frames.
3. Division 08 Sections "Door Hardware" for door hardware.

C. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI/BHMA A156.115 - Hardware Preparation in Steel Doors and Frames.
2. ASTM B 209 - Aluminum and Aluminum-Alloy Sheet and Plate.
3. ASTM B 221 - Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
4. ASTM D 256 - Determining the Pendulum Impact Resistance of Notched Specimens of Plastics.
5. ASTM D 543 - Evaluating the Resistance of Plastics to Chemical Reagents.
6. ASTM D 1308 - Effect of Household Chemicals on Clear and Pigmented Organic Finishes.
7. ASTM D 2126 - Response of Rigid Cellular Plastics to Thermal and Humid Aging.
8. ASTM D 6670-01 - Standard Practice for Full-Scale Chamber Determination of Volatile Organic Emissions from Indoor Materials/Products.
9. ASTM E 84 - Surface Burning Characteristics of Building Materials.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, components, hardware reinforcements, profiles, and finishes.
- B. Templates: Door hardware supplier is to furnish templates, template reference number and/or physical hardware to the door and frame supplier in order to prepare the doors and frames to receive the finish hardware items.

C. Shop Drawings: Include the following:

1. Elevations of each door design.
2. Details of doors.
3. Locations of reinforcement and preparations for hardware.
4. Details of each different wall opening condition.
5. Details of accessories.
6. Details of preparations for power, signal, and control systems.

D. Samples for Verification:

1. Samples are only required by request of the architect.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain doors and frames through one source from a single manufacturer wherever possible.
- B. Pre-Installation Conference: Conduct conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier, Installer, and Contractor to review proper methods and procedures for installing doors and frames and to verify installation of electrical knockout boxes and conduit at frames with electrified or access control hardware.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver work palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use non-vented plastic.
- B. Store materials under cover at Project site in accordance with the manufacturer's instructions. Do not store in a manner that traps excess humidity.
1. Provide minimum ¼-inch (6-mm) space between each stacked door to permit air circulation. Door and frames to be stacked in a vertical upright position.

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.7 COORDINATION

- A. Coordinate installation of anchorages for door frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.8 WARRANTY

- A. Provide manufacturer's written warranty against defects in materials and workmanship upon final completion and acceptance of Work in this section. Warranty period is ten years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. CECO Door Products.
 2. Curries Company.
 3. Special-Lite.
- B. Substitutions: Material from alternate door and frame fabricators will not be accepted on jobsite without prior written and sample approval in accordance with requirements specified in Division 01.

2.2 MATERIALS

- A. Aluminum: 6063-T6 hardened aluminum alloy.
- B. Fiberglass Reinforced Plastic Sheet: Thickness of .120" with the finish color for the full thickness of the sheet.
- C. Glazing: Comply with requirements in Division 08 Section, "Glass and Glazing."

2.3 FIBERGLASS REINFORCED POLYESTER DOORS

- A. General: Provide 1¾ inch doors of type and design indicated, not less than thickness indicated; fabricated without visible joints or seams on exposed faces unless otherwise indicated.
1. Design: As indicated on the drawings.
 2. Core Construction: Five pound density foam-in-place polyurethane core.
 3. Stiles and Rails: Extruded aluminum with mitered corners. Provide 3/8" diameter tie rods top and bottom.
 4. Faces: Fiberglass reinforced plastic sheets of .120" thickness with a pebble texture.
 5. Surface Applied Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6.

2.4 ALUMINUM FRAMES

- A. General: Provide frames from extruded tube backer with an applied stop.

1. Fabricate frames with butted ends.
2. Fabricate frames with corner brackets for secure fastening.
3. Stops are to be screw applied and include gasketing.

B. Surface Applied Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6.

2.5 FABRICATION

A. General: Fabricate work to be rigid and free of defects. Accurately form to required sizes and profiles.

B. Fiberglass Reinforced Polyester Doors:

1. Glazed Lites: Factory cut openings in doors with applied flush aluminum trim kit to fit.
2. Top Caps: Close tops of doors flush with aluminum top caps.

C. Aluminum Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.

D. Surface Hardware Preparation: Factory prepare work to receive template mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section, "Door Hardware."

1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
2. Reinforce doors to receive non-template, mortised and surface-mounted door hardware.
3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of work for hardware.

2.6 FINISHES

A. FRP Door finish shall be:

1. Light Gray.

B. Aluminum finish for stiles and rails, light kits, and door frames shall be:

1. Satin Clear.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prior to installation, check openings for squareness, alignment, twist, and plumbness.
- B. Drill and tap doors and frames to receive non-template, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

- A. General: Install work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.
- B. Aluminum Frames: Install aluminum frames of size and profile indicated.
1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. Shim as necessary to comply with installation tolerances.
 2. Floor Anchors: Provide floor anchors for each jamb, and secure with post-installed expansion anchors.
 3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with appropriate mortar.
- C. Fiberglass Reinforced Polyester Doors: Fit doors accurately in frames, within clearances specified below. Shim as necessary.
1. Non-Fire-Rated Doors:
 - a. Jamb and Head: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
 - b. Between Edges of Pairs of Doors: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
 - c. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch (19 mm).
- D. Glazing: Comply with installation requirements in Division 08 Section "Glass and Glazing" and with door manufacturer's written instructions.

3.4 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including stainless steel work that is warped, bowed, or otherwise unacceptable.
- B. Remove grout and other bonding material from stainless steel work immediately after installation.

- C. Remove stains and materials that will have an adverse affect on the doors and frames and restore slight blemishes in accordance with manufacturer's instructions to match original finish.

END OF SECTION 08 16 13

**SECTION 08 31 13
ACCESS DOORS AND FRAMES**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes:

1. Access doors and frames for walls and ceilings.
 - a. Non-Rated Flush Access Doors and Frames with Exposed Trim

1.3 ACTION SUBMITTALS

- A. General: Provide action submittals for all items in this specification section for review within a single submittal to the Architect.
- B. Product Data: For each type of access door and frame indicated.
- C. Schedule: Types, locations, sizes, latching or locking provisions, and other data pertinent to installation.

1.4 COORDINATION

- A. Verification: Determine specific locations and sizes for access doors needed to gain access to concealed plumbing, mechanical, or other concealed work, and indicate in the schedule specified in "Submittals" Article.

PART 2 - PRODUCTS

2.1 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

- A. Manufacturers and Products

1. Subject to compliance with requirements, available manufacturers and products that may be incorporated into the Work include, but are not limited to following:

Manufacturer	Framed Access Door Product Number
J. L. Industries, Inc.	Model TM
Karp Assoc., Inc.	Model DSC-214M
Larsen's Mfg Co.	Model L-MPG

- B. Flush Access Doors and Frames with Exposed Trim: Fabricated from steel sheet.
1. Locations: Non-fire rated flush access doors for all surfaces
 2. Door: Minimum 16-gauge thick sheet metal, insulated.
 3. Frame: Minimum 16-gauge thick sheet metal with 1-inch- (25-mm-) wide, surface-mounted trim.
 4. Hinges: Manufacturer's standard
 5. Latch(es): Screwdriver operated latch

2.2 FABRICATION

- A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.
- B. Metal Surfaces: For metal surfaces exposed to view, provide materials with smooth, flat surfaces without blemishes.
- C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.
- D. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.

2.3 STEEL FINISHES

- A. Factory priming: Manufacturer's standard.
- B. Field-Applied Paint Finish: Field paint all access panel doors and frames in accordance with architectural finish schedule and the painting sections in Division 09 of the specifications.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with manufacturer's written instructions for installing access doors and frames.
- B. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.2 ADJUSTING AND CLEANING

- A. Adjust doors and hardware after installation for proper operation.
- B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.
- C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying primer prior to field painting of finish coat(s).

END OF SECTION 08 31 13

**SECTION 08 33 26
OVERHEAD RAPID COILING DOORS**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
1. High-speed roll-up doors.
 2. Wiring from electric circuit disconnect to operator to control station.

1.3 REFERENCES

- A. NEMA: National Electrical Manufacturers Association.
- B. LED: Light Emitting Diode.

1.4 SYSTEM DESCRIPTION

- A. Motor Type: AC drive, and variable speed with soft acceleration and braking. Mechanical release lever on side column allows door to be easily opened in the event of a power failure.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type and size of overhead rapid coiling door and accessory. Include the following:
1. Construction details, material descriptions, dimensions of individual components, profile door sections, and finishes.
 2. Rated capacities, operating characteristics, electrical characteristics, and furnished accessories.
- B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.
1. Include plans, elevations, sections, details, and attachments to other work.
 2. Included detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
- C. Wiring Diagrams: For power, signal, and control wiring.

- D. Color Charts for Initial Selection: Manufacturer's finish charts showing full range of standard colors and textures available for units with factory-applied finishes for selection by Architect.
- E. Delegated-Design Submittal: Manufacturer of overhead coiling doors indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- F. Qualification Data: For qualified Installer provide manufacturer's letter of approval.

1.6 MAINTENANCE DATA

- A. Scheduled maintenance program available to include lubrication requirements and frequency, periodic adjustments required, scheduled maintenance suggested, manufacturer's data sheets, and equipment inter-connection diagrams.

1.7 REGULATORY REQUIREMENTS

- A. Electrical components UL listed.
- B. Electrical control panel NEMA approved.

1.8 QUALITY ASSURANCE

- A. Furnish high-speed roll doors and all components and accessories by one manufacturer.
- B. Specific door model used must have a proven track record of successful installations in similar applications of no less than three (3) years. References to be provided upon request.
- C. Delegated Design: Design sectional doors, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

1.9 FIELD MEASUREMENTS

- A. Verify field measurements are as indicated on shop drawings.

1.10 COORDINATION

- A. Coordinate the work with installation of electric power and locations and sizes of conduit.

1.11 WARRANTY

- A. Five-year limited warranty on mechanical components, including motor assembly
- B. Two (2) year limited warranty on electrical components
- C. Two (2) year limited warranty on standard door panels, rollers, hinges and door tracks
- D. Seven-year limited warranty on LEXAN™ sheets against breaks, coating failure, excessive increased haze, excessive yellowing or loss of light transmission

PART 2 - PRODUCTS

2.1 PRODUCTS

A. Exterior Coiling Doors: Aluminum slat frames - Rytec Spiral FV Door.

1. Door Panel:
 - a. Aluminum slat frames with 9" high clear polycarbonate windows.
 - b. Slat cavity filled with CFC-free foamed-in-place, polyurethane insulation.
 - 1) R-Value: 7.7, U-Value: 0.13.
 - c. Nominal Slat Size: Varies, use manufacturer's standard for door height.
 - d. Weather Seal: Integral rubber between each panel.
2. Weatherseals:
 - a. Vinyl bottom seal, exterior guide and internal hood seals.
 - b. Interior guide weatherseal.
 - c. Lintel weatherseal.
3. Spiral Door:
 - a. Provide clear vision slats: Number and location as shown on the drawings.
4. Side Frames: Galvanized steel side frames with full height weather seal on both sides to seal against door panel.
5. Bottom Bar: Extruded aluminum bottom bar with electric reversing edge. Door reverses direction upon contact with any object.
 - a. Provide dual thru-beam photo-eye – horizontal and diagonal. Coordinate mounting requirements with Owner.
6. Counterbalance: Manufacturer's recommended number of extension springs in each side column. Mechanical release lever on side column allowing door to be operated in a power failure. No exterior mounted coil cord.
7. Drive System: 2 HP, 480 Volt, three phase motor with variable speed AC drive to allow soft acceleration and braking.
8. Travel Speed: Open - 60 inches per second. Close - 30 inches per second.
9. Electrical Controls: AC drive system with self-diagnostic capability and pre-programmed menu options housed in a NEMA 4 electrical enclosure with vision window. Include cycle counter and 2-digit display and self-adjusting limit switches. Control Panel to be fully assembled, wired and tested at factory.
10. Manufacturer's standard factory finish on all components.
 - a. Capable of withstanding positive and negative wind loads of 14 psf without undue deflection or damage to components.
 - b. Hood Enclosure: Manufacturer's standard; primed steel.

2.2 MATERIALS

- A. Curtain Construction: Interlocking slats.
 - 1. Slat Ends: Alternate slats fitted with end locks to act as wearing surface in guides and to prevent lateral movement.
 - 2. Curtain Bottom: Fitted with angles to provide reinforcement and positive contact in closed position.
 - 3. Weatherstripping: Moisture and rot proof, resilient type, located at jamb edges, bottom of curtain, and where curtain enters hood enclosure of exterior doors.
- B. Aluminum Slats: ASTM 82.21 (ASTM B221M), aluminum alloy Type 6063, minimum thickness double slat 1¾ inch.
- C. Glazing: Manufacturer's standard polycarbonate view panels.
- D. Guide Construction: Continuous, of profile to retain door in place with snap-on trim, mounting brackets of same metal.
- E. Hood Enclosure: Internally reinforced to maintain rigidity and shape.
- F. Roller Shaft Counterbalance: Steel pipe and helical steel spring system, capable of producing torque sufficient to ensure smooth operation of curtain from any position and capable of holding position at mid-travel; with adjustable spring tension; requiring 25 lb (10 kg) nominal force to operate.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that opening sizes, tolerances, and conditions are acceptable.

3.2 INSTALLATION

- A. Install door unit assembly in accordance with manufacturer's instructions.
- B. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.
- C. Securely and rigidly brace components suspended from structure. Secure guides to structural members only.
- D. Fit and align assembly including hardware; level and plumb, to provide smooth operation.
- E. Complete wiring from disconnect to unit components.

3.3 TOLERANCES

- A. Maintain dimensional tolerances and alignment with adjacent work.

- B. Maximum Variation from Plumb: 1/16 inch (1.5 mm).
- C. Maximum Variation from Level: 1/16 inch (1.5 mm).
- D. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch per 10ft (3 mm per 3m) straight edge.

3.4 ADJUSTING

- A. Adjust operating assemblies for smooth and noiseless operation.

3.5 CLEANING

- A. Clean installed components.
- B. Remove labels and visible markings.

END OF SECTION 08 33 26

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**SECTION 08 45 23.01
FIBERGLASS-SANDWICH-PANEL WALL ASSEMBLIES**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

1. Assemblies incorporating fiberglass sandwich panels to be incorporated as window assemblies.
 - a. Assemblies will be installed in the exterior walls of wet and damp areas such as vehicle wash bays.

1.3 PERFORMANCE REQUIREMENTS

- A. Provide assemblies, including anchorage, capable of withstanding, without failure, the effects of the following:

1. Structural loads.
2. Thermal movements.
3. Movements of supporting structure.
4. Dimensional tolerances of building frame and other adjacent construction.

- B. Failure includes the following:

1. Deflection exceeding specified limits.
2. Water leakage.
3. Thermal stresses transferred to building structure.
4. Noise or vibration created by wind and thermal and structural movements.
5. Loosening or weakening of fasteners, attachments, and other components.
6. Delamination of fiberglass-sandwich-panel faces from panel cores.

- C. Structural Loads:

1. Window/wall system:
 - a. Wind Loads: As indicated by structural design data on Drawings.
 - b. Basic Wind Speed: 90 mph (40 m/s).
 - c. Importance Factor: 1.15.
 - d. Exposure Category: C.

- D. Deflection of Assemblies:

1. Vertical Assemblies: Limited to L/60 of clear span for each assembly component.

2. Overhead Assemblies: Limited to 1/180 of clear span for each assembly component.
- E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

1.4 PERFORMANCE TESTING

- A. Provide assemblies that comply with test-performance requirements indicated, as evidenced by reports of tests performed on manufacturer's standard assemblies by a qualified independent testing agency.
1. Structural-performance preloading (ASTM E 330).
 2. Air infiltration (ASTM E 283).
 3. Water penetration under static pressure (ASTM E 331).
 4. Water penetration under dynamic pressure (AAMA 501.1).
 5. Water penetration, wind-driven rain (ICBO ES AC07).
 6. Structural performance at design load (ASTM E 330).
 7. Repeat air filtration (ASTM E 283).
 8. Repeat water penetration under static pressure (ASTM E 331).
 9. Structural performance at specified maximum test load (ASTM E 330).
- B. Structural-Performance Test: ASTM E 330.
1. Performance at Design Load: When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
 2. Performance at Maximum Test Load: When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main supporting members exceeding 0.2 percent of span.
 3. Test Durations: As required by design wind velocity but not less than 10 seconds.
- C. Air-Infiltration Test: ASTM E 283.
1. Minimum Static-Air-Pressure Difference: 6.24 lbf/sq. ft. (300 Pa).
 2. Maximum Air Leakage: 0.30 cfm/sq. ft. (1.50 L/s per sq. m).
- D. Test for Water Penetration under Static Pressure: ASTM E 331.
1. Minimum Static-Air-Pressure Difference: 20 percent of positive wind-load design pressure, but not less than 10 lbf/sq. ft. (479 Pa).
 2. Water Leakage: None.
- E. Test for Water Penetration under Dynamic Pressure: AAMA 501.1.

1. Dynamic Pressure: 20 percent of positive wind-load design pressure, but not less than 15 lbf/sq. ft. (718 Pa.).
2. Water Leakage: None, as defined by AAMA 501.1. Water controlled by flashing and gutters that is drained to exterior and cannot damage adjacent materials or finishes is not considered water leakage.

1.5 ACTION SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for assemblies.
- B. Shop Drawings: For assemblies. Include plans, elevations, sections, details, and attachments to other work.
 1. Include details of provisions for assembly expansion and contraction, and for draining moisture within the assembly to the exterior.
- C. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.
- D. Fabrication Sample: Of each frame system intersection of assemblies, made from 12-inch (300-mm) lengths of full-size components and showing details of the following:
 1. Joinery.
 2. Anchorage.
 3. Expansion provisions.
 4. Fiberglass sandwich panels.
 5. Flashing and drainage.
- E. Delegated Design Submittal: For panel assemblies indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.6 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for assemblies. Test reports shall include the following:
 1. Flame Spread and Smoke Developed (ASTM E-84 by UL 723).
 2. Burn Extent (ASTM D-635).
 3. Color Difference (ASTM D-2244).
 4. Impact Strength (UL 972).
 5. Tensile Bond Strength (ASTM C-297 after aging by ASTM D-1037).
 6. Shear Bond Strength (ASTM D-1002 after 5 different aging conditions).
 7. Beam Bending Strength (ASTM E-72).
 8. Insulation "U" Factor (by NFRC 100)
 9. Solar-Heat-Gain Coefficient (NFRC).
 10. Condensation Resistance Factor (AAMA 1503).
 11. Class A Roof Covering Burning Brand (ASTM E-108).
 12. Light Transmission (NFRC 202).

- B. Preconstruction Testing Program: For assemblies, developed specifically for Project. Include plans, elevations, sections, and details of laboratory mockup.
- C. Preconstruction Test Reports: For assemblies.
- D. Field quality-control test reports.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance data.
- B. Manufacturer's signed warranty in compliance with "Warranty" article of this this specification section.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: Entity capable of assuming engineering responsibility, including preparation of Shop Drawings, and performing work of this Section and who is acceptable to manufacturer.
 - 1. Erection shall be by an installer that has been in the business of erecting specified materials for at least five (5) consecutive years; and can show evidence of satisfactory completion of projects of similar size, scope and type.
- B. Manufacturer Qualifications: For fiberglass sandwich panels, a qualified manufacturer whose facilities, processes, and products are monitored by an independent, accredited quality-control agency for compliance with applicable requirements in ICBO ES AC04, "Sandwich Panels," Or ICC-ES AC177, "Translucent Fiberglass Reinforced Plastic (FRP) Faced Panel Wall, Roof and Skylight Systems."
- C. Product Options: Information on Drawings and in Specifications establishes requirements for assemblies' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including testing conducted by an independent testing agency and in- service performance.
 - 1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.
- D. NFRC Certification: Provide fiberglass sandwich panels that are certified for U-factors indicated according to NFRC 100 and listed in its "National Fenestration Council Incorporated - Certified Products Directory."

1.9 PROJECT CONDITIONS

- A. Field Measurements: Verify Fiberglass Sandwich Panel openings and system support by field measuring before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measuring cannot be made without delaying the work, establish opening and spanning dimensions, and proceed with fabricating panels and frames without field measuring. Coordinate construction to ensure that actual dimensions correspond to establish dimensions.
2. Review, discuss and coordinate the interrelationship of fiberglass sandwich panels with aluminum curtainwall or storefront systems to receive panel and other wall finish details, include provisions for structural anchorage, glazing, flashing, weeping, sealants, edge finish, and protection of finishes.
3. Review and discuss sequence of work required to construct a watertight and weathertight exterior building envelope.
4. Inspect and discuss the condition of supporting structure, substrates and other preparatory work performed by other trades.

1.10 WARRANTY

- A. Special Assembly Warranty: Manufacturer's standard form in which manufacturer and Installer agree to repair or replace components of assemblies that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
 - a. Structural failures including, but not limited to, excessive deflection.
 - b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - c. Water leakage.
 - d. Air Infiltration
 - e. Condensation
 2. Warranty Period: Five years from date of Substantial Completion.
- B. Special Fiberglass-Sandwich-Panel Warranty: Manufacturer's standard form in which manufacturer agrees to replace panels that exhibit defects in materials or workmanship.
1. Defects include, but are not limited to, the following:
 - a. Fiberbloom.
 - b. Delamination of coating, if any, from exterior face sheet.
 - c. Discoloration of exterior face sheet of more than 8.0 units Delta E when measured according ASTM D 2244.
 - d. Delamination of panel face sheets from panel cores.
 2. Warranty Period: Five years from date of Substantial Completion.
- C. Special Aluminum-Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes fail within specified warranty period. Warranty does not include normal weathering.
1. Failures include, but are not limited to, checking, crazing, peeling, chalking, and fading of finishes.
 2. Warranty Period: Ten (10) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide products manufactured by the Kalwall Corporation.

2.2 FIBERGLASS SANDWICH PANELS

- A. Panel Construction: Assembly of uniformly colored, translucent, thermoset, fiberglass-reinforced-polymer face sheets bonded to both sides of a grid core and complying with requirements applicable to panel materials in ICBO ES AC04, "Sandwich Panels."
1. Face-Sheet, Self-Ignition Temperature: 650 deg F (343 deg C) or more per ASTM D 1929.
 2. Face-Sheet Burning Extent: 1 inch (25 mm) or less per ASTM D 635.
 3. Face-Sheet, Smoke-Developed Index: 250 or less per ASTM E 84.
 4. Flame-Spread Index: Not more than 50 per ASTM E 84.
 5. Combustibility Classification: Class CC1 per ASTM D 635.
 6. Interior Finish Classification: Class A per ASTM E 84.
- B. Panel Thickness: 2¾ inches (70 mm).
- C. Panel U-Factor: Not more than 0.23 (1.31), measured in Btu/sq. ft. x h x deg F (W/sq. m x K) according to NFRC 100 or ASTM C 1363 using procedures described in ASTM C 1199 and ASTM E 1423.
- D. Panel Strength Characteristics:
1. Maximum Panel Deflection: 1-7/8 inches (48 mm) when a 4-by-12-foot (1.2-by-3.6-m) panel is tested according to ASTM E 72 at 34 lbf/ sq. ft. (1.6 kPa), with a maximum 0.090-inch (2.3-mm) set deflection after 5 minutes.
 2. Panel Support Strength: Capable of supporting, without failure, a 300-lbf (1334 N) concentrated load when applied to a 3-inch- (76-mm-) diameter disk according to ASTM E 661.
- E. Grid Core: Thermally broken I-beam grid core shall be of 6063-T6 or 6005-T5 alloy and temper with provisions for mechanical interlocking of muntin-mullion and perimeter. Width of I-beam shall be no less than 7/16". Mechanically interlocked extruded-aluminum I-beams, with a minimum flange width of 7/16 inch (11.1 mm).
1. Extruded Aluminum: ASTM B 221 (ASTM B 221M), in alloy and temper recommended in writing by manufacturer.
 2. I-Beam Construction: Thermally broken; two separate extruded-aluminum components permanently bonded by a minimum 1" thermoset fiberglass composite.
 3. Grid Pattern: Shoji, 12" x 24".
- F. Exterior Face Sheet:
1. Thickness: 0.070 inches (1.778 mm).

2. Color Stability: Not more than 3.0 units Delta E when measured according to ASTM D 2244 after outdoor weathering in southern Florida according to procedures in ASTM D 1435 with panels mounted facing south and as follows:
 - a. Panel Mounting Angle: Not more than 5 degrees from horizontal.
 - b. Exposure Period: 60 months.
 3. Erosion Protection: Integral, embedded glass erosion barrier.
 4. Impact Resistance: No fracture or tear at impact of 60 ft. x lbf (81 J) by a 3¼-inch- (83-mm-) diameter, 5-lb (2.3-kg) free-falling ball according to test procedure in UL 972.
- G. Interior Face Sheet:
1. Thickness: 0.045 inch (1.143 mm).
- H. Color and Additional Materials
1. Type **FGP-1**:
 - a. Interior Face Sheet: White
 - b. Exterior Face Sheet: Crystal
 - c. SHGC: .31.
 - d. U Factor: .23
 - e. Light Transmittance: 26%
- I. Fiberglass-Sandwich-Panel Adhesive: ASTM D 2559.
1. Compatible with facing and core materials.
 2. Adhesive shall pass testing requirements specified by the International Conference of Building Officials "Acceptance Criteria for Sandwich Panel Adhesive."
 3. Minimum strength shall be 750 PSI tensile Strength by ASTM C-297 after two (2) exposures to six (6) cycles of each of the aging conditions prescribed by ASTM D-1037.
 4. Shear strength by ASTM D-1002 minimum after exposures to five (5) separate aging components:
 - a. 50% Relative Humidity at 73oF: 540 PSI.
 - b. 1820 F: 100 PSI.
 - c. Accelerated Aging by ASTM D-1037 at room temperature: 800 PSI.
 - d. Accelerated Aging by ASTM D-1037 at 182o F: 250 PSI.
 - e. 500 Hour Oxygen Bomb by ASTM D-572: 1400 PSI.
- J. Panel Fabrication: Factory assemble and seal panels.
1. Laminate face sheets to grid core under a controlled process using heat and pressure to produce straight adhesive bonding lines that cover width of core members and that have sharp edges.

- a. White spots indicating lack of bond at intersections of grid-core members are limited in number to 4 for every 40 sq. ft. (3.7 sq. m) of panel and limited in diameter to 3/64 inch (1.2 mm).
2. Fabricate with grid pattern that is symmetrical about centerlines of each panel.
3. Fabricate panel to allow condensation within panel to escape.
4. Reinforce panel corners.
5. Internal aluminum flashing tabs to be installed at all areas where two aluminum perimeters and or battens meet.
6. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2604 and containing not less than 50 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. All interior and exterior surfaces of aluminum extrusions must be painted to prevent corrosion from incidental contact with salt spray.
 - b. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General:
 1. Comply with manufacturer's written instructions.
 2. Do not install damaged components.
 3. Fit joints between aluminum components to produce hairline joints free of burrs and distortion.
 4. Rigidly secure nonmovement joints.
 5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
 6. Seal joints watertight, unless otherwise indicated.
- B. Metal Protection: Where aluminum components will contact dissimilar materials, protect against galvanic action by painting contact surfaces with bituminous paint or by installing nonconductive spacers as recommended in writing by manufacturer for this purpose.
- C. Install continuous aluminum sill closure with weatherproof expansion joints and locked and sealed or welded corners. Locate weep holes at rafters.
- D. Install components to drain water passing joints, condensation occurring within aluminum members and panels, and moisture migrating within assembly to exterior.

- E. Install components plumb and true in alignment with established lines and elevations.
- F. Erection Tolerances: Install assemblies to comply with the following maximum tolerances:
 - 1. Alignment: Limit offset from true alignment to 1/32 inch (0.8 mm) where surfaces abut in line, edge to edge, at corners, or where a reveal or protruding element separates aligned surfaces by less than 3 inches (76 mm); otherwise, limit offset to 1/8 inch (3.2 mm).
 - 2. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet (3.2 mm in 3.7 m); 1/2 inch (13 mm) over total length.

3.3 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name, manufacturer, and location of installation.
- B. Storage: Store products above the floor and under cover in a clean, dry area until ready for installation.
- C. Handling: Protect materials and finishes from damage during handling and installation.

3.4 SEQUENCING

- A. Ensure that locating templates and other information required for installation of products of this section are furnished to affected trades in time to prevent interruption of construction progress.
- B. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

3.5 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.

END OF SECTION 08 45 23.13

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**SECTION 08 45 23.23
FIBERGLASS-SANDWICH-PANEL SKYLIGHT ASSEMBLIES**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes:

1. Prefabricated fiberglass-sandwich-panel center-ridge skylight on existing roof curb.
 - a. Flat factory prefabricated structural insulated translucent sandwich panels; with glazed endwalls.
 - b. Aluminum installation system.
 - c. Aluminum flashing.

1.3 ACTION SUBMITTALS

- A. Product Data: Submit manufacturer's product data. Include construction details, material descriptions, profiles and finishes of components.
- B. Shop Drawings: Submit shop drawings. Include elevations and details.
- C. Color Charts: Submit manufacturer's color charts showing the full range of colors available for factory finished aluminum.
- D. Samples: Submit samples for each exposed finish required, in same thickness and material indicated for the work and in size indicated below. If finishes involve normal color variations, include sample sets consisting of two or more units showing the full range of variations expected.
 1. Sandwich panels: 14-inch x 28-inch units.
 2. Factory finished aluminum: 5 inch long sections.
- E. Certificates: Submit Installer Certificate, signed by installer, certifying compliance with project qualification requirements.
- F. Product Reports: Submit product reports from a qualified independent testing agency indicating each type and class of panel system complies with the project performance requirements, based on comprehensive testing of current products. Previously completed reports will be acceptable if for current manufacturer and indicative of products used on this project
 1. Reports required are:

- a. International Building Code Evaluation Report.
- b. Flame Spread and Smoke Developed (UL 723) - Submit UL Card.
- c. Burn Extent (ASTM D 635).
- d. Color Difference (ASTM D 2244).
- e. Impact Strength (UL 972).
- f. Bond Tensile Strength (ASTM C 297 after aging by ASTM D 1037).
- g. Bond Shear Strength (ASTM D 1002).
- h. Beam Bending Strength (ASTM E 72).
- i. Fall Through Resistance (ASTM E 661).
- j. Insulation U-Factor (NFRC 100).
- k. NFRC System U-Factor Certification (NFRC 700).
- l. Solar Heat Gain Coefficient (NFRC or Calculations)
- m. Condensation Resistance Factor (AAMA 1503).
- n. Air Leakage (ASTM E 283).
- o. Structural Performance (ASTM E 330).
- p. Water Penetration (ASTM E 331).
- q. Class A Roof Covering Burning Brand (ASTM E 108).
- r. Daylight Autonomy.

1.4 QUALITY ASSURANCE

A. Manufacturer's Qualifications:

1. Material and products shall be manufactured by a company continuously and regularly employed in the manufacture of specified materials for a period of at least ten consecutive years and which can show evidence of those materials being satisfactorily used on at least six projects of similar size, scope and location. At least three of the projects shall have been in successful use for 10 years or longer.
2. Panel system must be listed by an ANSI accredited Evaluation Service, which requires quality control inspections and fire, structural and water infiltration testing of sandwich panel systems by 14.14.001 SLOPED TRANSLUCENT METAL SKYLIGHT SYSTEM 084523-2 an accredited agency
3. Quality control inspections shall be conducted at least once each year and shall include manufacturing facilities, sandwich panel components and production sandwich panels for conformance with AC 177 "Translucent Fiberglass Reinforced Plastic (FRP) Faced Panel Wall, Roof and Skylight Systems" as issued by the ICC-ES.

B. Installer's Qualifications: Installation shall be by an experienced installer, which has been in the business of installing specified panel systems for at least two consecutive years and can show evidence of satisfactory completion of projects of similar size, scope and type.

1.5 PERFORMANCE REQUIREMENTS

A. The manufacturer shall be responsible for the configuration and fabrication of the complete panel system.

1. When requested, include structural analysis data signed and sealed by the qualified professional engineer responsible for its preparation.

2. Standard panel system shall have less than 0.01 cfM/ft² air leakage by ASTM E 283 at 6.24 PSF (50 mph) and no water penetration by ASTM E 331 at 15 PSF; and structural testing by ASTM E 330.
3. Structural Loads: Provide skylight system capable of handling the following loads, with L/ 60 deflection:
 - a. 20 PSF live load.
 - b. 25 PSF snow load.
 - c. 15 PSF wind load.
 - d. 0 PSF drift load.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver panel system, components and materials in manufacturer's standard protective packaging.
- B. Store panels on the long edge; several inches above the ground, blocked and under cover in accordance with manufacturer's storage and handling instructions.

1.7 WARRANTY

- A. Submit manufacturer's and installer's written warranty agreeing to repair or replace panel system work, which fails in materials or workmanship within 5 years of the date of delivery. Failure of materials or workmanship shall include leakage, excessive deflection, deterioration of finish on metal in excess of normal weathering and defects in accessories, insulated translucent sandwich panels and other components of the work.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Basis-of-Design Manufacturer name and products are given to clarify the designer's intent and are not intended to limit selection of similar products from acceptable manufacturers.
 1. Manufacturer: Kalwall Corporation
 2. Product: 2³/₄" Pre-engineered translucent center ridge skylight system.

2.2 PANEL COMPONENTS

- A. Face Sheets:
 1. Translucent faces: Manufactured from glass fiber reinforced thermoset resins, formulated specifically for architectural use. a. Thermoplastic (e.g. polycarbonate, acrylic) faces are not acceptable. b. Face sheets shall not deform, deflect or drip when subjected to fire or flame.
 2. Interior face sheets:
 - a. Flame spread: Underwriters Laboratories (UL) listed, which requires periodic unannounced retesting, with flame spread rating no greater than

50 and smoke developed no greater than 250 when tested in accordance with UL 723.

b. Burn extent by ASTM D 635 shall be no greater than 1 inch.

3. Exterior face sheets:

a. Color stability: Full thickness of the exterior face sheet shall not change color more than 3 CIE Units DELTA E by ASTM D 2244 after 5 years outdoor South Florida weathering at 5 degrees facing south, determined by the average of at least three white samples with and without a protective film or coating to ensure long-term color stability. Color stability shall be unaffected by abrasion or scratching.

b. Strength: Exterior face sheet shall be uniform in strength, impenetrable by hand held pencil and repel an impact minimum of 70 ft. lbs. without fracture or tear when impacted by a 3-1/4- inch diameter, 5 lb. free-falling ball per UL 972.

4. Appearance:

a. Exterior face sheets: Smooth 0.070 inch thick and super-weathering Crystal in color.

b. Interior face sheets: Smooth 0.045 inch thick and Crystal S-171 in color.

c. Face sheets shall not vary more than $\pm 10\%$ in thickness and be uniform in color.

B. Grid Core:

1. Thermally broken I-beam grid core shall be of 6063-T6 or 6005-T5 alloy and temper with provisions for mechanical interlocking of muntin-mullion and perimeter. Width of I-beam shall be no less than 7/16 inch

2. I-beam thermal break: Minimum 1 inch, thermoset fiberglass composite.

C. Laminate Adhesive:

1. Heat and pressure resin type adhesive engineered for structural sandwich panel use, with minimum 25-years field use. Adhesive shall pass testing requirements specified by the International Code Council "Acceptance Criteria for Sandwich Panel Adhesives".

2. Minimum tensile strength of 750 PSI when the panel assembly is tested by ASTM C 297 after two exposures to six cycles each of the aging conditions prescribed by ASTM D 1037.

3. Minimum shear strength of the panel adhesive by ASTM D 1002 after exposure to four separate conditions:

a. 50% Relative Humidity at 680 F: 540 PSI.

b. 1820 F: 100 PSI.

c. Accelerated Aging by ASTM D 1037 at room temperature: 800 PSI.

d. Accelerated Aging by ASTM D 1037 at 1820 F: 250 PSI.

2.3 PANEL CONSTRUCTION

- A. Provide sandwich panels of flat fiberglass reinforced translucent face sheets laminated to a grid core of mechanically interlocking I-beams. The adhesive bonding line shall be straight, cover the entire width of the I-beam and have a neat, sharp edge.
1. Thickness: 2¾ inches.
 2. Light transmission: 35%.
 3. Solar heat gain coefficient: 0.36.
 4. Panel U-factor by NFRC certified laboratory: 2-3/4-inch thermally broken grid 0.23 "U".
 5. Complete insulated panel system shall have NFRC certified U-factor of 0.28 "U".
 6. Grid pattern: Nominal size 12-inch x 24-inch shoji grid pattern.
- B. Standard panels shall deflect no more than 1.9 inches at 30 PSF in 10 foot span without a supporting frame by ASTM E 72.
- C. Standard panels shall withstand 1200 degree F fire for minimum one hour without collapse or exterior flaming.
- D. Thermally broken panels: Minimum Condensation Resistance Factor of 80 by AAMA 1503 measured on the bond line.
- E. Skylight System:
1. System shall pass Class A Roof Burning Brand Test by ASTM E 108.
 2. System shall meet the fall through requirements of OSHA 1910.23 as demonstrated by testing in accordance with ASTM E 661, thereby not requiring supplemental screens or railings.

2.4 BATTENS AND PERIMETER CLOSURE SYSTEM

- A. Closure System:
1. Extruded aluminum 6063-T6 and 6063-T5 alloy and temper clamp-tite screw type closure system.
 2. Skylight perimeter closures at curbs shall be factory sealed to panels.
- B. Sealing tape: Manufacturer's standard, pre-applied to closure system at the factory under controlled conditions.
- C. Fasteners: 300 series stainless steel screws for aluminum closures, excluding final fasteners to the building.
- D. Internal aluminum flashing tabs to be installed at all areas where two aluminum perimeters and or battens meet.
- E. Finish: Manufacturer's factory applied finish, which meets the performance requirements of AAMA 2604. Color to be selected by the Architect from manufacturer's full range of standard colors. All interior and exterior surfaces of aluminum extrusions must be painted to prevent corrosion from incidental contact with salt spray.

2.5 STRUCTURAL SUPPORT

- A. Center Ridge Skylight: Self-supporting Center Ridge Skylights outside curb dimension span shall have concealed support integral with the installation system with exposed gussets at ridge. Aluminum curb cap extrusions and flashing shall be supplied by the skylight manufacturer.
- B. The skylight manufacturer shall provide integral gabled translucent panel endwalls at exposed ends of skylight assembly.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, supporting structure and installation conditions.
- B. Do not proceed with panel installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Metal Protection:
 - 1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.
 - 2. Where aluminum will contact concrete, masonry or pressure treated wood, protect against corrosion by painting contact surfaces with bituminous paint or method recommended by manufacturer.

3.3 INSTALLATION

- A. Install the panel system in accordance with the manufacturer's installation recommendations and approved shop drawings.
 - 1. Anchor component parts securely in place by permanent mechanical attachment system.
 - 2. Accommodate thermal and mechanical movements.
 - 3. Set perimeter framing in a full bed of sealant compound, or with joint fillers or gaskets to provide weather-tight construction.
- B. Install joint sealants at perimeter joints and within the panel system in accordance with manufacturer's installation instructions.

3.4 FIELD QUALITY CONTROL

- A. Water Test: Test skylight system according to procedures in AAMA 501.2.
- B. Repair or replace work that does not pass testing or that is damaged by testing and retest the work.

3.5 CLEANING

- A. Clean the panel system inside and outside, immediately after installation.
- B. Comply with manufacturer's written recommendations.

END OF SECTION 08 45 23.23

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**SECTION 08 71 00
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. 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 08 Section "Hollow Metal Doors and Frames."
 2. Division 08 Section "Fiberglass Reinforced Polyester (FRP) Doors and Aluminum Frames."
 3. Division 08 Section "Overhead Rapid Coiling Doors."
- D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
 2. ICC/IBC - International Building Code.
 3. NFPA 70 - National Electrical Code.
 4. NFPA 80 - Fire Doors and Windows.
 5. NFPA 101 - Life Safety Code.
 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. Proof of Certification: Provide copy of manufacturer(s) official certification or accreditation document indicating proof of status as a qualified and authorized provider of the primary Integrated Wiegand Access Control Products.
- E. Proof of Certification: Provide copy of manufacturer(s) official certification or accreditation document indicating proof of status as a qualified installer of Windstorm assemblies.
- F. 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.
- G. Informational Submittals:
 - 1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.
- H. 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.

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. Integrated Wiegand, Wireless, and IP-Enabled Access Control Products Supplier Qualifications: Integrated access control products and accessories are required to be supplied and installed through current members of the ASSA ABLOY "Authorized Channel Partner" (ACP) and "Certified Integrator" (CI) programs. Suppliers are to be factory trained, certified prior to project bid, and a direct purchaser of the specified product. Installers are to be factory trained, certified prior to project bid, and are responsible for commissioning, servicing, and warranting the installed equipment specified 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. Seven years for heavy duty cylindrical (bored) locks and latches.
 3. Five years for exit hardware.
 4. Twenty-five years for manual surface door closer bodies.
 5. 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:
- C. 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.
- D. 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. 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 as specified in the Door Hardware Sets.
1. Quantity: Provide the following hinge quantity, unless otherwise indicated:
 - 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 where indicated in the Hardware Sets or on Drawings:
 - 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.

Acceptable Manufacturers:

- b. Hager Companies (HA).
 - c. McKinney Products (MK).
 - d. Stanley Hardware (ST).
- 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. Acceptable Manufacturers:
 - a. McKinney Products (MK).
 - b. Pemko Manufacturing (PE).

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. Acceptable Manufacturers:
 - a. Hager Companies (HA) - ETW-QC (# wires) Option.
 - b. McKinney Products (MK) - QC (# wires) Option.

- B. 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. Acceptable Manufacturers:
 - a. Securitron (SU) - EL-CEPT Series.
 - b. Von Duprin (VD) - EPT-10 Series.

- C. 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. Acceptable Manufacturers:
 - a. Adams Rite (AD) – 4612 Series.
 - b. Securitron (SU) - EL-EPT Series.

2.4 DOOR OPERATING TRIM

- A. Flush Bolts and Surface Bolts: ANSI/BHMA A156.3 and A156.16, Grade 1, certified.
 1. Manual flush bolts to be furnished with top rod of sufficient length to allow bolt 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. Acceptable Manufacturers:
 - a. Door Controls International (DC).
 - b. Rockwood Manufacturing (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. Acceptable Manufacturers:

- a. Door Controls International (DC).
 - b. Rockwood Manufacturing (RO).
 - c. Trimco (TC).
- C. Door Push Plates and Pulls: ANS/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.
 - a. Acceptable Manufacturers:
 - 1) Rockwood Manufacturing (RO).
 - 2) 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: Match Facility 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. Acceptable Manufacturers:
 - a. Stanley Best Access (BE).
 - b. No Substitution.
- F. Keying System: Each type of lock and cylinders to be keyed by the Owner's rep, Capital Lock, Inc – 608-256-5625.
- G. Key Quantity: Provide the following minimum number of keys:
1. Change Keys per Cylinder: Three (3).
 2. Construction Keys (where required): Ten (10).
 3. Construction Control Keys (where required): Two (2).
 4. Permanent Control Keys (where required): Two (2).
- H. Construction Keying: Provide temporary keyed construction cores.
- 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. Acceptable Manufacturers:
 - a. Lund Equipment (LU).
 - b. MMF Industries (MM).
 - c. 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. Acceptable Manufacturers:
 - a. Yale Locks and Hardware (YA) – 8800FL Series.
 - b. Corbin Russwin Hardware (RU) – ML2000 Series.
 - c. Sargent Manufacturing (SA) – 8200 Series.
- B. Lock Trim Design: As specified in Hardware Sets.

2.7 INTEGRATED WIEGAND OUTPUT ACCESS CONTROL LOCKING DEVICES

- A. Integrated Wiegand Output Mortise Locks: Wiegand output ANSI A156.13, Grade 1, mortise lockset with integrated proximity card reader, request-to-exit signaling, door position status switch, and latchbolt monitoring in one complete unit. Hard wired, solenoid driven locking/unlocking control of the lever handle trim, 3/4" deadlocking anti-friction latch, and 1" case-hardened steel deadbolt. Lock is U.L listed and labeled for use on up to 3 hour fire rated openings. Available with or without keyed high security cylinder override.
1. Open architecture, hard wired platform supports centralized control of locking units with new or existing Wiegand compatible access control systems. Latchbolt monitoring and door position switch act in conjunction to report door-in-frame (DPS) and door latched (door closed and latched) conditions.
 2. Reader supports either HID 125 kHz proximity (up to 39 bits, including Corporate 1000) or 13.56 MHz (2K-32K) iClass® credentials.
 3. 12VDC external power supply required for reader and lock, with optional 24VDC operation available with iClass® reader (125 kHz reader is always 12VDC). Fail safe or fail secure options.
 4. Installation requires only one cable run from the lock to the access control panel without requirements for additional proprietary lock panel interface boards or modules.
 5. Installation to include manufacturer's access control panel interface board or module where required for Wiegand output protocol.
 - a. Acceptable Manufacturers:
 - 1) Corbin Russwin Hardware (RU) - Access 600 - ML20600 RNE1 Series.
 - 2) Sargent Manufacturing (SA) - Harmony - H1/H2 8200 Series.
 - 3) Yale Locks and Hardware (YA) - Symphony - S8800 SYM Series.

2.8 AUXILIARY LOCKS

- A. Mortise Deadlocks, Small Case: ANSI/BHMA A156.5, Grade 1, certified 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. Acceptable Manufacturers:
 - a. Corbin Russwin Hardware (RU) - DL4100 Series.
 - b. Sargent Manufacturing (SA) - 4870 Series.
 - c. Yale Locks and Hardware (YA) - 350 Series.

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.

B. Standards: Comply with the following:

1. Strikes for Mortise Locks and Latches: BHMA A156.13.
2. Strikes for Bored Locks and Latches: BHMA A156.2.
3. Strikes for Auxiliary Deadlocks: BHMA A156.5.
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.
 - a. Fire Exit Removable Mullions: Provide keyed removable mullions for use with fire exit devices complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire and panic protection, based on testing according to UL 305 and NFPA 252. Mullions to be used only with exit devices for which they have been tested.
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 not acceptable except in any case where the door light extends behind the device as in a full glass configuration.
5. Flush End Caps: Provide heavy weight impact resistant flush end caps made of architectural metal in the same finish as the devices as in the Hardware Sets. Plastic end caps will not be acceptable.
6. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with four 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. Provided free-wheeling type trim where indicated.

- b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.
 7. Vertical Rod Exit Devices: Provide and install interior surface and concealed vertical rod exit devices as Less Bottom Rod (LBR) unless otherwise indicated.
 8. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2" wide stiles.
 9. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.
 10. Rail Sizing: Provide exit device rails factory sized for proper door width application.
 11. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.
- 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. Mounting rails to be formed from smooth stainless steel, brass or bronze architectural materials no less than 0.072" thick, with push rails a minimum of 0.062" thickness. Painted or aluminum metal rails are not acceptable. Exit device latch to be investment cast stainless steel, pullman type, with deadlock feature.
 1. Acceptable Manufacturers:
 - a. Corbin Russwin Hardware (RU) - ED4000 / ED5000 Series.
 - b. Sargent Manufacturing (SA) - 80 Series.
 - c. Von Duprin (VD) - 35A/98 XP Series.

2.11 ELECTROMECHANICAL CONVENTIONAL EXIT DEVICES

- A. Electrified Conventional Push Rail Devices (Heavy Duty): Subject to same compliance standards and requirements as mechanical exit devices, electrified devices to be of type and design as specified below. Include any specific controllers when conventional power supplies are not sufficient to provide the proper inrush current.
 1. Acceptable Manufacturers:
 - a. Corbin Russwin Hardware (RU) - ED4000 / ED5000 Series.
 - b. Sargent Manufacturing (SA) - 80 Series.
 - c. Von Duprin (VD) - 35A/98/99 Series.
- B. Electrified Options: As indicated in hardware sets, provide electrified exit device options including: electric latch retraction (shall be motorized type that fully retracts the touchpad/push bar), electric dogging, outside door trim control, exit alarm, latchbolt monitoring, lock/unlock status monitoring, touchbar monitoring and request-to-exit signaling. Unless otherwise indicated, provide electrified exit devices standard as fail secure.

2.12 INTEGRATED WIEGAND OUTPUT ACCESS CONTROL EXIT DEVICES

- A. Wiegand Output Integrated Card Reader Exit Hardware: Wiegand output ANSI 156.3 Grade 1 rim, mortise, and vertical rod exit device hardware with integrated proximity card reader, latchbolt and touchbar monitoring, and request-to-exit signaling, in one complete unit. Hard wired, solenoid driven locking/unlocking control of the lever handle exit trim

with 3/4" throw latch bolt. U.L listed and labeled for either panic or "fire exit hardware" for use on up to 3 hour fire rated openings. Available with or without keyed high security cylinder override.

1. Open architecture, hard wired platform supports centralized control of locking units with new or existing Wiegand compatible access control systems. Inside push bar (request-to-exit) signaling and door position (open/closed status) monitoring (via separately connected DPS).
2. Reader supports either HID 125 kHz proximity (up to 39 bits, including Corporate 1000) or 13.56 MHz (2K-32K) iClass® credentials.
3. 12VDC external power supply required for reader, with optional 24VDC operation available with iClass® reader (125 kHz reader is always 12VDC). 24VDC required for solenoid operated exit trim (12VDC if applicable). Fail safe or fail secure options.
4. Installation requires only one cable run from the exit hardware to the access control panel without requirements for additional proprietary lock panel interface boards or modules.
5. Acceptable Manufacturers:
 - a. Corbin Russwin Hardware (RU) - Access 600 - ED5000 RNE1 Series.
 - b. Sargent Manufacturing (SA) - Harmony - H1/H2 80 Series.

2.13 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 and UBC 7-2 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.
 - a. Where closers are indicated to have mechanical dead-stop, provide heavy duty arms and brackets with an integral positive stop.
 - b. Where closers are indicated to have mechanical hold open, provide heavy duty units with an additional built-in mechanical holder assembly designed to hold open against normal wind and traffic conditions. Holder to be manually selectable to on-off position.
 - c. Where closers are indicated to have a cushion-type stop, provide heavy duty arms and brackets with spring stop mechanism to cushion door when opened to maximum degree.

- d. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics. Provide drop plates or other accessories as required for proper mounting.
6. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates, and through-bolt or security type fasteners as specified in the door Hardware Sets.
- 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. Acceptable Manufacturers:
 - a. Corbin Russwin Hardware (RU) - DC8000 Series.
 - b. Sargent Manufacturing (SA) - 351 Series.
 - c. Norton Door Controls (NO) - 7500 Series.

2.14 AUTOMATIC DOOR OPERATORS

- A. General: Provide operators of size recommended by manufacturer for door size, weight, and movement; for condition of exposure; and for compliance with UL 325. Coordinate operator mechanisms with door operation, hinges, and activation devices.
 1. Fire-Rated Doors: Provide door operators for fire-rated door assemblies that comply with NFPA 80 for fire-rated door components and are listed and labeled by a qualified testing agency.
- B. Electrohydraulic Door Operators: Self-contained low-pressure units with rack and pinion design contained within a cast aluminum housing. Door closing speed controlled by independent hydraulic adjustment valves in the sweep and latch range of the closing cycle. Operator is to provide conventional door closer opening and closing forces unless the power operator motor is activated. Unit is to include an adjustable hydraulic backcheck valve to cushion the door speed if opened violently. Non-handed units for both push and pull side applications.
- C. Brackets and Reinforcements: Manufacturer's standard, fabricated from aluminum with nonferrous shims for aligning system components.
- D. Standard: Certified ANSI/BHMA A156.19.
 1. Performance Requirements:
 - a. Opening Force if Power Fails: Not more than 15 lbf required to release a latch if provided, not more than 30 lbf required to manually set door in motion, and not more than 15 lbf required to fully open door.
 - b. Entrapment Protection: Not more than 15 lbf required to prevent stopped door from closing or opening.

- E. Configuration: Surface mounted. Door operators to control single swinging and pair of swinging doors.
- F. Operation: Power opening and spring closing operation capable of meeting ANSI A117.1 accessibility guideline. Provide time delay for door to remain open before initiating closing cycle as required by ANSI/BHMA A156.19. When not in automatic mode, door operator to function as manual door closer with fully adjustable opening and closing forces, with or without electrical power.
 - 1. On-off switch to control power to be key switch operated.
- G. Features: Operator units to have full feature adjustments for door opening and closing force and speed, backcheck, motor assist acceleration from 0 to 30 seconds, time delay, vestibule interface delay, obstruction recycle, and hold open time from 0 up to 30 seconds.
- H. Provide outputs and relays on board the operator to allow for coordination of exit device latch retraction, electric strikes, magnetic locks, card readers, safety and motion sensors and specified auxiliary contacts.
- I. Activation Devices: Provide activation devices in accordance with ANSI/BHMA A156.19 standard, for condition of exposure indicated and for long term, maintenance free operation under normal traffic load operation. Coordinate activation control with electrified hardware and access control interfaces. Activation switches are standard SPST, with optional DPDT availability.
- J. Signage: As required by cited ANSI/BHMA A156.19 standard for the type of operator.
 - 1. Acceptable Manufacturers:
 - a. Norton Door Controls (NO) - 6000 Series.
 - b. Stanley Access (ST) - Magic Force Series.

2.15 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. Metal Protection Plates: ANSI/BHMA A156.6 certified metal protection plates (kick, armor, or mop), beveled on four edges (B4E), fabricated from the following:
 - a. Stainless Steel: 300 series, 050-inch thick, with countersunk screw holes (CSK).

4. Fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets.
5. Metal Door Edging: Door protection edging fabricated from a minimum .050-inch thick metal sheet, formed into an angle or "U" cap shapes, surface or mortised mounted onto edge of door. Provide appropriate leg overlap to account for protection plates as required. Height to be as specified in the Hardware Sets.
6. Acceptable Manufacturers:
 - a. Rockwood Manufacturing (RO).
 - b. Trimco (TC).

2.16 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. Acceptable Manufacturers:
 - a. Rockwood Manufacturing (RO).
 - b. 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. Acceptable Manufacturers:
 - a. Rixson Door Controls (RF).
 - b. Rockwood Manufacturing (RO).
 - c. Sargent Manufacturing (SA).

2.17 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.
1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and UBC 7-2, Fire Tests of Door Assemblies.
- D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated, based on testing according to ASTM E 1408.
- 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. Acceptable Manufacturers:
1. National Guard Products (NG).
 2. Pemko Manufacturing (PE).
 3. Reese Enterprises, Inc. (RS).

2.18 ELECTRONIC ACCESSORIES

- A. Door Position Switches: Door position magnetic reed contact switches specifically designed for use in commercial door applications. On recessed models the contact and magnetic housing snap-lock into a 1" diameter hole. Surface mounted models include wide gap distance design complete with armored flex cabling. Provide SPDT, N/O switches with optional Rare Earth Magnet installation on steel doors with flush top channels.
1. Acceptable Manufacturers:
 - a. Sargent Manufacturing (SA) – 3280 Series.
 - b. Securitron (SU) - DPS Series.
- B. Proximity Access Cards and Credentials: RF programmable, 125 kHz access control/identification cards utilizing a passive, no battery design allowing for infinite number of reads. Cards are programmable in any HID proximity format up to 85 bits and compatible with all HID proximity readers.
1. Acceptable Manufacturers (125 kHz Proximity):
 - a. Corbin Russwin Hardware (RU) - 794F Series.
 - b. Sargent Manufacturing (SA) - PCH Series.
- C. Wiegand Test Unit: Test unit verifies proper Wiegand output integrated card reader lock installation in the field by testing for proper wiring, card reader data integrity, and lock functionality including lock/unlock, door position, and request-to-exit status. 12 or 24VDC voltage adjustable operating as Fail Safe or Fail Secure.

1. Acceptable Manufacturers:
 - a. Corbin Russwin Hardware (RU) - WT1 Wiegand Test Unit.
 - b. Sargent Manufacturing (SA) - WT1 Wiegand Test Unit.

- D. 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. Acceptable Manufacturers:
 - a. Securitron (SU) - BPS Series.

- E. Energy Efficient Switching Power Supplies: Provide UL listed or recognized filtered and regulated power supplies. Provide single voltage units as shown in the hardware sets. Units must have one access control input and one fire alarm input. Standby power consumption of unit must be less than 10mW at 120VAC. Provide integral battery backup as standard for all units. 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. Acceptable Manufacturers:
 - a. Securitron (SU) – EPS Series.

2.19 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.

2.20 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.
- B. Wood Doors: Comply with ANSI/DHI A115-W 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:
 - 1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
 - 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. 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.
- D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."
- E. 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 SCHEDULE

- 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. Manufacturer's Abbreviations:
1. MK - McKinney
 2. PE - Pemko
 3. SU - Securitron
 4. RO - Rockwood
 5. SA - Sargent
 6. MC - Medeco
 7. RF - Rixson
 8. NO - Norton

9. BE – Stanely Best

10. YA - Yale

Hardware Schedule**Set: 1.0 – EXTERIOR FRP Door**

1	Continuous Hinge (AL Doors)	<u>CFM83SLIHD3 x Height Required</u>	CL	PE
1	Exit Device Rim (EO)	<u>6100 426F</u>	US32D	YA
1	Removeable Core	<u>7Pin</u>	626	BE
1	Door Closer	<u>CPS7500</u>	689	NO
1	Threshold	<u>2009APKx Width</u>		PE
1	Overhead Rain Drip	<u>346C 4" plus Door width</u>		PE
1	Gasketing	<u>312CR LAR</u>		PE
1	Sweep	<u>315CN x Width</u>		PE

Set: 1.1 – EXTERIOR HM Door – Fire Rated

3	BB Hinge NRP	<u>TA2314 4-1/2" x 4-1/2" NRP</u>	US26D	MK
1	Exit Device Rim (EO) w/ Alarm Kit	<u>6116ED(F) A-ALR 420F</u>	US32D	YA
1	Removeable Core	<u>7Pin</u>	626	BE
1	Door Closer	<u>CPS7500</u>	689	NO
1	Threshold	<u>2009APKx Width</u>		PE
1	Overhead Rain Drip	<u>346C 4" plus Door width</u>		PE
1	Gasketing	<u>312CR LAR</u>		PE
1	Sweep	<u>315CN x Width</u>		PE

Set: 2.0 – INTERIOR FRP Door - Passage

1	Continuous Hinge (AL Doors)	<u>CFM83SLIHD3 x Height Required</u>	CL	PE
1	Exit Device Rim (EO)	<u>6100 428F</u>	US32D	YA
1	Door Closer	<u>CPS7500</u>	689	NO
1	Gasketing	<u>312CR LAR</u>		PE
1	Sweep	<u>315CN x Width</u>		PE

Set: 3.0 – STOREROOM

3	BB Hinge	<u>TA2714 4-1/2" x 4-1/2"</u>	US26D	MK
1	Storeroom Set	<u>8805 AUR LC</u>	US32D	YA
1	Removeable Core	<u>7Pin</u>	626	BE
1	Door Closer	<u>7500 provide arm as required</u>	689	NO
1	Wall Stop	<u>406/409 to suit</u>	US32D	RO
1	Gasketing	<u>S88BL LAR</u>		PE

Set: 3.1 – DOUBLE STOREROOM

6	BB Hinge	<u>TA2714 4-1/2" x 4-1/2"</u>	US26D	MK
1	Storeroom Set	<u>8805 AUR LC</u>	US32D	YA
1	Removeable Core	<u>7Pin</u>	626	BE
1	Automatic Flush Bolt	<u>2842/2942 to suit dr mtl</u>	US26D	RO
1	Dust Proof Strike	<u>570</u>	US26D	RO
1	Coordinator	<u>2672</u>	US28	RO
2	Door Closer	<u>7500 provide arm as required</u>	689	NO
2	Wall Stop	<u>406/409 to suit</u>	US32D	RO
2	Gasketing	<u>S88BL LAR</u>		PE

Set: 4.0 – TOILET ROOM

3	BB Hinge	<u>TA2714 4-1/2" x 4-1/2"</u>	US26D	MK
1	Privacy Set with "Occupied" Indicator	<u>8864 AUR LC</u>	US32D	YA
1	Removeable Core	<u>7Pin</u>	626	BE
1	Door Closer	<u>7500 provide arm as required</u>	689	NO
1	Wall Stop	<u>406/409 to suit</u>	US32D	RO
1	Gasketing	<u>S88BL LAR</u>		PE

Set: 5.0 - PASSAGE

3	BB Hinge	Continuous Hinge (AL Doors)	<u>CFM83SLIHD3</u> x Height Required	CL
1	Passage Set	<u>8801 AUR LC</u>	US32D	YA
1	Wall Stop	<u>406/409 to suit</u>	US32D	RO
1	Gasketing	<u>S88BL LAR</u>		PE

Set: 6.0 – CARD READER

3	Hinge	<u>TA2714 4-1/2" x 4-1/2"</u>	US26	MK
1	Storeroom Lock	<u>8805 AUR LC</u>	US32D	YA
1	Removeable Core	7Pin	626	BE
1	Electric Strike	4500 Fail Sec x Faceplate as req'd	630	HS
1	SMART Pac Bridge Rectifier	2005M3		HS
1	Door Closer	351 O	689	SA
1	Kickplate	K1050 24" x 2" LDW 4BE CSK	630	RO
1	Wall Stop	400	626	RO
1	Set Gasketing	S88BL LAR		PE
1	Multi-Technology Reader	By Security Contractor		
1	Power Supply	BPS-24-1		
1	Door Position Switch	By Security Contractor		
1	Motion Detector	By Security Contractor		
1	Reader Interface	By Security Contractor		

Set: 7.0 – OVERHEAD DOORS

1	All hardware	by door manufacturer		00
1	Removeable Core	7Pin	626	BE

END OF SECTION 08 71 00

**SECTION 08 81 00
GLASS AND GLAZING**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes:
1. Glazing for the following products, including those specified in other Sections where glazing requirements are specified by reference in this Section:
 - a. Hollow metal doors
 - b. FRP Doors

1.3 DEFINITIONS

- A. Manufacturer: A firm that produces primary glass or fabricated glass as defined in referenced glazing publications.
- B. Interspace: Space between lites of an insulating-glass unit that contains dehydrated air or a specified gas.
- C. Deterioration of Laminated Glass: Defects developed from normal use attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.
- D. Deterioration of Insulating Glass: Failure of the hermetic seal under normal use attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1.4 PERFORMANCE REQUIREMENTS

- A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B. Glass Design: Glass thicknesses indicated on the Drawings are for detailing only. Design glass to comply with ASTM E 1300 and International Building Code (IBC) according to the following requirements:

1. Design Wind Pressures: As indicated on Structural Drawings.
 2. Design Snow Loads: As indicated on Structural Drawings.
 3. Vertical Glazing: For glass surfaces sloped 15 degrees or less from vertical, design glass to resist design wind pressure based on glass type factors for short-duration load.
 4. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch, whichever is less.
 5. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
- D. Thermal and Optical Performance Properties: Provide glass with performance properties specified based on manufacturer's published test data, as determined according to procedures indicated below:
1. For monolithic-glass lites, properties are based on units with lites ¼ inch thick.
 2. For insulating-glass units, properties are based on units with lites ¼ inch thick and a nominal ½-inch-wide interspace.
 3. Center-of-Glass Values: Based on using LBL-44789 WINDOW 5.0 computer program for the following methodologies:
 - a. U-Factors: NFRC 100 expressed as Btu/ sq. ft. x h x deg F.
 - b. Solar Heat Gain Coefficient: NFRC 200.
 - c. Solar Optical Properties: NFRC 300.

1.5 APPLICABLE STANDARDS

- A. Safety Glazing: Conform to Safety Standard for Architectural Glazing Materials (16 CFR 1201). Tempered glass and wire glass shall conform to requirements of ANSI Z97.1, with permanent label in accordance with statutes.
- B. Insulating Glass: ASTM E773, Seal Durability of Sealed Insulating Glass Units and ASTM E774, Sealed Insulating Glass Units. Certification through Insulating Glass Certification Council, Class A level.
- C. Flat Glass: ASTM C1036, Flat Glass. Flat Glass Marketing Association (FGMA) Glazing Manual.
- D. Heat Treated Flat Glass: ASTM C1048, Heat Treated Flat Glass.

1.6 ACTION SUBMITTALS

- A. General: Provide action submittals for all items in this specification section for review within a single submittal to the Architect.

- B. Product Data: Provide for structural, physical and environmental characteristics, size limitations, special handling or installation requirements.
- C. Shop Drawings: Review curtain wall and window shop drawings and submit acceptance of details as suitable for proposed glass products.
- D. Glass Samples: For each type of the following products; 12 inches square.
 - 1. Coated glass.
 - 2. Fire-resistive ceramic glazing products.
 - 3. Insulating glass.
- E. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on the Drawings.
- F. Qualification Data: For Installer.
- G. Product Certificates: For glass and glazing products, from manufacturer.
- H. Preconstruction adhesion and compatibility test report.
- I. Warranties: Samples of special warranties.

1.7 CLOSEOUT SUBMITTALS

- A. Warranties: Completed manufacturer's special warranties as described in the "Warranties" Article of this specification section.

1.8 QUALITY ASSURANCE

- A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
 - 1. FGMA Publication: "FGMA Glazing Manual."
 - 2. LSGA Publication: "LSGA Design Guide."
 - 3. SIGMA Publication: TM-3000 "Vertical Glazing Guidelines".
 - 4. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
 - 5. GANA Publications: GANA's "Laminated Glazing Reference Manual" and GANA's "Glazing Manual."
- B. Safety Glazing Labeling: Where safety-glazing labeling is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety-glazing standard with which glass complies.

- C. Manufacturer Qualifications for Insulating-Glass Units with Coatings: A qualified insulating-glass manufacturer who is approved and certified by coated-glass manufacturer.
- D. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.
- E. Single-Source Responsibility for Glass: Obtain glass from one source for each product indicated below:
 - 1. Primary glass of each (ASTM C 1036) type and class indicated.
 - 2. Heat-treated glass of each (ASTM C 1048) condition indicated.
 - 3. Insulating glass of each construction indicated.
- F. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method indicated.
- G. Preinstallation Conference: Conduct conference at Project site
 - 1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 2. Review temporary protection requirements for glazing during and after installation.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials according to manufacturer's printed instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

1.10 PROJECT CONDITIONS

- A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing materials manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
 - 1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or below 40 deg.

1.11 WARRANTIES

- A. General: Warranties specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under requirements of the Contract Documents.
- B. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form in which coated-glass manufacturer agrees to replace coated-glass units that

deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's printed instructions. Defects include peeling, cracking, and other indications of deterioration in coating, includes replacement of failed units.

1. Warranty Period: Ten (10) years from Date of Substantial Completion.

C. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form in which insulating- glass manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's printed instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass, includes replacement of failed units.

1. Warranty Period: Ten (10) years from Date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GLASS PRODUCTS, GENERAL

A. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass lites in thicknesses as needed to comply with requirements indicated.

1. Minimum Glass Thickness for Exterior Lites: Not less than ¼ inch.
2. Thickness of Tinted Glass: Provide same thickness for each tint color indicated throughout Project.

B. Strength: Where float glass is indicated, provide, Kind HS heat-treated float glass, or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened glass is indicated, provide Kind HS heat-treated float glass or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article. Where fully tempered glass is indicated, provide Kind FT heat-treated float glass.

C. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:

1. For monolithic-glass lites, properties are based on units with lites ¼ inch thick.
2. For laminated glass lites, properties are based on products of construction indicated.
3. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
4. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F (W/sq. m x K).
5. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.

6. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.2 GLASS MANUFACTURERS

- A. Subject to compliance with requirements, available manufacturers and products that may be incorporated into the Work include, but are not limited to following:
 1. Guardian Industries Corp.
 2. Interpane Glass Company
 3. Pilkington North America, Inc.
 4. PPG Industries, Inc.
 5. Viracon, Inc.
- B. Glass Products: Subject to compliance with the requirements, provide glass products specified in the Glazing Schedule at end of Part 3 of this Section.

2.3 GLASS PRODUCTS

- A. Clear Heat-Treated Float Glass: ASTM C 1048; Type I; Quality-Q3; Class 1 (clear) unless otherwise indicated; of kind and condition indicated.
 1. Kind HS (heat-strengthened) where recommended by the manufacturer.
 2. Kind FT (fully-tempered) where Safety Glass is indicated or, if not indicated, required by governing building code.
 3. For uncoated glass, comply with requirements for Condition A.
 4. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
- B. Tinted Heat-Treated Float Glass: ASTM C 1048; Type I; Quality-Q3; Class 2 (tinted) unless otherwise indicated; of kind and condition indicated.
 1. Kind HS (heat-strengthened) where recommended by the manufacturer.
 2. Kind FT (fully-tempered) where Safety Glass is indicated or, if not indicated, required by governing building code.
 3. For uncoated glass, comply with requirements for Condition A.
 4. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

2.4 INSULATING GLASS UNITS

- A. Sealed Insulating Glass Units: Factory-assembled units consisting of organically sealed lites of glass separated by dehydrated interspace, qualified according to ASTM E 2190, and complying with other requirements specified.
 1. Classification of Units: Class CB or CBA.
 2. Sealing System: Dual seal, with manufacturer's standard primary and secondary.
 3. Spacer: Aluminum with black color anodic finish.
 4. Desiccant: Molecular sieve or silica gel, or blend of both.
- B. Glass: Comply with applicable requirements in "Glass Products" Article as indicated by designations in "Insulating Glass Units" Article.

2.5 PREFORMED GLAZING GASKETS

- A. Dense Compression Gaskets: Molded or extruded black gaskets of profile and hardness required to maintain watertight seal, made from one of the following:
1. Neoprene complying with ASTM C 864.
 2. EPDM complying with ASTM C 864.
 3. Silicone complying with ASTM C 1115.
 4. Thermoplastic polyolefin rubber complying with ASTM C 1115.
- B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned neoprene, EPDM, silicone, or thermoplastic polyolefin rubber gaskets complying with ASTM C 509, Type II, black; of profile and hardness required to maintain watertight seal.
1. Application: Use where soft compression gaskets will be compressed by inserting dense compression gaskets on opposite side of glazing or pressure applied by means of pressure-glazing stops on opposite side of glazing.
- C. Lock-Strip Gaskets: Neoprene extrusions in size and shape indicated, fabricated into frames with molded corner units and zipper lock-strips, complying with ASTM C 542, black.
- D. Manufacturers: Subject to compliance with requirements, provide preformed glazing gasket products by one of the following manufacturers:
1. Advanced Elastomer Systems, L.P.
 2. Schnee-Morehead, Inc.
 3. Tremco, Inc.

2.6 GLAZING SEALANTS

- A. General:
1. Compatibility: Provide glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
 2. Suitability: Comply with sealant and glass manufacturers' printed instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
 3. VOC Content: For sealants used inside of the weatherproofing system, not more than 250 g/L when calculated according to 40 CFR 59, Subpart D.
 4. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.
- B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.
1. Products: Subject to compliance with requirements, provide one of the following:

- a. Dow Corning Corporation; 790.
- b. GE Advanced Materials - Silicones; SilPruf LM SCS2700.
- c. May National Associates, Inc.; Bondaflex Sil 290.
- d. Pecora Corporation; 890.
- e. Sika Corporation, Construction Products Division; SikaSil-C990.
- f. Tremco Incorporated; Spectrem 1.

2. Applications: Exterior glazing unless indicated otherwise.

2.7 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
- E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).
- F. Perimeter Insulation for Fire-Resistive Glazing: Product that is approved by testing agency that listed and labeled fire-resistant glazing product with which it is used for application and fire-protection rating indicated.

2.8 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with printed instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
 1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
 2. Presence and functioning of weep systems.
 3. Minimum required face and edge clearances.

4. Effective sealing between joints of glass-framing members.

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

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that will leave visible marks in the completed work.

3.3 GLAZING, GENERAL

A. Comply with combined printed instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Adjust glazing channel dimensions as required by Project conditions during installation to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass lites where length plus width is larger than 50 inches.

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.

2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

- H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
- I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- J. Set glass lites with proper orientation so that coatings face exterior or interior as specified.
- K. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.
- L. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 GASKET GLAZING (DRY)

- A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
- C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- E. Install gaskets so they protrude past face of glazing stops.

3.5 SEALANT GLAZING (WET)

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
- B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

- C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.6 LOCK-STRIP GASKET GLAZING

- A. Comply with ASTM C 716 and gasket manufacturer's printed instructions. Provide supplementary wet seal and weep system unless otherwise indicated.

3.7 CLEANING AND PROTECTION

- A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.
- C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.
- D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.
- E. Wash glass on both exposed surfaces in each area of Project not more than four (4) days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

3.8 GLAZING SCHEDULE

- A. General: Provide types of glazing products manufactured from glazing components specified in Part 2 of this Section, for locations shown on the Drawings and according to the following Glazing Schedule.
- B. Safety Glazing Requirements: Fully-tempered safety glass location requirements are not specifically addressed on the Drawings or in the glazing Schedule below, and are the responsibility of glass manufacturer and glazing Installer. Comply with applicable safety glazing requirements in 2009 International Building Code - Section 2406 'Safety Glazing' and in Subsection 2406.4 'Specific Hazardous Locations' including, but not limited to Paragraph Numbers 1, 6, 7 10, and 11.
- C. GL-1: Insulating Clear, Tempered
1. Tempered Low-E-Coated Insulating Glass: exterior silicone cap bead, 1" insulating glass, interior EPDM drive-in wedge or Santoprene™ bulb gasket threaded into aluminum glazing beads; glazed by the window manufacturer:
 2. Exterior Insulating Glass Unit: Cardinal LoE-270, Solarban 60, Viracon or equivalent by other manufacturer.

a. Materials

- 1) Spacer: polymer-coated stainless steel.
- 2) Spacer color: light gray.
- 3) Primary seal: polyisobutylene.
- 4) Secondary seal: silicone.
- 5) Airspace fill: argon.

b. Exterior Glass Lite:

- 1) Thickness: ¼".
- 2) Tint: clear.
- 3) Type: tempered
- 4) Coating: Soft coat low E on #2 surface.

c. Interior Glass Lite:

- 1) Thickness: ¼".
- 2) Tint: clear.
- 3) Type: tempered

3. Warranty: Provide manufacturer's standard 10-year product warranty on maintained hermetic seal.

- 1) Tint: white
- 2) Type: tempered

D. GL-2: Clear Float Glass, Tempered

1. ¼" Tempered Clear Glass

END OF SECTION 08 81 00

SECTION 08 91 19 FIXED LOUVERS

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. Section includes
 - 1. Fixed drainable louvers with blank-off panels, bird and insect screens.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of louver, vent and accessory indicated.
- B. Shop Drawings: Show layouts of louver and vents, including plans, elevations, sections, details, and attachments metal wall panels and other work.
- C. Color Chart: Provide Manufacturer's color chart with full range of standard colors.

1.4 QUALITY ASSURANCE

- A. Source Limitation: Obtain louvers and vents through one source from a single manufacturer.
- B. Installer Qualifications: An employer of workers trained and approved by manufacturer.
 - 1. Installer's responsibilities include fabricating and installing louvers and vents integral to metal wall panel assemblies and providing professional engineering services needed to assume engineering responsibility.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers:
 - 1. Basis-of-design manufacturer and product:
 - a. Manufacturer: Greenheck
 - b. Product: ESD-603
 - 1) 150-mm (6 inches) extruded aluminum stationary blade exterior louver

2.2 LOUVERS

- A. Louvers shall be horizontal, extruded-aluminum, drainable-blade louvers:

1. Aluminum Thickness: 2.06-mm (0.081 inches) for both blades and frames.
2. Six-inch-deep frames and drainable blades.

2.3 SIZE(S)

- A. Reference Louver Schedule on the mechanical drawing sheets for quantity and size of louvers.

2.4 ACCESSORIES

- A. Louver Screens: Provide removable bird screens at interior face of each exterior louver. Fabricate screen frames from same kind and form of metal as indicated for louver to which screens are attached.
- B. Provide manufacturer's standard insulated blank-off panels at all areas of louvers not being utilized for air intake and exhaust.

2.5 FINISHES

- A. Color Anodic Finish: AAMA 611, AA-M10C22A42, 0.0018-mm (0.07 mil) thicker.
 1. Color: As selected by Architect from full range of manufacturer's standard colors.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install louvers level, plumb, and at indicated alignment with adjacent work.
- B. Use concealed anchorages where possible.
- C. Protect metal surfaces from corrosion or galvanic action by applying a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.

END OF SECTION 08 91 19

**SECTION 09 22 16
NON-STRUCTURAL METAL FRAMING**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
1. Non-load-bearing steel framing systems for interior partitions.
 2. Suspension systems for interior ceilings and soffits.
 3. Grid suspension systems for gypsum board ceilings.

1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: The design of wall studs over nine feet high, including comprehensive engineering analysis shall be completed by a qualified professional engineer.

1.4 ACTION SUBMITTALS

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

1.5 DELIVERY, STORAGE AND HANDLING

- A. Delivery: In original unopened packaging or bundles, with manufacturer's labels intact and legible.
- B. Storage: For metal studs, in enclosed shelter providing protection from damage and exposure to weather, elevated above soil and concrete on wood sleepers.
- C. Handling: Promptly remove damaged or deteriorated products from site.

1.6 PROJECT CONDITIONS

- A. Environmental Conditions: In cold weather and during gypsum board application and finishing, maintain temperature within building between 55 degrees F and 70 degrees F.

PART 2 - PRODUCTS

2.1 NON-LOAD-BEARING STEEL FRAMING, GENERAL

- A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.

1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal, unless otherwise indicated.
2. Protective Coating: ASTM A 653/A 653M, G40, hot-dip galvanized, unless otherwise indicated.

2.2 SUSPENSION SYSTEM COMPONENTS

- A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch- diameter wire, or double strand of 0.0475-inch- diameter wire. B. Hanger Attachments to Concrete:
1. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching wire hangers and capable of sustaining, without failure, a load equal to 5 times that imposed by construction as determined by testing according to ASTM E 488 by an independent testing agency.
 - a. Type: Cast-in-place anchor, designed for attachment to concrete forms.
- B. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.162-inch diameter.
- C. Flat Hangers: Steel sheet, 1 by 3/16 inch by length indicated.
- D. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.0538 inch and minimum 1/2-inch- wide flanges.
1. Depth: As indicated on Drawings or 2½ inches.
- E. Furring Channels (Furring Members):
1. Cold-Rolled Channels: 0.0538-inch bare-steel thickness, with minimum 1/2-inch-wide flanges, 3/4 inch deep.
 2. Steel Studs: ASTM C 645.
 - a. Minimum Base-Metal Thickness: 0.0179 inch.
 - b. Depth: As indicated on Drawings.
 3. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch deep.
 - a. Minimum Base Metal Thickness: As indicated on Drawings or 0.0179 inch.
 4. Resilient Furring Channels: ½-inch- deep members designed to reduce sound transmission.
 - a. Configuration: Asymmetrical or hat shaped.
- F. Grid Suspension System for Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.

2.3 STEEL FRAMING FOR FRAMED ASSEMBLIES

- A. Steel Studs and Runners: ASTM C 645.
1. Minimum Base-Metal Thickness: 0.0179 inch or to suite size per manufacturer standard.
 2. Depth: As indicated on Drawings.
- B. Slip-Type Head Joints: Where indicated, provide one of the following:
1. Single Long-Leg Runner System: ASTM C 645 top runner with 2-inch- deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top runner and with continuous bridging located within 12 inches of the top of studs to provide lateral bracing.
 2. Double-Runner System: ASTM C 645 top runners, inside runner with 2-inch-deep flanges in thickness not less than indicated for studs and fastened to studs, and outer runner sized to friction fit inside runner.
 3. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
- C. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
- D. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
1. Minimum Base-Metal Thickness: 0.0179 inch.
- E. Cold-Rolled Channel Bridging: 0.0538-inch bare-steel thickness, with minimum 1/2-inch-wide flanges.
1. Depth: As indicated on Drawings.
 2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch- thick, galvanized steel.
- F. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
1. Minimum Base Metal Thickness: 0.0179 inch.
 2. Depth: As indicated on Drawings.
- G. Resilient Furring Channels: 1/2-inch- deep, steel sheet members designed to reduce sound transmission.
1. Configuration: Asymmetrical or hat shaped.
- H. Cold-Rolled Furring Channels: 0.0538-inch bare-steel thickness, with minimum 1/2-inch-wide flanges.

1. Depth: As indicated on Drawings.
 2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum bare-steel thickness of 0.0312 inch.
 3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch-diameter wire, or double strand of 0.0475-inch-diameter wire.
- I. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 inch, minimum bare-metal thickness of 0.0179 inch, and depth required to fit insulation thickness indicated.

2.4 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards.
1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates. B. Isolation Strip at Exterior Walls: Provide one of the following:
 2. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), nonperforated.
 3. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.
- B. Coordination with Sprayed Fire-Resistive Materials:
1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling tracks to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches (610 mm) o.c.

2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive materials below that are required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

3.3 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C 754, except comply with framing sizes and spacing indicated.
 1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.
- B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.
- C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- D. Install bracing at terminations in assemblies.
- E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING SUSPENSION SYSTEMS

- A. Install suspension system components in sizes and spacings indicated on Drawings, but not less than those required by referenced installation standards for assembly types and other assembly components indicated.
- B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
- C. Suspend hangers from building structure as follows:
 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
 - a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
 - a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.

3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 5. Do not attach hangers to steel roof deck.
 6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
 7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
 8. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- D. Seismic Bracing: Sway-brace suspension systems with hangers used for support.
- E. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

3.5 INSTALLING FRAMED ASSEMBLIES

- A. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- B. Install studs so flanges within framing system point in same direction.
- C. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.
1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
 2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
 - a. Install two studs at each jamb, unless otherwise indicated.
 - b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
 - c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
 3. Other Framed Openings: Frame openings other than door openings the same as required for door openings, unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
 4. Curved Partitions:

- a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
- b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of not less than 2 studs at ends of arcs, place studs 6 inches o.c.

D. Z-Furring Members:

1. Erect insulation (specified in Division 07 Section "Thermal Insulation") vertically and hold in place with Z-furring members spaced 24 inches o.c.
 2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
 3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.
- E. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

END OF SECTION 09 22 16

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SECTION 09 29 00 GYPSUM BOARD

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

1. Interior gypsum board.
2. Exterior gypsum board for ceilings and soffits.
3. Tile backing panels.

- B. Related Requirements:

1. Division 05 specification section "Structural Steel Framing" for structural steel framing and suspension systems that support gypsum board panels
2. Division 09 specification section "Non-Structural Metal Framing" for non-structural steel framing and suspension systems that support gypsum board panels.

1.3 ACTION SUBMITTALS

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

1.4 DELIVERY, STORAGE AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.5 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.

- B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

- C. Do not install panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

2.2 GYPSUM BOARD, GENERAL

- A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

- A. Gypsum Wallboard: ASTM C 1396/C 1396M.
 - 1. Thickness: 5/8 inch (15.9 mm).
 - 2. Long Edges: Tapered.
- B. Flexible Gypsum Board: ASTM C 1396/C 1396M. Manufactured to bend to fit radii and to be more flexible than standard regular-type gypsum board of same thickness.
 - 1. Thickness: 1/4 inch (6.4 mm).
 - 2. Long Edges: Tapered.
- C. Gypsum Ceiling Board: ASTM C 1396/C 1396M.
 - 1. Thickness: 5/8 inch (15.9 mm).
 - 2. Long Edges: Tapered.
- D. Moisture- and Mold-Resistant Gypsum Board: ASTM C 1396/C 1396M. With moisture- and mold-resistant core and paper surfaces.
 - 1. Core: 5/8 inch (15.9 mm), Type X.
 - 2. Long Edges: Tapered.
 - 3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.4 SPECIALTY GYPSUM BOARD

- A. Gypsum Board, Type C: ASTM C 1396/C 1396M. Manufactured to have increased fire-resistive capability.
 - 1. Thickness: As required by fire-resistance-rated assembly indicated on Drawings.
 - 2. Long Edges: Tapered.

- B. Glass-Mat Interior Gypsum Board: ASTM C 1658/C 1658M. With fiberglass mat laminated to both sides. Specifically designed for interior use.
1. Core: 5/8 inch (15.9 mm), Type X.
 2. Long Edges: Tapered.
 3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.5 EXTERIOR GYPSUM BOARD FOR CEILINGS AND SOFFITS

- A. Exterior Gypsum Soffit Board: ASTM C 1396/C 1396M, with manufacturer's standard edges.
1. Core: 5/8 inch (15.9 mm), Type X.
- B. Glass-Mat Gypsum Sheathing Board: ASTM C 1177/C 1177M, with fiberglass mat laminated to both sides and with manufacturer's standard edges.
1. Core: 5/8 inch (15.9 mm), Type X.

2.6 TILE BACKING PANELS

- A. Glass-Mat, Water-Resistant Backing Board: ASTM C 1178/C 1178M, with manufacturer's standard edges.
1. Core: 5/8 inch (15.9 mm), Type X.
 2. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
- B. Cementitious Backer Units: ANSI A118.9 and ASTM C 1288 or ASTM C 1325, with manufacturer's standard edges.
1. Thickness: 5/8 inch (15.9 mm).
 2. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
- C. Water-Resistant Gypsum Backing Board: ASTM C 1396/C 1396M, with manufacturer's standard edges. Water-resistant gypsum backing board is not permitted for use as a backing board for tile in tub and shower areas or as wall board or ceiling panels in shower areas.
1. Core: 5/8 inch (15.9 mm), Type X or Type C as required by fire-resistance-rated assembly indicated on Drawings.

2.7 TRIM ACCESSORIES

- A. Interior Trim: ASTM C 1047.
1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
 2. Shapes:
 - a. Cornerbead.

- b. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - c. L-Bead: L-shaped; exposed long flange receives joint compound.
 - d. U-Bead: J-shaped; exposed short flange does not receive joint compound.
 - e. Expansion (control) joint.
 - f. Curved-Edge Cornerbead: With notched or flexible flanges.
- B. Exterior Trim: ASTM C 1047.
1. Material: Hot-dip galvanized-steel sheet, plastic, or rolled zinc.
 2. Shapes:
 - a. Cornerbead.
 - b. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - c. Expansion (Control) Joint: One-piece, rolled zinc with V-shaped slot and removable strip covering slot opening.
- C. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.
1. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221 (ASTM B 221M), Alloy 6063-T5.
 2. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.

2.8 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475/C 475M.
- B. Joint Tape:
1. Interior Gypsum Board: Paper.
 2. Exterior Gypsum Soffit Board: Paper.
 3. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
 4. Tile Backing Panels: As recommended by panel manufacturer.
- C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.
1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use drying-type, all-purpose compound.
 - a. Use setting-type compound for installing paper-faced metal trim accessories.
 3. Fill Coat: For second coat, use drying-type, all-purpose compound.
 4. Finish Coat: For third coat, use drying-type, all-purpose compound.
 5. Skim Coat: For final coat of Level 5 finish, use drying-type, all-purpose compound.

- D. Joint Compound for Exterior Applications:
1. Exterior Gypsum Soffit Board: Use setting-type taping compound and setting-type, sandable topping compound.
 2. Glass-Mat Gypsum Sheathing Board: As recommended by sheathing board manufacturer.
- E. Joint Compound for Tile Backing Panels:
1. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.
 2. Cementitious Backer Units: As recommended by backer unit manufacturer.
 3. Water-Resistant Gypsum Backing Board: Use setting-type taping compound and setting-type, sandable topping compound.

2.9 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.
- B. Steel Drill Screws: ASTM C 1002 unless otherwise indicated.
1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.
 2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
- C. Sound-Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
- D. Acoustical Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
- E. Thermal Insulation and Vapor Retarders: As specified in Section 07 21 00 "Thermal Insulation."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

- A. Comply with ASTM C 840.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
 - 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. (0.7 sq. m) in area.
 - 2. Fit gypsum panels around ducts, pipes, and conduits.
 - 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- (6.4- to 9.5-mm-) wide joints to install sealant.
- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch- (6.4- to 12.7-mm-) wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- I. Wood Framing: Install gypsum panels over wood framing, with floating internal corner construction. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members or provide control joints to counteract wood shrinkage.

- J. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written instructions for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
- K. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 APPLYING INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations:
1. Wallboard Type: Vertical surfaces unless otherwise indicated.
 2. Type X: Where required for fire-resistance-rated assembly.
 3. Flexible Type: Apply in double layer at curved assemblies.
 4. Ceiling Type: Ceiling surfaces.
 5. Moisture- and Mold-Resistant Type: As indicated on Drawings.
 6. Type C: Where required for specific fire-resistance-rated assembly indicated.
 7. Glass-Mat Interior Type: As indicated on Drawings.
- B. Single-Layer Application:
1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
 2. On partitions/walls, apply gypsum panels horizontally (perpendicular to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
 - a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
 3. On Z-shaped furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
 4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.
- C. Multilayer Application:
1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 16 inches (400 mm) minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
 2. Fastening Methods: Fasten base layers and face layers separately to supports with screws.
- D. Curved Surfaces:

1. Install panels horizontally (perpendicular to supports) and unbroken, to extent possible, across curved surface plus 12-inch- (300-mm-) long straight sections at ends of curves and tangent to them.
2. For double-layer construction, fasten base layer to studs with screws 16 inches (400 mm) o.c. Center gypsum board face layer over joints in base layer, and fasten to studs with screws spaced 12 inches (300 mm) o.c.

3.4 APPLYING EXTERIOR GYPSUM PANELS FOR CEILINGS AND SOFFITS

- A. Apply panels perpendicular to supports, with end joints staggered and located over supports.
1. Install with ¼-inch (6.4-mm) open space where panels abut other construction or structural penetrations.
 2. Fasten with corrosion-resistant screws.

3.5 APPLYING TILE BACKING PANELS

- A. Glass-Mat, Water-Resistant Backing Panels: Comply with manufacturer's written installation instructions and install at showers, tubs, and where indicated. Install with 1/4-inch (6.4-mm) gap where panels abut other construction or penetrations.
- B. Cementitious Backer Units: ANSI A108.11, at showers, tubs, and where indicated.
- C. Water-Resistant Backing Board: Install where indicated with 1/4-inch (6.4-mm) gap where panels abut other construction or penetrations.
- D. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.6 INSTALLING TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Control Joints: Install control joints at locations indicated on Drawings.
- C. Interior Trim: Install in the following locations:
1. Cornerbead: Use at outside corners.
 2. LC-Bead: Use at exposed panel edges.
 3. L-Bead: Use where indicated.
 4. U-Bead: Use at exposed panel edges.
 5. Curved-Edge Cornerbead: Use at curved openings.
- D. Exterior Trim: Install in the following locations:
1. Cornerbead: Use at outside corners.
 2. LC-Bead: Use at exposed panel edges.

3.7 FINISHING GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints, rounded or beveled edges, and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
 - 1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
 - 2. Level 2: Panels that are substrate for tile Panels that are substrate for acoustical tile.
 - 3. Level 3: Not Used.
 - 4. Level 4: At locations receiving light-textured finishes, wallcoverings, and flat paints.
 - a. Primer and its application to surfaces are specified in Section 09 91 23 "Interior Painting."
 - 5. Level 5: At locations receiving gloss and semigloss enamel paints.
 - a. Primer and its application to surfaces are specified in Section 09 91 23 "Interior Painting."
- E. Glass-Mat Gypsum Sheathing Board: Finish according to manufacturer's written instructions for use as exposed soffit board.
- F. Glass-Mat Faced Panels: Finish according to manufacturer's written instructions.
- G. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.8 APPLYING TEXTURE FINISHES

- A. Surface Preparation and Primer: Prepare and apply primer to gypsum panels and other surfaces receiving texture finishes. Apply primer to surfaces that are clean, dry, and smooth.
- B. Prevent texture finishes from coming into contact with surfaces not indicated to receive texture finish by covering them with masking agents, polyethylene film, or other means. If, despite these precautions, texture finishes contact these surfaces, immediately remove droppings and overspray to prevent damage according to texture-finish manufacturer's written instructions.

3.9 PROTECTION

- A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

- B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

- C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 09 29 00

SECTION 09 67 23
SLIP-RESISTANT RESINOUS FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
1. Preparation of cast-in-place concrete floor for installation of slip-resistant resinous flooring system.
 2. Installation of industrial seamless epoxy/urethane slip-resistant resinous floor system and associated concrete joint filler.

1.3 REFERENCES

- A. Comply with the version of the following references used for basis-of-design product(s) or a more current version.
- B. ASTM INTERNATIONAL (American Society for Testing and Materials)
1. ASTM C 307: Tensile Strength of Chemical-Resistant Mortar, Grouts, and Monolithic Surfacing
 2. ASTM C 531: Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, and Monolithic Surfacing, and Polymer Concretes.
 3. ASTM C 579: Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes.
 4. ASTM C 679: Tack-Free Time of Elastomeric Sealants.
 5. ASTM C 884/C 884M: Thermal Compatibility between Concrete and Epoxy-Resin Overlay.
 6. ASTM D 1308: Effect of Household Chemicals on Clear and Pigmented Organic Finishes.
 7. ASTM D 2240: Standard Test Method for Rubber Property – Durometer Hardness.
 8. ASTM D 262: Infrared Identification of Vehicle Solids from Solvent-Reducible Paints.
 9. ASTM D 2697: Standard Test Method for Volatile Contents of Coatings.
 10. ASTM D 3335: Low Concentrations of Lead, Cadmium, and Cobalt in Paint by Atomic Absorption Spectroscopy.
 11. ASTM D 3718: Low Concentrations of Chromium in Paint by Atomic Absorption Spectroscopy.
 12. ASTM D 3925: Sampling Liquid Paints and Related Pigmented Coatings.
 13. ASTM D 412: Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers – Tension.

14. ASTM D 4541: Pull-Off Strength of Coatings Using Portable Adhesion Testers.
15. ASTM D 4060: Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser.
16. ASTM D 6237: Painting Inspectors (Concrete and Masonry Substrates).
17. ASTM D 638: Standard Test Method for Tensile Properties of Plastics.
18. ASTM E 11: Wire Cloth and Sieves for Testing Purposes.
19. ASTM F 1869: Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.

C. INTERNATIONAL CONCRETE REPAIR INSTITUTE (ICRI)

1. ICRI 03732: Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays

D. THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

1. SSPC-TU 2: Design, Installation, and Maintenance of Coating Systems for Concrete Used in Secondary Containment.

E. U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

1. 29 CFR 1910.1000: Air Contaminants
2. 29 CFR 1910.134: Respiratory Protection
3. 29 CFR 1926.59: Hazard Communications

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include manufacturer's technical data, application instructions, and recommendations for each resinous flooring component required.
- B. Concrete Guidelines: Submit recommendations for correct preparation, finishing and testing of concrete subfloor surfaces to receive floor system.
- C. Color Chart: Manufacturer's color chart with full range of standard solid colors for selection by Owner.
- D. Applicator Qualifications
 1. Pre-Qualification: Each offeror for this project shall be pre-qualified and approved in writing by the material manufacturer at the time product submittal.
 2. Applicator Experience: Contractor shall submit a list of three projects (with contact information) of similar size, scope and complexity. Contractor shall submit Letter attesting that Floor Contractor and Field Personnel have been properly trained to perform work per specifications and contract.
- E. Sample Warranty

1.5 INFORMATIONAL SUBMITTALS

- A. Concrete Moisture Test Reports.

B. Resinous Flooring Adhesion Test Reports.

1.6 CLOSEOUT SUBMITTALS

- A. Provide maintenance data for slip-resistant resinous flooring system as part of the Operation and Maintenance Manual as specified in Section 01 78 23.
- B. Provide manufacturer warranties with requirements specified in the "Warranty" article of this specification section as part of the Operation and Maintenance Manual as specified in Section 01 78 23.

1.7 QUALITY ASSURANCE

- A. Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, grouting coats, and topcoats, from single source from single manufacturer. Manufacturer must have been in business for a minimum of (10)-ten years. Provide secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from source recommended by manufacturer of primary materials
- B. Flooring System Installer's Qualifications:
1. Minimum requirements for the installation contractor are as follows. Completed three or more projects of similar size, scope and complexity within the last two years. Submit documentation listing location of work, point of contact at job site, total square footage of applied materials, and listing of both materials and equipment used.
 - a. The flooring installer's qualifications must include successful completion of the flooring work performed on the resinous flooring installations.
 - 1) Prepping the concrete floor surface via diamond grinding. Shot blasting is not permitted.
 - 2) Routing out joints as required by the material manufacturer including repair of floor joints, cracks, and spalling.
 - 3) Application of the entire resinous floor system.
 - 4) Installation of all joint sealants.
- C. Mockups: Apply mockups to verify selections made and to demonstrate aesthetic effects and set quality standards for materials and execution.
1. Apply full-thickness mockups on 120-inch- (3000-mm-) square floor area selected by the Owner.
 2. Simulate finished lighting conditions for the Owner review of mockups.
- D. Preinstallation Conference: Conduct conference at Project site with the Owner, General Contractor's Project Superintendent, Installer's Project Manager, Installer's Project Superintendent, and Manufacturer's Field Representative.

1.8 ENVIRONMENTAL CONDITIONS

- A. Permanent heat, light and ventilation shall be installed and operating during and after installation. Environmental temperatures must average a minimum of 65 degrees Fahrenheit for one full week proceeding, throughout, and 72 hours following application. Do not apply materials if relative humidity is above 85% (percent) or within 5° (3°) of dew point at time of application.

1.9 COATING HAZARDS

- A. Ensure that employees are trained in all safety plan aspects. Follow the coating manufacturer's written safety precautions throughout mixing, application, and curing of coatings. Comply with respiratory protection in 29 CFR 1910.135 and safe levels of airborne contaminants in 29 CFR 1910.1000.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Comply with CRI 104, Section 5, "Storage and Handling."
- B. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name, manufacturer, batch or lot number, and date of manufacture. Do not store materials in direct sunlight.
- C. Storage:
1. Store between 55-75°F (10°-25°C), do not store in direct sunlight or high heat conditions.
 2. Keep containers sealed until ready for use.
- D. Handling: Protect materials during handling and application to prevent damage or contamination.
- E. Condition materials for use to 60°-70°F (15-21°C) for 24 hours prior to application.

1.11 PATCH TEST DEMONSTRATION

- A. Prior to the submitted flooring system's approval, apply the complete flooring system to a 10 foot by 10 foot- (3 meter by 3 meter-) square concrete section as prepared in accordance with Part 3 "EXECUTION." Within this area, perform three adhesion tests using procedures as detailed in the Article entitled "ADHESION TESTING." If adhesion testing produces cohesive failures within the concrete, no less than 40 mils- (1 mm-) mils concrete removed over 95 percent of each pull-off coupon, and/or adhesion more than 400 psi- (2.75 MPa-), patch test adhesion is acceptable. If concrete surface preparation was insufficient, apply an additional coating system patch to properly prepared concrete followed by the above adhesion testing. If adhesion results are unacceptable for both the topcoat and the coatings below the grout coat, submit a new coating system manufactured by a different coating vendor. Apply new coating system to a patch and subject this patch to the above requirements for adhesion prior to approval. If customer dislikes non-skid application, adjustments to the specifications can be made. Grit additive is not permitted for non-skid floor. Immediately following "passing" adhesion results, remove urethane topcoats and grout coat by sanding, repair patch test holes

using epoxy mortar. Coarse scarification and/or pneumatic scabbling can be required to remove patch tests failing to meet adhesion requirements.

1.12 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of resinous flooring system that fail in materials or workmanship within specified warranty period.
1. Special warranty includes but is not limited to system failures such as blisters (chemical), checks, softening, or lifting.
 2. Warranty Period: Five (5) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Manufacturer name and products are given to clarify the designer's intent and are not intended to limit selection of similar products from acceptable manufacturers.
1. Manufacturer: Sika Corp., Industrial Flooring

2.2 RESINOUS FLOORING MATERIALS

- A. Resinous Flooring: Abrasion-, impact- and chemical-resistant, industrial-aggregate-filled, resin-based, monolithic floor surfacing designed to produce a seamless floor.
- B. System Characteristics:
1. Wearing Surface: Textured for slip resistance.
 2. Finish: High gloss.
- C. Primer: Sikafloor® 107 Primer
1. 100% solids, two component, low modulus, low viscosity primer.
 2. Apply at manufacturer's recommended thickness.
- D. Intermediate Wear Coat: Sikafloor® 264
1. Hardness-Shore D: (ASTM D2240) 76 (7 days)
 2. Pull-Off Strength: (ASTM D4541) > 400 psi (2.76 MPa) (100% concrete failure)
 3. Flexural Strength: (ASTM C580) 2,900 psi (20 N/mm²) (28 days)
 4. Compressive Strength: (ASTM C579) 7,250 psi (50 N/mm²) (28 days)
 5. VOC Content: (ASTM D2369) ≤ 50 g/L
 6. Apply at manufacturer's recommended thickness.
 7. Sikafloor® 264 Color: Applicator to coordinate pigmented solid color intermediate and sealer coating with manufacturer such that coating does not compromise finish color Sikafloor® 315 topcoat.
- E. Broadcast Coat: Natural silica sand.

1. Provide natural silica sand approved by the resinous flooring manufacturer.
2. Coverage: Broadcast surface to saturation.

F. Sealer Coat: Sikafloor® 264

1. Hardness-Shore D: (ASTM D2240) 76 (7 days)
2. Pull-Off Strength: (ASTM D4541) > 400 psi (2.76 MPa) (100% concrete failure)
3. Flexural Strength: (ASTM C580) 2,900 psi (20 N/mm²) (28 days)
4. Compressive Strength: (ASTM C579) 7,250 psi (50 N/mm²) (28 days)
VOC Content: (ASTM D2369) ≤ 50 g/L
5. Apply at manufacturer's recommended thickness.
6. Sikafloor® 264 Color: Applicator to coordinate pigmented solid color intermediate and sealer coatings with manufacturer such that coating does not compromise finish color Sikafloor® 315 topcoat.

G. Abrasion Resistant Aliphatic Polyurethane: Sikafloor® 315

1. Abrasion Resistance: (ASTM D4060); CS-17 Wheels 10-20 mgs./1,000 cycles (Taber Abraser , 1,000 gm load)
2. Hardness (ASTM D-3363 Pencil) 2H to 3H
3. Adhesion – Primed Concrete 350 psi (2.4 MPa) – concrete failure
4. Gloss (60°) 60-70
5. Coefficient of Friction: (ASTM 2047) .60-.70
6. Dry Film Thickness: 2.88 mils @ 3.2 wet mil application thickness
7. Tensile Strength: (ASTM D2370) 2882 psi
8. Percent Elongation: (ASTM D2370) 2.29
9. Sikafloor® 315 Color: As selected by Owner from manufacturer's full range of standard colors.

2.3 ACCESSORIES

A. Patching and Fill Material: Resinous product of or approved by resinous flooring manufacturer and recommended by manufacturer for application indicated.

B. Joint Material at Exposed Joints:

C. Joint Filler

1. Basis-of-Design Manufacturer name and products are given to clarify the designer's intent and are not intended to limit selection of similar products from acceptable manufacturers.
2. Manufacturer: Sika Corp., Industrial Flooring
3. Materials: As recommended by flooring system manufacturer.
 - a. Color: As selected by Owner from manufacturer's full range of standard colors.

PART 3 - EXECUTION

3.1 GENERAL

- A. The resinous flooring installation shall not be performed no sooner than 30 days prior to substantial completion. The General Contractor shall provide tempered conditions in the room(s) to receive the resinous flooring system which comply with the minimum and maximum requirements for air temperature and humidity. The tempered conditions shall be maintained by the General Contractor for no less than 48 hours prior to the resinous floor system installation and no less than 48 hours after the installation is completed.

3.2 EXAMINATION

- A. Examine surfaces to receive resinous flooring. Notify General Contractor if surfaces are not acceptable. Do not begin surface preparation or application until unacceptable conditions have been corrected (including fins, bugholes, curing compounds, cracks, skimming materials, slab exceeds 1/8" in 10', contaminants from other trades, etc.)
- B. Conduct Moisture Tests on the concrete slab utilizing a Tramex moisture meter. Do not proceed until the readings are 6% or less. Consult the manufacturer if readings exceed 6%.
- C. Do not apply to asphaltic or bitumen membranes, glazed or vitrified brick and tile, soft wood, aluminum, copper or fiberglass reinforced polyester/vinyl ester composites.

3.3 SURFACE PREPARATION

- A. Prepare concrete substrate in accordance with International Concrete Repair Institute (ICRI) Technical Guideline No. 03732 to CSP 3. Prepared surface shall be free of laitance and other bond-inhibiting contaminants.
- B. Roughen concrete substrates via diamond grinding. Use of shot-blast equipment is not permitted in this facility.

3.4 CONTROL JOINTS, CRACKS

- A. Provide repair and treatment of control joints and surface cracks utilizing manufacturer's standard materials and installation details.
- B. Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring according to manufacturer's written instructions.

3.5 APPLICATION

- A. Repair concrete substrate as required using materials approved by the Manufacturer.
- B. Do not add thinners to materials. No thinners shall be approved or allowed.
- C. General: Apply components of resinous flooring system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness indicated.
1. Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate, and optimum inter-coat adhesion.
 2. Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.

3. At substrate expansion and isolation joints, comply with resinous flooring manufacturer's written instructions.
- D. Apply primer over prepared substrate at manufacturer's recommended spreading rate.
- E. Apply intermediate wear coats in thickness indicated for flooring system.
 1. Broadcast aggregates at rate recommended by manufacturer and, after resin is cured, remove excess aggregates to provide surface texture indicated.
- F. Apply sealer coats to fill voids in surface of final intermediate wear coat and to produce wearing surface indicated.
- G. Apply abrasion resistant topcoats in number indicated for flooring system and at spreading rates recommended in writing by manufacturer.

3.6 FIELD QUALITY CONTROL

- A. Core Sampling: At the direction of manufacturer's field service representative and at locations designated by manufacturer's field representative (as coordinated with Owner), take one core sample per 1000 sq. ft. (92.9 sq. m) of resinous flooring, or portion of, to verify thickness. For each sample that fails to comply with requirements, take two additional samples. Repair damage caused by coring and correct deficiencies.
- B. Adhesion Testing
 1. Perform a minimum of three modified adhesion tests (ASTM D 4541) on the topcoat no less than forty-eight hours following application. Select three random flooring locations spaced a minimum of 20 feet between each location.
 2. Vertically core completely through the epoxy mortar flooring system and a minimum of 3/8 inch into concrete using a suitable drill fitted with a 1 inch diameter core bit.
 3. Throughout coring, employ a best effort to attempt to avoid fracturing and/or overheating both the mortar system and concrete as improper coring can affect adhesion results.
 4. Adhere directly to each cored surface's center a 3/4 inch diameter pull-off coupon.
 5. Lightly sand test area flooring surface prior to attaching pull-off coupons containing a grit-blasted anchor profile. When pull-off coupon adhesive has sufficiently cured, test adhesion and evaluate results.
 6. If testing produces cohesive failures within the concrete, no less than 40 mils concrete removal over 95 percent of each pull-off coupon, and/or adhesion more than 400 psi mortar system's adhesion is acceptable.
 7. If the above requirements are not satisfied, then perform one adhesion test per 100 square feet using the above procedures. Two additional tests will confirm results for each non-compliant area.
 8. Remove and rework all areas unable to meet adhesion requirements to sound material. Fill core holes using primer, sand-filled epoxy mortar, and urethane topcoat. Finish resulting repairs flush with adjacent coatings, displaying an equivalent appearance.

3.7 CLEANUP

- A. Remove masking, draping, and other protection from adjacent surfaces.
- B. Remove remaining materials and debris from job site and dispose of them in according with local rules and regulations. Leave area in clean condition free of debris.

3.8 PROTECTION

- A. Erect suitable barriers and post legible signs at points of entry to prevent traffic and trades from entering the work area during application and cure period of the floor. Protection of finished floor from damage by subsequent trades shall be the responsibility of the General Contractor. No other trades are to be allowed on floor until it is accepted in writing by Owner at Substantial Completion of all interior work of the project.

END OF SECTION 09 67 23

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SECTION 09 91 13 EXTERIOR PAINTING

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 surface preparation and the application of paint systems on the following exterior substrates:
1. Concrete.
 2. Steel.
 3. Galvanized metal.
 4. Wood.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Verification: For each type of paint system and each color and gloss of topcoat indicated.
1. Submit Samples on rigid backing, 200 mm (8 inches) square.
 2. Step coats on Samples to show each coat required for system.
 3. Label each coat of each Sample.
 4. Label each Sample for location and application area.

1.4 QUALITY ASSURANCE

- A. MPI Standards:
1. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List."
 2. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and paint systems indicated.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less 7 deg C (45 deg F).
1. Maintain containers in clean condition, free of foreign materials and residue.
 2. Remove rags and waste from storage areas daily.

1.6 PROJECT CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 10 and 35 deg C (50 and 95 deg F).
- B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 3 deg C (5 deg F) above the dew point; or to damp or wet surfaces.

1.7 EXTRA MATERIALS

- A. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.
 - 1. Quantity: Furnish an additional 5 percent, but not less than 3.8 L (1 gal.) of each material and color applied.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers' products that may be incorporated into the Work include, but are not limited to the following:
 - 1. Hallman Lindsay.
 - 2. Sherwin-Williams Company (The).
 - 3. Benjamin Moore & Co.

2.2 PAINT, GENERAL

- A. Material Compatibility:
 - 1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 - 2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
- B. Colors: See Architectural Finish Schedule.

2.3 PRIMERS/SEALERS

- A. Alkali-Resistant Primer: MPI #3.
 - 1. VOC Content: E Range of E1.
- B. Bonding Primer (Solvent Based): MPI #69.
 - 1. VOC Content: E Range of E1.

- C. Wood-Knot Sealer: Sealer recommended in writing by topcoat manufacturer for use in paint system indicated.

2.4 METAL PRIMERS

- A. Alkyd Anticorrosive Metal Primer: MPI #79.

- 1. VOC Content: E Range of E1.

- B. Quick-Drying Alkyd Metal Primer: MPI #76.

- 1. VOC Content: E Range of E1.

2.5 WOOD PRIMERS

- A. Exterior Alkyd Wood Primer: MPI #5.

- 1. VOC Content: E Range of E2.

- B. Exterior Oil Wood Primer: MPI #7.

- 1. VOC Content: E Range of E2.

2.6 EXTERIOR ALKYD PAINTS

- A. Exterior Alkyd Enamel (Flat): MPI #8 (Gloss Level 1).

- 1. VOC Content: E Range of E1.

- B. Exterior Alkyd Enamel (Semigloss): MPI #94 (Gloss Level 5).

- 1. VOC Content: E Range of E1.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.

- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

- 1. Concrete: 12 percent.
 - 2. Masonry (Clay and CMU): 12 percent.
 - 3. Wood: 15 percent
 - 4. Gypsum Board: 12 percent

- C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

- D. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.
1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.
- B. Remove plates, machined surfaces, and similar items already in place that are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
 2. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
- C. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.
1. Remove incompatible printers and reprime substrate with compatible primers as required to produce paint systems indicated.
- D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
- E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.
- F. Steel Substrates: Remove rust and loose mill scale. Clean using methods recommended in writing by paint manufacturer but not than the following.
1. SSPC-SP 2, "Hand Tool Cleaning."
 2. SSPC-SP 3, "Power Tool Cleaning."
 3. SSPC-SP 7/NACE No. 4, "Brush-off Blast Cleaning."
 4. SSPC-SP 11, "Power Tool Cleaning to Bare Metal."
- G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

- I. Aluminum Substrates: Remove loose surface oxidation.
- J. Wood Substrates:
 - 1. Scrape and clean knots. Before applying primer, apply coat of knot sealer recommended in writing by topcoat manufacturer for exterior use in paint system indicated.
 - 2. Sand surfaces that will be exposed to view, and dust off.
 - 3. Prime edges, ends, faces, undersides, and backsides of wood.
 - 4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Manual."
 - 1. Use applicators and techniques suited for paint and substrate indicated.
 - 2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
 - 3. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
 - 4. Paint entire exposed surfaces of window frames and sashes that are not factory finished.
 - 5. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 - 6. Primers specified in paint schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturer.
- B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
 - 1. Paint the following work where exposed to view:
 - a. Equipment, including panelboards and switch gear.
 - b. Uninsulated metal piping.
 - c. Uninsulated plastic piping.
 - d. Pipe hangers and supports.
 - e. Metal conduit.

- f. Plastic conduit.
- g. Tanks that do not have factory-applied final finishes.

3.4 FIELD QUALITY CONTROL

- A. Testing of Paint Materials: Architect reserves the right to invoke the following procedure at any time and as often as Architect deems necessary during the period when paints are being applied:
 - 1. Contractor will engage the services of a qualified testing agency to sample paint materials being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
 - 2. Testing agency will perform tests for compliance of paint materials with product requirements.
 - 3. Architect may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying-paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 EXTERIOR PAINTING SCHEDULE

- A. Concrete Substrates, Nontraffic Surfaces:
 - 1. Latex System: MPI EXT 3.1A.
 - a. Prime Coat: Primer, alkali resistant, water based, MPI #3.
 - b. Topcoat: Latex, exterior semi-gloss (Gloss Level 5), MPI #11.
- B. CMU Substrates
 - 1. Latex System: MPI EXT 4.2A
 - a. Prime Coat: Block filler, latex/interior exterior, MPI #4.

- b. Intermediate Coat: Latex, exterior, matching topcoat.
 - c. Topcoat: Latex, exterior, semi-gloss (Gloss Level 5), MPI #11.
 - 2. Latex over Alkali-Resistant Primer System: MPI EXT 4.2L
 - a. Prime Coat: Primer, alkali resistant, water based, MPI #3
 - b. Topcoat: Latex, exterior, semi-gloss (Gloss Level 5), MPI #11.
- C. Steel Substrates:
 - 1. Alkyd System: MPI EXT 5.1D.
 - a. Prime Coat: Alkyd anticorrosive metal primer.
 - b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
 - c. Topcoat: Exterior alkyd enamel (semigloss).
- D. Galvanized-Metal Substrates:
 - 1. Alkyd System: MPI EXT 5.3B.
 - a. Prime Coat: Cementitious galvanized-metal primer.
 - b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
 - c. Topcoat: Exterior alkyd enamel (semigloss).
- E. Dressed Lumber Substrates: Including architectural woodwork, doors.
 - 1. Alkyd System: MPI EXT 6.3B.
 - a. Prime Coat: Exterior alkyd wood primer.
 - b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
 - c. Topcoat: Exterior alkyd enamel (semigloss).

END OF SECTION 09 91 13

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SECTION 09 91 23 INTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes surface preparation and application of paint systems on the following interior substrates:
1. Steel
 2. Concrete
 3. Concrete Masonry Units
 4. Galvanized metal
 5. Wood and PVC foam (Fypon).
 6. Gypsum board

1.3 ACTION SUBMITTALS

- A. Product Data: For each product indicated.
- B. Samples for Verification: For each type of paint system and in each color and gloss of topcoat indicated.
1. Submit Samples on rigid backing, 200 mm (8 inches) square.
 2. Step coats on Samples to show each coat required for system.
 3. Label each coat of each Sample.
 4. Label each Sample for location and application.

1.4 QUALITY ASSURANCE

- A. MPI Standards:
1. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List."
 2. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and paint systems indicated.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).
1. Maintain containers in clean condition, free of foreign materials and residue.
 2. Remove rags and waste from storage areas daily.

1.6 PROJECT CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 10 and 35 deg C (50 and 95 deg F).
- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 3 deg C (5 deg F) above the dew point; or to damp or wet surfaces.

1.7 EXTRA MATERIALS

- A. Furnish extra materials described below are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.
 - 1. Quantity: Furnish an additional 5 percent, but not less than 3.8 L (1 gal) of each material and color applied.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers' products that may be incorporated into the Work include, but are not limited to the following:
 - 1. Hallman Lindsay
 - 2. Sherwin Williams Company (The)
 - 3. Benjamin Moore & Co.

2.2 PAINT, GENERAL

- A. Material Compatibility:
 - 1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 - 2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
- B. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction and, for interior paints and coatings applied at Project site, the following VOC limits, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 1. Flat Paints and Coatings: 50 g/L.
 - 2. Nonflat Paints and Coatings: 150 g/L.
 - 3. Dry-Fog Coatings: 400 g/L.
 - 4. Primers, Sealers, and Undercoaters: 200 g/L.
 - 5. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.
 - 6. Zinc-Rich Industrial Maintenance Primers: 340 g/L.
 - 7. Pretreatment Wash Primers: 420 g/L.

- 8. Floor Coatings: 100 g/L.
- 9. Shellacs, Clear: 730 g/L.
- 10. Shellacs, Pigmented: 550 g/L

C. Colors: See Architectural Finish Schedule.

2.3 BLOCK FILLERS

A. Interior/Exterior Latex Block Filler: MPI #4.

2.4 PRIMERS/SEALERS

A. Interior Latex Primer/Sealer: MPI #50.

B. Interior Alkyd Primer/Sealer: MPI #45.

C. Interior Low Permeability Latex Primer/Sealer: MPI #61. (Vapor Barrier)

D. Wood-Knot Sealer: Sealer recommended in writing by topcoat manufacturer for use in paint systems indicated.

2.5 METAL PRIMERS

A. Alkyd Anticorrosive Metal Primer: MPI #79.

2.6 WOOD AND PVC FOAM PRIMERS

A. Interior Latex-Based Wood Primer: MPI #39.

2.7 LATEX PAINTS

A. Interior Latex (Eggshell): MPI #52 (Gloss Level 3).

B. Interior Latex (Satin): MPI #43 (Gloss Level 4).

2.8 SOLVENT BASED EPOXY COATING

A. Solvent Based Epoxy: MPI #108

2.9 ALKYD PAINTS

A. Interior Alkyd (Semigloss): MPI #47 (Gloss Level 5).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.

- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - 1. Wood: 15 percent.
 - 2. Gypsum Board: 12 percent.
 - 3. Plaster: 12 percent.
- C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- D. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.
 - 1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.
- B. Remove plates, machined surfaces, and similar items already in place that are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
 - 2. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
- C. Clean substrates that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.
- D. Steel Substrates: Remove rust and loose mill scale. Clean using methods recommended in writing by paint manufacturer.
- E. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- F. Wood and PVC Foam Substrates:
 - 1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
 - 2. Sand surfaces that will be exposed to view, and dust off.
 - 3. Prime edges, ends, faces, undersides, and backsides of wood.
 - 4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

- G. Gypsum Board Substrates: Do not begin paint application until finishing compound is dry and sanded smooth.
- H. Plaster Substrates: Do not begin paint application until plaster is fully cured and dry.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions.
 - 1. Use applicators and techniques suited for paint and substrate indicated.
 - 2. Paint surfaces behind moveable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 - 3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
- B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- E. Painting Mechanical and Electrical Work: Paint items exposed in equipment rooms and occupied spaces including, but not limited to, the following:
 - 1. Mechanical Work:
 - a. Uninsulated metal piping.
 - b. Uninsulated plastic piping.
 - c. Pipe hangers and supports.
 - d. Tanks that do not have factory-applied final finishes.
 - e. Visible portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets.
 - f. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
 - g. Mechanical equipment that is indicated to have a factory-primed finish for field painting.
 - 2. Electrical Work:
 - a. Switchgear.
 - b. Panelboards.
 - c. Electrical equipment that is indicated to have a factory-primed finish for field painting.

3.4 FIELD QUALITY CONTROL

- A. Testing of Paint Materials: Architect reserves the right to invoke the following procedures at any time and as often as Architect deems necessary during the period when paints are being applied:
1. Architect will engage the services of a qualified testing agency to sample paint materials being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
 2. Testing agency will perform tests for compliance with product requirements.
 3. Architect may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying-paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

3.5 CLEANING AND PROTECTION

- A. At the end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities or other trades, touch up and restore damaged or defaced painted surfaces.

3.6 INTERIOR PAINTING SCHEDULE

- A. Concrete Substrates, Nontraffic Surfaces:
1. Institutional Low-Odor/VOC Latex System: MPI INT 3.1M.
 - a. Prime Coat: Institutional low-odor/VOC interior latex matching topcoat.
 - b. Intermediate Coat: Institutional low-odor/VOC interior latex matching topcoat.
 - c. Topcoat: Institutional low-odor/VOC interior latex (eggshell).
 2. Institutional - Vapor Retarder at Exterior Precast Concrete walls – Epoxy system:
 - a. Prime Coat: Interior/exterior latex block filler
 - b. Intermediate Coat: Epoxy, high-build, low gloss
 - c. Finish Coat: Epoxy, high-build, low gloss.
- B. CMU Substrates:

1. Institutional Low-Odor/VOC Latex System: MPI INT 4.2E.
 - a. Prime Coat: Interior/exterior latex block filler.
 - b. Intermediate Coat: Institutional low-odor/VOC interior latex matching topcoat.
 - c. Topcoat: Institutional low-odor/VOC interior latex (eggshell).
 - d. Toilet/shower room Topcoat: Latex, interior, institutional low odor/VOC, semi-gloss (MPI Gloss Level 5) MPI #147.

 2. Institutional - Vapor Retarder – Epoxy system:
 - a. Prime Coat: Interior/exterior latex block filler
 - b. Intermediate Coat: Epoxy, high-build, low gloss
 - c. Finish Coat: Epoxy, high-build, low gloss.
- C. Steel Substrates:
1. Prime Coat: Alkyd anticorrosive metal primer.
 2. Intermediate Coat: Interior alkyd matching topcoat.
 3. Topcoat: Interior alkyd semigloss.
- D. Galvanized-Metal Substrates:
1. Prime Coat: Cementitious galvanized-metal primer.
 - a. Prime Coat: Cementitious galvanized-metal primer.
 - b. Intermediate Coat: Interior alkyd matching topcoat.
 - c. Topcoat: Interior alkyd semigloss.
- E. Dressed Lumber and PVC Foam Substrates: Including architectural woodwork, doors and wall base.
1. Alkyd System: MPI INT 6.3B.
 - a. Prime Coat: Interior alkyd primer/sealer.
 - b. Intermediate Coat: Interior alkyd semigloss.
 - c. Topcoat: Interior alkyd semigloss.
- F. Gypsum Board Substrates:
1. Institutional Low-Odor/VOC Latex System: MPI INT 9.2M.
 - a. Prime Coat: Interior latex primer/sealer.
 - b. Intermediate Coat: Institutional low-odor/VOC interior latex matching topcoat.
 - c. Topcoat: Institutional low-odor/VOC interior latex (eggshell).
 - d. Toilet/shower room Topcoat: Latex, interior, institutional low odor/VOC, semi-gloss (MPI Gloss Level 5) MPI #147.

END OF SECTION 09 91 23

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SECTION 10 26 40 INDUSTRIAL FALL PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

1. Ceiling-Mounted Dual Track Monorail Anchor Track System

- B. Related Requirements:

1. Section 05 50 00 "Metal Fabrications" for metal vertical ladders, ships' ladders, and stairs for access to roof hatches.

- C. References

1. American Institute of Steel Construction (AISC): Manual of Steel Construction
2. American National Standards Institute (ANSI): ANSI Z359: Fall Protection Code
3. American Society for Testing and Materials (ASTM) A36: Carbon Structural Steel
4. American Society for Testing and Materials (ASTM) B221: Aluminum-Alloy Extruded Bar, Rod, Wire, Shape, and Tube
5. American Society of Automotive Engineer (ASAE) J429: Grade 5
6. American Welding Society (AWS) D1.1: Structural Welding Code
7. Occupational Safety and Health Administration (OSHA)—Specification 1910.66: Personal Fall Arrest System

1.3 COORDINATION

- A. Coordinate layout and installation of fall protection system with roof structure and ceiling mounted equipment.

- B. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

1.4 ACTION SUBMITTALS

- A. Product Data:

1. Submit product data for system and all accessories.
2. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
3. Provide capacities, performance, standard use, and applied forces to system.
4. Manufacturer's assembly and operation instruction manual with included assembly drawings.

B. Shop Drawings:

1. Include plans, elevations, keyed details, and attachments to other work. Indicate dimensions, loadings, and special conditions. Distinguish between plant- and field-assembled work.
2. Indicate size and location, method of attachment to structure, coordination with other systems and required clearances.

C. Delegated-Design Submittal: Validate structure, mounting, and securing complies with the performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Fall protection systems shall be designed by a Professional Engineer experienced in the design of fall protection systems.
2. Fall protection systems shall be designed for use above metro transit bus with up to two concurrent users. Provide a single rail above the length of the bus with the two users on the rail.
3. Dynamic and dead load reactions shall be generated for all intermediate and end supports of the fall protection system.
4. Design all fall protection systems to safely resist the dynamically applied loads while maintaining a safety factor of two against failure.
5. Design of fall protection systems shall be based on the understanding that the underlying structural steel supports are provided as part of the hangar and are adequate to support the imposed loads. Fall Protection loads shall be furnished to the building design structural engineer of record.
6. Design Engineer shall prepare a fall clearance analysis verifying adequate fall distance to safely stop the worker in the event of a fall.
7. Rail shall be designed for both workers falling at a time with full body harness and shock absorbing lifeline with a maximum arresting force of 900 pounds per worker.
8. The systems shall be designed to be supported by and integral with the building. Each anchor location shall be designed to support at least 5,000 pounds.
9. Design Engineer shall coordinate Fall Protection System with mechanical and electrical systems, lighting, fire protection equipment and other components of the building.
10. System shall be designed in accordance with ANSI/ASSE Z 359.6 Specifications and Design Requirements for Active Fall Protection Systems.

1.5 INFORMATIONAL SUBMITTALS

- A. Sample Warranties: For manufacturer's special warranties.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For anchor track system to include in operation and maintenance manuals.
- B. Manufacturer's Field Reports: Submit Letter of Certification from licensed design engineer indicating completion of operational proof testing on installed system.

- C. Training Owner's Employees: Submit list of attendees at training class in the use, care, and maintenance of fall protection equipment.

1.7 QUALITY ASSURANCE

- A. Standard system shall be designed, fabricated, and installed in accordance with ANSI Z359, OSHA 1910.66, and AISC.
- B. Manufacturer's Qualifications: An ISO 9001 registered company with more than 20 years of experience successfully designing and manufacturing fall protection solutions.
- C. Installer's Qualifications: A company that is acceptable to the manufacturer and meets OSHA requirements for a Qualified Person assembling and installing fall protection systems for multiple applications. Installer should be able to:
 - 1. Bolt connections in accordance with torque tightening procedures specified in AISC Manual, Part 5.
 - 2. Clearly label system with maximum average arresting force visible from tie-off position.

1.8 CONDITIONS/DELIVERY, STORAGE, AND HANDLING

- A. Field Measurements: Verify field measurements and indicate measurements on Shop Drawings to ensure required fit.
- B. Project Conditions
 - 1. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results.
 - 2. Do not install products under environmental conditions outside manufacturer's absolute limits.
- C. Delivery, Storage, and Handling
 - 1. Store products in manufacturer's packaging until ready for installation.
 - 2. Store and dispose of solvent-based materials in accordance with requirements of local authorities.

1.9 WARRANTY

- A. Manufacturer's Warranty: Included on manufacturer's standard form and outlines the manufacturer's agreement to repair or replace assemblies and components that fail in materials and/or execution within warranty period from date of substantial completion.
 - 1. Warranty covers the engineered track equipment, wearable end truck wheels, and anchor trolley wheels and teeth to be free from defects in material and workmanship for a period of ten (10) years.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Coverage: System shall provide linear coverage of size indicated on drawings and consist of:
 - 1. Enclosed track.
 - 2. Track hanger assemblies.
 - 3. Swiveling connector Anchor Trolley™.
- B. Modular, Pre-Engineered Design: System shall be designed for one, two, or multiple workers using single, dual, or multiple tracks.
 - 1. System shall be designed, fabricated, and installed in accordance with ANSI Z359, OSHA 1910.66, and AISC Manual of Steel Construction.
- C. Design Strength: For one user, the system shall be designed based on a worst-case placement of the 900-pound (408 kg) maximum average arresting force with a safety factor of two and the weight of the anchor system.
- D. Operating Temperature: 5 to 200 degrees F (-15 to 93 C)
- E. Structural Design: The system's structural design is based on dynamic load capacity. System shall be designed to withstand:
 - 1. System and dynamic load and impact factors.
 - 2. Dynamic load capacity equal to rated capacity.
 - 3. Inertia forces from the system and dynamic load movement.

2.2 Ceiling-Mounted Dual-Track Monorail Anchor Track System

- A. Manufacturers: Basis-of-Design Manufacturer name and products are given to clarify the designer's intent and are not intended to limit selection of similar products from acceptable manufacturers.
 - 1. Rigid Lifelines, Morgantown, PA and Las Vegas, NV; Phone: 800-869-2080; Website: RigidLifelines.com
- B. General:
 - 1. Provide as a complete assembly.
 - 2. System Options
 - a. Dual track for use by two workers.
 - b. Flush-cross mounted attachment to existing structures.
 - 3. Construction: Fabricated using high-strength steel or ASTM A36 steel for structural components
 - 4. Design Factors: Track, tubing, and welded track shall have a minimum yield strength of 46,000 pounds per square inch. Track profile design shall provide wheel protection, accurate alignment with minimum friction, and low-maintenance, self-cleaning profile. All track shall have full contact flange loading surfaces (flat) to decrease flange and wheel loads during a fall event.

5. Structure: Enclosed Anchor Track(s) bolted to existing structures with hanger assemblies.
 - a. Hanger assemblies: Includes hanger assemblies that provide a rigid connection for suspending tracks. Assembly to consist of angle truss clamps and truss clamp plates. Use of threaded rods in flush hanger assemblies not permitted.
 - b. Runways: Vertical truss fabricated from square steel tubes and enclosed steel track.
 - 1) Track: Enclosed cold-formed steel track that serves as bottom cord of trussed track and permits trolley(s) to ride on lower inside flanges. Fabricate lower running flanges with flat surface for higher durability and wheel contact. Sloped flanges are not permitted.
 - 2) Track splice: Includes truss splice plates and channel-shaped track splice joints for joining track sections. Splice joints must be located within 48 inches of a support point.
 - 3) Standard track cantilevers: Up to 18 inches of cantilever is allowed from a hanger location to the end of the trussed track. Up to 12 inches of cantilever is allowed from a hanger location to the end of the plain track. Longer track cantilevers are done on a customized basis.
 - c. Swiveling connector Anchor Trolley: Rigid-body trolley designed to ride inside enclosed track and to carry load.
 - 1) Construction: Steel body with two wheels on each side and positioning attachment point at center of trolley so load weight is evenly distributed to trolley wheels.
 - 2) Braking system: If at least 80 pounds of force, including the weight of the self-retracting lanyard, are exerted on the swiveling connector, a series of eight hardened-alloy steel contact points create friction against the enclosed track. The friction generated by the contact points, in conjunction with the weight of the worker, causes the trolley to stop all movement on the track.
 - 3) Wheels: Removable, self-centering wheels with sealed lifetime lubricated bearings. Vertical wheels shall be flat to match track profile. Non-removable or tapered wheels are not acceptable. Provide polyamide wheel material.
 - 4) Designed for attachment of carabiner.
 - d. End stops: Molded composite resilient bumper installed in track to prevent end trucks from rolling out of track. Bolt stops without energy absorbing bumper are not acceptable.
6. Accessories:
 - a. Cable Self-Retracting Lanyard (SRL): Provide one self-retracting lanyard for each track.

- 1) Housing: High Strength thermoplastic polymer
- 2) Cable Material: Galvanized steel wire roper – 3/16-inch diameter.
- 3) Working load capacity: 310 pounds.
- 4) Minimum capacity rating: 130 pounds.
- 5) Length: To be reviewed based on layout by manufacturer delegated design.
- 6) ANSI-rated steel swivel snap hook on lifeline end.
- 7) Installation carabiner for top
- 8) Meets ANSI 7359.11-2014, ANSI A10.32-2012, OSHA 1910, and OSHA 1926 Subpart M.

2.3 SHOP FINISHING

A. Standard Paint Colors:

1. All systems are painted with one coat of Rigid Lifelines® Yellow Industrial Enamel.

B. Surface Preparation and Painting Procedures:

1. Adhere to the standards of the Society for Protective Coatings (SSPC) for all product surface preparation.
2. System components shall be deburred and descaled using power tools equipped with sanding discs and wire wheels prior to painting.
3. Wash with high-pressure/high temperature biodegradable degreaser solution.
4. Coat with quick drying semi-gloss enamel applied to a minimum dry-film thickness of two to three mils.
5. Apply finishing with a hot airless electrostatic spray paint system.
6. Cure at air temperature.

PART 3 - EXECUTION

3.1 PREPARATION

A. DO NOT start installation until support structures are properly prepared.

B. Inventory:

1. Check materials to ensure all parts are present.

3.2 ASSEMBLY

A. Units and accessories should be installed in accordance with manufacturer's Assembly and Operation Instructions Manual.

B. Do not modify system components without manufacturer's approval.

C. Installation Manual/Assembly Drawings

1. Refer to installation manual to find dimensions for a specific model.
2. Consult included assembly drawings for list of building materials.

D. Enclosed Track Installation

1. Raise track into position and clamp it to structure with beam clamp hangers.
2. Do not cantilever ends of trussed tracks more than 48 inches beyond support centers.

E. Track Splice Installation (Application varies depending on required track length and support structure)

1. For systems with more than one section of track, an additional section is installed in the same manner, with the addition of splice joint assembly.
2. The track splice joint is made using a sleeve. Slide sleeve over end of first track, and butt second track against first. Center sleeve over joint. Tighten all top setscrews and side setscrews for correct track alignment. Do not over tighten screws.
3. Track splice joints include two splice plates. Install splice plates to connect ends of truss top tubes. For trussed track, splice joints should be within 48 inches of support hanger.

F. Swiveling Connector Anchor Trolley Installation

1. Install swiveling connector Anchor Trolley on track. Secure end stop bolts and rubber bumpers.
2. After installation is complete, enclosed tracks should be leveled. Check tightness for all
3. bolts and nuts.

G. Final Assembly

1. Torque locknuts, bolts, and flat washers to appropriate specifications shown in manual.
2. This system must be used with an ANSI-rated self-retracting lanyard (SRL). Connect SRL and retrieval tagline in accordance with manufacturer's specifications.

3.3 FIELD QUALITY CONTROL**A. Inspection**

1. Anchor Track System Inspection
 - a. Check that the beam clamps are installed horizontal within + / - five degrees.
 - b. Check that end stop bolts are present and have locknuts installed.
 - c. Using a torque wrench, check that all bolts are present and torqued to values shown on Assembly Drawing.
 - d. Check that splices, if supplied, are centered on track joints.
 - e. Verify that capacity labels are present, attached, and legible. See Label Placement Drawing. Verify that the number of trolleys matches the value on the capacity label.
 - f. Verify that the fall arrest system is not being used for material handling.

- g. Check the track for levelness within + / - 1/4 inches per 20 feet of track.
- h. Check the track flanges. Track flanges cannot be bent downward more than five degrees. Check the track thickness. Track thickness cannot be worn more than 10 percent.
- i. Check all system welds for cracks.
- j. Check system components for corrosion and bent or damaged areas.
- k. Check that all wheel studs, if supplied, are torqued to value shown on Assembly Drawing. Note that these 1/2-inch wheel studs have a different torque value than the system's other 1/2-inch bolts.
- l. Verify trolley can traverse entire length of track without snags.
- m. Check trolley for visibly bent swiveling connector, broken welds, or excessive wear or corrosion.
- n. Test the operation of the trolley's swiveling connector and verify that it can rotate freely. Test the operation of the trolley and verify the wheels rotate freely.
- o. Check system components for loose components.
- p. Check system components for loose or missing fasteners.
- q. Check system support structure for stability.
- r. Verify that hanger assemblies are installed properly and fasteners are torqued to proper values.
- s. Check that the support arms pivot bolts, if supplied, are properly installed and tightened. Check system for unauthorized modifications. Only Rigid Lifelines can authorize modifications. Remove system from service if it is modified in any way.

2. Before Each Use Inspection Checklist

- a. Test the swiveling connector(s) on each trolley to verify that each trolley rotates and swivels freely.
- b. Verify that the trolley(s) can easily and smoothly roll the full length of the track(s).
- c. Check all system welds for cracks.
- d. Check system components for corrosion.
- e. Check system components for bent or damaged areas.
- f. Check support structure for stability.
- g. Visually check all bolted assemblies for proper connections and properly secured bolts and nuts.

B. Acceptance Inspection

- 1. After the system has been installed and after any modifications, an acceptance inspection must be performed using the Anchor Track System Inspection Checklist included in the Assembly and Operation Instruction Manual before use. An authorized dealer or installer should perform acceptance inspections.

C. Maintenance

- 1. To keep systems in good operating order, engineers recommend establishing a regular schedule of inspection and lubrication. All parts should be inspected, all loose parts adjusted, and worn parts replaced at once.

2. Check track splices for alignment and verify that Anchor Trolley travels smoothly through joints.
 3. A qualified person must perform an annual system inspection using the Anchor Track System Inspection Checklist included in the Assembly and Operation Instruction Manual.
- D. Clean Surfaces
1. Touch up scratches and blemishes with matching paint from manufacturer.
 2. Keep surfaces clean and clear of build-up and residue.
- E. Protect System
1. Protect assembled products until completion of project.
 2. Touch-up, repair, or replace damaged products before substantial completion.
- F. Quality Standards
1. Manufacturer shall be an ISO 9001-2008 Registered Corporation.
 2. Welding performed during manufacturing process meets the American Welding Society's (AWS) D1.1 Standards.
 3. Systems shall be manufactured to standards ensuring safety, reliability, and the highest quality.

END OF SECTION 10 26 40

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SECTION 10 28 13 TOILET ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes:
1. Public-use washroom and private shower accessories.

1.3 ACTION SUBMITTALS

- A. General: Provide action submittals for all items in this specification section for review within a single submittal to the Architect.
- B. Product Data: For each type of product indicated. Include the following:
1. Construction details and dimensions.
 2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
 3. Material and finish descriptions.
 4. Features that will be included for Project.

1.4 QUALITY ASSURANCE

- A. Source Limitations: For products listed together in the same articles in Part 2, provide products of same manufacturer unless otherwise approved by the Architect.

1.5 COORDINATION

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.
- B. Deliver inserts and anchoring devices set into concrete or masonry as required preventing delay in Work.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Stainless Steel: ASTM A 666, Type 304, 0.8-mm (0.0312-inch) minimum nominal thickness, unless otherwise indicated.

- B. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.9-mm (0.0359-inch) minimum nominal thickness.
- C. Galvanized Steel Sheet: ASTM A 653/A 653M, with Z180 (G60) hot-dip zinc coating.
- D. Galvanized Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.
- E. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.

2.2 PUBLIC-USE WASHROOM ACCESSORIES

- A. Manufacturers:
 - 1. Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to following:
 - a. Bobrick Washroom Equipment, Inc. (Basis-of-Design)
 - b. American Specialties, Inc.
 - c. Bradley Corporation.
- B. Toilet Paper Dispenser (TPD): Bobrick B-265
- C. Paper Towel Dispenser (PTD): Bobrick B-262
- D. Soap Dispensers (SD): OFOI
- E. Electric Hand Dryers (EHD): Excel HO-BL Hands On, Surface Mounted, LEXAN Cover, White, 30 second time cycle, 120V.
- F. Grab Bars:
 - 1. 38-cm (1½ inch) diameter stainless steel tubing with satin finish; safety grip finish; minimum structural strength of 113-kg (250-pounds); concealed mounting.
 - a. B-6806.99 x 42: (GB1)
 - b. B-6806.99 x 36: (GB2)
 - c. B-6806.99 x 18: (GB2)
- G. Clothes/Robe Hook: (RH1)
 - 1. Surface-mounted stainless-steel clothes/robe hooks with bright polished finish; 2 vertically aligned hooks; concealed mounting.
 - a. B-233
- H. Sanitary Napkin Disposal: (SND1)
 - 1. Surface-mounted stainless-steel sanitary napkin disposal with satin finish; all seamless construction; one piece cover secured to container with a full-length

stainless steel piano-hinge. Container shall have integral finger depression for opening cover.

a. B-270

I. Mop Strip: (MS1)

1. Wall-mounted stainless-steel mop and broom holder with satin finish; 610 mm (24-inches) long with 3 holders.

a. B-223 x 24

2.3 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Equip units for concealed anchorage and with corrosion-resistant backing plates.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION 10 28 13

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SECTION 10 44 16 FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes:
1. Portable fire extinguishers.

1.3 ACTION SUBMITTALS

- A. Product Data.

1.4 QUALITY ASSURANCE

- A. Fire Extinguishers: NFPA 10 listed and labeled for the type, rating, and classification of extinguisher.

PART 2 - PRODUCTS

2.1 FIRE EXTINGUISHERS AND BRACKETS

- A. Portable Fire Extinguishers:
1. Multipurpose Dry-Chemical Type: UL-rated 4-A:60-B:C, 4.54 kg (10-lb) nominal capacity.
- B. Mounting Brackets: Manufacturer's standard steel, designed to secure fire extinguisher to wall or structure, of sizes required for fire extinguishers indicated, with plated or baked-enamel finish.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install mounting brackets in locations indicated at 1220 mm (48 inches) above finished floor to top of fire extinguisher.
- B. Install fire extinguishers on mounting brackets and in fire extinguisher cabinets where indicated.

END OF SECTION 10 44 16

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SECTION 11 11 19 LUBRICATION SYSTEMS

PART 1 - GENERAL

1.1 SCOPE

- A. Applicable provisions of the General and Supplementary Conditions and Division 01 govern work under this Section.

1.2 RELATED WORK

- A. Please refer to Section 11 11 28 "Vehicle Fuel Equipment."

1.3 DESCRIPTION

- A. Furnish and install a complete inside "lubrication system" as herein described and shown on drawings. This shall include all items necessary to complete the installation and as usually included in similar work whether specifically mentioned in the Contract Documents or not, including:

1. Lubrication reels
2. Piping, fittings and valves
3. Pipe support
4. Equipment mounting and support
5. Lube pumps
6. Lube tanks
7. Installation
8. Adapters
9. Emergency Shut Off
10. Low voltage wiring and components for controls/alarms.

- B. The entire project shall be designed, fabricated and installed by a contractor with not less than five years of installation experience with projects of this type and size.

- C. This Contractor shall hire all other trades as required to complete this project.

- D. All piping in building to run as high as possible, verify locations of all HVAC, electrical, plumbing, piping, ductwork and fire protection piping.

- E. Component and coordination of this system with fluid control system.

- F. This contractor will also supply and install the water and air reels. Piping to the water and air reels will be by the plumbing contractor.

1.4 MISCELLANEOUS EQUIPMENT AND INSTALLATION SPECIFICATIONS

- A. This system shall be bid on an installed basis by a qualified and experienced contractor with five years' experience in the installation of centralized lubrication systems.

- B. Lubrication system piping shall be of size required for proper function of systems, piping shall be annealed steel tubing and matching fittings.
- C. All reels and pumps shall have shut-off valves and union connections.
- D. The piping shall be installed as per the manufacturer's installation instructions and good practice as noted on the plans. The manufacturers' installation procedure shall be completely followed by the contractor.
- E. The reels shall be mounted and secured to a heavy-duty mounting assembly attached directly to the wall, structure, or column and extending down to 10' above the floor service lane.
- F. One portion of the procedure is being emphasized as follows, but in no way minimizes the remaining manufacturers' installation instructions.
 - 1. Blow all air lines clean before making final equipment connections.
 - 2. Flush lubricant lines with non-flammable cleaner to remove foreign materials.
 - 3. Do not install control valves before flushing.
 - 4. Each line shall be flushed with the pump to be used on the line.
 - 5. After the lines are flushed, install control valves and pressure test with line under pressure. Check all connections and fittings for leakage.
 - 6. Adjust the hose ball stops so valves hang 7' from floor.

1.5 DRAWINGS

- A. Contractor shall design a system based on equipment locations shown on drawings. Contractors shall use Architectural and Mechanical drawings to do so, coordinate locations with all other contractors, verify equipment, duct, electrical and plumbing locations.
- B. Intent: It is the intent and the requirement of these Contract Documents, including Specifications, to provide finished work, complete in all respects and ready for operation by the Owner.
- C. It is the Contractor's responsibility to review all materials and equipment hereinafter specified or indicated on the Architectural drawings with regard to their proper operation and compliance with all governing Codes and then include in his bid proposal all materials required to provide the Owner with a completely approved and operating system whether or not all items have been specifically mentioned herein.
- D. Any dimensions given in figures on the drawings and details regarding the locations and configuration of any part of this work shall take precedence over dimensions and locations obtained by scaling the drawings. All dimensions, whether given in figures or scaled from the drawings, shall be field verified by the Contractor prior to fabricating any materials or ordering any equipment.
- E. The contractor shall design working shop drawings for review and coordination.

1.6 CODES AND APPROVALS

- A. Comply with all codes, laws and ordinances of all governing bodies having jurisdiction over this work. In the event that the requirements of any of the codes, laws or ordinances conflict with these Contract Documents the more stringent requirements shall govern the Contractor.
- B. This entire installation shall be in complete compliance with guidelines set forth in:
 - 1. N.F.P.A. - latest edition and all other applicable N.F.P.A. Standards.
 - 2. Applicable Local Codes.
 - 3. Fire insurance requirements. (Rating Bureau and Owners)
 - 4. State Codes.
 - 5. Local Codes.
- C. Secure all required permits and pay all fees.

1.7 SUBMITTALS

- A. Submit to the Engineer, preliminary layout and detail drawings with pipe locations and sizes, as specified hereinafter, for approval as to compliance with contract intent.
- B. Submit layout drawings, details and calculations of the system design to Engineer. Engineer shall approve these submittals prior to fabrication or installation of any materials by the contractor and proof of such approval shall be submitted to the Architect.
- C. The above mentioned submittal shall be submitted in triplicate and shall include catalog cut sheets on the following:
 - 1. All equipment, fittings, pipe, hangers, etc.

1.8 MATERIALS AND WORKMANSHIP

- A. All materials furnished for this work shall be suitable for use on this type of installation.
- B. All work shall be guaranteed for one year from the date of final acceptance by the Owner against defective materials and careless workmanship.
- C. Contractor shall patch the holes made necessary by this work and provide sleeves and waterproof members for any protrusions of the exterior building walls.

1.9 RECORD DRAWINGS

- A. Upon completion of the project the Contractor shall provide the Owner with three (3) sets of Record Drawings updated to reflect any field changes that may have been made to the shop drawings.
- B. Contractor shall review the system installation with the Owner or his representative and instruct him as to the proper care and maintenance procedures. This instruction should include providing all instruction charts describing operation and proper maintenance.

PART 2 - PRODUCTS**2.1 EQUIPMENT****A. General**

1. All hose reels located in the lube reel banks, Lube dispensing Station, control valves and pumps shall be matched to a single source manufacturer. This contractor will also supply and install the water and air reels. Piping to the water and air reels will be by the plumbing contractor.

B. Equipment by Lincoln, Graco, Sampson or pre-approved equal shall be used.**C. Reels**

1. Reels shall be rated "heavy duty" with single pedestal and hose roller arms, permanently lubricated bearings, extra large ratchet latch, fully ported swivel, be capable of retracting a minimum of 50' x 1/2" hose, carry a minimum one (1) year limited parts and labor warranty, and have metal product identification tags.

2. Oil Reels:

- a. Design to handle the following products 15W40 Oil and Transmission (TRANS).
- b. 50' x 1/2" 2250 psi WP hose
- c. Hose Inlet Kit
- d. Control valve
- e. Solenoid valve with ready light
- f. Medium pressure inlet hose kit (comes with hose Reel)
- g. Lubricant Filter
- h. 2,000 psi shut-off ball valve
- i. Non-metered dispensing valve
- j. Oil, transmission fluids, metering control valve, 60 quart, preset countdown

3. Antifreeze:

- a. Design to handle Antifreeze fluid.
- b. 50' x 1/2" 2250 psi WP hose
- c. Hose Inlet Kit
- d. Control valve
- e. Solenoid valve with ready light
- f. Medium pressure inlet hose kit (comes with hose Reel)
- g. Lubricant Filter
- h. 2,000 psi shut-off ball valve
- i. Non-metered dispensing valve
- j. Metering control valve, 60 quart, preset countdown

4. Windshield Fluid

- a. Design to handle Windshield fluid.
- b. 50' x 1/2" 2250 psi WP hose

- c. Hose Inlet Kit
- d. Control valve
- e. Solenoid valve with ready light
- f. Medium pressure inlet hose kit (comes with hose Reel)
- g. Filter
- h. 2,000 psi shut-off ball valve
- i. Non-metered dispensing valve
- j. Metering control valve, 60 quart, preset countdown

D. Timer:

1. Provide and install a 24-hr/ 7-day programmable timer (this is a simple HVAC type) and normally closed 2" air solenoid valve with valved bypass at air Main that supplies all Lube air pumps.
 - a. Install a 2" air valve before solenoid valve at 4' above floor.
 - b. This contractor shall add normally closed air solenoid valve, panic push button for shut off and wiring from push button to solenoid valves to shut off supply air to air pumps.
 - c. System shall operate by closing air solenoid valves at air pump inlets when panic button is pushed.
 - d. Include sign indicating "emergency shut off for lubrication reels."
 - e. Equipment: Similar to BJ Enterprises air solenoid valve
 - f. Locations: Mount panic button on wall opposite of the tanks.

E. Pumps:

1. All pumps shall have a minimum 4" diameter air motor size and the lubrication pumps shall have a limited parts and labor warranty.
2. General Lubrication:

Quantity	Part #	Description
8		Powermaster 3, 8:1 ratio stub pump with 4" diameter air motor and 6" stroke and built-in air muffler with remote wall mount brackets/supports
8		2' air connect hose
8		5' x 3/4" product hose
8		Bung adapter
8		low-level cut off
8		Thermal relief valves
8		Suction tubes for between pump and low level cutoff High pressure valves

- a. As needed: suction and pressure hosed for remote location of pumps
- b. Other miscellaneous items for proper system function.

3. Miscellaneous Pump Accessories:

Quantity	Part #	Description
8		1/2" air regulator and gauge
8		3/4" product shut off ball valve
8		1/2" pump air shut off ball valve

8		3/4" airline filter
8		3/4" airline lubricator
8		3/4" shut-off ball valve for main airline

F. Above Ground Tanks

1. Shall be stackable Poly tanks made for stackable installation or Double wall Steel tanks approved for use with Lubrication fluids will be allowed.
2. Include Base frame supports, openings as needed, opening plugs, fasteners, secondary containment pans and all other misc. items as needed for complete system. Venting and double float gauges are to be included. Fluidall or equal.
3. Provide 1 tank per reel. The tanks shall be 240gallon capacity each – with containment tanks.

G. Piping:

1. All piping shall be as required for intended use and per industry standards.
2. Piping:
 - a. Oil and, Trans, etc.: 1" OD steel tubing with a wall thickness of 0.049" with matching joint systems, 2200PSI minimum. Windshield fluid piping should be stainless steel.
 - b. Air Piping (at Lube Pumps)
 - 1) ASTM A53, Type E or S, standard weight, SCH40 black steel with ASTM A 197/ANSI B16.3 Class 150 black iron threaded Fittings.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

- A. Inspection: Prior to all work of this Section, carefully inspect the installed Work of all other trades and verify that all such Work is complete to the point where this installation may properly commence. Verify that lubrication systems shall be installed in strict accord with all pertinent codes and regulations and the approved Shop Drawings.
- B. Discrepancies: In the event of discrepancy, immediately notify the Architect for clarification and await his decision before proceeding.

3.2 INSTALLATION

A. Openings, Cutting, Sleeves and Repairing

1. The Contractor shall do all necessary openings, required to install all piping, fixtures and equipment. Only saw cutting or core drilling will be allowed. All piping shall be concealed wherever possible.
2. All openings or holes shall be sleeved.
3. Provide as necessary to permit installation of piping or any other part of the Work under this Section. Cooperate with other trades and adjust with them, subject to Architect's review, all questions of interference, right-of-way for piping,

- etc. Make all arrangements with various Contractors for any special framing or chases.
4. All openings or holes thru new walls, floors, ceiling or footings shall be sawcut or core drilled.
 5. Openings around pipes penetrating required fire resistance rated floor, wall and roof assemblies shall be filled solidly with material of fire-resistance rating equal to the required rating of assembly penetrated. On all pipes passing through floors, walls and ceilings, provide chrome plated brass escutcheons of approved design and finish having outside diameter to cover sleeved openings and inside diameter to fit pipe. Securely fasten in place to floors, walls and ceilings.
 6. Holes through exterior walls shall be waterproofed and made watertight.
 7. Plumber shall patch and return to original condition all areas damaged, sawcut, core drilled, etc. on this project and site.
 8. All holes, openings, etc. cut through any reinforced concrete must be drilled with care so as to avoid spalling and unnecessary damage or weakening of the structural members. Chopping or breaking out will not be permitted. BEFORE cutting or drilling, permission must be obtained from Architect and any damage shall be repaired to Architect's satisfaction. Holes for piping through floors and walls already in place will be by means of core drilling.
 9. Provisions for openings, holes, chases and clearances through walls, floors, ceilings, etc. in new construction shall be made in advance of construction of such parts of the building. The openings shall be provided by others during construction of the building, but it shall be the responsibility of the Contractor to furnish the applicable Contractor with all openings, dimensions and sleeves where required for installing this Work. These dimensions shall size and locate the opening sites.
 - a. If the Contractor neglects to inform the other Contractors of opening requirements before that portion of the building has been constructed, the Contractor shall, at his own expense, cut his own opening and provide framing and lintels as required and approved by the Architect.
 10. Sleeves shall be SCH 40 galvanized iron, except pipes passing through floors shall have steel sleeves extended one inch above finished floors. Sleeve shall be ½ inch larger than piping. Seal in open space around sleeve with caulking rope and finish with caulking to level of sleeve. Sleeves in outside wall shall be galvanized steel pipe, Schedule 40. 1 inch larger than piping, seal with oakum and finish with caulking to level of sleeve. Take special care in core drilling thru concrete floors so as not to spill water below and cause damage.
 11. This contractor shall protect existing/New building, structure, drives, walks, equipment, etc. and furnishings when saw cutting, core drilling or installing this work.

B. Electrical Work:

1. Contractor shall see that starters are properly located allowing for easy access and where ambient temperatures do not exceed normal room temperatures. Starters should not be secured to equipment, but instead to walls in close proximity to equipment. Where walls are not available, provide steel sandwich panels mounted on pipe legs and floor flange.

2. Contractor shall furnish: All motors in connections with this work, starters for all motors, overload protection for all motors and wiring diagrams, mercury float switches with 20' wire.
 3. This Contractor shall provide: All conduit, wiring and connectors of all requirements for all equipment requiring electrical service, all remote control devices including starters and final wiring connections.
- C. Painting and Finishes:
1. Painting will be done by others.
 2. Structural iron, iron pipe supports, platforms exposed pipe hangers, etc., provided by this Contractor and any equipment which is not furnished with an enamel finish shall be wire brushed free of rust, scale, etc., and given one coat of aluminum colored "Rustoleum" paint by a Journeyman Painter under the employ of the Contractor.
 3. Any surfaces of equipment in these areas where finish has been rusted or destroyed shall be refinished.
- D. General Pipe Work:
1. All piping shall be cleaned before installation by blowing out with compressed air or by other approved method. Provide temporary plugs or cap for all open ends of pipe and fixture when work is not being carried on to completion.
- E. Lubrication System Layout:
1. General:
 - a. Layout the lubrication system in careful coordination with the approved Shop Drawings, determining proper elevation for all components of the system and using only the minimum number of bends to produce a satisfactorily functioning system.
 - b. Diagrammatic layouts for water, soil and vent piping are intended as a guide only and do not relieve the Contractor of any and all requirements of the State and Local Codes.
 2. Information given herein and on Drawings is as exact as could be secured. Size and location shown are taken from the field survey. This Contractor must, therefore, examine location carefully and verify all measurements, distances, levels, etc. before starting work.
 3. Wherever the location of piping of equipment is governed by architectural features, this Contractor shall establish their location by referring to the General Drawings; he shall not scale the Drawings for exact dimensions.
 4. Services: Locations of services are approximate and Contractor shall:
 5. Check existing locations, elevations and pitches of present piping before making connections to same;
 6. Report immediately to Architect in writing any existing conditions which will prohibit the installation of new work;
 7. Await Architect's decision on approximate adjustment of line locations and elevations before proceeding.

8. In event Drawings and Specifications are not in full accord and alterations, additions or deductions are necessary or exception in regard to size of equipment, notify Architect immediately, in writing and await his decision.
9. These Specifications and the accompanying Drawings are intended to provide for a finished and complete lubrication system.

3.3 FIELD QUALITY CONTROL

A. Tests

1. General:
 - a. All tests and trials requested or directed by the Architect must be made by the Contractor without additional cost before acceptance of the Work.
 - b. Furnish all test pumps, gauges, equipment and personnel required and test as necessary to demonstrate the integrity of the finished lubrication installation to the approval of all pertinent authorities and the Architect.
2. The contractor shall conduct tests of systems as required by codes, regulatory agencies and this specification. Tests shall be made with the medium and under pressure as stated in the test requirements. Notify the Engineer and regulatory agencies prior to conducting tests. Contractor shall complete the attached certification form and submit to the Engineer when tests have been completed.

Type of System	Gauge Pressure	Medium
Lube Piping	150% of Normal Static Pressure	Air

3. The pressure in pounds per square inch, gauge, are given as an initial pressure to be applied to lines being tested, together with test medium. Tests are to be applied for a minimum period of four (4) hours and until tests are complete. Final pressures at the end of test period may vary only by that caused by expansion of the test medium due to temperature changes.
4. Check of systems during application of test pressures should include visual check for water medium leakage, soap bubble or similar for air and nitrogen medium.
5. This Contractor shall include all temporary caps, plugs, valves, fittings, air bleeds, etc. as required for tests.
6. Architect's Right to Retesting
 - a. Should the Contractor refuse or neglect to make any tests necessary to demonstration of the integrity of the completed system, the Architect may retain the services of an outside consultant to make all such tests and their resulting adjustments and balance.
 - b. The cost for such tests shall be deducted from amounts owing to the Contractor and shall not be borne by the Owner.

3.4 ADJUSTMENT AND CLEANING

- A. As completion of the Work, remove protective material from all lubrication equipment and piping, all paint and plaster splatterings and clean the fixtures and equipment. They are to be left and ready for use.
- B. Make good and pay for glass breakage, plaster patching and repairs to all other finished Work caused by this installation. Contractor shall patch and return to original condition all floors, walls, ceiling, etc., damaged as a result of his work.
- C. Rubbish removal as directed by Architect during progress of Work and at time of completion. Leave building and premises in clean, orderly condition.

3.5 HOLES THRU FIRE WALLS

- A. Comply with all State and Local Codes with regard to all pipe types passing thru fire walls and rated rooms.

3.6 PIPE IDENTIFICATION

- A. Identify all mechanical equipment with nameplate bearing equipment name and number, using 1½" white Bakelite with ½" black letters permanently mounted in a conspicuous place. Use mechanical fasteners instead of adhesive to mount nameplates wherever possible.
- B. Markings. Each piping system furnished and installed shall be identified. The direction of flow shall be indicated by means of stenciled legends and flow arrows. The marking shall be applied after all painting and cleaning of the piping and insulation is completed.
- C. Location. The legend and flow arrow shall be applied at all valve locations at all points where piping enters or leaves a wall, partition, bulkhead, cluster of piping, or similar obstruction and at approximately 30 feet intervals on pipe runs with at least one in each space or room. Color shall be verified with owner with stencils sized as follows: Over 2" - 1" high; 2" and under - ½" high. The marking shall be located so as to be conspicuous and legible at all times from any reasonable point.
- D. Valve Charts and Tags. Valve charts will be provided for each piping system. They shall consist of schematic drawings of piping layouts, which show and identify each valve and describes its function. Upon completion of the work, two copies of each chart, sealed to rigid backboard with clear lacquer under glass and framed, shall be mounted in the mechanical room where directed by the Owner. Valve lists shall be furnished as required. Provide 1¼ " plastic or brass tags with ¼" letters for all valves. Attach tags to valve handles by chrome plated "S" hooks. Furnish printed lists showing valve number, service, and location in each copy of Owner's Service Manual. Tags equal to Seton #2960 are acceptable.
- E. Identification Symbol types and colors shall be verified with Owner.

3.7 PIPE HANGERS AND SUPPORTS

- A. This Contractor shall be responsible to support and hang this work in a proper manner as per all codes and jobsite requirements.

END OF SECTION 11 11 19

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**SECTION 11 11 26.1
BUS WASH**

PART 1 - GENERAL

1.1 SCOPE

- A. Bus Wash Model XJ-404 -4X4 Rear Wrap-Around with Touchless Front and Top Wash Feature Plus Blowers, Transit Bus Wash System with Water Reclamation Technical Specifications.

1.2 GENERAL

- A. The general provisions of the Contract, including General and Supplementary Conditions apply to the work specified in this contract.

1.3 RELATED WORK

- A. Site work: Division 32 – site work related sections.
- B. Concrete: Division 03 – concrete related sections.
- C. Plumbing: Division 22 – plumbing related sections.
- D. Electrical: Division 26 – electrical related sections.

1.4 QUALITY ASSURANCE

- A. The system shall be produced by a manufacturer of established reputation with a minimum of five (5) years' experience supplying specified equipment in similar applications.
- B. Installation: Provide a qualified manufacturer's representative to supervise work related to equipment installation, check out and start-up.
- C. Training: Provide technical representative to train Owner's maintenance personnel in operation and maintenance of specified equipment.

1.5 SUBMITTALS

- A. Product Data
 - 1. This bid is for the custom engineered vehicle wash and blower system for the Bus Wash Bay(s). The intent is to install a combination friction / touchless bus wash system and blowers that is capable washing all of the owners' transit fleet vehicles. All systems and designs have to be prepared and engineered along the Owner set design and engineering parameters.
 - 2. The above information must be complete in all details and must provide the Owner the basis for the proposed system evaluation. The submitted drawings shall be corrected for the details after the completion of the system installation for the as-built drawings.

3. Operation and Maintenance Manual

- a. Provide copies of the proposed system Operations and Maintenance Manuals.
- b. Assemble and provide copies of manual in 8.5 x 11 inch format. Fold out diagrams and illustrations are acceptable. Manuals to be reproducible by dry copy method.

B. Deviations from These Specifications

1. These specifications are not designed to limit the competition or to limit the equipment to any specific bidder.
 - a. The specified features, wash concepts and functions are mandatory and cannot be altered.
 - b. If the specifications call for "no substitution", the item(s) is deemed to be equally available for all bidders and shall be provided as specified. If "no substitution item is erroneously specified for a patented item not available for the bidder or for an item not available for all bidders for other reasons, the bidder is encouraged to file a complaint with the Owner's Engineer.
 - c. All specified GPM and PSI are listed as minimum and must be met or exceeded. All horse powers, dimensions of structural steel and other components that are stated as minimum must be met or exceeded.
 - d. All specified materials are minimums and must be met or exceeded. Lower grade material cannot substitute higher grade material. Material listing from lowest grade to higher grade is as follows:
 - 1) Galvanized steel (lowest acceptable for any application)
 - 2) Aluminum 6061 T6 Hard Coat Anodized
 - 3) Stainless steel 304
 - 4) Stainless steel 316
 - e. The number of equipment packages, modules, number of pumps, arches and all other components listed herein must be met or exceeded.
 - f. All wash equipment and water recycling performance functions are minimum that must be met or exceeded. All deviations from the specified equipment performance must be fully documented with the drawings, engineering calculations and clearly explained why the proposed system meets and exceeds to specifications. The responsibility to meet the specified performance shall be bidder's.

C. Supplier's Qualifications

1. The equipment specified herein is based on the system specification as desired by the Owner's operations people. The Owner shall not approve or provide approved equal status for any bidders, equipment packages or for various manufacturers (including any listed manufacturers). Any mentioning or listing of manufacturers (in these specifications) shall not be considered to be approval by the Owner or Owner's Engineers for the named supplier equipment or equipment packages.

2. The brush wash system, high pressure cleaning systems, friction systems, pumping stations and all electrical controls shall be designed and supplied by one supplier.

1.6 WARRANTY

- A. Warranty work specified herein is for one (1) year from substantial completion against defects in materials and in labor and workmanship.
- B. Defects shall include, but not be limited to:
 1. Operation; Noisy, rough or substandard operation
 2. Parts; Loose, damaged and missing parts
 3. Finish; Abnormal deterioration

1.7 SCOPE OF WORK

- A. To furnish a completely automatic, friction and touchless combination heavy-duty vehicle wash, water reclamation system and blowers which is designed for all types of transit vehicles used by fleet owners for front, roof, rear and both sides in drive through mode.
- B. Sides and Rears of the vehicles shall be able to be washed with friction and fronts with touchless high pressure with an optional friction wash (by operator selection). Washing roofs of the vehicle shall be touchless and/or friction.
- C. Blowers are supplied at the exit to help remove water from the front, roof and sides of the transit vehicles in drive through mode
- D. The supplier is to be responsible for the supply of necessary equipment, materials and service for the complete assembly and erection of the equipment so that it is ready for operation as per these specifications.

PART 2 - PRODUCTS

2.1 WASH SYSTEM OPERATION AND PERFORMANCE

- A. Operation mode – Transit Bus Wash:
 1. The bus enters the wash and receives full soap on front, sides and rear. When bus enters the brush and high pressure system, the four brushes scrub the sides and rear with the rotating brushes. The fronts of the buses are washed with high pressure touchless cleaning. High Pressure water volume and pressure are as follows: 150 GPM at 115 PSI.
 2. The supplier shall acknowledge the fact that rear washing of transit buses always has been and continue to be the problem area in any transit bus wash operations. Subsequently the activation of the rear wash activation for the side/rear brushes shall be precise. The brush on each side of the bus shall be independently controlled. Movement of the brushes shall be by an air over oil system, systems that rely on pneumatic or electric alone are not acceptable. The

rear wash follow-up of the brush shall be by separately adjustable air pressure only for the rear follow-up feature.

- a. The activation of higher air pressure for the side/rear brushes must not take place while the brush(es) is on the side the bus and such activation must take place separately for each side/rear brush. The higher air pressure must be activated immediately as the bus rear corner has already passed each brush. The traffic light visible to the driver must indicate separately on each side and only for the period of time while the rear brush moves across of the rear of the bus. It is up to each supplier to select the method to achieve the above by using a series of photo eyes, sonar detectors, magnetic detectors, proximity sensors, lasers and or radars or other methods to achieve the desired results.
3. If the supplier feels that his/her technical capabilities are not adequate to achieve the specified brush movement features or if he/she feels that such specified performance feature are impossible, he/she shall take an exception in his/her bid forms and state precisely with supporting technical data the reasons for such.
- B. The supplier is responsible to design the equipment to satisfactorily wash up to 30 vehicles per hour.
- C. **The supplier is solely responsible for the equipment performance.** Should the equipment not perform, as per these specification requirements, the supplier shall modify, add and/or alter the equipment supplied at his own expense until the performance is satisfactory. The Owner shall approve all such changes. Should the performance criteria not be met after the changes, the supplier shall remove the system at no cost to the owner.
- D. The vehicle wash system to be capable of washing all vehicles up to 12' in height including the following:
 1. Vans, Para-Transit buses
 2. Transit Buses
- E. The system shall have a built-in feature to operate either with recycled water or with all fresh water as may be desired by the Owner. The arrangement of such option shall be shown on the engineering drawings to be submitted with the bid package. Switching between recycled and fresh water modes shall require no specialty tools and shall be accomplished in a matter of minutes.

2.2 WATER RECLAMATION PERFORMANCE

- A. The water reclamation system shall be capable of reclaiming water from the vehicle washer and process it by means of settling pits, in-line filters, centrifugal filter system and bio-remediation system. The system must be able to continuously supply adequate amount of water for high-pressure pump regardless of traffic volume through the washer.
- B. Prior to final acceptance of the system by the owner, the supplier shall demonstrate the continuous operating capacity of the reclamation system in relation to the truck wash

system by running (on manual override) both the high pressure wash system and the water reclamation system for a period of 60 minutes (without a pause).

1. During the 60 minutes test no manual adjustments or overrides are allowed and no solenoid shall be allowed to fill the reclamation tank with fresh water should the sump pump capacity be not able to keep the recycled water tank full.
- C. Regardless of technical specifications, the equipment supplier explicitly assumes the responsibility to design the water reclamation system for the intended purpose and has made himself familiar with all performance requirements prior to bidding.
- D. All equipment located outside the wash bay area including reclamation tank, high pressure pump, sump pump, aeration pump, booster pump, cyclonic separators and all float switches must be mounted on a single modular skid assembly.
- E. The equipment module shall be tested for all plumbing connections (pressure tested), all electrical circuitry, pump rotations and for all component functions at the factory prior to shipping.
- F. The odors must be kept in total control without the use of any chemicals including ozone, enzymes, bacteria or masking agents. Algae build-up in wash water that will results in objectionable odors is not acceptable to the Owner.
- G. The above ground tank or tanks must be of self-cleaning type and shall be designed not to accumulate any dirt build-up.
- H. Bio-Remediation system shall be included in total system design. The bio-remediation system shall be designed to eliminate and/or reduce the total load of hydrocarbon loading within the recycled water body. The system shall included and consist at least the following components:
1. Enzyme dispensing system
 2. Accelerator dispensing system
 3. Dissolved oxygen and aeration system

2.3 MECHANICAL INTERCONNECTING PIPING

- A. The equipment module including recycle tank, high pressure pump, sump pump, booster pump, aeration and pit dirt removal pump is to be pre-plumbed and pressure tested prior to shipment to the site.
- B. All field plumbing and mechanical work will be done by the bidder, including:
1. Water and gas utilities up to and connecting to the equipment.
 2. Interconnecting piping between various equipment components located in the equipment room.
 3. Interconnecting piping between the equipment located in the equipment room and the equipment located in the wash bay.

2.4 ELECTRICAL INTERCONNECTING WIRING

- A. The equipment module including electrical panel, tank float switches, high-pressure pump, sump pump, booster pump, aeration and pit dirt removal pump is to be pre-wired and tested prior to shipment to the site.
- B. All field electrical work will be done by the bidder:
 - 1. Electrical service up to and connecting to the equipment panel.
 - 2. Interconnecting wiring between various equipment components located in the equipment room.
 - 3. Interconnecting wiring between the equipment located in the equipment room and the equipment located in the wash bay.

2.5 WASH SYSTEM TECHNICAL SPECIFICATIONS

- A. Chemical Arch Components:
 - 1. Timing of operation and position of the arch shall be determined by manufacturer to provide optimum detergent penetration before high-pressure / brush wash cycle.
 - 2. Detergent pumps (**total of two required**) shall be Inject-o-meter Model HVI82, ICE DN or engineer approved equal with variable volume output ratio from 1:10 to 1:100. The selected soap pump set up shall allow the owner to spray separately side and rear of the vehicle at ratios varying from 1:10 to 1:100 separately. The amount of detergent delivery (by the pump) has to be readable on the pump calibrated settings. The detergent pumps must be of positive displacement type.
 - 3. The system shall have 1 HP water booster pump to ensure even water pressure under all circumstances.
 - 4. Chemical Arch(s) must be made of 1.25-inch stainless steel pipe compatible with used detergents and equipped with adequate number of nozzles to evenly apply detergent, hot water solution to front, rear, sides and roof of vehicle proceeding through the arch. The design of the detergent arch shall allow immediate activation of the nozzles upon arch activation by the vehicle. All arch piping and structures must be stainless steel – **no substitution allowed**. Piping from the equipment room to the soap arch to be made of PVC or stainless steel.
 - 5. Intensified Rear Detergent Feature: The detergent for the rear of the vehicle shall be applied via a separate, stainless steel rear wash arch which is activated immediately after the vehicle has passed through the detergent arch. **The detergent concentration for the rear wash arch shall be individually adjustable and must have its own soap pump**. The intensified rear detergent arch shall be controlled and operated via its own vehicle sensing device, solenoid valves and chemical pumps as required for proper performance.
 - 6. Water softener for detergent arch: If the domestic water exceeds 3 grains of hardness, the equipment supplier shall include a dual head water softener as part of the package. Should the water softener not be needed, the supplier shall provide the owner testing results of water hardness being acceptable (3 grains or lower).
 - 7. Water Heater for detergent arch: Chemical arch shall be supplied soft water, heated by a 199,000 BTU natural gas sealed combustion water heater supplied

as a part of the equipment package. Venting for the heater will be by the mechanical contractor.

8. Activation: All system functions are activated by photo eyes.
9. The chemical spray components located in the equipment room must be assembled in a modular, wall mounted assembly containing the following components:
 - a. Solenoid valves (2 required)
 - b. Pressure gauge
 - c. Pressure regulator
 - d. In-line screen
 - e. Isolator ball valves for all components
 - f. Isolator ball valves to bi-pass water softener

B. The 4x4 Side/Rear Brush System

1. The system shall be equipped with a 4-brush wrap-around brush wash system. The two leading brushes (1 per side) are in a fixed position and supported on the top and bottom and scrub the sides of the bus. The two brushes (1 per side) following the fixed position leading brushes are supported on the top and bottom and also scrub the sides and then wrap around the rear of the bus in an overlapping fashion to assure optimal cleaning on the rear of the bus.
2. Proximity sensors for the brushes and air over oil cylinders to provide precise movement of the brushes. This will provide consistent pressure on the vertical surfaces of the bus for optimizing cleaning results.
3. The bus shall not be required to stop during the washing process.
4. The brush wash system structure shall be made of heavy duty steel and shall be hot dip galvanized.
5. The brush motors shall be maximum 2 hp each and shall be supported by bearing to the brush arm structure both on the top of the brush and at the bottom of the brush.
6. The hanging roof mop shall wash the top of the bus and shall wash the upper part of the front window. The roof mop shall be designed as not to interfere with any mirrors or other protrusions of the buses.

C. High Pressure Arch Assemblies:

1. The front wash shall be maximum 150 GPM.
2. It is solely the supplier's responsibility to design and build the high pressure arches to meet the specified operational characteristics. All high pressure water shall be recycled water
3. All bidders are notified and are aware of the fact that the sides of most transit buses are not well suited to be washed by high pressure due to the issues related to leaking (high pressure water penetrating inside of the bus).
4. It is bidder's responsibility to design the system taking this into consideration.
5. It is the supplier's responsibility to design the system to be safe for all buses and still be able to provide adequate cleaning performance on fronts, sides and rears of the buses.

D. Pumping Module:

1. The high-pressure pump is of the centrifugal diffuser type as manufactured by Goulds Pump, Peerless or Carver and shall be capable of producing volumes up to 150 GPM of fresh or recycled water. Any pump selected by the bidder shall meet the performance of the specified pump.
2. Impellers: The impellers are of the enclosed single suction type, hydraulically balanced to minimize axial thrust loads. Each impeller is individually keyed to the shaft. Impeller is bronze
3. Stuffing box: Packed type stuffing boxes are equipped with a mechanical seal.
4. Shaft sleeves: The shaft sleeve through the stuffing box is 11-13% chrome stainless steel hardened to a minimum of 225 Brinell and is keyed to shaft.
5. Shaft: The shaft is standard carbon steel adequately sized for loads transmitted.
6. Bearing: The bearings are designed for an average life of 50,000 hours. The outboard bearing is a deep groove type; the in-board bearings are of the radial roller type with grease fittings.
7. Base: A steel base plate contains the mounting of the pump and motor, which are carefully aligned and bolted in place prior to shipment. Final alignment will be checked and certified after installation and prior to operation by the user.
8. Coupling: The pumping module has a "Jaw" type coupling as manufactured by Lovejoy or equal and includes a coupling guard.

E. Electric Motor

1. The electric motor shall be of the squirrel cage induction type suitable for across the line starting. Motor shall operate on 460 Volt, 3-phase, 60 cycle and be ODP with a 1.15 service factor.
2. The motor shall be sized so as not to exceed the name plate horse power during operation.
3. The motor shall be certified by the manufacturer for 30 activations per hour.

F. Final Rinse Arches

1. The final rinse arches shall use fresh water.
2. Timing of operation and position of the rinse arch shall be determined by manufacturer to provide optimum rinse penetration after wash cycle.
3. Final Rinse Arches shall be made of 1.25-inch stainless steel pipe and equipped with 25 pcs. of dual, adjustable Spraying Systems Swivel Nozzle Bodies QJ-8600 with Spraying Systems Diaphragm Check Valve Model 8360 to evenly apply fresh water rinse to front, rear, sides and roof of vehicle proceeding through the arch.

G. Blowers (Aerodry is the basis of design)

1. Motor: 4-15 HP Motors per lane (2 per tower) TEAO, 254T frame, 3600 RPM, 1.15 SF, 3 phase, useable with VFDs 208-230-460v
 - a. Max running amps each motor is 18.5@460v
 - b. Operating on 60 Hz, Aerodry fans do not require the motor to run at full load.
2. Axial Fan: Direct Drive, One-piece tensiloid aluminum molded. 6800 CFM Conforms to ASTM Certification: B179-06.

3. Motor and Fan Assembly: (dissipates heat) mounted on plate welded to interior of 24" OD x 24"H housing.
 - a. Motor is totally enclosed. Factory lengthened motor leads encased in water-tight pipe extend to OEM junction box located on exterior of stainless housing, for electrician's access.
4. Stainless Steel Housing: 304 SS, Polished. 24" OD. Assembled via flange system with 316 SS hardware, provided by Aerodry.
5. Flanges: 304 SS Laser cut, component joining angles, hole ID = 31/64". Floor mount flange hole ID = 5/8" to allow for customer supplied anchors.
6. Stainless Steel Ductwork: 304 SS, Insulated for sound abatement
7. Side Silicon Nozzles: 6" - 4" ID, 20" long. Attach to dryer outlet via SS worm gear clamp.

H. Electric Control Panel and Components

1. The panel and controls must be built according to these specifications. No substitutions shall be allowed. The control system shall be PLC based with separate HMI.
2. The PLC shall be the process application controller and provide near real time control of the entire wash system. It shall be connected to distributed I/O via an Ethernet network. The operator interface shall be through a separate HMI not integral to the PLC, connected to the PLC via Ethernet.
3. The PLC shall be panel mounted in a 48"x36"x12" electrical enclosure, which also houses the electrical controls for the wash system. The PLC may be mounted in its own enclosure in an office environment. The PLC provides the centralized infrastructure to enable simple and complete integration with other systems.
4. The PLC and HMI programs shall be developed and provided by the bidder. These programs shall include the specified wash components and provide capacity for future expansion. The PLC program shall be provided in RSLogix 5000 v20 and the HMI program shall be provided in RSView ME v6.1
5. PLC and HMI programs shall provide the following:
 - a. GUI shall be intuitive to use by people without computer experience. Little or no training should be required.
 - b. At program start up, all devices shall be initialized to a known state.
 - c. All system settings, such as baud rates, parity, comm. port configurations, etc shall be reconfigurable without necessitating recompiling the application software.
 - d. All user configurable settings shall be stored in the PLC and/or HMI and saved to their respective SD cards. These include all timing set points, alarm settings, and communication settings.
 - e. Periodic polling of I/O shall be every 20 ms or less.
 - f. Alarms should have user configurable delays to prevent nuisance tripping.
 - g. Latency: scanning interval for all closed loop processes should be executed <20 ms.

3. The system has angled entry at the entrance. Ends of rails are capped and all headings are smoothly finished to prevent tire damage. Brackets supporting pipe shall be made of minimum of 3/8" steel plate that are welded to concrete imbedded cleats or anchor bolted to the concrete.
4. The system shall have stainless steel skid plates to allow misaligned bus to slide sideways for proper positioning.

2.6 WATER RECLAMATION AND TREATMENT SYSTEM SPECIFICATIONS

A. Sump Pump:

1. Self priming type for transferring water from sump pit to the above ground recycled water tank through the filtration system. Minimum capacity shall be 300 GPM of cleaned water.
2. The capacity of sump pump shall allow for the pressure losses from two cyclone separators used in series and GPM after the pressure losses shall be bigger or equal to the high pressure wash water usage.
3. The sump pump shall be designed to handle solids that will be found in wash water.

B. Cyclone Separators:

1. **A minimum of two (2) cyclone separator systems used in series**, the cleaned water from the first cyclone shall pass through the second cyclone separator to ensure maximum solid removal performance. Two cyclone separators shall be provided in series with at least one of them being in-line. (no substitutions)
2. Cyclone Centrifugal Separators shall provide second and third stage filtration.

C. Cyclone Solid Removal:

1. Downflows (purge water from cyclone separators containing solids) from cyclones separators shall pumped back to the exit end of the trench pit with a solid handling pump. The solid removal pumping shall be activated when cyclone separators need to be purged. Solid removal from cyclone separators by gravity alone shall not be acceptable.

D. Aeration System:

1. Aeration system shall provide air into the trench pit to prevent algae and odor build-up. Aerated water shall be evenly distributed throughout the pit even when the wash system is not operational. The system shall be designed to have no odors from algae. No odor masking deodorants or other chemical use to kill odors shall be allowed.

E. Stainless Steel Pump Intake Filter:

1. Stainless Steel Intake Filter Screen to provide first stage filtration for sump pump intake. The pump intake filter shall be InterScreen or engineer approved equal and shall be sized 0.015" or smaller.

2. The intake filter shall be made of stainless steel and shall have slotted orifices, wire mesh filters are not acceptable. Intake filter shall prevent any dirt from clogging the recycled water spray nozzles under all circumstances.
3. Intake Filter Screen shall be equipped with high-pressure air back wash system that is automatically activated by the reduced flow into the pump intake.

F. Reclamation Tank:

1. Reclamation Tank shall be made of linear low-density polyethylene with a minimum holding capacity to allow recycling a minimum of 300 GPM continuous operational flow.
2. The tank shall have conical bottom with minimum of 35-degree slope equipped with a 6" bottom manhole, float switch connections and other required fittings. The tank to be equipped with the steel support structure with ½" thick polyethylene continuous support for the cone part of the tank.

G. Enzyme-Catalyzed Water Treatment System:

1. A biological water treatment system shall be included in total system design. This water treatment system, the Enzyme-Catalyzed Water Treatment System, shall be designed to eliminate and/or reduce the total petroleum hydrocarbon loading within the recycled water body. When used in conjunction with the specified recycling equipment, the systems shall remove both organic contaminants and inorganic particulate from the reclaimed water stream.
2. The Enzyme-Catalyzed Water Treatment System shall be equipped with an automatic product injection system for delivery of specialized biological products and enhancements. These biological products shall be specifically suited for wash water treatment applications, including degradation of petroleum hydrocarbon components commonly found in vehicle wash systems. This system will treat the reclaim wash water generated during the vehicle wash process. The bulk of the treatment process shall take place in the wash water pit, where continuous biological treatment of organic wastes in the vehicle wash water shall occur.
3. The Enzyme-Catalyzed Treatment System shall deliver a constant supply of biological products, bio-enhancements, and oxygen to support degradation of organic constituents. The biological products and enhancements shall be injected directly into the circulation/aeration discharge pipeline of the recycling system, where they will then subsequently be discharged into the wash water pit. Oxygen shall be provided by the aeration pumping and mixing system.
4. The automatic product injection system shall consist of low-flow injector pumps that inject biological products on a continuous basis. The injector pumps shall be:
 - a. Operating Temp -35 – 110° F
 - b. Product Flow rate -0.5-1.5 liters per day, adjustable
 - c. Product Delivery -Up to 10 feet of 3/8-inch diameter polyethylene tubing
 - d. Two 3/8-inch NPT polyethylene check valves
 - e. Two 3/8-inch compression fittings

PART 3 - EXECUTION

3.1 INSTALLATION, START-UP, TRAINING AND SERVICE

- A. Install equipment in accordance with manufacturers' supplied installation drawings.
- B. Equipment supplier shall undertake the commissioning of the system and make all required adjustments to ensure proper operation.
- C. The equipment manufacturer shall start-up the system. The owner shall have all operating personnel present during the start-up and equipment training.
- D. The supplier shall arrange adequate amount of detergent for the performance testing.
- E. The owner's personnel shall be trained for a minimum of 5 hours in the system operation and maintenance.
- F. The supplier shall provide the owner the names and the addresses of all local service and maintenance personnel to assist in future service

END OF SECTION 11 11 26.1

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**SECTION 11 11 26.2
CHASSIS WASH (Fresh Water, 2 Spinner Chassis)**

PART 1 - GENERAL

1.1 SCOPE

- A. Bus Wash Model XJ-404 -4X4 Rear Wrap-Around with Touchless Front and Top Wash Feature Plus Blowers, Transit Bus Wash System with Water Reclamation Technical Specifications.

1.2 GENERAL

- A. The general provisions of the Contract, including General and Supplementary Conditions, apply to the work detailed in this specification.

1.3 RELATED WORK

- A. Site Work: Division 32 – site work related sections.
- B. Concrete: Division 03 – concrete related sections.
- C. Plumbing: Division 22 – plumbing related sections.
- D. Electrical: Division 26 – electrical related sections.

1.4 QUALITY ASSURANCE

- A. Experience: The system shall be produced by a manufacturer of established reputation with a minimum of five (5) years' experience supplying the specified equipment in similar applications.
- B. Installation: Provide a qualified manufacturer's representative to supervise the work related to equipment installation, check out and start up.
- C. Training: Provide a technical representative to train Owner's maintenance personnel in the operation and maintenance of specified equipment.

1.5 SUBMITTALS

- A. Product Data:
 - 1. Submit Product Data in strict accordance with the requirements of these specifications.
 - 2. Restrict submitted material to pertinent data. For instance, do not include a manufacturer's complete catalog when pertinent information is contained on a single page.
 - 3. All bidders shall provide the spinner manufacturer's certified test results that the spinner to be supplied has passed the required 5,000-hour continuous test run. Such certified test results shall indicate the condition of the spinner and the spinner components after the 5,000-hour test run

B. Engineering Drawings:

1. Submittal engineering drawings must include the following:
 - a. Equipment general layout
 - b. Electrical layout
 - 1) Provide UL listing card or equivalent document of a Nationally Recognized Testing Laboratory from the company building the electrical panel(s) and attach with the electrical drawings indicating that the electrical panels will be built to the required standards (see section 11.10 Electric Control Panel).
 - c. Mechanical layout
 - d. Floor plan view
 - e. Isometric view with bill of materials
 - f. Any related in-ground electrical or mechanical installation

C. Operation and Maintenance Manual:

1. Assemble and provide copies of manual in 8.5 x 11 inch format. Fold out diagrams and illustrations are acceptable. Manuals shall be reproducible by dry copy method.

D. Supplier Qualifications:

1. The supplier shall have been regularly engaged in the design and supply of the type of equipment specified herein, for a period of not less than five (5) years.
2. The wash system, high pressure cleaning systems, pumping stations and all electrical controls shall be designed and supplied by one supplier.
3. All similar items shall be the products of one manufacturer.

E. Approved Equal Status:

1. No deviations from these specifications will be allowed unless approved by the Owner in writing prior to bid closing.
2. All bidders with an "Approved Equal Status" shall submit the following with their bid package:
 - a. A complete list of spinner and touchless heavy-duty vehicle wash systems manufactured and installed by the bidder. The list shall include all such installations made by the bidder in the last five (5) years, including the duration of service and application. Should the reference list have more than twenty-five (25) names, a list of the last twenty-five (25) installations shall suffice.
 - b. Provide the name of a contact person at each location that is familiar with the operation and maintenance of the wash system.
 - c. Based on the information supplied and discussions with the contact persons named, the engineer will determine the acceptability of the proposed supplier and the equipment.

1.6 WARRANTY

- A. Warranty work specified herein is for one (1) year from the date of substantial completion against defects in materials. All rotating spinners have a three (3) year full parts warranty.
- B. Defects shall include, but not be limited to:
 - 1. Operation: Noisy, rough or substandard operation
 - 2. Parts: Loose, damaged and missing parts
 - 3. Finish: Abnormal deterioration

1.7 SCOPE OF WORK

- A. To furnish a completely automatic, touchless heavy-duty vehicle chassis wash system for all types of vehicles used by fleet owners in drive through mode.
- B. The supplier is to be responsible for the supply of necessary equipment, materials and service for the complete assembly and erection of the equipment so that it is ready for operation as per these specifications.

PART 2 - PRODUCTS

2.1 WASH SYSTEM PERFORMANCE

- A. The equipment specified herein is based on the system model CENTRI*-SPINNER as supplied by InterClean Equipment, Inc. (800-468-3725) or engineer approved equal.
- B. Regardless of the Owner's approval for any deviations and/or changes, the supplier is solely responsible for the performance of the supplied equipment per these specifications. All equipment and equipment functions must be built and designed to these specifications.
- C. Should the equipment not perform as per these specifications, the supplier shall modify, add and/or alter the equipment supplied at his own expense until the performance is satisfactory.
- D. The equipment offered shall be the latest standard product, modified as necessary to meet the requirements of this specification, of a type that has been commercially available and in satisfactory use for at least five years.
- E. The vehicle washer shall be actuated in cycle sequence by vehicles driven in a fixed path between tire guides at a slow speed (50-60 feet / minute) through the washing system. All washing operations shall be automatically activated by the vehicle (driving through).
- F. The supplier is responsible to design the equipment to satisfactorily wash up to 30 vehicles per hour. The vehicle wash shall be able to remove all visible heavy dirt accumulation and most of the road film from the vehicles' chassis when driven through the washer at 50 feet / minute.

- G. The vehicle wash system to be capable of washing all vehicles and construction equipment

2.2 MECHANICAL INTERCONNECTING PIPING

- A. All field plumbing and mechanical work will be done by the Mechanical Contractor or General Contractor, including:
1. Water and gas utilities up to and connecting to the equipment.
 2. Interconnecting piping between various equipment components located in the equipment room.
 3. Interconnecting piping between the equipment located in the equipment room and the equipment located in the wash bay.
 4. Furnish and installation of:
 - a. Exhaust duct for water heater
 - b. Backflow preventer
 - c. Underground pipe for chassis wash
 - d. Grating for trench

2.3 ELECTRICAL INTERCONNECTING WIRING

- A. All field electrical work will be done by the Electrical Contractor or General Contractor, including:
1. Electrical service up to and connecting to the equipment panel.
 2. Interconnecting wiring between various equipment components located in the equipment room.
 3. Interconnecting wiring between the equipment located in the equipment room and the equipment located in the wash bay.
 4. Furnish and installation of:
 - a. Underground conduits (if required) to be laid when concrete pad is being poured.

2.4 WASH SYSTEM TECHNICAL SPECIFICATIONS

- A. Chassis Wash System:
1. The chassis wash system shall have two of the specified or engineer approved spinners located in the center trench for effective under-chassis cleaning. Normal spray nozzles, stationary or oscillating, are not acceptable.
 2. The chassis wash spinners shall be mounted in the pit trench by a removable (for cleaning purposes) modular skid assembly.
 3. The removable chassis wash assembly shall be equipped with a protective plate at the bottom of the assembly. This plate will prevent a person, who accidentally steps into the chassis wash spinner opening, from further falling into the trench.
 4. The chassis wash module system shall be designed to be flush with the concrete surface. The spinner shall be located within the module so that each spinner cleans $\frac{1}{2}$ of the vehicle chassis by covering the entire half of the vehicle chassis.

B. Spinners:

1. Spinners are to be CENTRI*SPINNER, Spraying Systems Spinner or engineer approved equal. All spinners submitted for approved equal must have been tested and passed a 5,000 hour continuous test run.
2. Each spinner is to have four (4) fully adjustable spray nozzles. The nozzles are to be of the zero-degree type and be supported at the end by adjustable position elbows.
3. The rotational speed of each spinner is to be adjustable between 90 – 300 RPM. The rotational speed adjustment of the spinners is to be achieved through an internal oil pump. No free-floating oil pump gears without center shaft supports will be acceptable.
4. The rotational high-pressure water seal must be of the mechanical seal type.
5. The spinner inlet hookup must be a minimum of 1" stainless steel. Spinners equipped with smaller inlet hookups shall not be acceptable.
6. The nozzles are to be equipped with air jet nozzles. Zero-degree water is to pass through the secondary orifice, which will be a minimum of three (3) inches long and have eight (8) openings for air intake at the joint of the spray nozzle and air jet nozzle. Air jets and nozzles must be made of stainless steel. Spinners not equipped with air jet nozzles are not acceptable.
7. The spinner assembly shall have no periodic maintenance or lubrication requirements.
8. Rotary joint spinners, i.e. spinners without built-in oil pump controlled speed adjustment, are acceptable only if they are equipped with electrical or hydraulic motor drives for speed control.

C. Spinner Adjuster Tool:

1. The spinner adjuster tool, to set all four spinner elbows in an exact, pre-determined angle, shall be supplied with the system.
2. Adjustment of spinner elbow angles to a precise position by the adjustment tool shall be done without removing the spinners from the arch.

D. Pumping Module:

1. The high-pressure pump is of the vertical multi-stage inline pump, direct drive with floating outer casing and a dish shaped insert fitted to the intermediate casing to promote smooth flow and reduce erosion of the pump, High Temp Carbon/Silcon Carbide Graphite filled/Viton single mechanical seal and Tungsten Carbide lower pump bearing and sleeves, square edged six spline shaft which is capable of producing pressures up to 260 PSI. The pump shall deliver a nominal flow of 30 GPM as determined by the nozzle sizes incorporated in zero-degree spinners.

E. Electric Motor:

1. The motor shall operate on 208 Volt, 3 Phase, 60 Cycle and be ODP with a 1.15 service factor.
2. The motor shall be sized to not exceed the name plate horse power during operation. The motor should be a minimum of 15 HP.

F. Electric Control Panel and Components:

1. The Industrial Control Panel shall be manufactured and evaluated in accordance with the Underwriters Laboratories, Inc. (UL) standard 508A (Industrial Control Panels). In addition, the panel shall be evaluated for high-capacity short circuit withstand and shall bear the appropriate UL marks including the short circuit withstand value mark as part of the official UL label.
2. The Industrial Control Panel shall be designed to meet the requirements of the National Electric Code (NEC) Articles 430 and 670, also the National Fire Protections Association (NFPA) Standard 79 (Industrial Machinery).
3. Electric panels that are not UL approved are not acceptable.
4. The industrial control panel shall be designed for operation on a 208 Volt, 3 Phase, 60 Hertz system, with a short circuit capacity of 25,000 amperes RMS Symm. Available at the incoming line terminals of the control panel.
5. Control system will control the wash operation, turning system off, tank fill and low water level protection.

G. Tire Guides:

1. Tire guides shall be fabricated from 3 inch diameter painted steel pipe headings, supported at 5 foot intervals, to provide guide runs on both sides of the vehicle. The tire guides shall run the full length of the wash system.
2. The system shall have an angled entry. The ends of the rails are capped and all headings are smoothly finished to prevent tire damage. Brackets supporting the pipe shall be made of a minimum 3/8" steel plate that is welded to concrete imbedded cleats or anchor bolted to the concrete.

H. Water Holding Tank:

1. The system shall be equipped with 400 gallon polyethylene water holding tank equipped with high and low level float switches. The system holding tank shall be filled with water from the Owner's water treatment plant. Should the treated plant water be used, it will be equipment suppliers responsibility to supply adequate filtering for the water purification as is required for the proper cleaning and film removing requirements.
2. The holding tank shall be filled via 2", slow closing float valve in the holding tank.

I. Splash Wall Assembly:

1. The splash wall assembly shall be designed to protect the wash equipment contained within the wash bay, and prevent a direct splash of water onto the pumps, control panels and other electric devices during the wash process.
2. Walls shall be of a modular construction to allow expansion of the equipment room should additional equipment be added at a later time.
3. Walls shall consist of modular galvanized frame structure for all wall assemblies and doorways, as per the attached drawings.
4. Walls shall also include a fiberglass vertical panel, as per wash equipment supplier specification, that is a minimum of 38 inches wide and 12 feet tall. Each panel shall overlap the previous by a minimum of one inch on any wall run.

5. Doors shall be provided, per the drawings, which will allow for routine access to the equipment, as well as removal and replacement of wash chemical drums, minimum 55 gallons in size.
6. Assembled wall structure shall be secured to the floor and the sidewall of the wash bay to prevent flex, and distortion over time during wash use.
7. Wall shall also be designed to not limit passage of any vehicle through the wash bay.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Equipment shall be installed in accordance with manufacturer's supplied installation drawings.
- B. Equipment supplier shall undertake the commissioning of the system and make all required adjustments to ensure proper operation.
- C. The equipment manufacturer shall start up the system. The Owner shall have all operating personnel present during the start up and equipment training.
- D. The supplier shall arrange for an adequate amount of detergent to be available for the performance testing.
- E. The Owner's personnel shall be trained for a minimum of five (5) hours in the system's operation and maintenance.
- F. The supplier shall provide the Owner with the names and addresses of all local service and maintenance personnel to assist in future service.

END OF SECTION 11 11 26.2

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**SECTION 11 11 28
VEHICLE FUEL EQUIPMENT**

PART 1 - GENERAL

1.1 SCOPE

- A. Applicable provisions of the General and Supplementary Conditions and Division 01 govern work under this Section.

1.2 DESCRIPTION

- A. Furnish, deliver, unload, store, protect and install all equipment and piping so as to provide a complete operating system.
- B. Or Equal: The Owner will accept bids on materials other than those herein after specified if they are equal to or better than specified. "Or equal" bidders must submit specifications and other data to Owner eight (8) days prior to closing of bids. The Owner will make a final determination on "or equal" bids. Such "or equal" bids shall be submitted in an alternate bid proposal.
- C. Shop drawings: Submittals are required for piping and fittings, flexible piping connectors.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Product Piping: Black steel ASTM A53, Grade B, seamless – ANSI B16.11 forged steel socket-weld (All joints to be welded) - All new pipe will required to be installed 1” fiberglass with .016 aluminum outer jacket.
- B. Dispensers: Diesel Nozzle (2 required) – OPW #11AF-300F (15 gallons per minute) and required fittings – This contractor to relocated the existing fuel reads that are mounted to the existing nozzles
- C. Dispensers: DEF Nozzle (2 required) – OPW #21GU-0500 Model 9862XX-ZWW – M34 fitting
- D. Existing Fuel Master Fuel Management System will be relocated by this contractor. Two units and the existing two units will be cleaned and repainted by this contractor.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

- A. System must be done by State of Wisconsin certified installer. The installation must conform to manufacturer’s installation instruction. The new dispensing will be within the new service lane.

- B. The new piping will connect to the existing piping. The existing fuel tanks will remain. The two existing dispensers are located within the existing service lane. The dispenser that is against the wall will remain and the dispenser and reel that is in the center of the lane will be removed and capped by the contractor.
- C. Provide necessary local and state permits.
- D. Install all products in accordance with the manufacturer's written instructions.
- E. Install no smoking, instruction and warning signs as required by law.
- F. Communications Lines: The communication lines will link the system components together and allow information to flow between them. Phone lines will not be utilized. The communication lines should be installed with cat6 cable. See electrical sheets for conduit location.

3.2 TESTING, GUARANTEE AND TRAINING

- A. Test all equipment of system for compliance with the requirements of local, state and federal regulations.
- B. In addition to required tests, provide a final hydrostatic state approved test by an independent state approved testing firm.
- C. Guarantee all labor and materials for a period of one (1) year.
- D. Training: Contractor must provide on site technical training for the Owner's operating personnel on the overall fuel handling system installed. Training to include thorough descriptions of the safety devices, the environmental monitoring well function, operational procedures, etc. This training must be provided by authorized representatives of the tank and equipment manufacturers.

END OF SECTION 11 11 28

**SECTION 11 11 31
CYCLONE VACUUM (ICS-VA-30-23000)**

PART 1 - GENERAL (Not Used)

PART 2 - PRODUCTS

2.1 VACUUM SYSTEM, BUS INTERIOR

- A. General Description: The bus interior vacuum system shall provide a means for removal of dust and debris from the bus' interior while the bus is located in a service and fueling lane. A blower shall cause an air stream inside the bus when a retractable bellows unit seals the front door opening and the rear door or a rear window of the bus is opened. Dust and debris shall be captured in the air stream, aided by a person with a compressed air wand inside the bus, and carried through a separator that removes dirt and debris from the air stream and discharges clean air into the fuel lane area. The vacuum system bellows must comply with all applicable codes pertaining to the installation and operation in a Class 1, Division 2 area.
1. Sequence of operation: Operation of the vacuum system involves the following sequence of events:
 - a. Front door of the bus is aligned to bellows assembly. Bus driver pushes the start button and the bellows move against the side of the bus, sealing the perimeter of the door opening. The slide dump gate closes off the container from the debris collection chamber and after an adjustable time delay, the air moving fans and dust filter blower starts.
 - b. When the cleaning process is completed, the operator presses the stop button. The bellows retract and the fans remain long enough to clean the air system, moving all dust and debris into the collection chamber. When the fan stops, the dump gate opens, allowing the debris to fall into the container chute. The gate remains open until the unit is activated to clean the next bus interior. Each bus interior system shall be a self-contained installation and shall include: bellows assembly, pick up suction hood, fans and housing, air filter, receptacle, supporting structure, slide dump gate, compactor and container, electrical wiring, and piping.
 2. Major components: Each vacuum system shall consist of, but not necessarily limited to, the following major components:
 - a. Bellows assembly.
 - b. Plenum assembly.
 - c. Duct work.
 - d. Refuse collection receptacle.
 - e. Dust collector.
 - f. Dumpster.
 - g. Controls.

B. Capacities and Dimensions:**1. Capacities:****a. Blower**

- 1) Capacity: 23,000 CFM at 4 inches static pressure at bellow entrance, minimum.
- 2) Motor: 30 HP, 1800 RPM, TEFC, Hi-Efficiency.
- 3) Sound Level: Approximately 80 dbA

b. Dust collector: 7.5 HP**c. Air blowgun capacity: 100 SCFM at 100 PSIG.****2. Dimensions:****a. Overall dimensions:**

- 1) Width: 60 inches, nominal.
- 2) Length: 300 inches, nominal.
- 3) Height: 188 inches, nominal.

b. Air blowgun hose: 3/8 inch diameter by 50 feet long.**C. Features and Construction:****1. Bellows assembly:**

- a. Performance: High efficient sealing and air flow bellows capable of sealing against current standard type transit buses and coaches with pantograph front doors. Riding on overhead rails, complete assembly shall be hung from a swivel suspension frame attached to overhead trolley carriage, riding overhead rails. Rails shall be an integral part of the plenum housing requiring no additional exterior support.
- b. Seals: All seals shall be made of heavy neoprene impregnated nylon (sponge rubber is not acceptable) with aluminum stays and mounting straps to form an accordion-type retractable assemble. Foam rubber padding covered by the same material as used for bellow framing shall be attached to the outer perimeter of the bellows to assure a snug fit to the front door of the Owner's buses. Providing a seal on the inner door opening, a second inner pad shall be provided.
- c. Frame work: Bellow base shall be 3 inches at 5 pound channel, 1/4" x 3" x 3" tubing for vertical supports, 1/4" x 3" x 3" angle for fan plate supports, 1/4 inch thick fan plate, bellows track and support 4" x 4" at 13 pound WF-1 beam. Bellow frame shall be 1/4" x 2 1/2" x 2 1/2" angle iron.
- d. Air hose/reel: Accessory plate and grill shall be located in a moving portion of the bellows.
 - 1) The assembly shall be equipped with a control, a 150 watt floodlight for lighting the stepwell of the coach, and an air sweep hand gun. The hand gun equipment shall include a self-retracting

type hose reel with latching stops; 50 feet of 3/8 inch ID air hose, with removable hose pulley and stanchion clip; and two (2) air sweep guns. Hose reel shall be mounted on and supported by the plenum housing.

- e. Bellows controls: Air cylinders and air controls shall be located and factory piped on the side of the plenum housing.
 - 1) Two air cylinders ($\frac{1}{2}$ inch bore x 24 inch stroke, $\frac{1}{2}$ inch bore x 27 inch stroke) attached via trunnion on each side of the plenum housing shall be provided, and installed to ensure proper alignment of the bellows to the presentation angle of the vehicle front opening.
 - 2) Operation of air cylinders shall be controlled by in-line mounted valve. Valve shall be 4-way, 5 ported. Cylinder exhaust shall be throttled by the adjustable speed control orifice, and back pressure is developed that will control cylinder stroke speed.
 - 3) Air preparation shall include a filter regulator with gauge and micro mist lubricator.
- 2. Plenum assembly: A plenum connected to the bellows assembly shall be fabricated from minimum 12-gauge galvanized sheet steel, welded to structural framework of angles and channels, all of sufficient rigidity to support the cantilevered load of the extendable bellows assembly and the imposed load of the overhead duct work. Plenum to be within a frame fabricated from 2 inch square steel tubing mounted on angle legs with base plates drilled to receive anchor bolts.
- 3. Air cleaning equipment: Air cleaning equipment for the air being returned to the garage area shall be accomplished by special cellular inertial separators, each cell to consist of U-shaped blades arranged to present a circuitous path to the airflow and to redirect the air toward the clean air outlet.
 - a. Blades shall be fabricated from no less than 20-gauge, high strength, low alloy, corrosion resistant steel. The air passageway between adjacent blades shall be not less than $\frac{3}{16}$ ".
 - b. The efficiency of the air cleaner shall not be less than 94% using Standardized Air Cleaner Dust Test, coarse, with inlet airflow of 1,000 CFM per single cell when using a bleed rate of 10%. Pressure loss from the inlet to the clean air outlet shall not exceed 0.8" water gauge at this airflow. The inertial separators shall be equipped with a bleed air duct, connected to a powered dust collector.
 - c. Dust collectors of the bag type, shall have a minimum 7.5 HP TEFC motor driven blower unit. Collector shall bleed a minimum of 10% of the air input to the refuse collection receptacle and shall have a cloth area of not less than 350 square feet. Collector shall have a capacity of not less than 15 cubic feet, and shall incorporate a bag shaker.
- 4. Ductwork: Duct from bellows plenum to collection receptacle shall be fabricated from minimum 12-gauge galvanized sheet steel, properly reinforced to withstand the negative pressures involved. Duct from the dust separator to the dust

- collector shall be a minimum 22-gauge galvanized steel flue ducting or plastic pipe or air duct hose.
5. Refuse collection receptacle: Refuse collection receptacle shall be double sealed chambered and fabricated from galvanized sheet steel panels. Receptacle shall be approximately 600 cubic feet mounted on a supporting structure of heavy 12 inch channel steel plate with structural steel I-beam legs. A hopper outlet shall be provided in the minimum 12-gauge galvanized steel floor of the support structure. Intake chamber shall be completely closed at the top and incorporate a system of interior screen baffles with automatic rotary air sweeps. The open top of the outlet chamber shall be fitted with screening of suitable meshed size for the purpose.
 - a. Access to each chamber shall be provided via galvanized hatchways in the steel side walls. An air operated blast gate with two (2) air cylinders shall automatically dump refuse from hopper into dumpster. System shall include an air control panel enclosure for all air controls complete with an automatic moisture drain system.
 6. Trash separation unit: Fan housing and fan (with electric motor) shall be located where it is accessible for easy maintenance. The design of the system must be such that debris thrown into bellow shall be shredded into pieces immediately after passing through the bellows.
 - a. Inlet of the fan housing shall be flanged and matched to discharge of plenum housing.
 - b. Fan must be 36½ inches diameter machete type fan, 30 HP V-Belt drive, and guard, 1800 RPM TEFC motor, 24,300 CFM at 4 inches static pressure. The fan assembly shall be designed to handle material normally expected to come out of bus interior cleaning operations including newspapers. Fans (propeller type) designed only for gas handling are not allowed. Fan shall be mounted in housing fabricated from minimum 12-gauge galvanized steel. The actual performance shall be 23,000 CFM at the bellow (entrance) and must be verified by a certified testing agency before acceptance. Failure to meet the actual CFM performance criteria at the bellows shall be considered unacceptable.
 7. Refuse container: Three (3) cubic yard dumpster with two swivel and two fixed casters shall be provided with receiving hopper to encompass sealed unit with vacuum system. Dumpster shall be capable of being lifted by forklift and by standard refuse/disposal truck.
 8. Primary & secondary debris separators & air cleaners: Primary debris separation shall be by baffles and self-cleaning screens. Secondary air cleaning for air being returned to the garage area shall be accomplished by replaceable air filters. The efficiency of the air filters shall not be less than OSHA regulations of TLV (Threshold Limit Value) of 15 mg/cubic meter of total dust.
- D. Electrical Controls:

1. A pre-wired 480 VAC, 3 phase, electrical and control panel shall be enclosed in a NEMA-12 enclosures along with necessary relays, transformers, numbered terminal strip and through-door non-fused disconnect.
2. The panel shall be conveniently mounted on plenum housing. Panels shall contain electric heaters for moisture removal. Signal lights and push buttons for accessories shall be provided. All electrical and control devices shall comply with applicable local codes and shall meet National Electrical Code standards. Electrical wiring shall be run within conduit or raceways.

E. Finish:

1. All components of vacuum system shall be hot-dipped galvanized, and areas where galvanizing is not possible, shall be epoxy coated.

F. Utilities Available:

1. Electrical: 460 VAC, 3 phase, 37.5 HP, plus controls.
2. Compressed air: ½ inch, 100 CFM, 100 PSI

G. Manufacturers References:

1. Prime manufacturer: Specifications are based on equipment identified herein by manufacturer's name and model to establish acceptable standards of quality, performance, features, and construction.
 - a. Ross & White Company
1090 Alexander Court
P.O. Box 970
Cary, IL 60013-0970
Phone: 847-516-3900
Fax: 847-516-3989
Website: www.rossandwhite.com
 - b. Model: ICS-VA-30-23000 Automatic Bus/Train Interior Vacuum System as specified above.

PART 3 - EXECUTION (Not Used)

END OF SECTION 11 11 31

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SECTION 14 40 00 VEHICLE LIFTS

PART 1 - GENERAL

1.1 SCOPE

- A. Applicable provisions of the General and Supplementary Conditions and Division 01 govern work under this Section.

1.2 SECTION INCLUDES

- A. Scissors style in-ground lifts.

1.3 RELATED SECTIONS

- A. Refer to Section 03 30 00 "Cast-In-Place Concrete."
- B. Refer to Section 26 05 00 "Common Work Results for Electrical."

1.4 SUBMITTALS

- A. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
- B. Shop Drawings: Submit drawings showing full layout of all lifts with dimensions and details shown for services and conduits between lifts and the control consoles.
- C. Operation and Maintenance Manual: Submit Owner's manual to include system operation, maintenance and troubleshooting, spare part numbers, drawings and schematics.

1.5 QUALITY ASSURANCE

- A. Manufacturer qualifications: The lift company selling the product shall possess ISO-9001 certification.
- B. Installer qualifications: For warranty validation, installation shall be performed by qualified factory authorized and trained personnel.
- C. Product requirements / design standards and certification: The lift shall be certified by a Nationally Recognized Testing Laboratory (NRTL) to the ANSI/ALI ALCTV (current edition) "Standard for Automotive Lifts: Safety Requirements for Construction, Testing, and Validation".

1.6 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.

1.7 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.

1.8 WARRANTY

- A. Manufacturer's Warranty: Lift system shall be warranted for a minimum period of two (2) years for parts and one (1) year for labor.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable manufacturer: Stertil-Koni USA, Inc., which is located at: 200 Log Canoe Circle; Stevensville, MD 21666; Toll Free Tel: 800-336-6637; Tel: 410-643-9001; Email: lifts@stertil-koni.com; Web: www.stertil-koni.com
- B. Substitutions: Prior approval required.

2.2 SCISSOR STYLE IN-GROUND LIFTS

- A. Scissor style in-ground Lift Model ECO90 as manufactured by Stertil-Koni USA, Inc.
- B. General Description:
 - 1. The lift shall consist of three lifting units in line with the longitudinal axis of the vehicle, each lifting unit so equipped as to engage the axle, suspension, and/or frame as specified herein. Both of the two lifting units shall be movable fore and aft to affect variable spacing between lifting mechanisms. The other lifting unit shall be fixed.
- C. Lifting Capacity:
 - 1. Lift shall be capable of raising 90,000 lbs. (40,826 kg), 30,000 lbs. (13,608 kg) each fixed/ 30,000 lbs. (13,608 kg) each movable lifting unit.
 - 2. Unbalanced Loads, Movable to Fixed: Lift shall be capable of raising 30,000 lbs (13,608 kg) on one unit and 0 lbs (0 kg) on the other unit.
- D. Dimensions:
 - 1. The lifting height shall be no less than 70 inches (1,780 mm) as measured from the point of adapter contact at full rise to the finished floor.
 - 2. Lifting Rate: 90 seconds; 45 inches (1,140 mm) per minute, minimum.
 - 3. Maximum depth below finished floor for any structural component or member: 34 inches (864 mm) maximum.
 - 4. Movable and fixed lifting unit synchronization: 2 inches (51 mm).

5. Travel range for the movable lifting unit shall be as follows, depending on selected model:
 - a. ECO 90-3.25-xx: 39 inches (991 mm)
 - b. ECO 90-10-xx: 120 inches (3,048 mm)
 - c. ECO 90-13-xx: 156 inches (3,962 mm)
 - d. ECO 90-17-xx: 204 inches (5,182 mm)

E. Lifting Units:

1. Lifting units and continuous recess inserts shall be completely removable with no lift components or structural framing permanently embedded in the concrete.
2. Lifting units shall be hydraulically powered, mechanically articulating scissors, complete with a mechanical locking system.
3. All steel surfaces shall be powder coated.
4. By means of a centering link, the lifting unit structure shall articulate symmetrically about the center axis of the lift unit as it raises and lowers.

F. Movable Lifting Units:

1. The movable lifting unit shall relocate horizontally fore and aft while in the fully retracted position.
2. When the entire continuous recess insert has the covers in place and the lift is operational, it shall form a continuous recess that shall meet the following design and performance criteria:
 - a. The movable lifting unit shall not be required to recess, or park, in only one "pocketed" location, providing increased productivity in servicing fleet vehicles of varying wheelbases.
 - b. The movable lifting unit may be recessed below finished floor at any position between the minimum and maximum dimensions of the travel range.
 - c. The movable lifting unit shall be capable of fore and aft travel while recessed below floor.
3. Maximum depth below finished floor for the continuous recess insert, rear lifting unit or any fixed or movable component shall be 34 inches (864 mm).
4. The movable steel box insert shall have an open floor design, mounted off the concrete floor of the trench to allow for the collection, cleaning and drainage of all liquids and solids that accumulate in the trench.
5. The aluminum covers for the movable mechanism shall be anodized structural 6061 aluminum extrusions engineered to accept a 7,500 lb. (3,402 kg) point load on a contact area of 2 x 2 inches (50 x 50 mm) and shall be shaped to include a full-length interlocking hinge. Covers shall fit together tightly and uniformly to promote smooth travel so as to prevent jamming and twisting. The covers shall be able to accept a 13,500 lb. (6,123 kg.) drive over load on a 6 x 9 inch (152 x 228 mm) contact area.
6. The aluminum covers for the movable mechanism shall be attached to UHMW slider blocks for reduced friction and increased longevity. These slider blocks shall keep the covers properly centered at all times. Horizontal grooves in the UHMW sliders shall, together with half-moon shaped guide rails in the end

section of the lift's steel box insert, securely guide the covers as they travel in and out of the recess.

7. Transition plates shall be bolted to the continuous recess insert to provide for a flush and smooth transition from the shop floor to the aluminum covers. The transition plates also shall assist the cover travel by holding the covers down so they can't buckle during horizontal travel.
8. The aluminum covers for the movable mechanism shall be flush with the finished floor within a tolerance of less than 1/8 inch. Covers that are lower than the finished floor shall not be acceptable.
9. The movable lifting unit and the covers shall bear on and slide over UHMW surfaces for low friction and minimal maintenance.
10. The hydraulically powered carriage drive shall utilize a rack and gear arrangement on both the left and right sides for smooth and even fore-aft travel without binding.
11. The rack shall be inverted and positioned under the load channel of the movable lifting unit insert where it is protected so as not to collect dirt, grease etc.
12. All hydraulic and compressed air service lines shall be fed from the control console to the movable lifting unit insert through one PVC chase way per lifting unit.
13. All low voltage, intrinsically safe electric service lines shall be fed from the control console to the movable lifting unit insert through one 3/4 inch rigid conduit per lifting unit, installed to meet local requirements.

G. Fixed Lifting Unit:

1. The fixed lifting unit shall be bolted in place with eight each 7/8 inch (22 mm) stainless steel anchors.

H. Hydraulic System:

1. System shall be comprised of three high pressure, low volume, single acting, 7 inch (178 mm) diameter cylinders, one in each lifting unit.
2. The hydraulic system shall be a power up / gravity down design. Lifts that rely on the power units to run during the lowering cycle shall not be acceptable due to increased power consumption and wear.
3. High pressure seals shall be internal to the cylinder, where they are protected from salt, dirt, etc.
4. Each cylinder shall require no more than 3.5 gallons (13.25 liters) of hydraulic fluid for lifting to full height.
5. Combined, the three cylinders shall only require 10.5 gallons (39.75 l) of AW 15 hydraulic fluid for lifting to full height.
6. Each cylinder shall have a hose break velocity fuse (safety check valve) integrally mounted to prevent excessive loss of fluid from the cylinder.
7. The hoses shall be of reinforced construction and utilize JIC fittings throughout.
8. The hoses feeding the movable lift carriage shall be supported and contained by a cable carrier to prevent the hoses from dragging or tangling.
9. The lift shall be driven by three individual power units, readily available as an off-the-shelf component.

I. Adapters:

1. The lift system shall include a variety of axle engaging accessory adapters designed to raise heavy vehicles by the axles or frame. Adapters shall be either axle or frame oriented. Spinning adapters shall not be acceptable due to risk of accidental rotation during vehicle spotting and setup.
2. The base adapter shall have at least a five hole pattern that will allow every accessory adapter to be used in the reverse direction, allowing up to eight positions of the accessory adapter on the base adapter.
3. Sliding base adapters shall be restrained to prevent over extension.
4. Bolster and base adapters for all lifting units shall recess below finished floor.
5. Adapter Adjustment: Minimum 13.25 inches (337 mm); Maximum 56 inches (1,422 mm).
6. Bolster Width: 40 inches (1,016 mm) minimum.

J. Controls:

1. The control system shall conform to all current NEC, UL 201 and OSHA codes.
2. The control system shall be PCB operated and continuously monitor all operating functions and safety systems of the lifting units.
3. The control system shall utilize intrinsically safe inclinometers to constantly monitor the elevation of the lifting units to ensure synchronized operation.
4. The control system shall allow the user to adjust the sensitivity of the electronic synchronization without the use of special tools, within the absolute limits of ANSI/ALI ALCTV standard.
5. The control system shall have the ability to receive regular software updates/upgrades as control system advances become available. All updates/upgrades shall be possible through data transfer without the need for component replacement.
6. On the face of the control console, control elements shall include:
 - a. "UP" button.
 - b. "Down" button.
 - c. "Lock release" button.
 - d. "Confirm" button
 - e. A high definition 7 inch (178 mm) LCD screen touch screen. The touch screen shall be specifically designed for a harsh workshop environment. The touch screen shall provide systems information, but operation of the lift shall be initiated by the primary operational buttons. The touch screen shall include a removable micro-SD memory card for storage of user configurable information. The touch screen shall be capable of providing the following functions:
 - 1) "Lifting unit selection" indicator: displays to the operator which lifting units in the lift have been selected for operation. The display illustrates the ability to operate the lifting units singularly, or groups of lifting units as synchronized sets.
 - 2) "Lifting unit height" indicator: displays to the operator the height of each individual lifting unit. The height indicator shall also provide, on the touch screen, a clear indicator if the lifting unit has been set to stop at a restricted lifting height.

- 3) “Lifting units fully lowered” indicator: displays to the operator that all lifting units are fully retracted into the ground to inform the operator that the bay is clear to allow entry and exit by the vehicle.
- 4) “Error message” indicator: displays to the operator when a fault code has been registered by the control system, the touch screen shall inform the operator of any fault situations being present in the lift. The control system shall have the ability to display error messages including fault description on the screen.
- 5) One-touch access to the **Guide screen**: This area of the touch screen provides to the operator:
 - a) Owner information
- 6) One-touch access to the **Information screen**: This area of the touch screen provides to the all users:
 - a) Owner information
 - b) Contact information for service provider
 - c) Equipment time log including lifting unit run times
- 7) One-touch access to the **Settings screen** which displays various options. The settings screen shall allow control of:
 - a) Settings screen option (1): authorized users shall have the ability to change the language (English, Spanish, French) displayed on the screen as well as the units of measure for height and weight (imperial or metric units).
 - b) Settings screen option (2): authorized users shall have the ability to retract the mechanical locks during raising for reduced noise, as well as to set a restricted maximum lifting height.
 - c) Access to the Shop and Assistance screens: from the Settings screen, authorized users shall have the ability to control the service settings.
- 8) One-touch access to the **Shop configuration screen** options which is PIN protected. The shop configuration screen shall allow adjustment of:
 - a) Edit of owner’s details: allows the ability to edit the information displayed on the Owner’s field.
 - b) One-touch access to the **Assistance configuration screen** which displays various options and is PIN protected. The maintenance configuration screen shall allow adjustment of:
 - i. **Screen 1:**
 - i. Initiation of crush protection which guards against a crushing hazard during lowering when using the optional remote control. This safety system, when enabled, will interrupt lowering as the lift reaches 18

inches (457 mm) above finished floor. At that time, the operator needs to return to the control console and continue the lowering cycle by utilizing the control buttons located on the face of the control console.

- ii. Ability to disable height difference monitoring to aid in trouble shooting. Once initiated, this control system option allows the maintainer to operate the lifting system outside normal safety limits. This system is only for use by the lift system maintainer during repair procedures. This system option will automatically be disabled and the control system returned to default operating parameters after 10 minutes.

Screen 2:

- i. Ability to view lift system run time to properly plan for lift system maintenance.
- ii. Ability to view individual lifting unit motor run time to properly plan for lift system maintenance.

Screen 6:

- i. This screen shall allow back up of the operating system

Screen 7:

- i. This screen shall display operating system information

7. The enclosure for electrical control components shall be IP 54 rated.
8. The control console shall be equipped with a main power disconnect switch which interrupts all incoming power. Main power disconnect shall be lock-out capable.
9. Control console access panels shall have key-hole slots and recessed handles for easy removal and installation.
10. The control system shall automatically prohibit horizontal movement of the movable lifting unit when raised above 12 inches (305 mm) above finished floor. This parameter shall be user programmable without the use of special tools.
11. The lift, when fitted with the proper electrical motors, shall operate at the following voltages: 208/230V (3 phase), 460V (3 phase), 575V (3 phase)

K. Safety Devices:

1. Each lifting unit shall be equipped with double lock jaw, gravity engaged, mechanical locks with the first lock position engaging at a minimum height of 18 inches (457 mm).
2. Number of Mechanical Lock Stops: 12, minimum.
3. Vertical height spacing between each lock stop: 6 inches (152 mm), maximum.
4. The mechanical locks shall be made of high strength T-1 steel.
5. All push buttons shall be of momentary contact, dead man type.

L. Optional: Automatic Wheel Base Positioning:

1. The control system shall be equipped with an AWBP (automatic wheel base positioning) system that allows the operator to program an infinite number of wheelbase positions into the control system for reduced set up times. The AWBP system shall be controlled via the 7 inch (178 mm) color touch screen to allow the operator to select and program vehicle wheel bases. The AWBP system shall allow the operator to store wheel base positions by vehicle brand and year or license plate for ease of use and safety to avoid selection of the incorrect vehicle.
2. Once a vehicle has been selected, the movable lifting unit shall travel to the pre-programmed position without interruptions or stops.

M. Optional: Wired Remote Control:

1. The lift shall be equipped with an ergonomic industrial remote control, rated for use in NEC Class 1, Div. 2, hazardous locations.
2. Remote control shall be connected to the control console through a multi-conductor cable with military-style DIN connector. Standard cable length shall be 35 feet. (10.6 m)
3. Remote control shall allow full function control of the lift, with the following:
 - a. Push/Pull E-Stop Button
 - b. Push buttons for Lift Raise, Lower and Unlock
 - c. Selector button for synchronized (group) or single operation
 - d. Push buttons for hydraulic movable carriage drive
4. Remote control shall be equipped with an emergency E-Stop button that de-energizes power to all outputs of the PCB. Re-activation of the control system requires resetting the E-Stop and re-energizing the control system.
5. The control box shall have a provision to disable operation of the remote control during lowering when the bolster is below 18 inches (457 mm) above finished floor.

N. Optional: HOME Beacon Stack Light:

1. The lift shall be equipped with an external HOME beacon stack light. This beacon light shall turn green when all lifting units are fully retraced to inform the operator that the bay is clear to allow entry and exit by the vehicle. When one or more lifting units are not fully lowered the beacon light shall turn red to inform the operator that the bay is not clear and it is not safe to move the vehicle into or out of the bay.
2. The beacon light shall have the option to be mounted in a remote location (e.g. by the bay door) for optimum visibility.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

- A. Clean 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.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions. Test for proper operation, and re-test if necessary until satisfactory results are obtained.

3.4 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before substantial completion.

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